(RESEARCH ARTICLE)

A cross-sectional study on prescribing pattern analysis of antidiabetic drugs in diabetes mellitus and its associated co-morbidities in tertiary care hospital

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Abstract

Importance: Diabetes is defined as a heterogeneous metabolic disorder characterized by chronic hyperglycemia and disruptions in carbohydrate, fat, and protein metabolism

Objective: To analyze the patterns of use of major pharmaceutical drug classes given for diabetes and comorbidities. To determine the which age group and gender are more prone to diabetes mellitus.

To identify and analyze the prescriptions with multiple drug therapy. To determine the signs and symptoms, risk factors, life style modifications, complications & co-morbidities in patients with diabetes mellitus. To provide patient counselling regarding life style changes in diabetes mellitus.

Design and Settings: It is prospective, observational study conducted on 100 patients in endocrinology Department at Prathima Institute of Medical Sciences. In this study, we analyzed the prescription pattern of anti-diabetic drugs, insulin treatment and its combination therapy in patients with Diabetes mellitus with or without comorbidities in a tertiary care hospital.

Participants: Study population: 100.Study Criteria; Inclusion criteria include: Adults of age group above 20 years of both sexes with Dm. Exclusion criteria includes: Pediatrics, Pregnant women.

Results: The present study included a total of about 100 patients out of which were 72 males and 28 were females. Maximum numbers of patients were found to be from 50-60 years of age, which contributed to 30% of the total sample size. 68% of the patients are mostly prescribed with class biguanides(metformin),11 % with class insulin and less prescribed were Thiazolidinediones (pioglitazone) 2% of whole. 48% of the patients are mostly prescribed combination therapy with class biguanides + sulfonyl urease (metformin + Glimepiride), 21 % with Biguanides+Dpp4 inhibitors (Metformin + sitagliptin) and less prescribed were Biguanides+ sulfonyl urease+SGLT2(metformin + Glimepiride + Dapagliflozin) with 3% of whole. 95 (75%) of the patients are prescribed monotherapy ,27(21%) with 2 drug therapy and 5(4%) with 3 drug therapy of the whole.

Hypertension was the common co-morbidity followed by CAD. DM+ HTN (52%), DM +CAD (10%), DM+CVA (5%), DM + others (7%) and DM without comorbidities (26%).40%,38%,12%,10% were under weight, normal weight, over weight and obese respectively. 53% were hypertensive and 47% were Non – hypertensive. 96 patients with medication adherence and 4 were neglecting. 46%,20%,15%,11%,1% were alcoholic, smokers, tobacco chewers, smokers + alcoholic, smokers + alcoholic + tobacco chewer respectively. However, 7% of the sample were neither alcoholic, smoking nor   tobacco chewers. 80 (80%) of patients had No form of physical activity, 14(14%) were doing regular

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exercise. 68% were consuming rice and chapati, 23% were consuming only rice, 68% were inadequate sleep, 30%were normal sleep, 30% were decreased Appetite, 53% were increased appetite, 26% were Less thirst, 60% were more thirst. The prescribed therapeutic class of drugs for co-morbidities among patients were ARB'S-Telmisartan in 17 number of patients, Beta blockers-Carvedilol in 27 number of patients, CCB'S- amlodipine in 16 number of patients, HMG-COA reductase-Atorvastatin in 26 number of patients, Diuretics-Hydrochlorothiazide, spironolactone in 18 number of patients, Vasodilators-Nitro glycerin in 8 number of patients, Antiplatelets-clopidogrel, Aspirin in 29 number of patients, Anticoagulants-Warfarin in 4 number of patients, Anticonvulsants-Gabapentin in 10 number of patients, Antidepressants- Nortriptyline in 3 number of patients, combinations -Telmisartan + Amlodipine in 7 number of patients, others - vitamins, antibiotics, PPI in 37 number of patients.

Conclusion: According to the findings of our study, there is a greater need for patient education about Diabetes mellitus in order to improve patient outcomes, identify and prevent complications, and provide knowledge about medication adherence. The current study sought to examine the prescription patterns of diabetic patients with or without comorbidity, with the specific goal of determining the current trend of anti-diabetic drug. According to observed social habits, diabetic patients' lifestyles must change. The study's other goal was to implement a patient education program and treat co-morbidities among type 2 diabetes patients. Hypertension was the most common co-morbidity in our study, followed by CAD.

Keywords: Diabetes mellitus; Metabolic disorder; Hypertension; Metformin; Coronary Artery Disease

1. Introduction

Diabetes is defined as a heterogeneous metabolic disorder characterised by chronic hyperglycaemia and disruptions in carbohydrate, fat, and protein metabolism. [1] Diabetes is classified into three types: type I, type II, and gestational diabetes.

Type 1 diabetes is also known as insulin dependent diabetes mellitus (IDDM), and it is caused by an absolute lack of insulin and results from autoimmune cell destruction.

Type 2 diabetes mellitus (Type 2 DM) was previously known as non-insulin dependent diabetes mellitus (NIDDM), and it is caused by insulin resistance with an inadequate compensatory increase in insulin secretion and progressively lower insulin secretion over time. GDM (gestational diabetes mellitus) is defined as glucose intolerance that appears during pregnancy. The complications of GDM affect about 7% of all pregnancies.[2]

Diabetes risk can be increased by metabolic syndromes such as insulin resistance syndrome. [1] Diabetes symptoms include frequent urination, excessive thirst, blurred vision, sweating, rapid weight loss, slow wound healing, and fatigue.[3] India ranks second after China in the global diabetes epidemic with 77 million people with diabetes. Of these, 12.1 million are aged >65 years, which is estimated to increase to 27.5 million in the year 2045.[4] Major risk factors for developing Diabetes includes: Age >35 year, Positive family history of diabetes, Obesity (Body mass index ≥25 kg/m2), Enlarged waist or upper body adiposity (>90 cm for men and >80 cm for women), Presence of hypertension Recent weight gain, Sedentary lifestyle, Gestational diabetes.[3] Long Term Complications includes damage to your tiny blood vessels causes microvascular complications like Retinopathy, Neuropathy, Nephropathy and damage to large blood vessels causes macrovascular complications such as Coronary artery disease, Cardiovascular disease and Peripheral vascular disease[5]. Diagnosis can be done be seeing signs and symptoms, family history, FBS, RBS, Glycosylated hemoglobin (HbA1C), PLBS, Urine examination, Lipid profile. Type 1 Diabetes mellitus can be managed by Insulin, along with diet. It is also used in type 2 diabetes patients with intercurrent illness/stress (e.g., surgery, pregnancy).[7] The use of antidiabetic agents like Metformin (Biguanides), chlorpropamide (Sulphonylureas) are used to reduce blood glucose levels. Pioglitazone (Thiazolidinedione) is given in combinations with other class of drug to decrease sugar levels in plasma in type 2 diabetes. Major Risk with these drugs is Lactic acidosis, gastro intestinal, hypoglycaemia, weight gain, liver dysfunction side- effects were seen. Patients who can't take these drugs they can prefer for Acarbose (Alpha- glycosidase inhibitors) (5).

2. Methodology

A cross-sectional observational study was conducted on 100 patients in Endocrinology Department at Prathima Institute of Medical Science. In this study, we studied about prescribing pattern analysis of anti- diabetic drugs in Diabetes mellitus and its associated co-morbidities. A structured questionnaire was prepared by referring to previous literature and inferring our interaction with patients in the local language after obtaining the informed consent from the subjects.

