Research Article

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Teneligliptin's Role in Anti-Diabetic Drug Trends for Type II Diabetes

Abstract

Background: The assessment of prescription patterns is a critical step toward the rational use of drugs. Type II diabetes mellitus (T2DM) is a condition of insulin resistance and beta-cell dysfunction that often necessitates pharmacological intervention beyond lifestyle modifications. Teneligliptin, a DPP-4 inhibitor, has emerged as a promising therapy for managing uncontrolled T2DM. **Methods:** The Department of Pharmacology collaborated with the General Medicine department for conducting a cross-sectional study. A total of 570 patients were included in the study on the basis of predefined criteria including inclusion and exclusion criteria. The demographic details, as well as the prescription patterns, were reviewed and tabulated based on ADA guidelines. **Results:** Combination therapy was prescribed to 54% of patients, while 46% received monotherapy. Biguanides (40.58%) were the most commonly prescribed class, followed by sulfonylureas (32.8%) and DPP-4 inhibitors (18.71%). Teneligliptin was the most frequently prescribed DPP-4 inhibitor. Among combination therapies, Metformin+Teneligliptin (12.54%) and Metformin+Glimepiride (12.16%) were the most common. Triple-drug combinations featuring Metformin, Glimepiride, and Teneligliptin (9.6%) showed significant glycemic control. Physicians increasingly opted for newer agents such as Teneligliptin, not only as a mono-therapy but also as a combination therapy. **Conclusion:** Teneligliptin, part of the rational prescribing practices in T2DM management, has increasingly gained momentum. Prescribing trends do have a lot of scope to optimize by closely adhering to essential drug lists and brand-neutral prescribing practices.

Keywords: anti-Diabetic drug, type II diabeties, Teneligliptin

1 Introduction

The prescription patterns of anti-diabetic drugs can help in the evaluation of treatment trends and adoption of new therapies. Traditional agents like metformin are still at the center of T2DM management due to their established efficacy, affordability, and weight-neutral properties. Sulfonylureas and insulin are often added in patients who fail to reach glycemic targets with metformin alone [1]. However, with newer agents coming into the market, such as DPP-4 inhibitors, GLP-1 receptor agonists, and SGLT2 inhibitors, there's an intrinsic shift in the prescription trend.

DPP-4 inhibitors, which include

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Teneligliptin, have become the preferred drugs for physicians to treat patients with mild hyperglycemia, at high risk of hypoglycemic episodes, or with contra-indications for traditional agents [2]. They are commonly used as monotherapy for drug-naïve patients and in combination with metformin and other oral agents to have tighter glycemic control. The use of Teneligliptin particularly has been in an increasing phase in countries, where affordability and access to the medication are main concerns [3]. Also, the medication is available relatively as a less expensive option against other DPP-4 inhibitors, which contributes to its popular usage. The prominent role of Teneligliptin in managing T2DM can be attributed to its multifaceted benefits [4].

First, it effectively reduces fasting and postprandial glucose levels without causing significant hypoglycemia or weight gain, addressing two major challenges in diabetes management. Second, it exhibits renoprotective properties, making it suitable for patients with varying degrees of renal impairment, a common comorbidity in T2DM. Besides, Teneligliptin has demonstrated preclinical and observational cardiovascular benefits in various studies [5]. Although there are limited CVOTs in the long-term, Teneligliptin has been reported to reduce inflammation and improve endothelial function. In addition, its safety profile is excellent in elderly patients and polypharmacy patients, hence a versatile drug that can be used in multiple conditions [6].

Despite its benefits, certain barriers limit the widespread adoption of Teneligliptin and other newer agents [7]. Cost considerations remain a critical factor, particularly in low- and middle-income countries where healthcare resources are constrained. Physician awareness and familiarity with newer therapies also play a role, as practitioners often adhere to established regimens unless clear evidence supports a switch [8].

Another major challenge is patient adherence. Although Teneligliptin provides a very convenient once-daily dosing regimen, the patients with T2DM usually suffer from polypharmacy and may experience difficulty in adhering to long-term therapy [9]. This requires efforts to improve education and awareness on both sides, that is, among healthcare providers and patients.

Teneligliptin marks a great deal of advancement in the pharmacological management of T2DM. Its mechanism of action, effectiveness in glycemic control, and favorable safety profile have made it a very viable option in the expanding arsenal of anti-diabetic therapies. Analysis of prescription trends underscores the ongoing evolution of trends in diabetes management, which shifts gradually towards agents that offer benefits not only to glycemic effects but also patient outcomes overall [10].

