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## Knowledge Assessment of Diabetes in Patients and Cost Analysis Study of Antidiabetic Drugs in Type 2 Diabetes Mellitus



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**Keywords:** Diabetes mellitus, Antidiabetic drugs, Cost analysis, Diabetes knowledge questionnaire (DKQ)

### ABSTRACT

Diabetes mellitus is a group of metabolic disorders characterized by hyperglycemia. It is associated with abnormalities in carbohydrate, fat and protein metabolism, thus result in chronic complications including microvascular, macrovascular and neuropathic disorder. India is one among the top three countries where diabetes is prevalent according to the study carried out in 2015. Since diabetes is a chronic condition that occurs extremely due to the combination of sedentary lifestyle and imbalanced diet. The medications are to be taken for lifetime. So there is a need for the prescribers to prescribe the medication, which would be cost effective to the patients. Through this study, we aim to analyse cost variations of antidiabetic drug available in Indian market and we also assess the knowledge of patients about diabetes mellitus. Aim: The aim of this study is to assess the knowledge of patients about diabetes and to perform a cost analysis study of antidiabetic drugs in type 2 diabetes mellitus. Materials & Method: A Prospective, Cross sectional study was carried out in a 450 bedded tertiary care hospital. The study subjects include 80 patients admitted in the general medicine, cardiology, surgery, orthopedics, gynecology and neurology departments. Ambulatory patients, patients in emergency ward, pediatric and psychiatry departments were excluded from the study. Result: Prescription of 80 patients were studied and found that 63.75% were males and 36.25% were females. Most of the patients are from age group of 66-75 years (31.75%). The mostly prescribed drug is metformin and in combination, metformin + glimepride is given most. In cost analysis of drug it was found that instead of prescribing combination of drug, mono-drug regimen is more cost effective. And most patients were unaware about the diabetic condition and its treatment. Conclusion: Our study emphasizes on the cost analysis of anti-diabetic drugs and knowledge assessment of patients with type 2 DM. The cost analysis reveals that metformin and glimepride were highly prescribed drugs. When analysis the cost of single drug and combinations, we conclude that single drug regimen is more cost benefit. In assessing patients knowledge about diabetes, most of the elderly had poor knowledge compared to middle age group patients. This can be improved through giving proper counseling to patients.

## INTRODUCTION

Diabetes Mellitus is a group of metabolic disorders characterized by hyperglycemia. It is associated with abnormalities in carbohydrate, fat, and protein metabolism and results in chronic complications including microvascular, macrovascular, and neuropathic disorders.<sup>[58]</sup> WHO project that DM will be the 8<sup>th</sup> leading cause of death around 2030. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the  $\beta$ -cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. In type 1 diabetes, the cause is an absolute deficiency of insulin secretion. In type 2 diabetes, the cause is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response. Type 2 diabetes accounts for ~90–95% of all diabetic cases.

The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. According to statistics from the International Diabetes Federation (IDF), India has more diabetics than any other nation of the world. Current estimates per the number of diabetics in the country at about 62 million – an increase of over 10 million from 2011 when estimate suggested that about 50.8 million people in the country were suffering from the disease. By the year 2030 over 100 million people in India are likely to suffer from diabetes.<sup>[8]</sup>

## MANAGEMENT

- Non-pharmacological treatment
  - Diet – Medical nutrition therapy is recommended for all person with DM
  - Physical activity – It include aerobic exercise
  - Weight reduction if obese
- Pharmacological treatment
  - Biguanides ( Metformin)

- Sulphonylureas ( Glimepiride, Glipzide, Glibenclamide)
- Thiazolidinediones ( Pioglitazone)
- Alpha-glucosidase inhibitors (Voglibose, Acarbose)
- DPP-4 inhibitors (Vidagliptin, Sitagliptin)
- Meglitinide analogues (Repaglinide, Nateglinide)
- Glucagon-like peptide -1/ GLP – 1 ( Liraglutide, Exenatide)
- Amylin analogue ( Pramlintide)
- Dopamine- D2 receptor agonist (Bromocriptine)
- Sodium-glucose cotransport -2 (SGLT-2) inhibitor (Dapagliflozin)

## **INSULIN THERAPY**

### **CLASSIFICATION OF INSULIN**

#### **Rapid acting**

- Lispro
- Aspart
- Glulisine

#### **Intermediate acting**

- NPH(Isophane)
- Lente

#### **Slow acting**

- Ultralente
- Protamine zinc



➤ Glargine and Detemir<sup>[62]</sup>

## NEED FOR COUNSELING IN DIABETES

The principal task of the health care team is to give each patient knowledge, self- confidence and support. Patients with diabetes and their families provide 95% of their care themselves, and, as a consequence, educational efforts to improve self- management are central components of any effective treatment plan.

Studies have confirmed that the complications of diabetes can be reduced by proper control of blood glucose. The proper control is dependent on the patient's adherence to medications, lifestyle modifications, frequent monitoring of blood glucose, etc and can be influenced by proper education and counseling of the patient. Pharmacists, being one of the indispensable members of the health care team, have an immense responsibility for counseling these patients.

## ROLE OF PHARMACISTS IN DIABETES MANAGEMENT

Because of the rapid expansion of available therapeutic agents to treat diabetes, the pharmacist's role in caring for diabetic patients has expanded. The pharmacist can educate the patients about the proper use of medication, screening for drug interactions, explain monitoring devices, and make recommendations for ancillary products and services.

Since diabetes is a chronic complication affecting diabetic patient at various levels, the counseling should focus on the nature of the disease, lifestyle modifications, medications, and acute and chronic complications.

## MATERIALS AND METHODS

A prospective cross sectional study was conducted in the general medicine, cardiology, surgery, orthopedics, obstetrics and neurology department of a 450 bedded tertiary hospital (st.james hospital chalakudy, Kerala, India) for a period of 6 months in 2019. The sample population of 80 was selected based on inclusion exclusion criteria. The study was conducted by collecting data from the medical records of inpatients receiving anti-diabetic drugs in various departments.

The protocol of study submitted to Institutional Human Ethics Committee (IHEC). The protocol was approved by committee with an approval number of SJPCEC/P25/PP/2016/028 and hospital approval number SJCP/DIR/A.13/2018-2019.

A computerized literature and manual search was conducted to identify relevant studies, for knowledge assessment of diabetes and cost analysis. Literatures which found to support the study was collected and properly reviewed. A data entry form was specially designed to collect the relevant information, and a properly validated DKQ was utilized. The mostly used drug alone and in combination was identified and the cost effective analysis was done. The study was done to investigate and compare the cost of various brands of same generic drug. Patient compliance with the drug plays a key role. Increase in drug cost is associated with the decline in medication adherence, which in turn lead to poor patient outcome. Cost between different brands of same generic drug was compared and the least cost was selected. This was also done for combinations of drugs and the most cost benefit one was selected.

#### Inclusion criteria

- Diabetic patients from general medicine, cardiology, surgery, orthopedics, obstetrics and neurology departments.
- Patients above the age of 35 years.

#### Exclusion criteria

- Ambulatory patients, patients present in emergency, pediatric and psychiatry departments.
- Patients below the age of 35 years.
- Patients who were not prescribed with antidiabetic drugs.
- Patients who were not willing to take part for the study.

## RESULT AND DISCUSSION

Diabetes is a chronic condition where compliance with drugs plays a key role. Adherence of the drugs can be ensured by decreasing the cost of the drugs prescribed. The study entitled "knowledge assessment of diabetes in patients and cost analysis of anti-diabetic drug in type 2 diabetes mellitus" was a prospective cross sectional study carried out for a period of 6

months in all the departments of a 450 bedded tertiary care hospital. A total of 80 patients who met the inclusion criteria were enrolled in the study.

## **AGE**

In the study (Table 1, fig 1) shows out of 80 patients majority belonged to 66 -75 years( 31.25%) followed by 56-65 years (23.75) and 23.75% was above 75 years. The lowest age group was found to be 35-45 years (2.5%).

## **GENDER**

36.25% male and 63.75 % being female. From this study, the majority was found to be female.(Table 2 & fig 2 )

## **LENGTH OF STAY**

Out of 80 patients, average length of stay of most were found to be between 1-5 days (66.25%) and only 7.5% stayed above 11 days.