2.1. Study criteria

2.1.1. Inclusion criteria

Patients diagnosed with diabetes mellitus above20 years of age group with other co-morbidities.

2.1.2. Exclusion criteria

Pediatric patients, Pregnant women.

2.2. Data sources

Patient Demographic information (age, gender, BMI, vital signs, sleep, appetite, frequency of urination, physical activity), past medical history and chief complaints, co-morbidities, prescribed drugs, and a questionnaire can all be collected. The information gathered will be correlated and compared.

3. Results

3.1. Gender Wise distribution

Table 1 Distribution of gender among the study population

Gender	frequency	percentage
Female	28	28 %
Male	72	72%

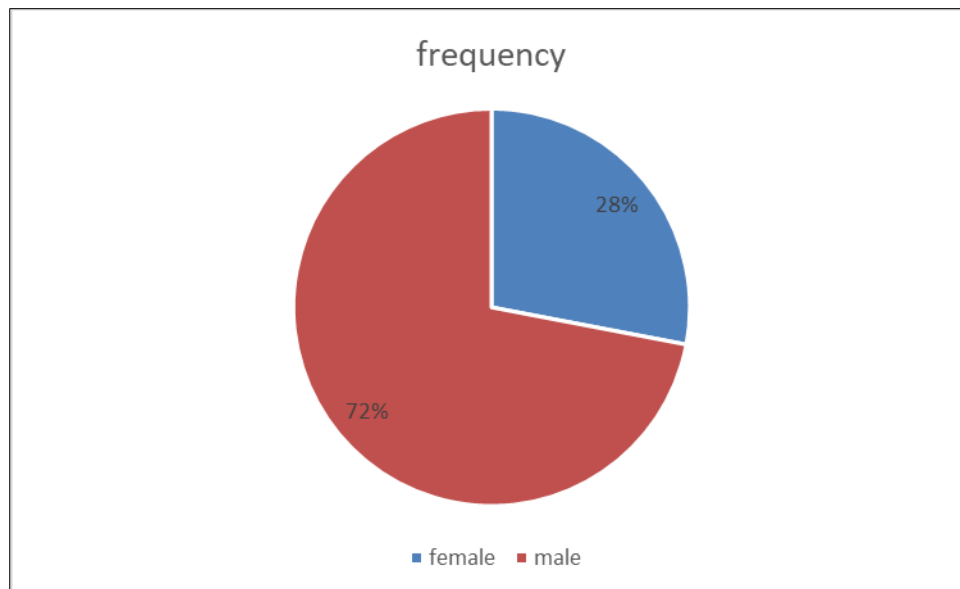Among 100 patients 72% males and 28 % female were enrolled in the study

Figure 1 Gender distribution among the study population

3.2. Age wise distribution

Table 2 Age-wise distribution

Age	Percentage
20-30	2%
30-40	4%
40-50	25%
50-60	33%
60-70	26%
70-80	10%

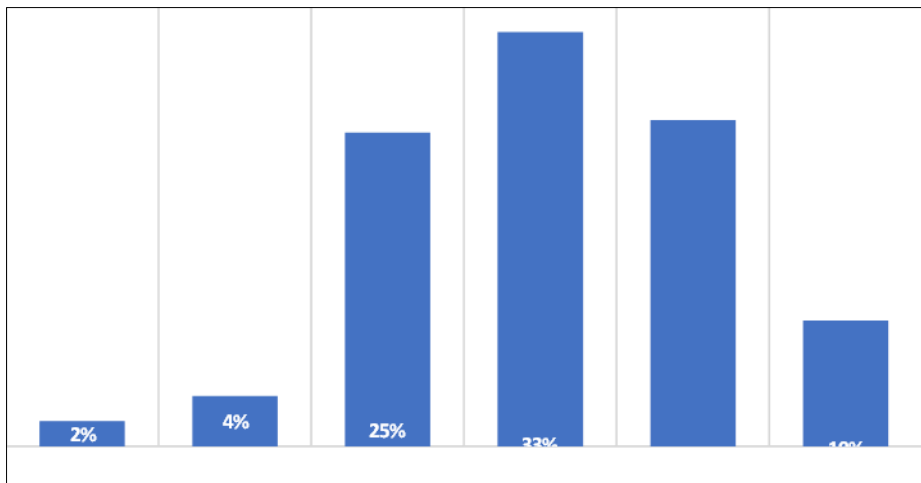The highest percentage of subjects were from the age group 50-60 accounting 33% of the whole .

Figure 2 Age-wise distribution of the subjects

3.3. Distribution based on BMI

Table 3 Distribution based on BMI

BMI	No. of patient	Percentage
Under weight	40	40%
Normal weight	38	38%
over wight	12	12%
Obese	10	10%

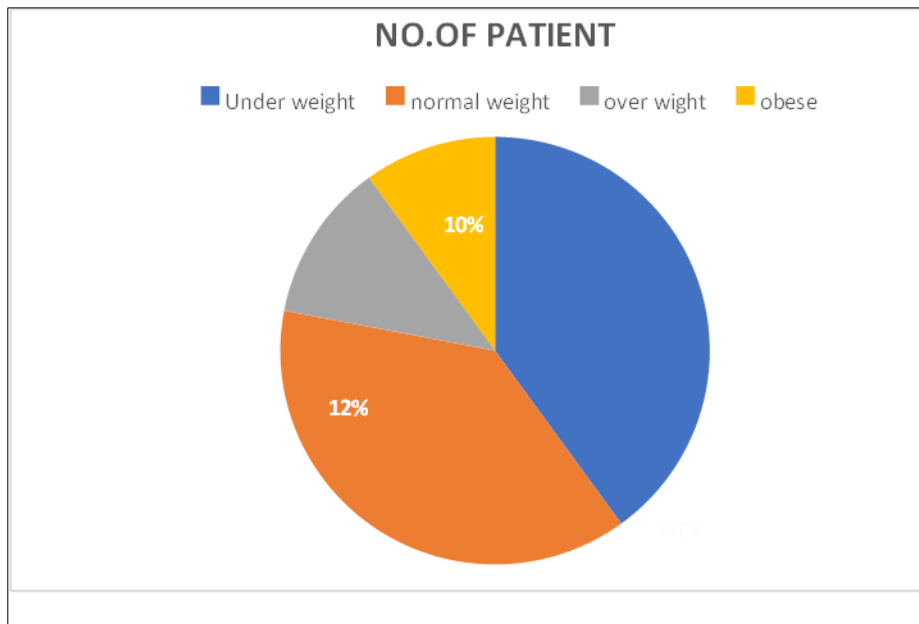Among the 100 Subjects majority of the subjects in our study 40% were under weight of BMI in male and female of whole.

