

ASSESSMENT OF GLYCATED HEMOGLOBIN LEVEL AND PRESCRIBING PATTERN OF ORAL HYPOGLYCEMICS IN TYPE 2 DIABETES MELLITUS PATIENTS ADMITTED AT TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Diabetes is a chronic condition associated with abnormally high levels of glucose in the blood. It may be due to impaired insulin secretion, resistance to peripheral actions of insulin, or both. Evaluating the managing strategies, including prescribing pattern of hypoglycemics is crucial for ensuring effective glycemic control, reducing complications, and optimizing patient outcomes. Glycated hemoglobin (HbA1c) is a key marker that indicates a person's glycemic control over the past two to three months. Monitoring HbA1c levels provides insights into how well diabetes is managed and can guide adjustments in therapy to prevent complications.

Objectives: To assess the prescribing pattern of hypoglycemics, and also to evaluate the HbA1c level in T2DM patients admitted at tertiary care hospital.

Methodology: This was a prospective cross-sectional study on Type II diabetes mellitus (T2DM) patients admitted in the department of General Medicine at Siddaganga hospital, Tumkur. Ethical approval was obtained from SMCRI. A total of 117 cases were enrolled based on the inclusion criteria over a period of 6 months. Details such as demographics, personal history, past history, current lab investigations, medical condition and medication information were obtained using a pre-designed patient data collection form. The collected information was documented and subjected to appropriate statistical methods.

Results: Among the 117 cases, higher incidence of T2DM was found in males 67(57.3 %). The majority of the patients belong to the category of age between 50-59 and 60-69 years (28.2%). Dual-therapy was the most preferred therapy, used in 75 (64.1%) patients. The most prescribed oral hypoglycemic agent is Glimpiride +Metformin (65.1%). Biguanides were the most preferred class of drugs, accounting for 141 (53.5%) patients. Most of the diabetic patients were having poor control 21 (17.9%) as per HbA1c investigation. Our study results shows that HbA1c level is not having relationship with Oral Hypoglycemics by the chi-square test. T-test results were showed that there is a relationship between the before and after hospitalization in response to therapeutic effect for the p-value < 0.05. The major complication of T2DM was found to be Hypertension and affecting 20 (46%) patients.

Conclusion: Our study concludes that male patients have a higher incidence of T2DM. The majority of patients are receiving dual-therapy with the Glimpiride + Metformin combinations. Among Hypoglycemic medications, Biguanides are the most commonly preferred class of drugs, with Metformin being the most frequently used. T2DM patients are often associated with Hypertension. Most proportion of patients exhibited poor glycemic control as indicated by HbA1c level. Therefore, there is a need for clinical pharmacists to educate patients about lifestyle changes, improve medication adherence, optimize therapeutic outcomes and prevent complications.

KEYWORDS: Diabetes Mellitus, Glycated hemoglobin, Dual-therapy, Metformin, Hypertension.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia. It may be due to impaired insulin secretion, resistance to peripheral actions of insulin, or both [1]. According to the latest International Diabetes Federation (IDF) (January 16, 2023), type II diabetes mellitus (T2DM) is the most common type of diabetes, making up around 90% of all diabetes. In 2021, the global prevalence of type II diabetes mellitus in adults was 536.6 million people (10.5%) [2]. The prevalence of diabetes in India has risen from 7.1% in 2009 to 8.9% in 2019. Currently 25.2 million adults are estimated to have IGT (impaired glucose tolerance) [3]. The risk factors that cause T2DM are multiple and consist of unfavourable dietary patterns, sedentary lifestyle, obesity, smoking, race, ethnicity and genetic influences. The main causes for T2DM are insulin resistance in which the response to insulin is diminished and pancreatic beta-cell dysfunction where sufficient insulin is not produced [4]. The laboratory investigations performed to diagnose T2DM include random blood sugar (RBS), fasting blood sugar (FBS), post-prandial blood sugar (PPBS), glycosylated haemoglobin test (HbA1c) and oral glucose tolerance test (OGTT) [5]. HbA1c is a key surrogate marker of chronic glycaemia which reflects the average blood glucose level over the previous two to three months [6]. It is usually used in