## **COMORBIDITES**

Most of the patients with diabetes had comorbid conditions like hypertension, dyslipidemia and other. Out of this 80 patients 59 had hypertension, 26 had dyslipidemia, 13 had coronary artery disease and 30 were diagnosed with other disease. (Table 3 & fig 3)

## **COMMONLY PRESCRIBED ORAL ANTI-DIABETIC DRUGS**

In this study, it was found that metformin was prescribed for 36 patients, followed by glimepiride for 19 patients, 8 were prescribed with teneligliptin, 4 patients prescribed with gliclazide. Voglibose was prescribed only for 3 patients and 2 patients with glipizide. (Table 4 & fig 4)

## **DISTRIBUTION BASED ON COMMONLY PRESCRIBED COMBINATIONS OF ANTI-DIABETIC DRUGS**

Out of 80 patients, most (17) were prescribed with a combination of glimepiride & metformin. A combination of sitagliptin & metformin was prescribed only for 3 patients. And only 2 patients each were prescribed with pioglitazone + metformin, vildagliptin + metformin, glipizide + metformin and gliclazide + metformin. (Table 5 & fig 5)

## **DISTRIBUTION BASED ON COMMONLY PRESCRIBED INSULINS**

Through our study we found that insulin isophane and human insulin combination were prescribed mostly to all patients (20) followed by 19 patients with regular human insulin and only 2 patients were prescribed with human premix. Insulin glargine was only given to 1 patient.(Table 6 & fig 6)

## **DISTRIBUTION BASED ON INSULIN AND ORAL ANTI-DIABETIC DRUGS**

This study shows that about 69 patients were prescribed with oral anti-diabetic agent. And combination of anti-diabetic drug was given for 26 patients. And 42 patients were prescribed with insulin.(Table 7 & fig 7)

## **DISTRIBUTION BASED ON MOSTLY PRESCRIBED ANTI-DIABETIC MEDICATIONS**

Analysis of the study shows that metformin (36) was mostly prescribed drug. In combination therapy, metformin + glimepiride (17) was frequently administered. And in case of insulin about 20 patients were administered with a combination of isophane + human insulin.(Table 8 & fig 8)

## **COST ANALYSIS**

According to the study, we found that there is an extensive variation in the cost of anti-diabetic drugs. In the analysis of the comparative cost of therapies, it showed that the monotherapy is less costlier than that of the combination therapy.

Study showed that there is a wide variation in the prices of different brands of anti-diabetic drugs. Highest number of trades usable are respectively Metformin-500mg (n=6brands) Teneligliptin-20mg (n=5brands); followed by Glimepiride-1mg (n=3brands); Glimepiride-2mg (n=2brands) and Voglibose-0.2mg, 0.3mg, Pioglitazone-15mg, Glipizide-2.5mg, 5mg (n=1brand)(Table 9-13 & fig 9-13)

In combination with Metformin-500mg, highest number of brands are observed in Glimepiride-2mg & 1mg (n=2brands); Sitagliptin-50mg (n=2brands); vildagliptin-50mg & Pioglitazone-15mg (n=1brand); Gliclazide-80mg (n=1brands) and Metformin-1000mg+Glimepiride-2mg (n=2brand) (Table 14-16 & fig 14-16).

From the above data we assume that, if a mono drug regimen is given to the patient for a month then, in Metformin **Glyciphage** is the least costly (47.17 Rs) prescribed drug compared to other brands. In glimepride 1 mg **Glimestar** (79.2Rs), 2mg **Amaryl** (179.7 Rs) was least prescribed brand. In case of Teneligliptin 20 mg **Tenepride** (288 Rs) was cost beneficial drug. When comparing the cost of mono-drug regimen and combination of metformin & glimepride, the combination therapy was found to be costlier.

## QUESTIONNAIRE RESULT

In our study, by using a validated DKQ we found that most of the patients (80%) within the age group 46-55yrs have adequate knowledge about diabetes, followed by 68.42% from the age group 56-65. Between the age of 66-75 only 40% have knowledge about their condition. In geriatric patients (above 75), only 31.56% were aware about diabetes mellitus. (Table 18)

When statistically analyzed there was no significance between age and the knowledge about diabetes.

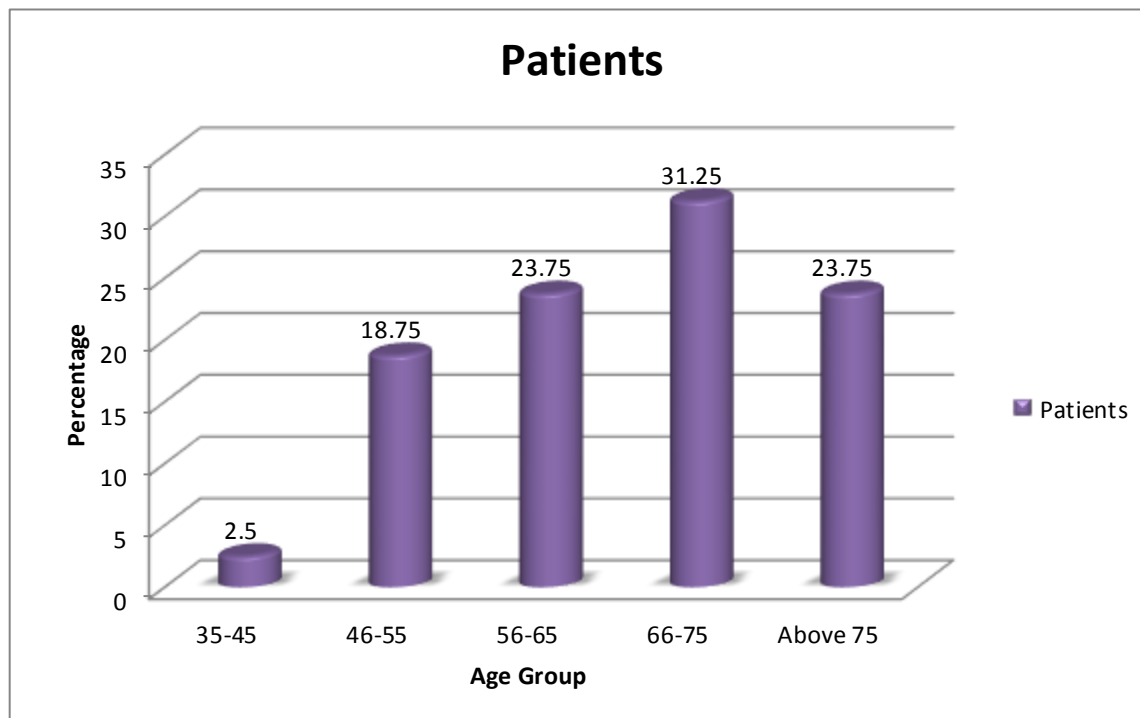
## DISTRIBUTION OF PATIENTS BASED ON AGE GROUP

N=80

Table No. 1: Distribution Based On Age

AGE GROUP(YEARS)	FREQUENCY	PERCENTAGE (%)
35-45	2	2.5
46-55	15	18.75
56-65	19	23.75
66-75	25	31.25
Above 75	19	23.75





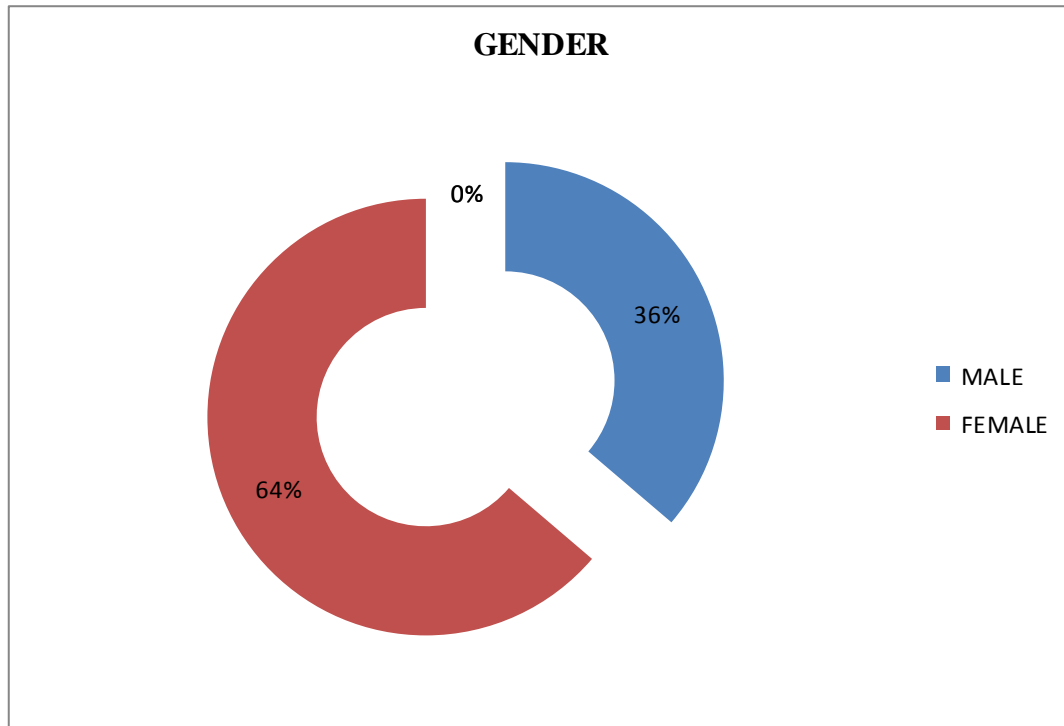
**Figure No. 1: Percentage Distribution Based on Age**