Figure 3 Distribution based on BMI

3.4. Hypertension

Table 4 Based on hypertension

BP	NO. of patients	Percentage
HTN	53	53%
NON-HTN	47	47%

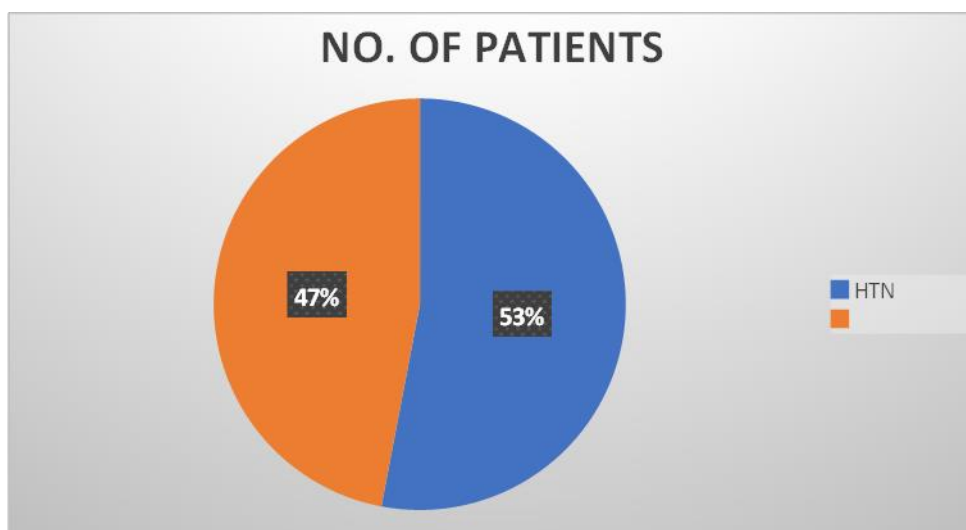Among 100 patients 53% were hypertensive and 47% were non-hypertensive

Figure 4 Distribution based on hypertension

3.5. Hypertension exist in study population

Table 5 Hypertension exist in study population

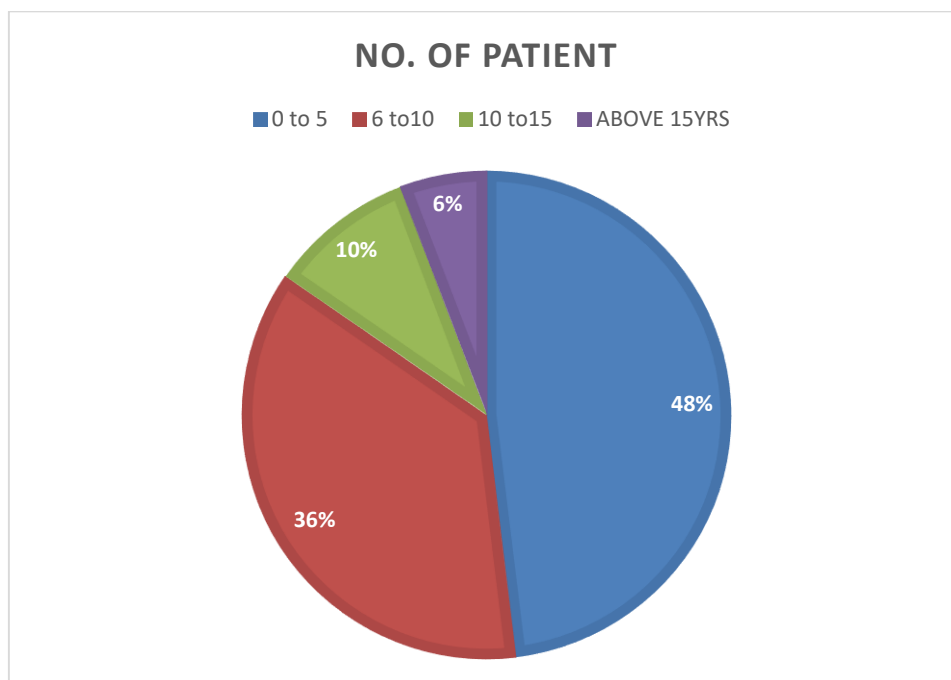| HTN (years)	NO. of patient s	Percentage
0 to 5	25	48%
6 to10	19	36%
10 to15	5	10%
ABOVE 15YRS	3	6%

Figure 5 Distribution of hypertension exist in study population

The highest percentage of hypertension were from the range 0 to 5 years accounting 48% of the whole

3.6. DM Exist in study population

Table 6 DM Exist in study population

DM (Since No. of years)	No. of Patients	Percentage
0-5	55	55 %
6 - 10	31	31%
10 - 15	7	7%
ABOVE 15	7	7%

The highest percentage of diabetics were from the range 0 to 5 years accounting 55 % of the whole
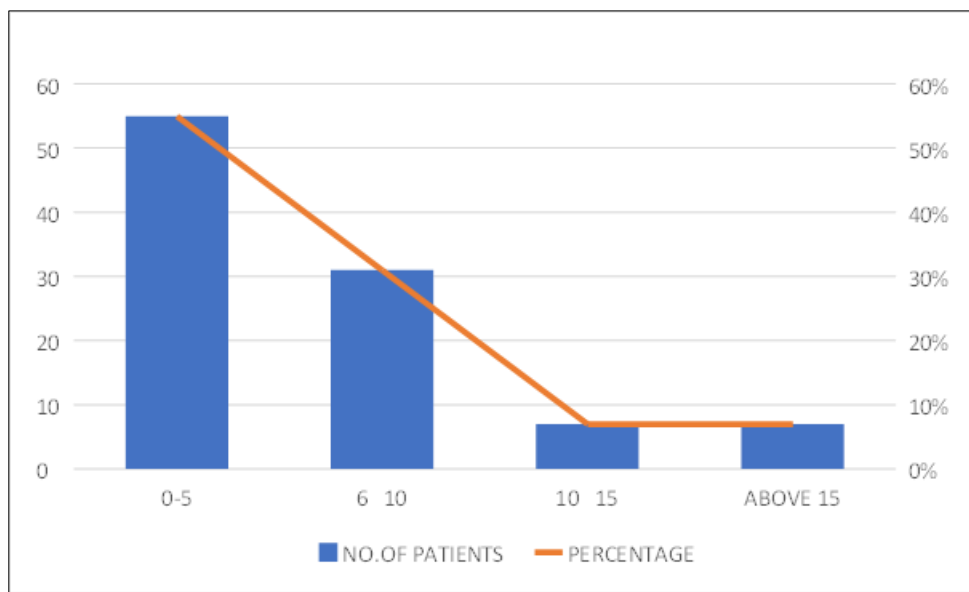
Figure 6 Distribution of DM Exist in study population

3.7. Co-morbidities exist in study population

Table 7 Co-morbidities exist in study population

Comorbidities	Frequency	Percentage
CAD	23	66%
CVA	3	8%
PARALYSIS	2	6%
OTHERS	7	20%