diabetes management to determine glucose control, but advances in instrumentation and standardisation have led to marked improvements in the accuracy and precision of HbA1c assays and its use as a diagnostic tool. According to the American Diabetes Association (ADA) Guidelines 2007, HbA1c is also referred as Alc and the value of HbA1c should be kept below 7%. Values greater than 7% indicate an increased chance of progression to diabetic complications [7]. Type II Diabetes Mellitus can be prevented and managed primarily through life style modification and diet control. Treatment includes oral hypoglycaemic agents (Biguanides, Sulfonylureas, Meglitinides, Thiazolidinediones, Alpha-Glucosidase Inhibitors, Incretin-Based Therapies, and Dipeptidyl-Peptidase IV Inhibitors) and insulin [8] Among these Biguanides such as Metformin is commonly preferred anti-diabetic medication. It reduces HbA1c level by approximately 1.5-2% and blood glucose by 50-70 mg/dl [9].

If monotherapy fails to achieve the glycemic goal, then combination therapy is preferred. Selecting a class of anti-hyperglycemic agents for combination therapy, the glucose-lowering efficacy, risk of hypoglycemia, body weight gain, and cardiovascular benefits associated with the drugs are preferentially considered [10]. Dual therapy is initiated when HbA1c is in between 7.6-9%. Various dual therapy combination approved by USFDA includes metformin with glibenclamide, pioglitazone, saxagliptin, linagliptin and dapaglifozin. Triple fixed drug combination includes metformin with sulfonylureas and pioglitazone or sulfonylureas and voglibose [11]. Studies show that the quadruple therapy metformin in combination with thiazolidinediones, sulfonylureas, dipeptidyl peptidase 4 inhibitors and sodium glucose co transporter 2 inhibitors decrease HbA1c level by 1.1% to 1.3% [12].

Various factors such as inappropriate drug selection, medication error, patients non-adherence, drug interactions and drug poor bio-availability affects the therapeutic outcomes. So, proper selection of hypoglycemic agents is necessary to optimize the clinical outcomes [13].

Prescribing pattern is the manner in which medications are prescribed by the healthcare professionals, including the types of medications, dosages and treatment regimens such as monotherapy, dual therapy, triple therapy and quadruple therapy [14]. A study on prescribing pattern can provide valuable information to the physicians, researchers, policy makers and the health care professionals to determine the drug use pattern. So, this study aims to assess the prescribing pattern of hypoglycaemics, and also to evaluate the HbA1c level in T2DM patients admitted at tertiary care hospital.

METHODOLOGY

Study Design

This was a prospective cross-sectional study.

Study Period

This study was conducted for a period of 6 months.

Study Population

Patients who were suffered from Type 2 Diabetes Mellitus and was exposed to Hypoglycemics upon admitted in general medicine department at SMCRI, Tumkur.

Ethical Approval

The study was under taken after obtaining ethical approval from Siddaganga medical college and Research institute ethics committee.

Sample Size

Formula: $n = (Z^2 (1-\alpha) \times P(1-P))/d^2$

(n = sample size, z = 1.96, d = 5%, p = 8.3 % = 0.083)

Calculation: $n = ((1.96)^2 \times 0.083(1-0.083))/(0.05)^2 = 116.96 \approx 117$

The sample size is calculated by considering prevalence rate of diabetes mellitus parameter 8.3 % and for margin of error 5% and 95% confidence interval, the minimum number of subjects required for the present study is 117.15

Sampling Method

Convenience sampling.

Inclusion Criteria

- Both male and female patients aged >30 years.
- Patients on treatment with hypoglycemics and received minimum of 3 days treatment.
- Patients admitted to general medicine department and receiving treatment for type II diabetes mellitus and co morbidities.

Exclusion Criteria

- Patients who are admitted to Intensive care unit.
- Gestational diabetes mellitus.
- Patients who are not given inform consent form.

Method Of Data Collection

Type II diabetes mellitus patients who were admitted to Siddaganga hospital. Data was collected by using pre designed and semi- structured profile form.

Following information was collected:

- Socio-demographic details like name, age, sex, IP number, UHID and occupation.
- Details on oral hypoglycemic agents and other drugs prescribed for the treatment of T2DM was obtained from inpatient case records.
- Laboratory investigations such as FBS, PPBS, RBS levels were collected daily and HbA1c level was collected once and documented.