Since T2DM remains on the increase across the world, the continued pursuit of adequate and accessible therapy becomes a concern. Agents like Teneligliptin addressing multifaceted issues in the management of diabetes promise better control of glycemic parameters and enhance quality of life in millions worldwide [11]. More research studies, especially those with real-world application, should continue to identify the long-term benefits of its administration and ensure proper positioning of Teneligliptin as an integral agent in the multidisciplinary treatment of diabetes.

2 Materials and Methods

The study was a non-interventional, observational study conducted in a tertiary care teaching hospital for 18 months. The main objective of this study was to assess the prescribing pattern of antidiabetic drugs in

patients suffering from Type II Diabetes Mellitus (T2DM). This study was carried out in an outpatient clinic wherein patients used to visit periodically for follow-up purposes and alteration of their treatment programs. Such observational studies are crucial in identifying real-world trends in medication usage, evaluating adherence to treatment guidelines, and understanding the practicality of pharmacological interventions in routine clinical settings [12]. The tertiary care teaching hospital was chosen as the study setting, allowing access to a large, diverse pool of patients and facilitating collaboration with multidisciplinary teams, including endocrinologists, diabetologists, and pharmacists. This allowed for comprehensive data collection and analysis, ensuring that the study outcomes were robust and reflective of current prescription practices [13, 14].

2.1 Inclusion Criteria

With clear inclusion criteria, the study population remained focused and relevant. Inclusion criteria were: age of 30 to 60 years, which is a group that is most prone to T2DM, and conditions when usually emerging during certain years of life in the working period of human beings, especially at times of family and professional responsibilities, making it the most demanding period in managing diabetes and adherence to lifestyle changes and medication.

Diagnosis: All patients included in the analysis were diagnosed with T2DM and were at least on anti-diabetic drug therapy. Therefore, including an active treatment status of patients means that the efficacy of different prescriptions can be established in real clinical practice.

Consent: Only those patients who gave their informed consent were considered for the study. This helped maintain ethical compliance and ensured respect for the patient's autonomy, as participants were well aware of the purpose and methodology of the study.

2.2 Exclusion Criteria

Several exclusion criteria were identified to remove confounding variables and to target a homogenous population of T2DM patients. The following groups were excluded:

Type I Diabetes Mellitus: Patients with Type I diabetes were excluded due to significant differences in pathophysiology, treatment regimens, and disease management strategies compared to T2DM.

Age Restrictions: Individuals below 30 years or above 60 years were excluded to limit the variability associated with age-related factors, such as pediatric diabetes or geriatric complications.

Pregnant or Lactating Women: These patients were excluded because pregnancy-induced diabetes and physiological changes due to lactation may affect prescription patterns and outcomes.

Secondary Diabetes or ICU Care: Patients with secondary diabetes, such as those caused by pancreatic disorders or endocrinopathies, and those requiring ICU management were excluded because their treatment protocols are significantly different from standard T2DM care in outpatient settings.

2.3 Data Collection

Data were collected from a total of 570 patients who met the inclusion criteria. A structured data collection approach was adopted to ensure consistency and accuracy. Prescription details were recorded using predesigned case report forms that captured information such as drug names, dosages, routes of administration, and durations of treatment.

The systematic documentation of prescription details provided valuable insights

into the real-world application of anti-diabetic therapies. Furthermore, the structured forms facilitated the identification of common drug combinations, trends in monotherapy versus combination therapy, and adherence to treatment guidelines [15].

The American Diabetes Association's 2015 guidelines were used to evaluate the prescriptions for rationality. These guidelines provide evidence-based recommendations for the management of hyperglycemia in T2DM, including individualized therapy based on the characteristics of patients, comorbidities, and preferences. The study adhered strictly to these guidelines in order to find out whether the prescribed therapies conformed to current best practices [16].

The recorded data were processed using Microsoft Excel, which is an application useful for the structuring, processing, and graphing of data. The application was used in summarizing descriptive statistics, describing the age group, gender spread, and time duration since being diagnosed with diabetes. It further included frequency patterns and patterns for prescribed anti-diabetic drugs by indicating the drugs that were more frequently prescribed, including their respective drug combinations.

The study focused much on the rationality of prescriptions. This was done by assessing the appropriateness of drug selection, dosages, and combinations relative to the ADA guidelines. Rational prescriptions were defined as those that provided optimal glycemic control while minimizing the risk of adverse effects, such as hypoglycemia and weight gain.