Out of 100 participants in the study majority 23 (66%) are with CAD as Comorbidities.
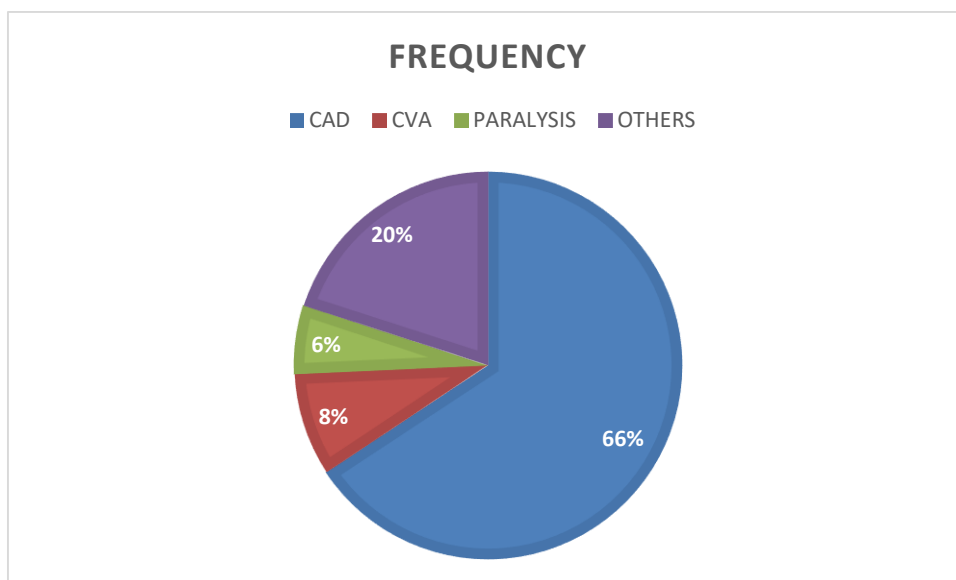

Figure 7 Co-morbidities exist in study population

3.8. Medication Adherence wise distribution

Table 8 Medication Adherence wise distribution

Medication Adherence	Frequency	Percentage
Yes	96	96%
No	0	0%
Neglect	4	4%

Among 100 patients 96 subjects with medication adherence and 4 were neglect.
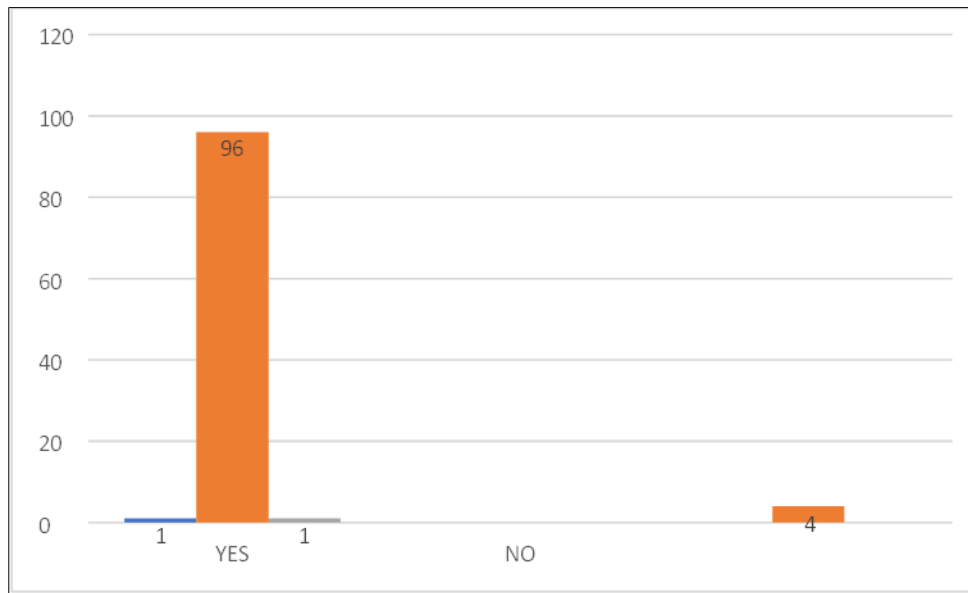

Figure 8 Medication Adherence wise distribution

3.9. Social history wise distribution

Table 9 Social history wise distribution

Social history	NO. of patient s	Percentage
Smoker	20	20%
Alcohol	46	46%
Tobacco	15	15%
Smoker + alcoholic	11	11%
Smoker + alcoholic + tobacco	1	1%
None	7	7%

Among100 participants in the study, 46% were alcoholic and 20% were smokers
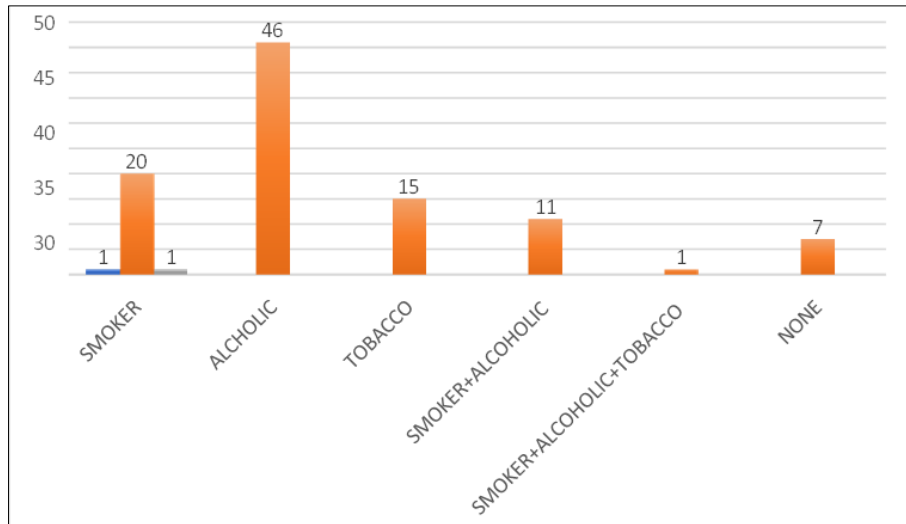
Figure 9 Social history wise distribution

3.10. Physical Activity wise distribution

Table 10 Physical Activity wise distribution

Physical Activity	Frequency	Percentage
Exercise	1	1%
Walking	14	14%
No physical activity	85	85%

According to the study, among 100 patients 80 (80%) of patients had No form of physical activity, 14(14%) were doing regular exercise.
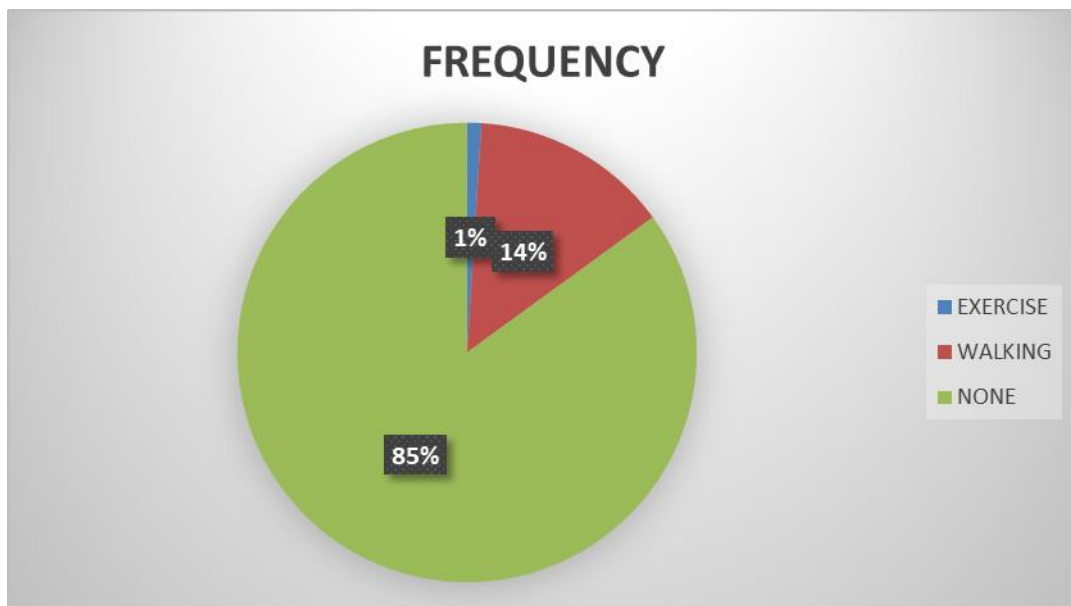

