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A Prospective Observational Study of Drug Usage Pattern and Potency of Antihypertensives and Oral Hypo Glycemics in a Multispeciality Hospital

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ABSTRACT

Objectives: The objective of this study was to evaluate drug usage patterns and potency of anti-hypertensives and oral hypoglycemics in general medicine department in Malla Reddy Multispeciality Hospital, Surraram. A well-designed case record form was used to collect the data of the recruited patients prospectively and by direct interaction with the patient or attendee of the patient, from laboratory reports and case file of the patient. 200 inpatients receiving antihypertensives and/or oral hypoglycemics over a period of six months were included in the study. The patients demographics and prescription details were recorded and analyzed on the basis of age, gender, Anatomical therapeutic classification(ATC), Defined Daily Dose (DDD) and World Health Organisation (WHO). **Results**: 200 patients (67% were males and 33% were females) with mean age group of 49.7 ± 8 were evaluated. The most commonly prescribed class of antihypertensives was Calcium channel blockers (CCB's) (42%) followed by Angiotensin II Receptor Blockers(ARB's)(36.82%). In monotherapy, Telmisartan 40mg(32.4%) was mostly prescribed followed by Amlodipine 5 mg (29%), in combination therapy Amlodipine+Telmisartan (31.7%). Among Biguanides, Metformin (73.19%) was most commonly prescribed monotherapy and combination therapy was Metformin+Glimepiride (90%). **Conclusion**: From this study, we could conclude that all the prescriptions were according to WHO guidelines and the most commonly prescribed antihypertensives and oral hypoglycemics showed least side effects with more effectiveness with almost 85% improved quality of life in the patients. The study concluded that the most commonly prescribed class of antihypertensives was calcium channel blockers, Telmisartan in monotherapy and in combination telmisartan+amlodipine. In oral-hypoglycemics, metformin was mostly prescribed with least adverse effects and in combination, metformin+glimepiride.

INTRODUCTION

Hypertension is leading cause of deaths in the world. Approximately 7.6 million deaths (13-15% of the total) and 92 million disability-adjusted life years worldwide were attributable to high blood pressure in 2001. Hypertension attributes to 10% of Ischemic Heart Disease, 21% of peripheral vascular disease, 24% of Acute Myocardial infarction and 29% of strokes.

CLASS OF ANTIHYPERTENSIVE DRUGS	
DIURETICS	
Thiazides	Hydrochlorthiazide, Chlorthalidone, Indapamide
High Ceiling	Furosemide, Torsemide, Furosemide, Ethacrynic acid.
K+ Sparing Diuretics	Captopril, Enalapril, Lisinopril, Perindopril, Ramipril, Fosinopril
Calcium Channel Blockers	Amlodipine, Verapamil, Diltiazem
Angiotensin II Receptor Blockers	Telmisartan, Losartan, Candesartan, Irbesartan
β Adrenergic Blockers:	Propranolol, Metoprolol, Atenolol
Direct Renin Inhibitor	Aliskiren

➢ **DIURETICS:** Diuretics, preferably a thiazide, are first-line agents for hypertension. Moreover, when combination therapy is needed in hypertension to control BP, a diuretic is recommended to be one of the agents used.

➢ **THIAZIDE DIURETICS:** In patients requiring diuresis to treat concurrent edema, such as in heart failure, a loop diuretic should be considered. Diuretics should ideally be dosed in **the morning if given once daily**, and in the **morning and afternoon** when dosed twice daily to minimize risk of **nocturnal diuresis.**

Side effects of thiazide-type diuretics include hypokalemia, hypomagnesemia, hypercalcemia, hyperuricemia, hyperglycemia, dyslipidemia, and sexual dysfunction. Many of these side effects were identified when high-doses of thiazides were used in the past (e.g., hydrochlorothiazide 100 mg/day).[(1)]

➢ **ACE INHIBITORS :** ACE inhibitors have the following actions:

- Dilate arteries and veins by blocking angiotensin II formation and inhibiting bradykinin metabolism. This vasodilation reduces arterial pressure, preload and afterload on the heart.