## DISTRIBUTION BASED ON GENDER

N=80

**Table No. 2: Distribution Based On Gender**

SEX	FREQUENCY	PERCENTAGE (%)
MALE	29	36.25
FEMALE	51	63.75



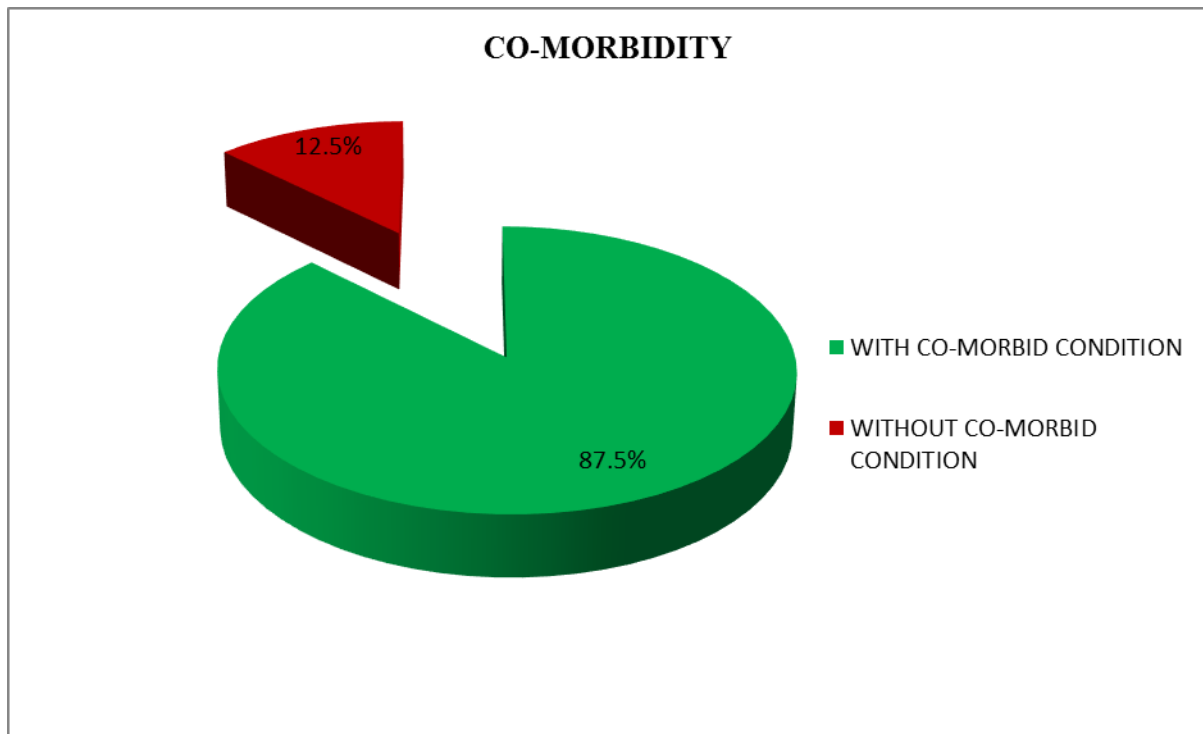
**Figure No. 2: Percentage Distribution Based on Gender**

#### DISTRIBUTION BASED ON CO-MORBIDITY

N=80

**Table No. 3: Distribution Based On Co-Morbidity**

Past medical history	Number of patients	Percentage (%)
With co-morbid conditions	70	87.5
Without co-morbid conditions	10	12.5

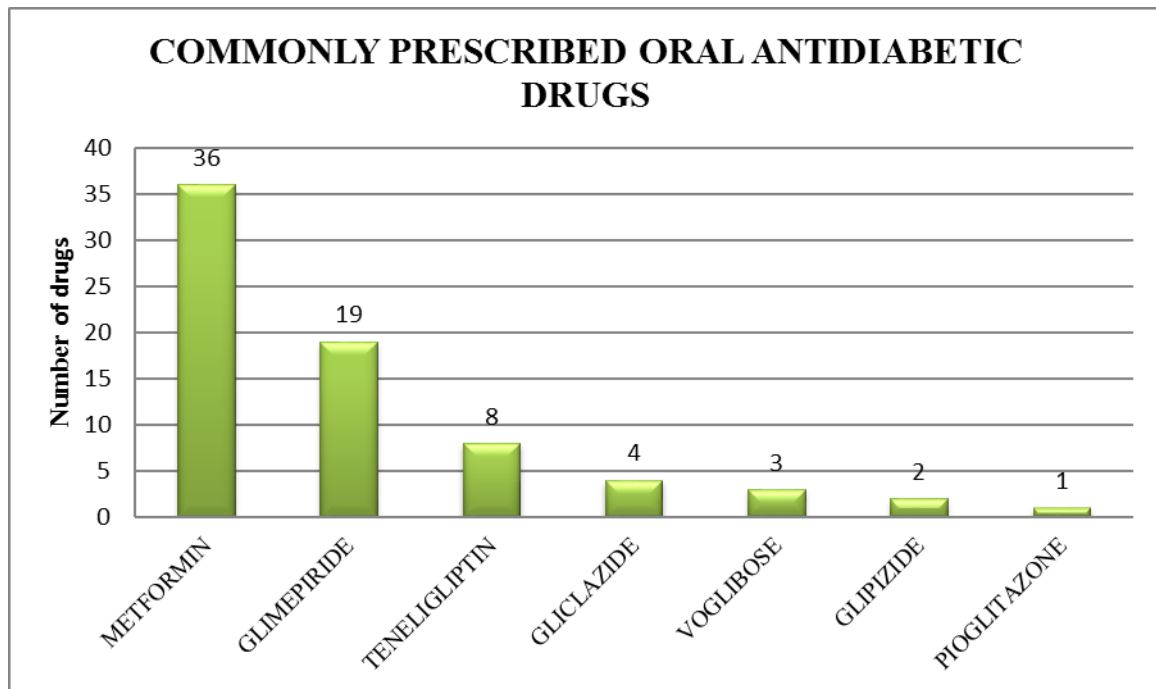


**Figure No. 3: Percentage Distribution Based on Co-Morbidity**

#### **DISTRIBUTION BASED ON COMMONLY PRESCRIBED ORAL ANTI-DIABETIC DRUGS**

**Table No. 4: Distribution Based On Commonly Prescribed Oral Anti-Diabetic Drugs**

ORAL ANTI-DIABETIC DRUGS	NUMBER
METFORMIN	36
GLIMEPIRIDE	19
TENELIGLIPTIN	8
GLICLAZIDE	4
VOGLIBOSE	3
GLIPIZIDE	2
PIOGLITAZONE	1

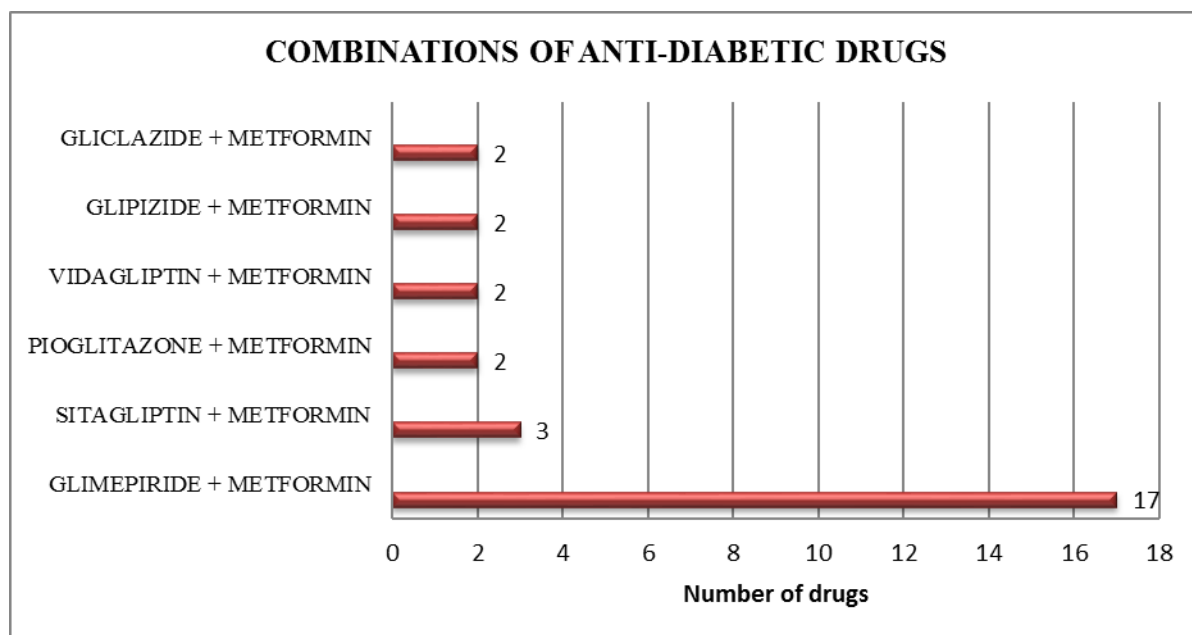


**Figure No. 4: Distribution Based On Commonly Prescribed Oral Anti-Diabetic Drugs**

#### **DISTRIBUTION BASED ON COMMONLY PRESCRIBED COMBINATIONS OF ANTI-DIABETIC DRUGS**

**Table No. 5: Distribution Based On Commonly Prescribed Combinations of Anti-Diabetic Drugs**

DRUGS	NUMBER
GLIMEPIRIDE + METFORMIN	17
SITAGLIPTIN + METFORMIN	3
PIOGLITAZONE + METFORMIN	2
VIDAGLIPTIN + METFORMIN	2
GLIPIZIDE + METFORMIN	2
GLICLAZIDE + METFORMIN	2