Study Procedure

This is a cross-sectional study conducted for a period of 6 months with the patients suffering from Type 2 Diabetes Mellitus admitting in Siddaganga Hospital. Before conducting the study, the informed consent will be obtained from the patients. The data will be collected using pre designed data collection form such as patient demographic details, past medical and medication history, laboratory investigations and current treatment. The collected information will be assessed for prescribing pattern and glycated hemoglobin level to classify whether the patients are in good glycemic control (<7%), poor glycemic control (7-11 %) and very poor glycemic control (> 11.1 %) for the prescribed medications. The descriptive statistics including percentage/ proportions, frequencies, mean, median and mode will be calculated and represented graphically for the collected data.

Statistical Analysis

The data collected was entered in MS Excel worksheet and descriptive statistics like percentage, mean, chi-square test, t-test etc. were used in our study.

RESULTS

This was a prospective cross-sectional study conducted for a duration of 6 months in inpatients suffering from type 2 DM patients admitted at tertiary care hospital. A total of 117 patients were enrolled in the study based on inclusion criteria. The demographic details such as age, sex, occupation along with information about past medication history, current treatment, laboratory investigations such as HbA1c level, RBS and FBS was obtained from the patients and collected by using a suitably designed data collection form.

Totally, 117 patients were included during the study period. The number of male patients 67 (57.3%) were more admitted to hospital for T2DM when compared to female patients 50(42.7%). In our study maximum number of patients were found in the group of 50-59 years (28.2%) and 60-69 years (28.3%) followed by 40-49 years (18.8%), 70-79 years (17.1%), 80 years and above (6%) and minimum number of patients were found in the age group of 30-39 years (1.7%). Regarding educational status, 76 patients (64.95%) were educated, while 41 (35.05%) were uneducated. Of the patients admitted to the hospital, 61 (52.14%) were from urban areas and 56 (47.86%) were from rural areas. (Table 1)

Table 1: General Characteristics of the Participants

Variables	Category	No. of Patients	In Percentage
Gender	Male	67	57.3 %
	Female	50	42.7 %
Age in Years	30-39	2	1.7 %
	40-49	22	18.8 %
	50-59	33	28.2 %
	60-69	33	28.2 %
	70-79	20	17.1 %
	>80	7	6 %
Educational status	Educated	76	64.95%
	Uneducated	41	35.05 %
Area of Residence	Rural	56	47.9 %
	Urban	61	52.1%

Among 117 patients, 16(13.7%) of patients were prescribed with monotherapy followed by 75(64.1%) of them were prescribed with dual therapy, 23(19.6%) of them were prescribed with triple therapy and 3 (2.6%) of them were prescribed with quadruple therapy. Among these the most prescribed was Dual therapy with Glimperide +Metformin, followed by+ Monotherapy with Metformin, followed by triple therapy with Glimperide + Metformin + Voglibose and the least prescribed was quadruple therapy with Glimperide + Metformin with Dapagliflozin+ Sitagliptin/ Dapagliflozin+ linagliptin. (Table 2)

Table 2: Details on Prescribing Pattern

THERAPY PATTERN	NO. OF PATIENTS	IN PERCENTAGE
Mono therapy	16	13.7 %
Dual therapy	75	64.1 %
Triple therapy	23	19.6 %
Quadruple therapy	3	2.6 %

In our study it was found that the most commonly preferred class of Hypoglycemic agents was found to be Biguanides 141 (53.5%) followed by Sulfonylureas 89 (31.9%), DPP4 inhibitors 24 (8.6%), alpha- glucosidase inhibitors 11 (3.9%), SGLT2 inhibitors 7 (2.5%), Thiazolidinediones 6 (2.1%) and the least prescribed class of drug was Meglitinide 1 (<1%). (Table 3)

Table 3: Categorization Based on Class of Oral Hypoglycemic Agents

CLASS OF ORAL HYPOGLYCAEMIC	NO. OF PATIENTS	IN PERCENTAGE
Biguanides	141	53.5%
sulfonylureas	89	31.9%
DPP4 inhibitors	24	8.6%
Alpha glucosidase inhibitors	11	3.9%
SGLT2 inhibitors	7	2.5%
Thiazolidinediones	6	2.1%
Meglitinide	1	<1%

In our study, we found that 50 patients were having complications from Type 2 Diabetes Mellitus. 3 patients suffering from gangrene, 9 of them is having cellulitis, 5 of them renal complications, 20 of them had hypertension, 13 of them had cardiovascular complications due to diabetes mellitus. (Figure 1)