- Down regulate sympathetic adrenergic activity by blocking the facilitating effects of angiotensin II on sympathetic nerve release and reuptake of norepinephrine.

- Promote renal excretion of sodium and water (natriuretic and diuretic effects) by blocking the effects of angiotensin II in the kidney and by blocking angiotensin II stimulation of aldosterone secretion. This reduces blood volume, venous pressure and arterial pressure. ACE INHIBITORS ARE CONTRAINDICATED IN PREGNANCY. [(2)]

➢ **ANGIOTENSON RECEPTOR BLOCKERS**: ARBs have the lowest incidence of side effects compared to other antihypertensive agents. [(3)]Because they do not affect bradykinin, they do not have the potential to illicit a dry cough like ACE inhibitors.

ARBs may cause renal insufficiency, hyperkalemia, and orthostatic hypotension.

➢ **CALCIUM CHANNEL BLOCKERS:** In patients with hypertension and diabetes, dihydropyridine CCBs appear to be less cardioprotective than ACE inhibitors.[(4)]

Dihydropyridine CCBs are very effective in older patients with isolated systolic hypertension. A long-acting dihydropyridine CCB should be strongly considered in isolated systolic hypertension.

Among dihydropyridines, short-acting nifedipine may rarely cause an increase in the frequency, intensity, and duration of angina in association with acute hypotension.

➢ **BETA BLOCKERS [(5):]** Many of the side effects of beta-blockers are related to their cardiac mechanisms and include bradycardia, reduced exercise capacity, heart failure, hypotension, and atrioventicular (AV) nodal conduction block. Beta-blockers are therefore contraindicated in patients with sinus bradycardia and partial AV block.

The side effects listed above result from excessive blockade of normal sympathetic influences on the heart.

α1-Blockers: Prazosin, terazosin, and doxazosin are selective α1-receptor blockers.

They work in the peripheral vasculature and inhibit the uptake of catecholamines in smooth muscle cells resulting in vasodilation and BP lowering.severe side effect of α1-blockers is a "first-dose" phenomenon that is characterized by transient dizziness or faintness, palpitations, and even syncope within 1 to 3 hours of the first dose. (6)

COMBINATION THERAPY: The goal of antihypertensive therapy is to abolish the risks associated with blood pressure (BP) elevation without adversely affecting quality of life. Drug selection is based on efficacy in lowering BP and in reducing cardiovascular (CV) end points including stroke, myocardial infarction, and heart failure.

Specific Drug Combinations: Two-drug combinations involving classes of pharmacologic agents that reduce CV end points (diuretics, 'are not reviewed. Combinations that are less effective on the basis of efficacy, safety, or tolerability concerns are also identified.

- **ACE/ARB Inhibitor + THIAZIDE Diuretic:** The combination of an ACE inhibitor, ARB, or direct renin inhibitor with a low-dose, thiazide-type diuretic results in fully additive BP reduction. (7)

Diuretics initially reduce intravascular volume and activate the RAAS, leading to vasoconstriction as well as salt and water retention. Addition of a RAAS inhibitor to a thiazide-type diuretic also improves its safety profile by ameliorating *DIURETIC-INDUCED HYPOKALEMIA***,** but can result in hyperkalemia in susceptible patients.

- **ACE/ARB + CCB:** The combination of an ACE inhibitor or ARB with a CCB results in fully additive BP reduction.

- **Renin Inhibitor + ARBs:** The combination of a renin inhibitor with an ARB produces partially additive BP reduction and is well-tolerated. In a study in which maximum approved doses of valsartan and aliskiren were combined, a 30% additional BP response was observed compared with either monotherapy.(37).