Figure 10 Physical Activity wise distribution

3.11 Diet wise distribution

Table 11 Diet wise distribution

Diet	Frequency	Percentage
Rice	23	23%
Chapati	3	3%
Rice and chapati	68	68%
Rice and others	2	2%
Chapati and others	4	4%

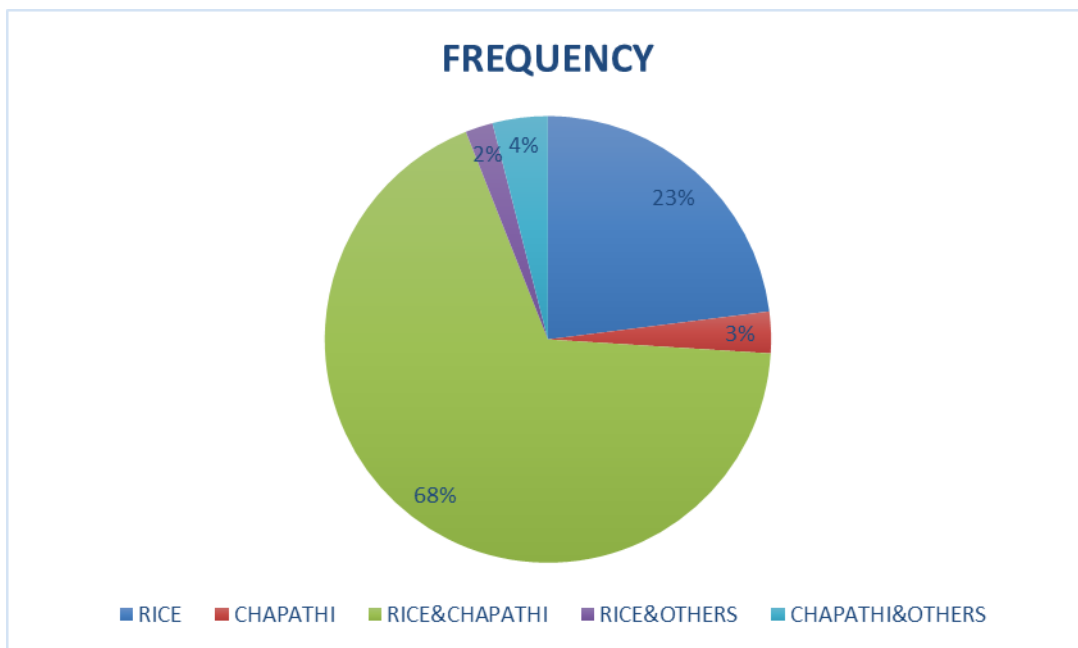Among 100 patients 68% were consuming rice and chapati ,23% were consuming only rice.

Figure 11 Diet wise distribution

3.12. Sleep wise distribution

Table 12 Sleep wise distribution

Sleep	Frequency	Percentage
Less	68	68 %
Normal	30	30%
More	2	2%

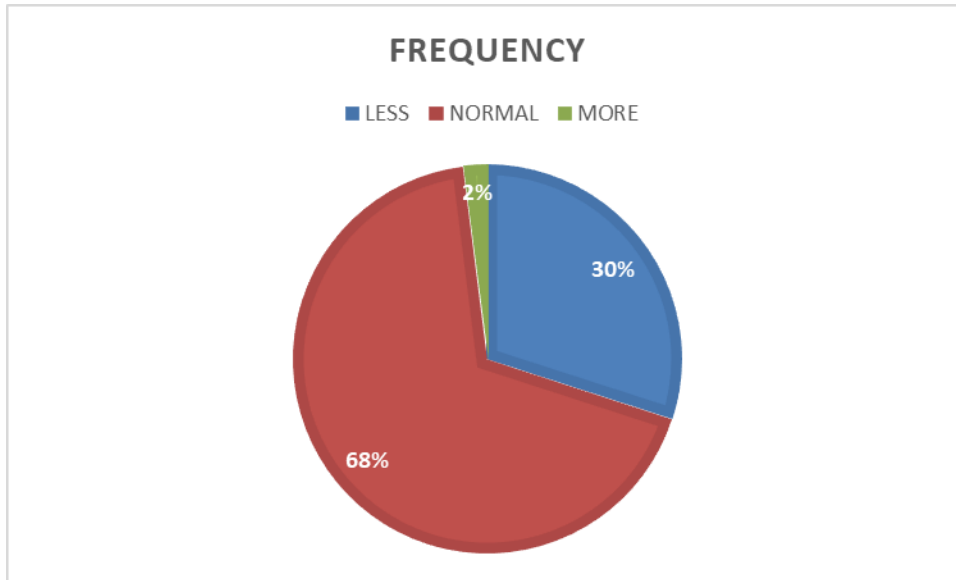Among 100 patients 68% were inadequate sleep,30%were normal sleep.

Figure 12 Sleep wise distribution

3.13. Appetite wise distribution

Table 13 Appetite wise distribution

Appetite	Frequency	Percentage
LESS	17	17%
NORMAL	30	30%
MORE	53	53%

Among 100 patients 53% were Increased Appetite,17 % were decreased appetite.