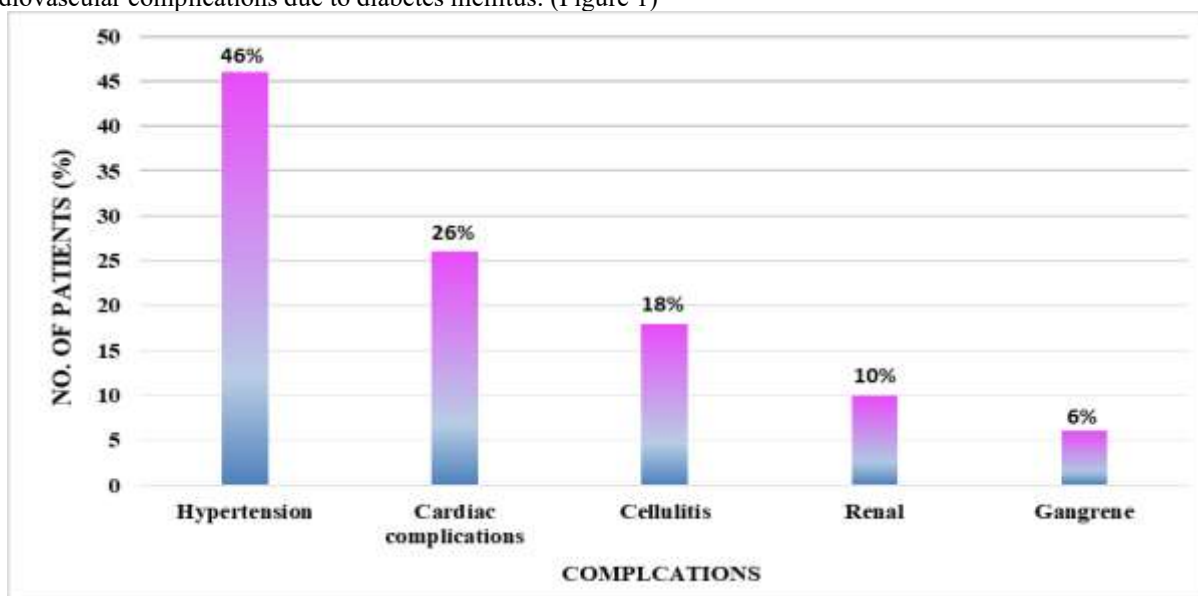


Figure 1: Diabetic complications among Participants

Among participants, 55 patients were subjected to HbA1c investigations. It was found that out of 55 patients 9 (7.6%) patients were having normal HbA1c (< 5.6%) level, 6 (5.1%) patients were at pre diabetic range (5.7-6.4%), 5 (4.3%) patients were having good control (6.5-7%), 10 (8.5%) patients were having fair control (7-8%) and 21 (17.9%) patients were having poor control (>8%). (Table 4)

Table 4: Patients Distribution Based on HbA1c level

No. of Patients (%)	CATEGORY BASED ON HbA1c LEVEL				
	NORMAL (<5.6%)	PRE DIABETIC (5.7-6.4%)	GOOD CONTROL (6.5-7%)	FAIR CONTROL (7-8%)	POOR CONTROL (>8%)
	7.6 %	5.1 %	4.3 %	8.5 %	17.9 %

The chi-square test was applied to check the relationship between Oral Hypoglycemics and HbA1c level. The calculated chi-square value was found to be 25.31 which was less than the expected table value 31.41. The degree of freedom was found to be 20 and the P value was 0.05. Hence our study accepts the null hypothesis and rejects the alternative hypothesis. It concludes that HbA1c level is not having relationship with Oral Hypoglycemics (Table 5)

Table 5: Relationship between Oral Hypoglycemics and HbA1c level among Patients

ORAL HYPOGLYCEMICS	HbA1C LEVEL	CHI-SQUARE VALUE
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	GOOD CONTROL	FAIR CONTROL	POOR CONTROL	
Vildagliptin + Metformin	1	3	2	25.31
Sitagliptin + Metformin	1	0	0	
Glimepiride + Metformin	3	2	10	
Glimepiride + Pioglitazone + Metformin	0	0	2	
Tenegliptin + Metformin	0	1	0	
Sitagliptin + Metformin + Glimepiride	0	0	2	
Glimepiride + Pioglitazone + Dapagliflozin	0	0	1	
Vildagliptin + Metformin + Dapagliflozin	0	0	1	
Glimepiride + Metformin + Voglibose	0	1	2	
Dapagliflozin	0	1	0	
Glimepiride + Metformin + Vildagliptin	0	0	1	