- **CCBS + Diuretics:** The combination of a diuretic and a CCB results in partially additive BP reduction.(8)

Presumably, this partial effect reflects overlap in the pharmacologic properties of the two drugs. CCBs increase renal sodium excretion, albeit not to the same extent as diuretics. Moreover, long-term treatment with both classes is associated with vasodilation, given that volume depletion does not occur with diuretics.

➢ **β-Blockers + Diuretics:** Although β-blockers reduce CV end points , but they are less effective than diuretics, ACE inhibitors, ARBs, and CCBs.

➢ **THIAZIDE Diuretics + Potassium-sparing Diuretics:** Hypokalemia is an extremely important dose-related side effect of thiazide diuretics. Because of the risk of hypokalemia that can lead to cardiac arrhythmias, and sudden death, HCTZ 50 mg and chlorthalidone 25 mg should generally be used in combination with a potassium-sparing agent (or an inhibitor of the RAAS).

➢ **CCBs + β-Blockers:** In one study, a low-dose combination of felodipine ER and metoprolol ER produced BP reduction comparable to maximum doses of each agent with an incidence of edema similar to placebo.[9]The combination of a β-blocker and a dihydropyridine CCB is acceptable.

β-blockers should not generally be combined with nondihydropyridine CCBs such as verapamil or diltiazem because their additive effects on heart rate and A-V conduction may result in severe bradycardia or heart block.

LESS EFFECTIVE COMBINATIONS

ACE Inhibitors + ARBs

RAAS Inhibitor + β-Blocker

β-BLOCKERS + CENTRALLY ACTING AGENTS

ORAL HYPOGLYCEMICS: Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart and blood vessels.

CLASS OF ORAL HYPOGLYCEMICS	
BIGUANIDES	
SULFONYL UREAS	Metformin
First Generation:	Acetohexamide, Tolbutamide, Chlorpropamide, Tolbutamide
Second Generation:	Glibenclamide, Glimepiride, Gliclazide
Meglitinides	Repaglinide, Nateglinide
Thiazolidinediones	Rosiglitazone, Pioglitazone
Alpha Glucosidase Inhibitors	Acarbose, Miglitol
DPP-4 Inhibitors	Sitagliptin, Vidagliptin, Saxagliptin
Incretin Agonists	Exenatide, Liraglutide

➢ **SULFONYL UREAS:** Sulfonylureas are classified as first-generation and second-generation agents. First generation agents consist of acetohexamide, chlorpropamide, tolazamide, and tolbutamide. Each of these agents is lower in potency relative to the second-generation drugs: glimepiride, glipizide, and glyburide.

Individuals at high risk for hypoglycemia (e.g., elderly individuals and those with renal insufficiency. Hyponatremia (serum sodium 60 years, female gender, and concomitant use of thiazide diuretics. Weight gain is common with sulfonylureas. Other notable, although much less common, adverse effects of sulfonylureas are skin rash, hemolytic anemia, GI upset, and cholestasis. Disulfiram-type reactions and flushing have been reported.

➢ **BIGUANIDES:** Metformin is the oldest agents that work by reducing hepatic glucose output and, to a lesser extent, enhancing insulin sensitivity in hepatic and peripheral tissues.

➢ **MEGLITINIDES: Repaglinide**: Repaglinide is a short-acting glucose-lowering drug recently approved by the Food and Drug Administration for therapy of type 2 diabetes alone or in combination with metformin. It is structurally different than sulfonylureas, but acts similarly by increasing insulin secretion**.**

Natiglinide: Natiglinide is a very short-acting glucose lowering drug whose mode of action is similar to the sulfonylureas and is nearing approval by the FDA. A potential advantage of this drug is that it seems to have its effect on the first phase of insulin release rather than the late phase release.

➢ **THIAZOLIDINEDIONE'S:** The thiazolidinediones such as (Rosiglitazone) and (Pioglitazone) reverse insulin resistance by acting on muscle, fat and to a lesser extent liver to increase glucose utilization and diminish glucose production.