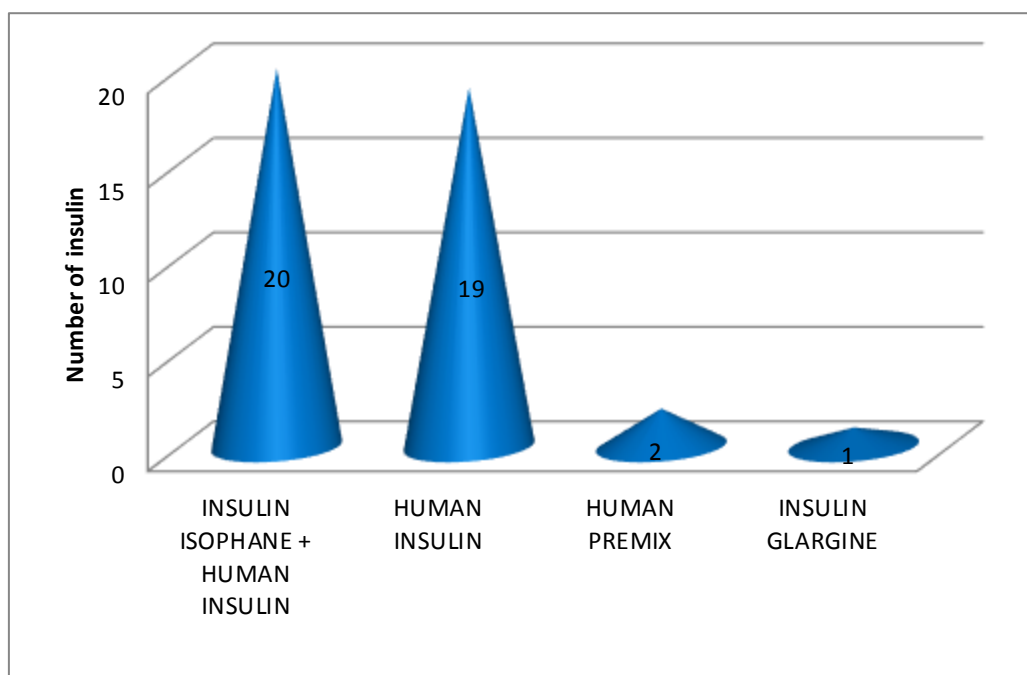


**Figure No. 5: Distribution Based On Commonly Prescribed Combinations of Anti-Diabetic Drugs**

#### **DISTRIBUTION BASED ON COMMONLY PRESCRIBED INSULIN**

**Table No. 6: Distribution Based On Commonly Prescribed Insulin**

INSULIN	NUMBER
INSULIN ISOPHANE + HUMAN INSULIN	20
HUMAN INSULIN	19
HUMAN PREMIX	2
INSULIN GLARGINE	1



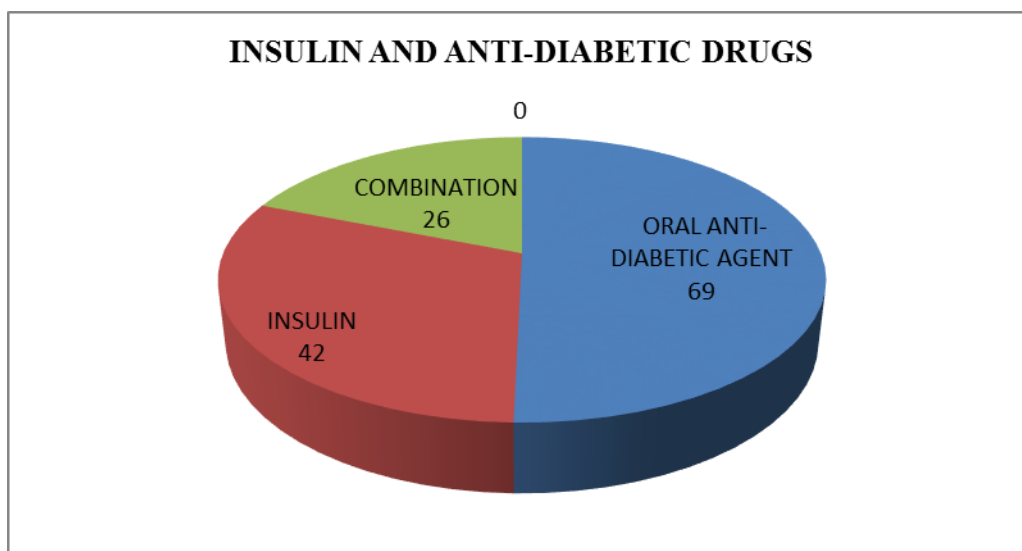
**Figure No. 6: Distribution Based On Commonly Prescribed Insulin**

#### **DISTRIBUTION BASED ON INSULIN AND ORAL ANTI-DIABETIC DRUGS**

(N=137)

**Table No. 7: Distribution Based On Insulin and Oral Anti-Diabetic Drugs**

DRUGS	NUMBER OF PATIENTS
ORAL ANTI-DIABETIC AGENT	69
INSULIN	42
COMBINATION	26



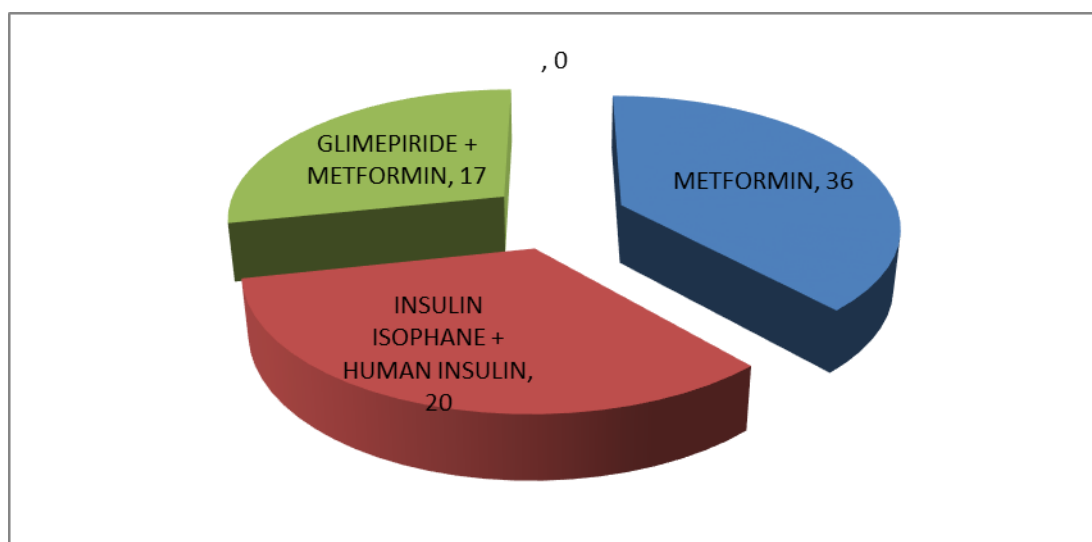
**Figure No. 7: Distribution Based On Insulin and Oral Anti-Diabetic Drugs**

**Distribution based on mostly prescribed anti-diabetic medications**

(N=73)

**Table No. 8: Distribution Based On Mostly Prescribed Anti-Diabetic Medications**

DRUGS	NUMBER OF PATIENTS
METFORMIN	36
INSULIN ISOPHANE + HUMAN INSULIN	20
GLIMEPIRIDE + METFORMIN	17

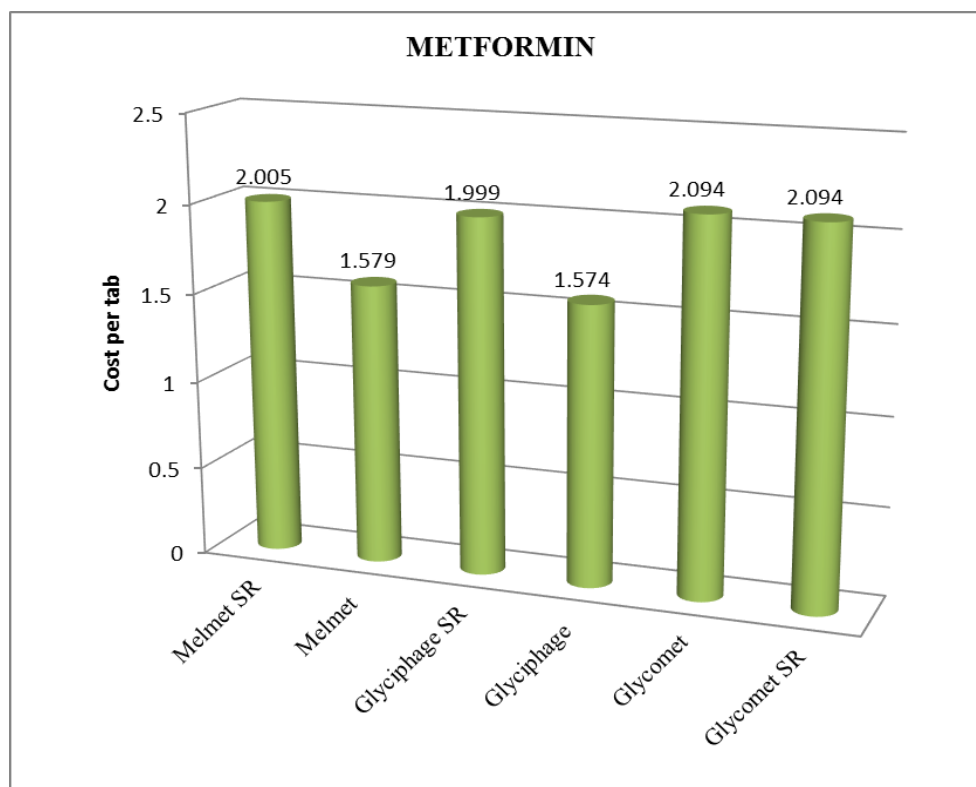


**Figure No. 8: Distribution Based On Mostly Prescribed Anti-Diabetic Medications**

## COST COMPARISON OF DIFFERENT BRANDS OF METFORMIN

**Table No. 9: Cost Comparison of Different Brands Of Metformin(Cost/Tab)**

DOSE	Melmet SR	Melmet	Glyciphage SR	Glyciphage	Glycomet	Glycomet SR
500 MG	2.005	1.579	1.999	1.574	1.579	2.094