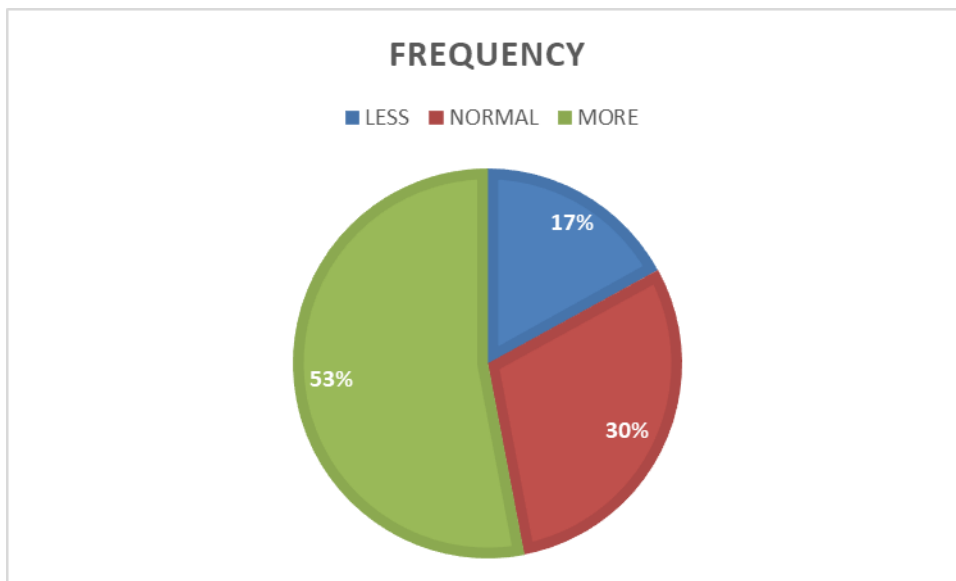**Figure 13** Appetite wise distribution

3.14. Thirst wise distribution

Table 14 Thirst wise distribution

Thirst	Frequency	Percentage
LESS	14	14%
NORMAL	26	26%
MORE	60	60%

Among 100 patient's 60 %were Increased thirst,14% were decreased thirst.
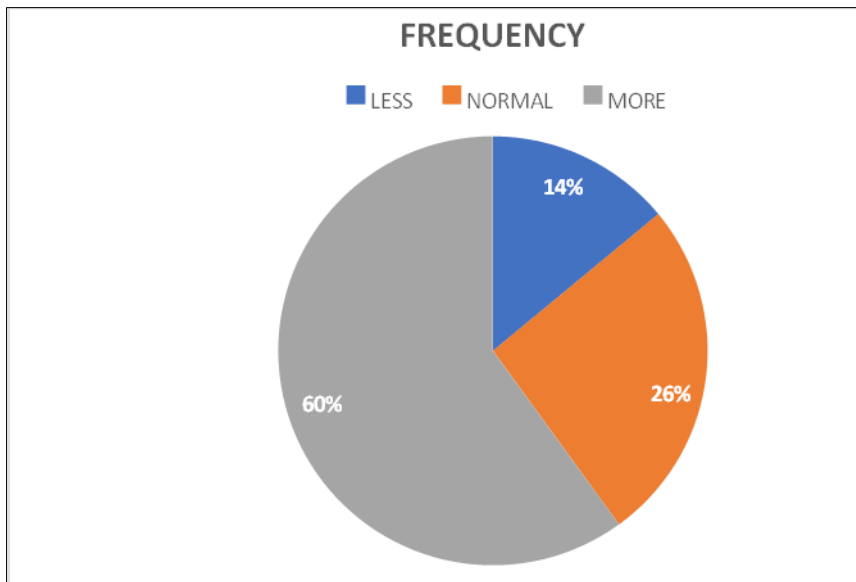

Figure 14 Thirst wise distribution

3.15. Fasting blood sugar levels

Table 15 Fasting blood sugar levels

FBS Levels	NO. of patients	Percentage
60-110	12	12%
111-150	34	34%
151-180	10	10%
More than 180	6	6%
None	38	38%

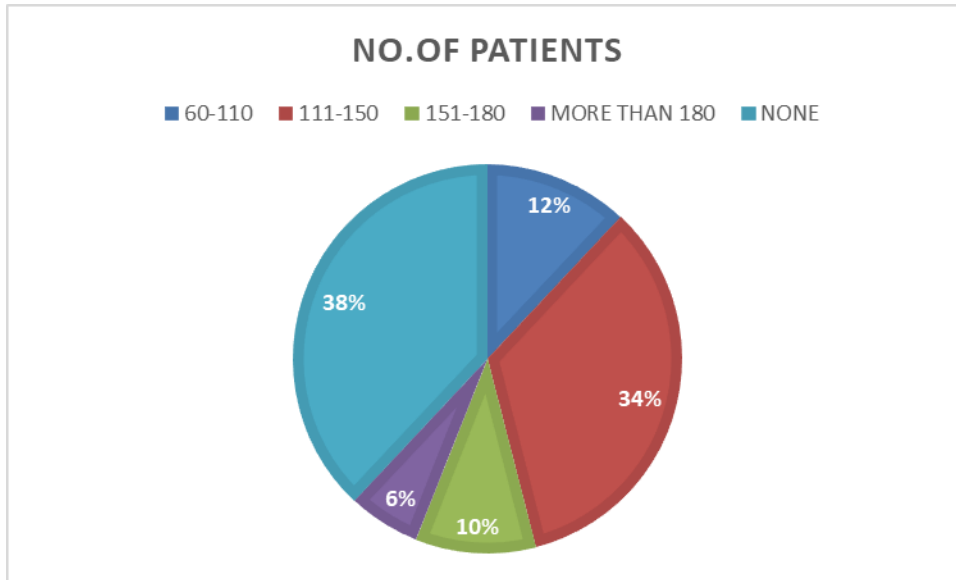Among 100 patients the highest percentage of FBS were from the range 111 -150mg/dl accounting 34(34%) of the whole.

Figure 15 Fasting blood sugar levels

3.16. Hemoglobin A1c test

Table 16 Hemoglobin A1c test

HBA1C	No of patients	Percentage
UPTO 7	5	5%
7_10	8	8%
More than 10	1	1%
None	86	86%

Among 100 patients the highest percentage of HBA1C were from the range 7-10 accounting 8(8%) of the whole
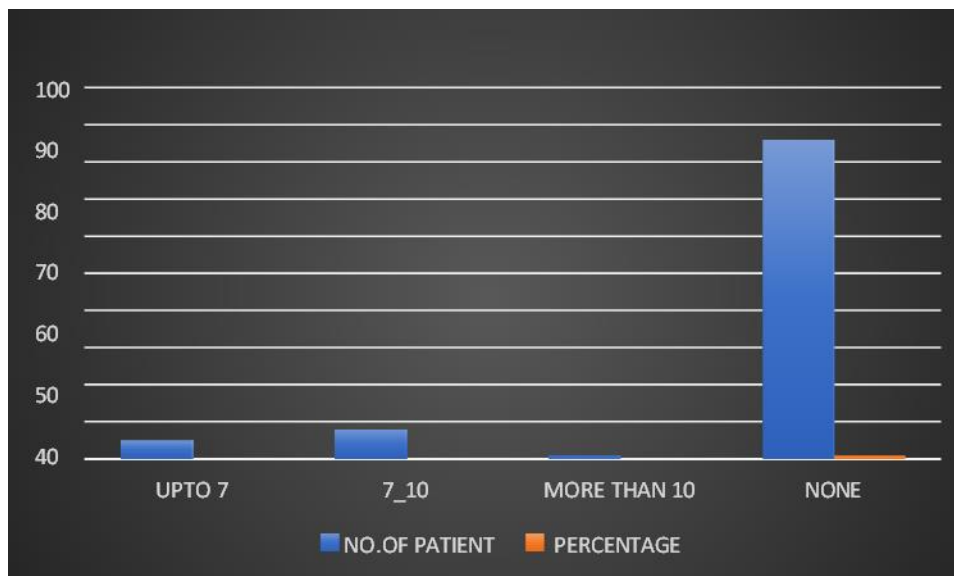

Figure 16 Haemoglobin A1c test

3.17. Post prandial blood sugar test

Table 17 Post prandial blood sugar test

PLBS Ranges	No. of patients	Percentage
UPTO 160	11	11%
161-200	14	14%
201-300	30	30%
More than 300	4	4%
None	41	41%