➢ **ALPHA-GLUOSIDASE INHIBITORS:** The alpha-glucosidase inhibitors include acarbose (Precose) &Miglitol (Glycet) and are available in the United States. They inhibit the upper gastrointestinal enzymes that converts dietary starch and other complex carbohydrates into simple sugars which can be absorbed. The result is to slow the absorption of glucose after meals.

➢ **DIPEPTIDYL PEPTIDASE-IV INHIBITORS (DPP-IV INHIBITORS):** Sitagliptin is currently approved for use in the United States, whereas vildagliptin has received an approvable letter from the FDA.

DRUG UTILIZATION EVALUATION

Drug use evaluation (DUE) is a system of ongoing, systematic, criteria-based evaluation of drug use that will help ensure that medicines are used appropriately (at the individual patient level). If therapy is deemed to be inappropriate, interventions with providers or patients will be necessary to optimize drug therapy. A DUE is drug- or disease-specific and can be structured so that it will assess the actual process of prescribing, dispensing or administering a drug (indications, dose, drug interactions, etc.). DUE is the same as drug utilization review (DUR) and terms are used synonymously. [10]

CLASSIFICATION OF DUE

DURs are classified into three categories:

• Prospective - evaluation of a patient's therapy before medication is dispensed.

• Concurrent - ongoing monitoring of drug therapy during the course of treatment

• Retrospective - review of therapy after the patient has received the medication [10]

USAGE OF DUE

Drug use evaluation (DUE) helps us to understand how and why drugs are used as they are, so that drug use and health outcomes can be improved. DUE can play a key role in helping

the health care system to understand, interpret and improve the prescribing, administration and use of medications. DUE information may assist healthcare systems and hospitals to design educational programs that may improve prescribing and drug use [11]. Once the main problem areas have been identified, (from aggregate data, health facility indicators, qualitative studies, other DUE studies, or even recommendations from DTC members), a DUE system can be established relatively quickly.

COMPONENTS OF DRUG USE FOR DUE CRITERIA

- **Uses:** appropriate indication for drug, absence of contraindications
- **Selection:** appropriate drug for clinical condition
- **Dosing:** indication-specific dosing, intervals and duration of treatment
- **Interactions:** absence of interactions - drug-drug, drug-food, drug-laboratory
- **Preparation:** steps involved with preparing a drug for administration
- **Administration:** steps involved in administration, quantity dispensed
- **Patient education:** drug and disease-specific instructions given to patients
- **Monitoring:** clinical and laboratory
- **Outcome, for example:** decreased blood pressure, blood glucose, asthma attacks [12]

ANATOMICAL THERAPEUTIC CHEMICAL (ATC) CLASSIFICATION SYSTEM

ATC is a drug classification system that classifies the active ingredients of drugs according to the organ or system on which they act and their therapeutic, pharmacological and chemical properties. It is controlled by the World Health Organization Collaborating Centre for DruStatistics Methodology (WHOCC), and was first published in 1976. [13]

Table 1: ANATOMICAL THERAPEUTIC CHEMICAL (ATC) CLASSIFICATION

LEVEL 1	SYSTEM ON WHICH DRUG ACTS
A	ALIMENTARY AND METABOLISM
B	BLOOD
C	CARDIOVASCULAR SYSTEM
D	DERMATOLOGICAL
G	GASTROINTESTINAL SYSTEM
H	HORMONAL PREPARATION
J	ANTI – INFECTIVES
L	ANTI NEOPLASTICS AND IMMUNOMODULATORS
M	MUSCULO-SKELETON SYSTEM
N	NERVOUS SYSTEM
P	ANTI PARASITIC
R	RESPIRATORY SYSTEM
S	SENSORY ORGANS
V	VARIOUS

DEFINED DAILY DOSE: The basic definition of the unit is: The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults. A DDD will only be assigned for drugs that already have an ATC code.

APPLICATIONS OF DDD

- Make international comparisons.
- Examine changes in drug utilization over time.
- Evaluate the effect of an intervention on drug use.
- Document the relative therapy intensity with various groups of drugs.
- Follow the changes in the use of a class of drugs.
- Evaluate regulatory effects and effects of interventions on prescribing patterns.