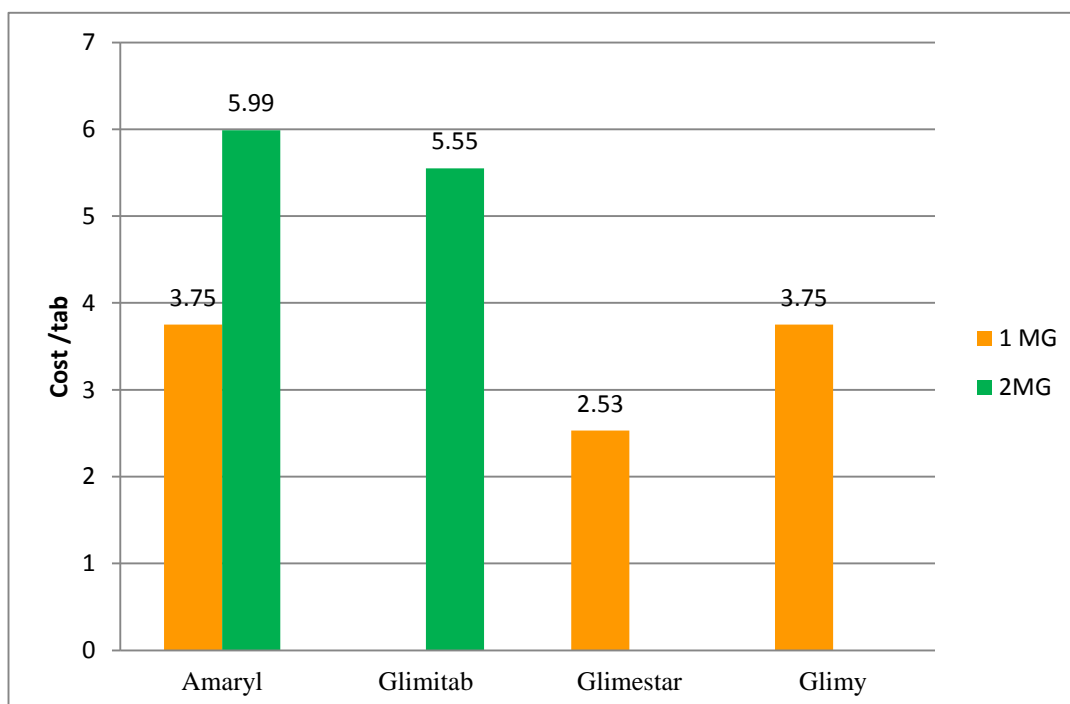
**Figure No. 9: Cost Comparison of Different Brands of Metformin(Cost/Tab)**