2.4 Importance of the Study

This study has high relevance to understanding the real-world prescription patterns and finding the areas for improvement in T2DM management. Observational studies like this one are vital to bridge the gap between clinical guidelines and daily practice. This study evaluates the adherence to the established treatment protocols, thus it indicates the opportunity to optimize the patient care and ensure the safe and effective use of anti-diabetic medications. This study ensures the relevance of its findings not only to the local setting but also for the international understanding of diabetes management trends by following well-structured data collection and adhering to internationally recognized guidelines. The focus on a diverse patient population in a tertiary care teaching hospital adds robustness and generalizability to the results; this study will be very useful for clinicians, researchers, and policymakers. Concluding, this observational study sets out a design and methodology solidly based to help evaluate the patterns of prescription and advance our knowledge of the pharmacological treatment in T2DM. Given this, and analyzing trends for current practices in treatment, lays groundwork for more studies and intervention aiming to benefit diabetes patients living with the illness.

3 Results

The study involved 570 participants with a mean age of 49.56 ± 7.4 years, representing the target demographic most affected by Type II Diabetes Mellitus (T2DM). The gender distribution showed a slight male predominance (55.4% male vs. 44.5% female). This finding is in line with the global trends where T2DM is more prevalent among men. This could be attributed to lifestyle factors, genetic predisposition, and differences in healthcare-seeking behavior. However, the prominent representation of females calls for gender-sensitive approaches in diabetes management (Table 1 and Figure 1).

3.1 Drug Classes Prescribed

Among the drug classes:

- **Biguanides (40.58%):** As expected, Biguanides, primarily Metformin, dominated prescriptions. This aligns with its well-established role as the first-line therapy for T2DM, recommended by major guidelines due to its efficacy, affordability, and safety profile.
- **Sulfonylureas (32.8%):** These were the second most commonly prescribed agents, often used as add-ons to Metformin for patients requiring further glycemic control.
- **DPP-4 Inhibitors (18.71%):** The growing preference for these agents reflects their ability to manage blood glucose with a low risk of hypoglycemia and minimal weight gain.
- **Alpha-glucosidase inhibitors (5.1%) and Thiazolidinediones (2.79%):** These were less frequently prescribed, likely due to limited efficacy, side effects, or contraindications in certain populations.

These prescription trends indicate that physicians increasingly prefer newer agents like DPP-4 inhibitors, like Teneligliptin, in addition to relying on established agents for baseline control (Table 2 and Figure 2).

3.2 Monotherapy vs. Combination Therapy

Further analysis revealed the changing scenario of therapeutic approaches with T2DM (Figure 3).

3.3 Monotherapy (30.88%):

The most notable single-agent therapy was metformin; there was revalidation for its position as the first drug in therapy for T2DM. This drug is, due to its improvement in insulin sensitivity and cardiovascular benefits, an indispensible drug for treatment at diagnosis.

3.4 Double-Drug Combinations

- **Metformin + Teneligliptin (12.54%):** This combination gained traction due to its complementary mechanisms. While Metformin reduces hepatic glucose production, Teneligliptin enhances incretin activity, making it effective in achieving tighter glycemic control.
- **Metformin + Glimepiride (12.16%):** Sulfonylureas, like Glimepiride, augment insulin secretion, providing an effective boost to Metformin in patients with moderate hyperglycemia (Table 3).

3.5 Triple-Drug Combinations (9.6%)

Metformin, Glimepiride, and Teneligliptin formed a frequent approach for those in need of treatment intensification. This approach harnesses the beneficial effects of three different mechanisms, namely insulin sensitization, augmentation of insulin secretion, and incretin modulation.

3.6 Four-Drug Combinations: 10.42%

In patients whose condition had advanced into a stage of significant progression, Acarbose was often added to Metformin, Glimepiride, and Teneligliptin, representing a bridging therapy before resorting to insulin therapy. The stepwise progression from monotherapy to multi-drug regimens reflects the clinician's approach to balance efficacy and tolerability.

3.7 Prescription Rationality

The prescriptions were rational, adhering to ADA's 2015 guidelines, with individualized therapy based on patient needs, comorbidities, and treatment goals. The preference for combinations containing Teneligliptin reflects its growing acceptance as a safe and effective option in modern diabetes care.

3.8 Graphical Insights

The presented charts effectively summarize the study's key findings:

- **Gender Distribution:** A bar chart visualizes the balanced male-to-female ratio, reflecting the diverse participant pool.
- **Drug Class Utilization:** A horizontal bar chart emphasizes the predominance of Biguanides, with a notable presence of DPP-4 inhibitors.
- **Therapy Trends:** The therapy chart demonstrates the significant role of combination therapies, particularly those incorporating Metformin and Teneligliptin.