➢ Drug utilization figures should ideally be presented as numbers of DDDs per 1000 inhabitants per day or, when drug use by inpatients is considered, as DDDs per 100 bed-days These terms are explained below.

DRUG USAGE (in terms of DDD's)

If the DDD for a certain drug is given, the number of DDDs used by an individual patient or (more commonly) by a collective of patients is as follows.

$$Drug\ usage\ (in\ DDDs) = \frac{Items\ issued \times Amount\ of\ drug\ per\ item}{DDD}$$

MATERIALS AND METHODS

This is a prospective observational study conducted for a period of six months. After getting approval from the Institutional Ethical Committee (IEC), the whole data was collected from the general medicine wards (both male and female) during ward rounds through prescription based pattern in Malla Reddy Hospital located in Suraram, Hyderabad. Total 200 inpatients with or without comorbidities, receiving antihypertensives and/or oral hypoglycemics, who were willing to participate in the study and signed in the consent form were included. Patients who were unable to communicate, patients who were severely ill i.e., Emergency visits and pregnant women were excluded from the study. The data was collected from the inpatient case medical records. The collected data was analyzed using Statistical methods in Microsoft excel 2007.

REULTS AND DISCUSSION:

The present study is considered to be a good prescription-based evaluation study and the study is used as one of the systemic ways for rationality and assessment of drug utilization, aiming to measure the rationality which can reduce morbidity and mortality. Regular evaluation of prescribing patterns of antihypertensives and oral hypoglycemics is essential these days due to the growing epidemic of hypertension and diabetes as there is increase in number of new antihypertensive and oral hypoglycemic drugs and the drug combinations that are introduced into the market each year with the alteration in the guidelines. At present, physicians have different options to manage hypertension and diabetes as there are numerous pharmacological agents.

The drug utilization study is being conducted widely and it is being carried out in different health care setups. Such studies are helpful to determine the behavior of the use of medicines in the society.

Objective: The present study was undertaken to obtain data on current prescribing patterns and drug utilization patterns of anti-hypertensives and oral hypoglycemics in tertiary care hospital with ultimate goal to promote rational drug use.