## COST COMPARISON OF DIFFERENT BRANDS OF GLIMEPIRIDE

**Table No. 10: Cost Comparison of Different Brands of Glimepiride (cost/tab)**

DOSE	Amaryl	Glimitab	Glimestar	Glimy
1MG	3.75	—	2.53	3.75
2MG	5.99	5.55	—	—



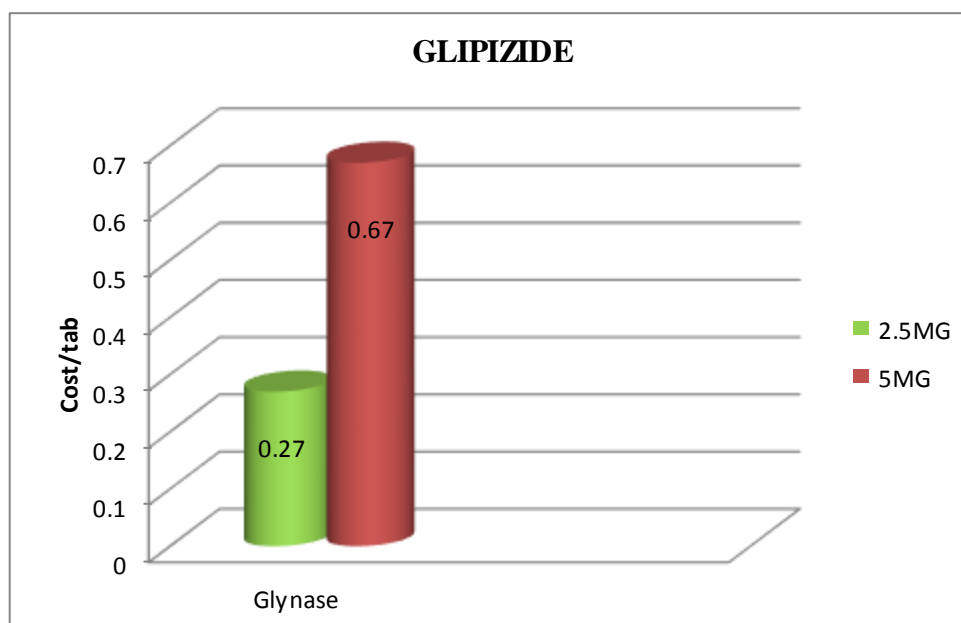


**Figure No. 10: Cost Comparison of Different Brands of Glimepiride (cost/tab)**

#### COST COMPARISON OF DIFFERENT BRANDS OF GLIPIZIDE

**Table No. 11: Cost Comparison of Different Brands of Glipizide (Cost/Tab)**

DOSE	Glynase
2.5MG	0.27
5MG	0.67

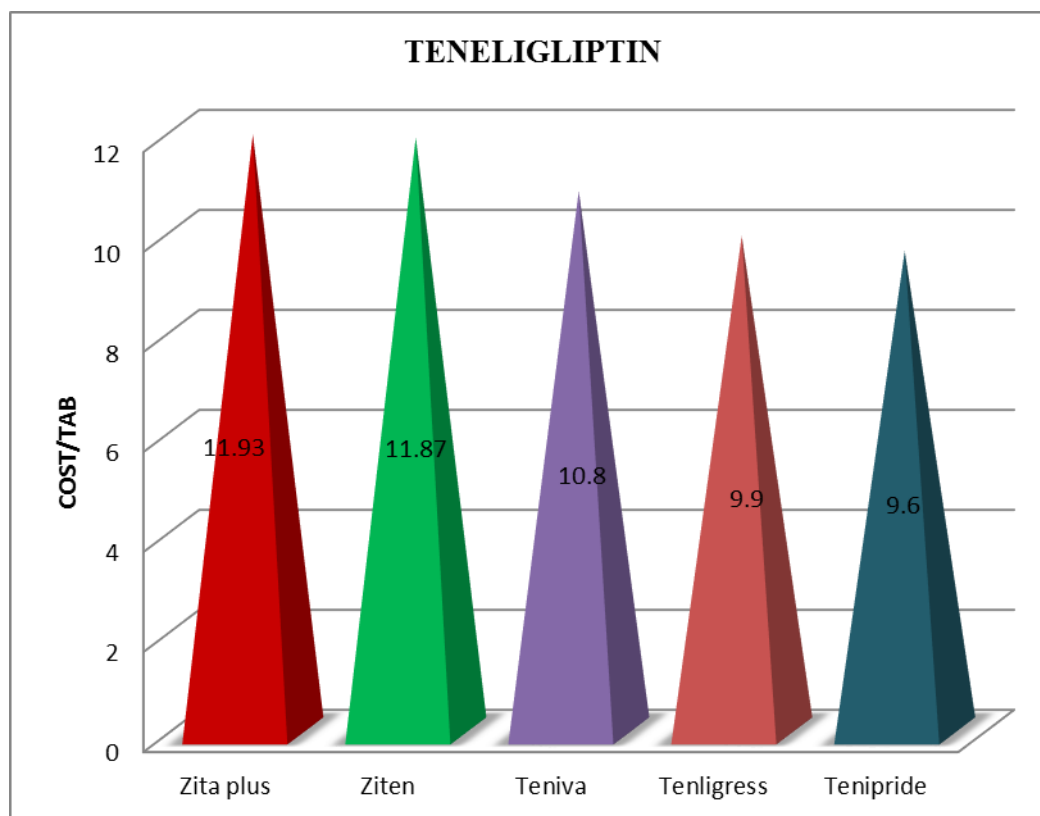


**Figure No. 11: Cost Comparison of Different Brands of Glipizide(Cost/Tab)**

#### **COST COMPARISON OF DIFFERENT BRANDS OF TENELIGLIPTIN**

**Table No. 12: Cost Comparison of Different Brands of Teneligliptin (Cost/Tab)**

DOSE	Zita plus	Ziten	Teniva	Tenligress	Tenipride
20MG	11.93	11.87	10.8	9.9	9.6



**Figure No. 12: Cost Comparison of Different Brands of Teneligliptin (Cost/Tab)**

#### **COST COMPARISON OF DIFFERENT BRANDS OF VOGLIBOSE**

DOSE	Vobose	Voglite
0.2MG	–	3.3
0.3MG	10.4	–

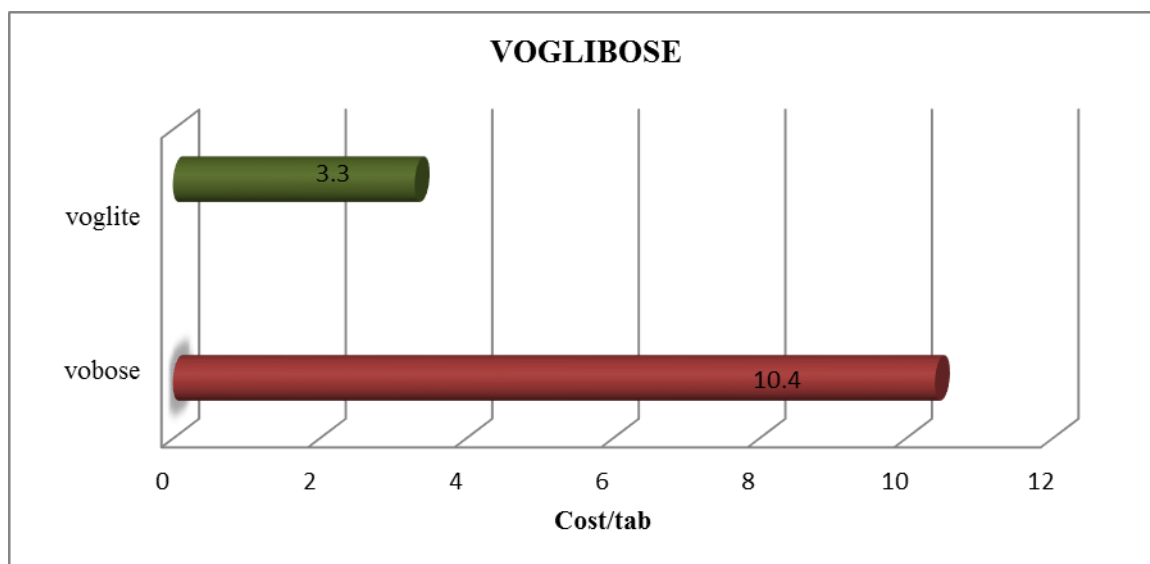


Figure No. 13: Cost Comparison of Different Brands of Voglibose

### COST COMPARISON OF DIFFERENT BRANDS OF METFORMIN + GLIMEPIRIDE

Table No. 13: Cost Comparison of Different Brands of Metformin + Glimepiride (Cost/Tab)

DOSE	Glimed MF2	Glisimet M2	Glimp M1	Azulix MF	Megamet G2	Glycomet GP2
500 + 2MG	4.73	–	–	–	–	9.46
500+ 1MG	–	–	7.23	7.12	–	–
1000+ 2MG	–	8.20	–	–	12.02	–

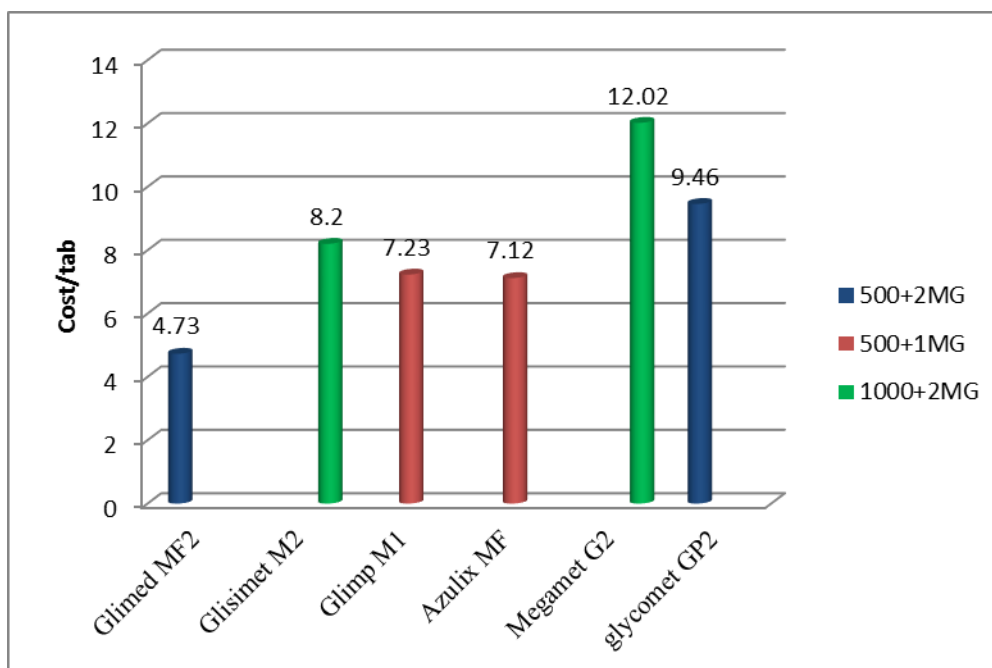


Figure No. 14: Cost Comparison of Different Brands of Metformin+Glimepiride

#### COST COMPARISON OF DIFFERENT BRANDS OF METFORMIN+SITAGLIPTIN

Table No. 14: Cost Comparison of Different Brands of Metformin+Sitagliptin (Cost/Tab)

DOSE	JANUMET	ISTAMET
500+50MG	25.33	25.33

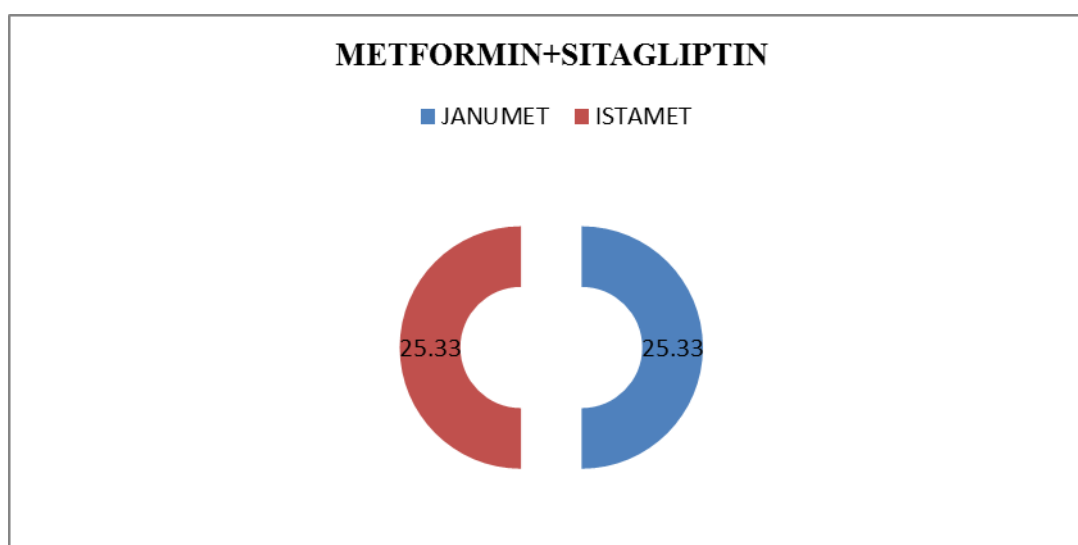


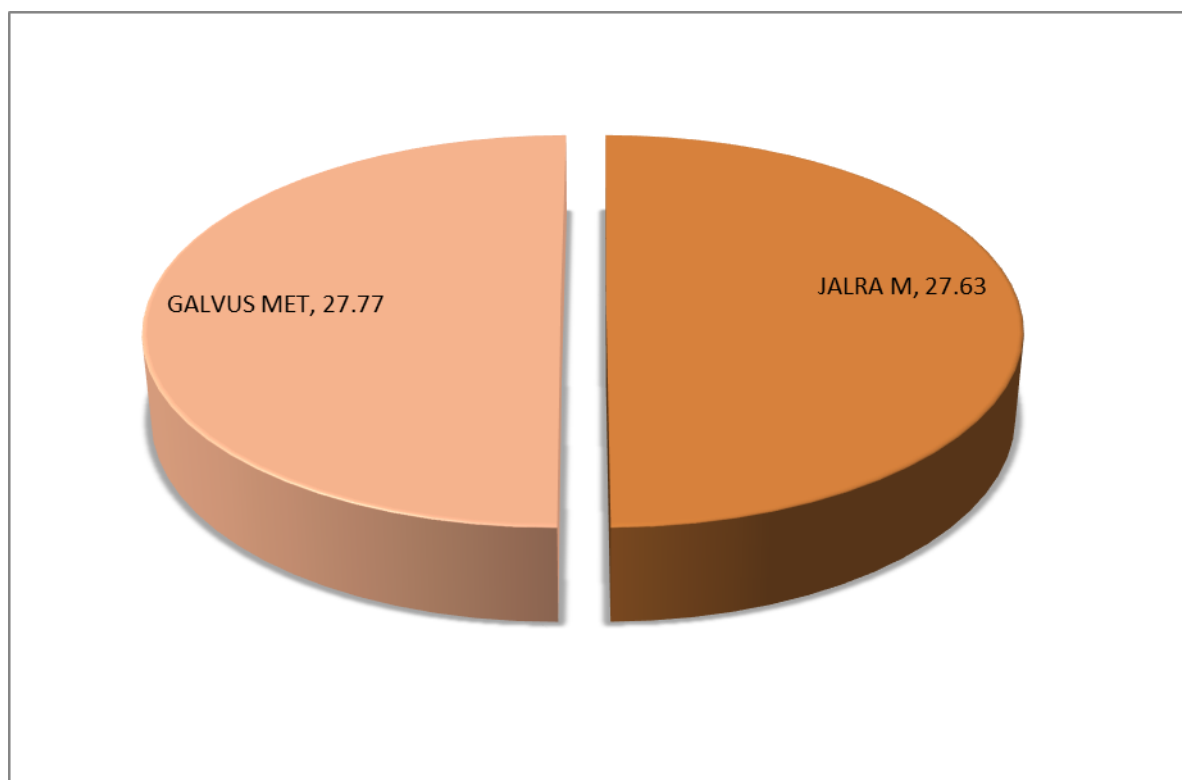
Figure No. 15: Cost Comparison of Different Brands of Metformin+Sitagliptin