4 Discussion

Our findings are in line with the existing literature, which emphasizes the importance of Metformin as the cornerstone of Type II Diabetes Mellitus (T2DM) management. This dominance is due to its well-documented efficacy, affordability, and safety profile, making it the first-line therapy recommended by international guidelines such as those of the American Diabetes Association (ADA). Metformin's ability to reduce hepatic glucose production, improve insulin sensitivity, and confer cardiovascular benefits has cemented its place as the foundational drug for T2DM.

In the class of Sulfonylureas, Glimepiride emerged as the most commonly prescribed agent. Sulfonylureas have been an old standby in T2DM because they can stimulate pancreatic insulin secretion. Glimepiride is preferred due to its once-daily dosing, a lower risk of hypoglycemia than older sulfonylureas, and ability to attain glycemic targets. This preference also reflects the increased trend among physicians to adopt drugs with better safety profiles.

Teneligliptin was considered the first choice DPP-4 inhibitor, an indication of the gradual popularity towards managing T2DM. Teneligliptin belongs to the class of dipeptidyl peptidase-4 (DPP-4) inhibitors that enhance incretin hormone activity, stimulating insulin secretion and suppressing glucagon levels in a glucose-dependent fashion. Due to its pharmacological properties, characterized by strong and sustained DPP-4 inhibition, it is a practical drug for patients at a higher risk of hypoglycemia or with contraindications to other classes of drugs. The results reflect the increasing number of physicians including newer agents, such as Teneligliptin, into their treatment algorithms, which represents an awareness of updated therapeutic guidelines and the effectiveness of these drugs in managing glycemic control.

One of the most striking features of the study was the high prevalence of combination therapies, especially those containing Teneligliptin. These combinations showed better glycemic control than monotherapy, which is consistent with previous studies. Combination therapies are increasingly being recognized for their ability to address the complex and multifactorial pathophysiological defects in T2DM, including insulin resistance, beta-cell dysfunction, and hepatic glucose overproduction.

The most common combinations were Metformin with either Teneligliptin or

Glimepiride. Metformin's glucose-lowering effects on the liver complement the insulin secretion-enhancing properties of Glimepiride or the incretin-boosting effects of Teneligliptin. These combinations are particularly effective in patients with moderate hyperglycemia, offering a balanced approach to addressing both fasting and postprandial glucose levels. The combination of Metformin, Glimepiride, and Teneligliptin demonstrated a logical intensification in therapy for those patients who necessitated enhanced glycemic control. Each drug focuses on a specific mechanism, synergizing to cause the maximum extent of glycemic control with least side effects [17, 18].

For patients with advanced disease progression, the addition of Acarbose to Metformin, Glimepiride, and Teneligliptin was frequently observed. Acarbose, an alpha-glucosidase inhibitor, delays carbohydrate absorption, reducing postprandial glucose spikes. This four-drug regimen served as a bridge before initiating insulin therapy, reflecting a stepwise approach to managing T2DM progression.

The results of the study pave the way for the growing consensus that combination therapy is the only means to attain glycemic targets in T2DM. These combinations of agents with complementary mechanisms of action enhance overall glucose control while reducing the risk of hypoglycemia and long-term complications.

Current Prescription Practices: Challenges Despite the promising trends in T2DM management, the study highlights several areas that require improvement in prescription practices: A large percentage of prescriptions included brand-name drugs, which may add to the treatment cost for the patient. Promotion of generic medication use can lower healthcare costs without sacrificing efficacy or safety. Policymakers and healthcare providers need to promote prescription of generics in order to make care more accessible.

Adherence gaps in essential drug lists were also determined, which would promote cost-effective and evidence-based therapies. Increasing physicians' awareness of such lists and integrating them into the prescription workflow could ensure that patients receive the most appropriate and affordable treatments. While combination therapies result in better glycemic control, they also complicate the drug regimen, and this may be a factor affecting patient adherence. Adherence needs to be tackled through education of the patient, simplification of dosing regimens, and follow-up appointments to remind patients of the necessity of consistent therapy.

The findings above have several implications for clinical practice, emphasizing a balanced approach combining updated therapeutic strategies with cost-effectiveness and patient-centered care. The rise in Teneligliptin use, its incorporation into combination therapies, and the general positive opinions of this addition to therapies represent the importance of including new agents in treatment protocols. Physicians should continue monitoring emerging evidence on the efficacy and safety of such agents to optimize therapy.