Among 100 patients the highest percentage of PLBS were from the range 201-300 mg/dl accounting 30(30%) and 161-200 mg/dl accounting 14(14%) of the whole.
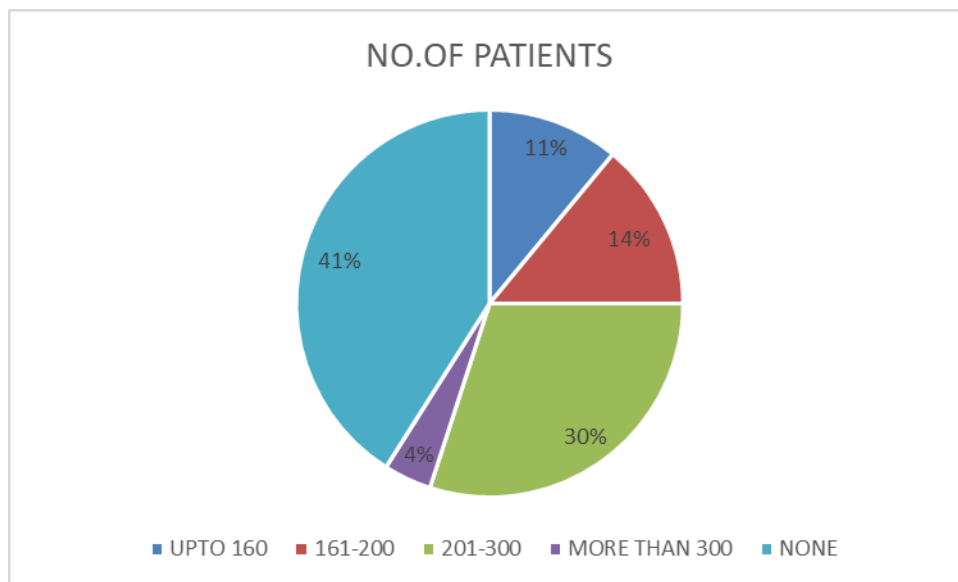

Figure 17 Post prandial blood sugar test

3.18. Random blood sugar test

Table 18 Random blood sugar test

RBS	No. of patients	Percentage
Up to 160	7	7%
161-200	12	12%
201-300	31	31%
More than 300	5	5%
RBS not done	45	45%

Among 100 patients the highest percentage of RBS were from the range 201-300 mg/dl accounting 31(31%) and 12(12%) of the whole.
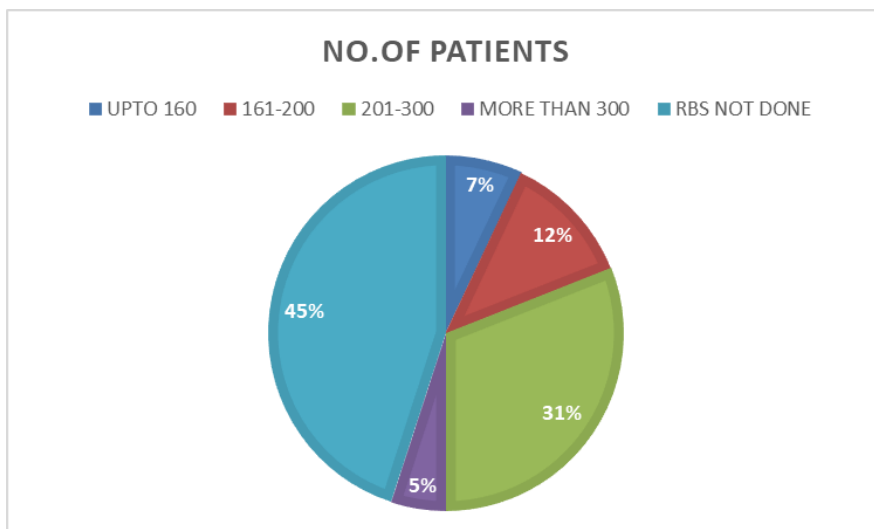
Figure 18 Random blood sugar test

3.19. Antidiabetic drugs

Table 19 Antidiabetic drugs wise distribution

class of the drug	No. of patients	Percentage
Biguanides(metformin)	49	68%
Sulfonyl urease (glimepiride)	6	8%
Thiazolidinediones (Pioglitazone)	1	2%
Dpp4inhibitors Reductase(sitagliptin)	5	7%
SGLT2(dapagliflozin)	3	4%
Insulin (Human insulin)	8	11%

Among 100 patients 68% of the patients are prescribed with class biguanides(metformin) ,11 % with class insulin (human insulin) and 8%with class sulfonyl urease(glimepiride) of whole.
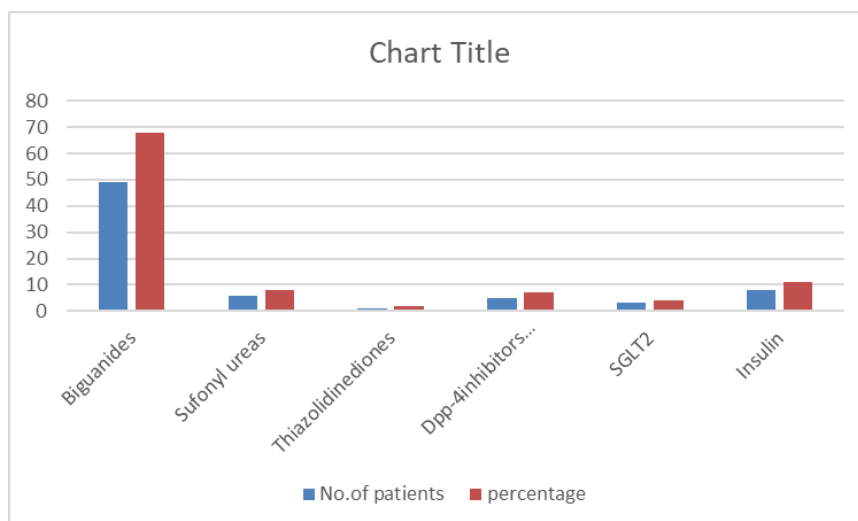

Figure 19 Antidiabetic drugs wise distribution

3.20. Combination therapy

Table 20 Combination therapy wise distribution

Combinations drugs	No. of patients	percentage
Biguanides+ Thiazolidinediones (metformin +pioglitazone)	1	4%
Biguanides+ Thiazolidinedione s+ sulfonyl urease (metformin + pioglitazone + glimepiride)	2	7%
Biguanides+SGLT2(metformin + Dapagliflozin)	3	10%
Biguanides+Dpp4 inhibitors (metformin+ sitagliptin)	6	21%
Biguanides +sulfonyl urease (metformin+ Glimepiride)	14	48%
Biguanides+ sulfonyl urease+SGLT2(metformin +glimepiride+ dapagliflozin)	1	3%
Biguanides + sulfonyl urease + alpha glucoside inhibitors (metformin+ glimepiride+ acarbose)	2	7%

Among 100 patients 48% of the patients are prescribed combination therapy with class biguanides + sulfonyl urease (metformin+ Glimepiride), 21 % with Biguanides+Dpp4 inhibitors (metformin+ sitagliptin) and 10% with Biguanides+SGLT2 (metformin + Dapagliflozin) of whole.
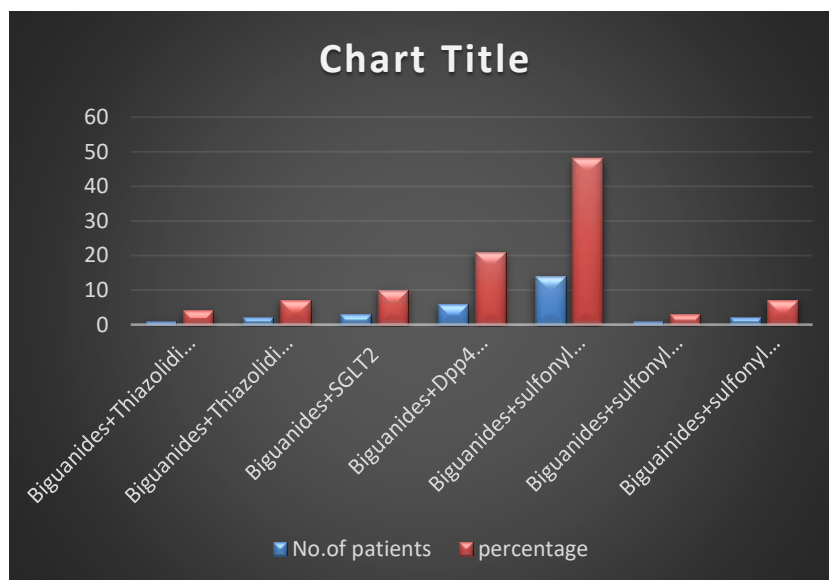