# COST COMPARISON OF DIFFERENT BRANDS OF METFORMIN+VILDAGLIPTIN

**Table No. 15: Cost Comparison of Different Brands of Metformin + Vildagliptin (Cost/Tab)**

DOSE	JALRA M	GALVUS MET
500 + 50 MG	27.63	27.77

## METFORMIN+VILDAGLIPTIN



**Figure No. 16: Cost Comparison of Different Brands of Metformin + Vildagliptin**

**TABLE No. 16: MINIMUM AND MAXIMUM COST AMONG MONO-DRUG REGIMEN**

Sl. No.	Generic name	Strengt h [mg]	Least cost brand	Price (per tab)	Highest cost brand	Price (per tab)	Numbe r of brands	Averag e price	Percentage variation [%]
1	Metformin	500	Glyciphage	1.57	Glycomet SR	2.09	6	1.83	33.12
2	Glimepride	1	Glimestar	2.64	Amaryl	3.77	3	3.21	42.80
		2	Amaryl	5.99	Glimitab	6.76	2	6.37	12.85
3	Teneligliptin	20	Tenepride	9.60	Zita plus	11.93	5	10.77	24.27

**Single brand**

Sl. No.	Generic Name	Strength [mg]	Brand	Price	Number of brands
4	Glipizide	2.5	Glynase	0.27	1
		5	Glynase	0.67	1
5	Vildagliptin	50	Galvus	26.52	1
6	Gliclazide	40	Glizid	3.75	1
		80	Glizid	6.05	1
7	Pioglitazone	15	Pioz	5.25	1
8	Voglibose	0.2	Voglibose	3.3	1
		0.3	Vobose	10.43	1

**TABLE No. 17: MINIMUM AND MAXIMUM COST AMONG COMBINATION DRUG**

Sl. No.	Drug 1	Strength [mg]	Brand	Least Price	Brand	Highest Price	Number of brands	Mean	Percentage variation[%]
1	Metformin+ Glimepiride	500+ 1mg	Azulix MF	7.12	Glimp M1	7.23	5	7.17	1.54
2	Metformin+ Vildagliptin	500+ 50mg	Jalra M	27.63	Galvus met	27.77	2	27.70	0.50

**Single brand**

Sl. No.	Drug	Strength (mg)	Brand	Price	No.of brands
3	Metformin+gliclazide	500+40	Glycinorm M 40	5.84	1
4	Metformin+glipizide	500+5	Glynase MF	1.53	1
5	Metformin + pioglitazone	500+15	Pioz MF	9.67	1
6	Metformin+sitagliptin	500+50	Janumet, Istamet	25.3	2

**TABLE No. 18: QUESTIONNAIRE RESULT**

Variables	Subgroups	General questions		p-value	Significance
		Adequate	Inadequate		
Age group	35-45	1 (50)	1 (50)	0.220	NS
	46-55	12 (80)	3 (20)		
	56-65	13 (68.42)	6 (31.58)		
	66-75	10 (40)	15 (60)		
	Above 75	6 (31.57)	13 (68.43)		

## CONCLUSION

Diabetes mellitus is a group of metabolic disorders associated with abnormalities in carbohydrate, protein, and fat metabolism which results in hyperglycemia. Its risk factor can be related to obesity, history of GDM, hypertension, dyslipidemia, PCOD and history of cardiovascular disease. DM is frequently caused by physical inactivity and diet, which is often accompanied by excessive thirst and hunger, weight loss, blurred vision and skin infections.

From the above data, we found that in mono-drug regimen Metformin followed by Glimepiride were frequently prescribed. When comparing the cost of mono-drug regimen and combination of Metformin & Glimepiride, the combination therapy was found to be costlier. By assessing the patient's knowledge about diabetes using a DKQ we found that most of the patients were unaware of diabetes. So we done the patient counseling to improve the patient's knowledge.

The major advantage of our study is that it helps to decrease the overall health care cost and increase the patient's adherence which results in better patient outcome. The limitation is that no patients having diabetes from gynecology department is reported in our study. Most of our supporting studies shows that combination therapy is cheaper than mono- drug regimen. But our study result reflects that mono-drug regimen is cheaper when compared to combination therapy.



## ACKNOWLEDGEMENT

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## REFERENCES

1. Dr. Shikha Mishra<sup>1</sup>, Dr. Parag Sharma, Dr. Manuj Sharma. Prescribing Pattern and Efficacy of Oral Hypoglycaemic Agents in Maintaining Optimal Glycemic Levels in Diabetic Patients. IJMHR 2018;4(9):32-36.
2. Rajesh Dupaguntla, Hima Bindu Gujarlamudi. Pharmacoeconomic Evaluation of Oral Hypoglycemic Drugs Available in Indian market. The Pharma Innovation Journal 2017;6(9):436-439.
3. Jha N. Cost Analysis for Management of Type 2 Diabetes: A Case Study of Rural and Urban Setting. Journal of Nepal Health Research Council 2004;2(2):55-59.
4. Luh Putu Febryana Larasanty, Made Ary Sarasmita, I Gusti Ngurah Agung Dewantara Putra. Cost-Effectiveness Analysis of Insulin Regimen on Type 2 Diabetes Mellitus Outpatient in Denpasar Municipality. Asian Journal of Pharmaceutical and Clinical Research 2018;11(1):89-92.
5. Soumya Mary Alex, Sreelekshmi BS, Smitha S, Jiji KN, Arun S Menon, Uma Devi P. Drug Utilization Pattern of Anti-Diabetic Drugs among Diabetic Outpatients in a Tertiary Care Hospital. Asian Journal of Pharmaceutical and Clinical Research 2015;8(2):144-146.
6. Shuyan Gu, Zhiliu Tang, Lizheng Shi, Monika Sawhney, Huimei Hu, Hengjin Dong. Cost-Minimization Analysis of Metformin and Acarbose in Treatment of Type 2 Diabetes. Value in Health Regional Issues 2015;6(3):84-88.
7. Jambu Jain, Parag Sharma, Jigisha Jain, Mustafa Raja. Utilization Pattern of Oral Hypoglycemic Agents for Diabetes Mellitus Type 2 Patients Attending Out-patient Department at Tertiary Care Centre in Bhopal, Madhya Pradesh, India. IJBCP 2016;5(5):1826-1830.
8. Sarah Wild, Richard Sicree, Gojka Roglic, Hilary King, Anders Green. Global Prevalence of Diabetes. Diabetes Care 2004;27(5):1047-1053.
9. Chinmay D. Deshmukh, Anurekha Jain. Diabetes Mellitus: A Review. International Journal of Pure & Applied Bioscience 2015;3(3):224-230.
10. Scot H. Simpson, Paula Corabian, Philip Jacobs, Jeffrey A. Johnson. The Cost of Major Comorbidity in People with Diabetes Mellitus. CMAJ 2003;168(13):1661-1667.
11. Charles AK Yesudian, Mari Grepstad, Erica Visintin and Alessandra Ferrario. The Economic Burden of Diabetes in India: A Review of the Literature. Globalization and Health 2014;10(1):1-18.
12. Giwa Abdulganiyu, Tayo Fola. Cost Effectiveness Analysis of Anti-Diabetic Therapy in a University Teaching Hospital. International Journal of Pharma Sciences and Research 2014;5(3):82-91.
13. Giuseppe Derosa and Sibilla Anna Teresa Salvadeo. Glimepiride Pioglitazone Hydrochloride in the Treatment of Type 2 Diabetes. Clinical Medicine: Therapeutics 2009;1(1):835-845.
14. Rui L, Farah M. Chowdhury, Ping Zhang, Lawrence E Barker, Xuanping Zhang. Cost Effectiveness of Interventions to Prevent and Control Diabetes Mellitus: A Systematic Review. Diabetes Care 2010;33(8):1872-1894.
15. Suzanne A. Boren, Karen A. Fitzner, Pallavi S. Panhalkar and James E. Specker. Costs and Benefits Associated With Diabetes Education: A Review of the Literature. American Association of Diabetes Educators 2009;35(1):72-96.
16. Gyeongsil Lee<sup>1</sup>, Seung-Won Oh<sup>2</sup>, Seung-Sik Hwang, Ji Won Yoon. Comparative Effectiveness of Oral Antidiabetic Drugs in Preventing Cardiovascular Mortality and Morbidity: A Network Meta-Analysis. Journal.Pone 2017;1(1):1-16.
17. Tri Murti Andayani, Ike Imaningsih. Cost Analysis of Antidiabetic Drugs for Diabetes Mellitus Outpatient in Kodya Yogyakarta Hospital. Malaysian Journal of Pharmaceutical Sciences 2007;5(1):19-23.