Variability in drug choice and combination therapy also underlines the need for an individualized approach to treatment. Decisions have to be based on the patient's age, comorbidities, lifestyle, and other financial constraints in order to get the best outcomes. Decrease reliance on brand-name drugs, encourage generics to decrease the health care costs considerably, especially in resource-limited settings. Physicians and policymakers have to collaborate and ensure that drug lists of essence are put first in routine practice.

5 Conclusion

In conclusion, the study highlights the dominance of Metformin in T2DM management, the strategic use of combination therapies, and the growing role of newer agents like Teneligliptin. These findings align with updated therapeutic guidelines and reflect physicians' commitment to achieving optimal glycemic control. However, addressing challenges such as brand-name prescribing and patient adherence remains critical to improving outcomes. By fostering a holistic approach that incorporates evidence-based therapies, cost-effectiveness, and patient-centered care, healthcare providers can further enhance the management of T2DM and reduce its global burden.

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Table 1: Distribution of Gender

Gender	Number of patients
Male	309
Female	261
Total	570

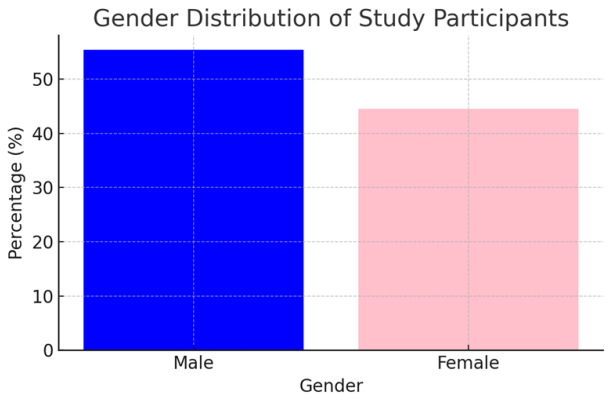

Figure 1: Gender Distribution Of Study Participants

Table 2: Age range of the patients under investigation

Age in years	Number of patients
30-34	25
35-40	76
41-45	90
46-50	90
51-55	120
56-60	169
TOTAL	570

Table 3: Antidiabetic drugs prescribed

Antidiabetic drugs	%
Metformin+glimepiride	30.88
Metformin+pioglitazone	12.54
Metformin+Teneligliptin	10.54
Metformin+Acarbose	3.23
Glimepiride+ Acarbose	2.9
Glimepiride+Teneligliptin	4.47
Glimepiride+Pioz	0.98

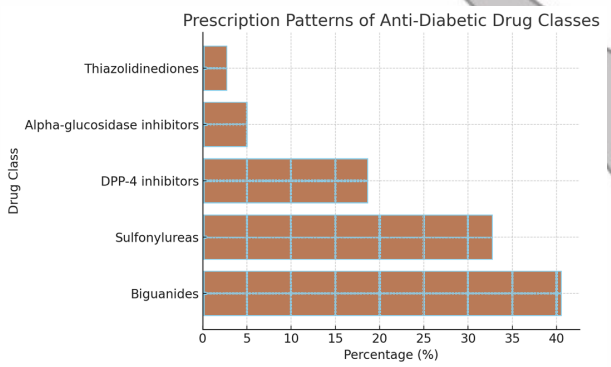

Figure 2: Prescription Patterns Of Anti-Diabetic Drug Classes

Table 4: Oral antidiabetic drugs prescribed as single and combination drug therapy

	No	%
Total number of oral antidiabetic agents prescribed	857	98.0
Number of oral antidiabetic drugs prescribed as single drug formulation	491	45.27
Number of prescribed formulation oral as antidiabetic combination drugs drug	391	47.32

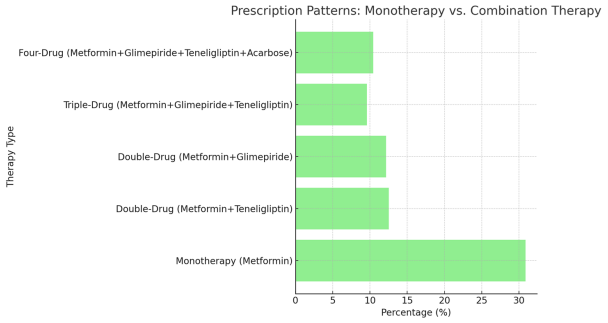

Figure 3: Prescription Patterns: Monotherapy Vs. Combination Therapy