Figure 20 Combination therapy wise distribution

3.21. Monotherapy and combination therapy of antidiabetic drugs prescribed in type-2 diabetic patient

Table 21 Monotherapy and combination therapy of antidiabetic drugs prescribed in type-2 diabetic patient

Drugs	Frequency (%)
Monotherapy	95(75%)
2 drug therapy	27(21%)
3 drug therapy	5(4%)

Among 100 patients 95 (75%) of the patients are prescribed monotherapy ,27(21%) with 2 drug therapy and 5(4%) with 3 drug therapy of the whole.
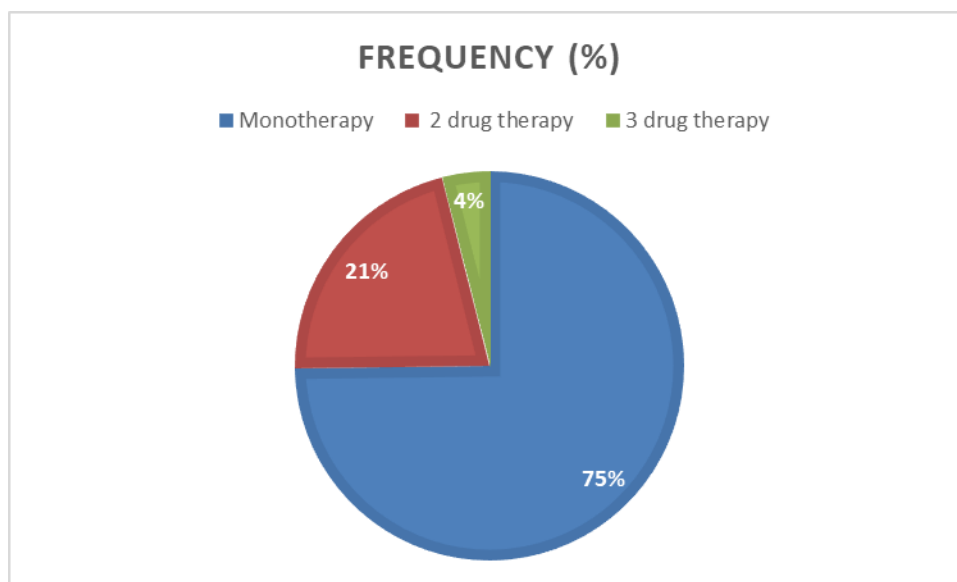
Figure 21 Monotherapy and combination therapy of antidiabetic drugs prescribed in type-2 diabetic patients

3.22. Diabetes mellitus with co-morbidities

Table 22 Distribution based on Diabetes mellitus with co-morbidities

DM with comorbidities	NO. of patients	Percentage
DM + HTN	52	52%
DM +CAD	10	10%
DM+CVA	5	5%
DM+ OTHERS	7	7%
DM without comorbidities	26	26%

Out of 100 participants in the study 52% were with DM+ HTN ,10% are with DM + CAD and 26% are without comorbidities.
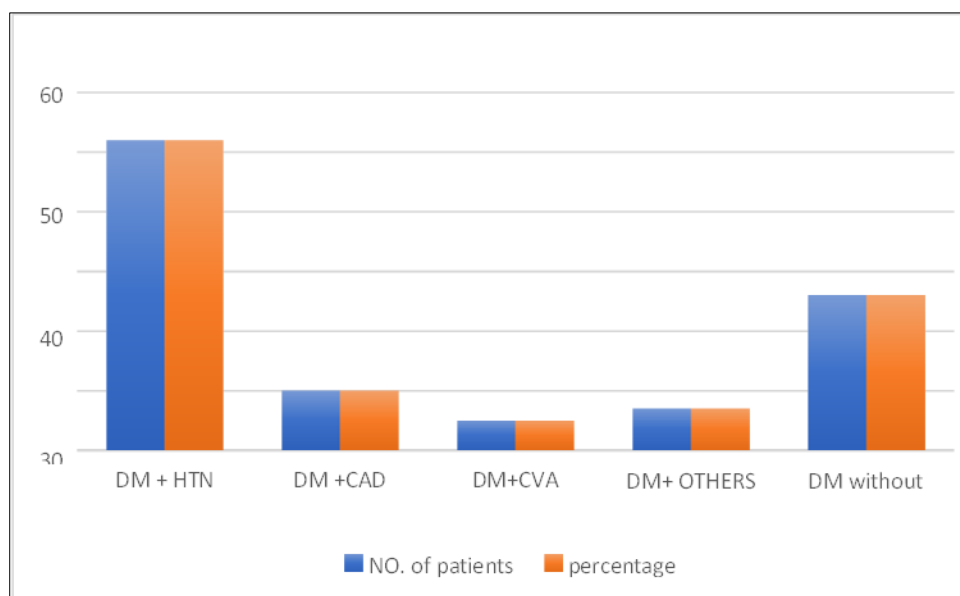
Figure 22 Distribution based on Diabetes mellitus with co-morbidities

3.23. Therapeutic class of drugs

Table 23 Therapeutic class of drugs

Drug class	No. of patients
ARB'S(Telmisartan)	17
Beta blocker(carvedilol)	27
CCB'S (amlodipine)	16
HMG-CO A reductase (Atorvastatin)	26
Diuretics (Hydrochlorothiazide, spironolactone)	18
Vasodilators (Nitro glycerine)	8
Antiplatelets (clopidogrel, aspirin)	29
Anticoagulants (Warfarin))	4
Anticonvulsants (gabapentin)	10
Antidepressants (Nortriptyline)	3
Combinations (telmisartan +amlodipine)	5
(vitamins, antibiotics, PPI)	37

Among 100 Subjects in our study 29 patients have been prescribed with class Antiplatelets (clopidogrel, aspirin),27 patients with class Beta blocker (carvedilol) ,26 patients are prescribed with HMG-COA reductase(atorvastatin) and 37 patients with other class of drugs of whole.

4. Conclusion

According to the findings of our study, there is a greater need for patient education about Diabetes mellitus in order to improve patient outcomes, identify and prevent complications, and provide knowledge about medication adherence. The current study sought to examine the prescription patterns of diabetic patients with or without comorbidity, with the specific goal of determining the current trend of anti-diabetic drug. According to observed social habits, diabetic patients' lifestyles must change. The study's other goal was to implement a patient education program

and to treat co-morbidities among type 2 diabetes patients. Hypertension was the most common co-morbidity in our study, followed by CAD. The most prescribed class was biguanides(metformin) followed by class insulin. The most prescribed combination therapy was class biguanides + sulfonyl urease (metformin+ glimepiride) followed by Biguanides+Dpp4 inhibitors (metformin+ sitagliptin). Monotherapy is preferred mostly in the diabetic patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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