18. Shah Jainam V, Patni Kalyani N, Deshpande Shrikalp S. Pharmacoeconomic Evaluation, Cost Minimization Analysis of Anti-Diabetic Therapy in Gujarat. IJMRHS 2016;5(3):34-43.
19. Dnyanesh Limaye<sup>1</sup>, Krishna Todi, Jay Shroff, Ashutosh Ramaswamy. Cost-Effectiveness Study of Antidiabetic Drugs in Type 2 Diabetes Mellitus Patients from Mumbai, India. International Journal of Community Medicine and Public Health 2017;4(9):3180-3185.
20. David R. Whiting, Leonor Guariguata, Clara Weil, Jonathan Shaw. IDF Diabetes Atlas: Global Estimates of the Prevalence of Diabetes for 2011 and 2030. Diabetes Research and Clinical Practice 2011;94(1):311-321.
21. Rabiya Ahamed, K. Dileep, J. John Kirubakaran<sup>1</sup>, M.D Dhanaraju. Cost Analysis of Anti- Diabetic Drugs in India. Saudi Journal of Medical and Pharmaceutical Sciences 2018;4(11):1291-1294.
22. Richard F. Pollock, William J. Valentine, Gordon Goodall, Michael Brandlec. Evaluating the Cost-Effectiveness of Self-Monitoring of Blood Glucose in Type 2 Diabetes patients on Oral Anti-Diabetic Agents. Swiss Medical Weekly 2010;5(1):1-10.
23. Christina S. Kwon, Enrique Seoane Vazquez, Rosa Rodriguez Monguio. Cost-Effectiveness Analysis of Metformin+Dipeptidyl Peptidase-4 Inhibitors compared to Metformin+Sulfonylureas for Treatment of Type 2 Diabetes. BMC Health Services Research 2018.
24. Khushali G. Acharya, Kartik N. Shah, Nilay D. Solanki, Devang A. Rana. Evaluation of Antidiabetic Prescriptions, Cost and Adherence to Treatment Guidelines: A Prospective, Cross-Sectional Study at a Tertiary Care Teaching hospital. Basic Clin Pharm 2013;4(4):82-87.
25. Nirmal George, Ajith Kumar PV, Vijayalekshmi Amma S. Glycemic Control and Cost-Effectiveness attained by the Drug Utilization of Oral Antidiabetic Agents in a Tertiary Care Hospital in South India.
26. Pertiwi P, Setia , Perwitasari D.A. Cost Effectiveness Analysis of Type-2 Antidiabetic Drugs in PKU Muhammadiyah Yogyakarta Hospital, Indonesia. Advanced Science Letters 2017;23(12):12482-12485.
27. Kannan, Arshad, Senthil K. A Study on Drug Utilization of Oral Hypoglycemic Agents in Type-2 Diabetic Patients. Asian J Pharm Clin Res 2011;5:60-4.
28. King H, Aubert RE, Herman WH. Global Burden of Diabetes 1995-2025: Prevalence, Numerical Estimates, and Projections. Diabetes Care 1998;21:1414-1431.
29. Hermansen K, Mortensen LS, Hermansen ML. Combining Insulins with Oral Antidiabetic Agents: Effect on Hyperglycemic Control, Markers of Cardiovascular Risk and Disease. Vasc Health Risk Manag 2008;4:561-574.
30. Scot H. Simpson, Paula Corabian, Philip Jacobs, Jeffrey A. Johnson. The cost of major comorbidity in people with diabetes mellitus. CMAJ 2003;168(13):1661-1667.
31. Dr. Shashikanth Hedge, Dr. Litty Brijith Antony, Dr. Rajesh K.S, Dr. Arun Kumar M.S. Assessment of Knowledge and Attitude among Diabetic Patients about Their Oral Health-A Questionnaire study. IOSR-JDMS 2017;17(1):28-33.
32. Kaveeshwar, S. A., & Cornwall, J. The current state of diabetes mellitus in India. The Australasian medical journal 20147(1), 45.
33. International Diabetes Federation, I. D. IDF diabetes atlas. Seventh. International Diabetes Federation. 2015;9(3):20-25.
34. World Health Organization. World Health Day 2016: Diabetes. SEARO 2016;5(2):52-55
35. Gale, J. India's Diabetes Epidemic Cuts Down Millions Who Escape Poverty. Bloomberg. 2010;2(1):10-12.
36. Mojtabai, R., & Olfson, M. Medication costs, adherence, and health outcomes among Medicare beneficiaries. Health Affairs (2003)22(4), 220-229.
37. Gagne, J. J., Choudhry, N. K., Kesselheim, A. S., Polinski, J. M., Hutchins, D., Matlin, O. S., & Shrank, W. H. Comparative effectiveness of generic and brand-name statins on patient outcomes: a cohort study. Annals of internal medicine (2014)161(6), 400-407.
38. M. Ray. Pharmaco-Economics In: A. Remington Text Book of Pharmaceutical Science and Practice of Pharmacy, 19th edition, Mack Publishing Company, Easton Pennsylvania, 1993, 1931-1933.
39. W. F. McGhan. Pharmaco-Economics In: A. Remington Text Book of Pharmaceutical Science and Practice of Pharmacy, 19th edition, Mack Publishing Company, Easton Pennsylvania, 1993, 1929-1930.
40. J. L. Bootman, R. J. Townsend and W. F. McGhan. Pharmacoeconomics In: J. L. Bootman and R. J. Townsend Text Book of Principles of Pharmacoeconomics, 2nd edition, Harvey Whitney Books, Cincinnati Ohio, 1996, 1-98.

41. S. Enright. Hospital Pharmacy. Am Med J., 1983, 40: 83.
42. F. Curtiss. Pharmaco-Economics In: A. Remington Textbook of Pharmaceutical Science and Practice of Pharmacy, 19th edition, Mack Publishing Company, Easton Pennsylvania, 1993. 1928-1937.
43. F. Popcorn and M. Melby. (1992). The 21st Century Hospital Pharmacy In: F. Popcorn and M. Melby (eds) Book of Changing Healthcare Delivery System, City Press, Orlando, 1992, 1-32.
44. R. H. Townsend. Postmarketing Drug Research and Development. Drug Intell Clin Pharm., 1987, 21: 134-136.
45. World Health Organization. Taskforce on Health Economics and Health Sector Reform report (WHO-TF/HE/HSR/75), 1996, 1-56.
46. R. Arenas- Guzman, A. Tosti, R. Hay et al. Pharmacoeconomics: an aid to better decision making. J Eur Acad Dermatol Venereol., 2005, 19 (1): 34-39.
47. J. Ahuja, M. Gupta, A. K. Gupta et al. Pharmaco-Economics. Natl Med J India, 2004, 17 (2): 80-83.
48. F. Rachael. An Introduction to Health Economics. The PJ., 2003, 271: 679-681.
49. M. Napper, J. Newland. Health Economics Information Resources. Self Study Course. United State National Library of Medicine, Bethesda, 2003, 1-106.
50. World Health Organization. Defined Daily Dose approach to economic evaluation of drug therapy. World Health Organization Health economics and Health sector reform document (WHO/HE/HSR-2007), 2007, 1-176.
51. World Health Organization. Arising Global Burden of Diabetes. WHO Diabetes Programme/WHO Diabetes Action, now booklet on country and regional data on diabetes mellitus, 2010, 1-326.
52. J. A. Cantrill. (1999). Diabetes Mellitus In: R. Walker, and C. Edward Text Book of Clinical Pharmacy and Therapeutics, 2nd edition, McGraw-Hill companies Inc., USA, 1999, 633-652.
53. A.G. Bakari, G. C. Onyemelukwe. Glucose intolerance among apparently healthy Hausa-Fulani in North-Eastern Nigerian. Ann Afr Med., 2004, 3: 32-34.
54. C.M. Kozma, C.E. Reeder, R.M. Schulz. (1993). Economic, Clinical and Humanistic Outcomes: a planning model for Pharmacoeconomic research. Clin Ther., 1993, 15 (6): 1121-1132.
55. Joshi SR, Parikh RM. India - diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007;55:323-4.
56. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. Australas Med J. 2013;6(10):524-31.
57. Sanne G, Swinnen, Joost B, Hoekstra, J. Hans De Vries. Insulin Therapy for Type 2 Diabetes. Diabetes care 2009;32(2):112-125.
58. Joseph T. Di Piro, Robert L. Talbert, Gary C. Yee, Gary R. Matzke, Barbara G. Wells, L. Michael Posey. Pharmacotherapy A Pathophysiologic Approach 7<sup>th</sup> edition 2008:1205-1206.
59. S. Palaian, AChhetri, M Prabhu, S Rajan, P Shankar. Role of Pharmacist in Counseling Diabetes Patients. Internet Journal of Pharmacology 2004;4(1):20-25.
60. Kasper, Fauci, Hauser, Longo, Jameson, Loscalzo. Harrison's Principles of Internal Medicine 19<sup>th</sup> edition 2017:2399-2421.
61. Sanne G. Swinnen, Joost B. Hoekstra, J. Hans De Vries. Insulin Therapy for Type 2 Diabetes. Diabetes care 2009;32(2):253-259.
62. KD Tripathi. Essentials of Medical Pharmacology 7<sup>th</sup> edition 2013: 259,270.