The t-test was applied to check the RBS level before and after three days of hospitalization. It shows that, the t-test value was found to be 6.5 which is more than the t-critical value 1.98. Hence results show that rejects the null hypothesis and accept the alternative hypothesis. It concludes that there is a significant difference between the before and after hospitalization which indicates the outcome of the therapy (Table 6).

Table 6: Relationship Between Before and After Hospital Admission.

Statistical measures	Statistical values for RBS level at the time of admission	Statistical values for RBS level after three days
Mean	213	164.9
Variance	9077.155	2893.5
Observations	117	117
t Stat	6.5	
t Critical for two-tail	1.98	

DISCUSSION

A total of 117 patients were included during the study period. The number of male patients 67 (57.3%) were more admitted to hospital for T2DM when compared to female patients 50(42.7%). And maximum number of patients were found in the group of 50-59 years and 60-69 years (28.2%). These results are similar to the study conducted by Kalpana Tiwari et al, indicating males are at higher risk due to factors like diet, lifestyle, and physical inactivity, age [16].

In our study, prescribing pattern shown that the majority of the study population were on Dual therapy when compared to Monotherapy, Triple therapy and Quadruple therapy. This aligns with the study conducted by Agarwal AA et al, this is for achieving the better glycemic control [17]. In Dual therapy, Glimepiride +Metformin combination 56 (65.1 %) was the most prescribed. This is similar to the study conducted by Kakade A et al, this combination therapy justified the reason for its better glucose control as fixed- dose combination for treating Type 2 Diabetes Mellitus [18]. It was found that the most commonly preferred class of Hypoglycemic agents was found to be Biguanides 141 (53.5%) followed by Sulfonylureas 89 (31.9%) in our study. This is similar to the study conducted by Vengurlekar S et al, due to the fact that metformin was the only drug of its class to be prescribed, whereas many second-generation sulfonylureas are available

and were prescribed making their individual frequency low but as a group/class their prescribing was higher than biguanide class [19].

Out of 55 study participants who had HbA1c test, a majority of the population 21(17.9 %) were having poor control over their blood glucose level ranging >8%. This differs from the previous study conducted by Kalpana Tiwari et al, because of various factors like age, gender, diabetic duration, physical inactivity, stress, comorbidity, poor medication adherence [16]. Our study found that the most of the study population with Type 2 Diabetes Mellitus were also having complications of hypertension 20 (40 %) followed by cardiovascular diseases 13 (26 %). These results concur with the study done by Butt M D et al, because Type 2 Diabetes Mellitus, Hypertension and Cardiovascular diseases involve shared underlying mechanisms and conditions can damage blood vessels, contributing to atherosclerosis [20].

The chi-square test was applied to check the relationship between Oral Hypoglycemics and HbA1c level. Our study concludes that HbA1c level is not having relationship with Oral Hypoglycemics. This finding is in accordance with the study conducted by Fang H S A et al, due to poor medication adherence, genetic variability among individuals, dose and duration of oral hypoglycemic agents, lifestyle factors and presence of comorbidities [21]. The t-test was applied to check the RBS level before and after three days of hospitalization. And our study concludes that there is a significant difference between the before and after hospitalization which indicates the outcome of the therapy.

CONCLUSION

Our study concludes that, male patients are more suffering from T2DM and they were in the age group between 50-59 and 60-69 years. Maximum of patients are receiving Dual-therapy with the Glimepiride + Metformin combination. Biguanides class of hypoglycemic drugs were most preferred class of drug and individual drug Metformin is commonly used in the management of T2DM. T2DM patients are often associated with Hypertension. Most proportion of patients exhibited poor glycemic control as indicated by HbA1c level. So, there is a need of clinical pharmacist in providing patient education about counselling on lifestyle modifications, improving adherence, and preventing complications. This contributes to reduce morbidity and mortality.

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Conflict Of Interest

The authors declare no conflict of interest.

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