RESULTS AND DISCUSSION

Table No. 2:- GENDER WISE DISTRIBUTION

GENDER	n = 200	Percentage
MALE	131	65.5%
FEMALE	69	34.5%

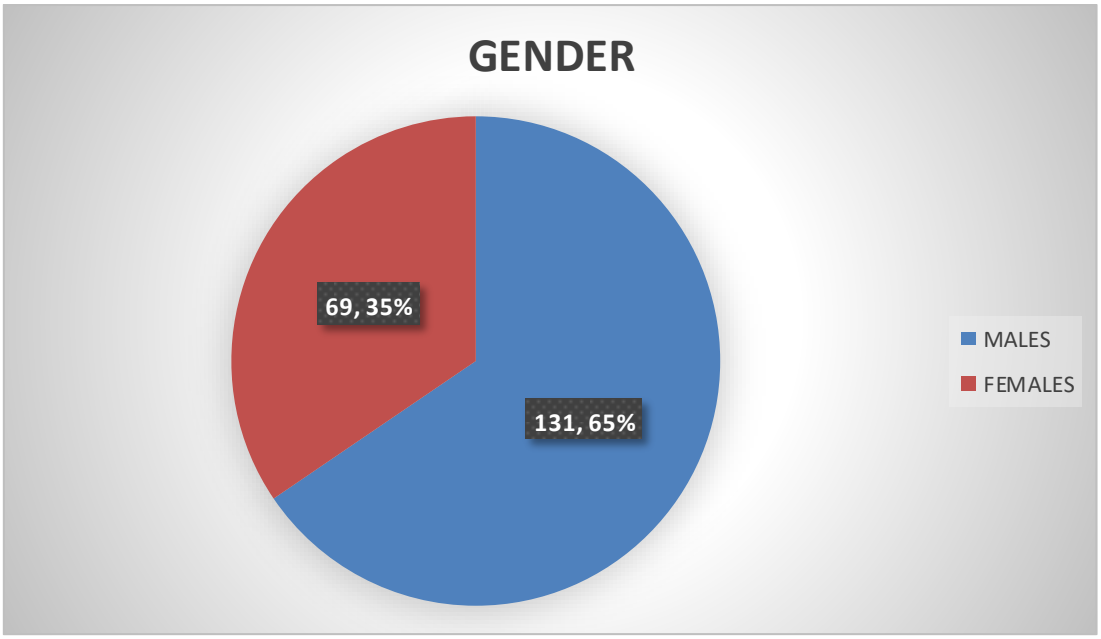

Figure No. 1: **GENDER WISE DISTRIBUTION**

Table No. 3:-AGE DISTRIBUTION BASED ON GENDER

AGE INTERVALS	MALE	FEMALE
20 – 30	2	-
31 – 40	13	10
41 – 50	37	19
51 – 60	37	28
61 – 70	32	6
71 – 80	9	3
81 – 90	1	3

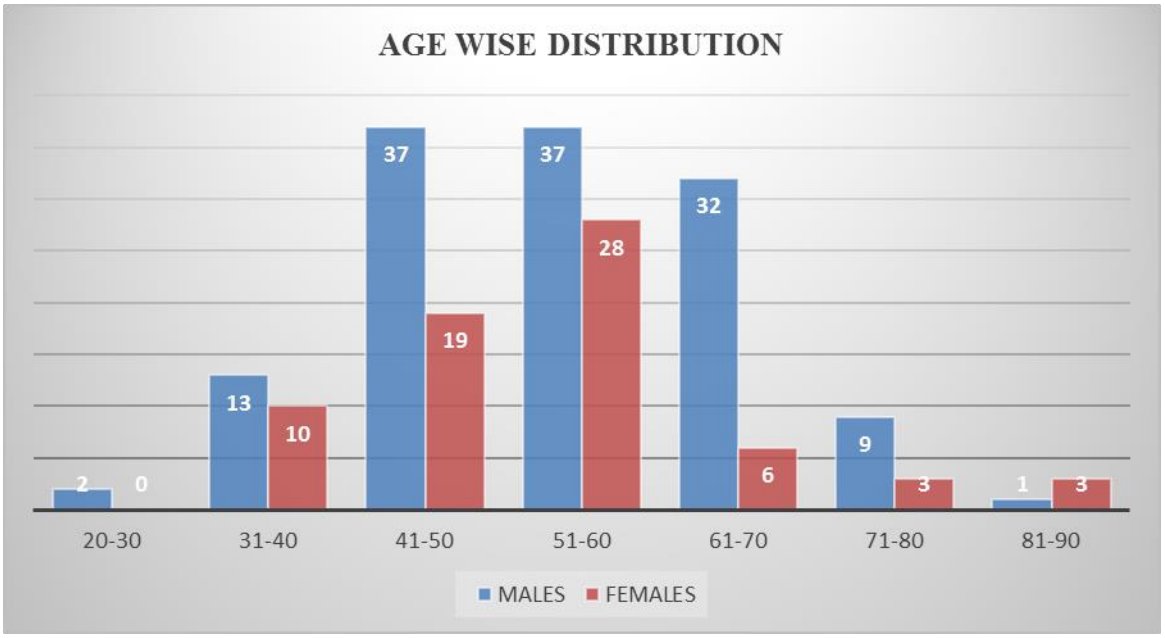

Figure No. 2:- AGE DISTRIBUTION BASED ON GENDER

Table No. 4:- DISTRIBUTION OF PATIENTS BASED ON SOCIAL HABITS

SOCIAL HABITS	(n=200)	PERCENTAGE
YES	133	66.5%
NO	67	33.5%

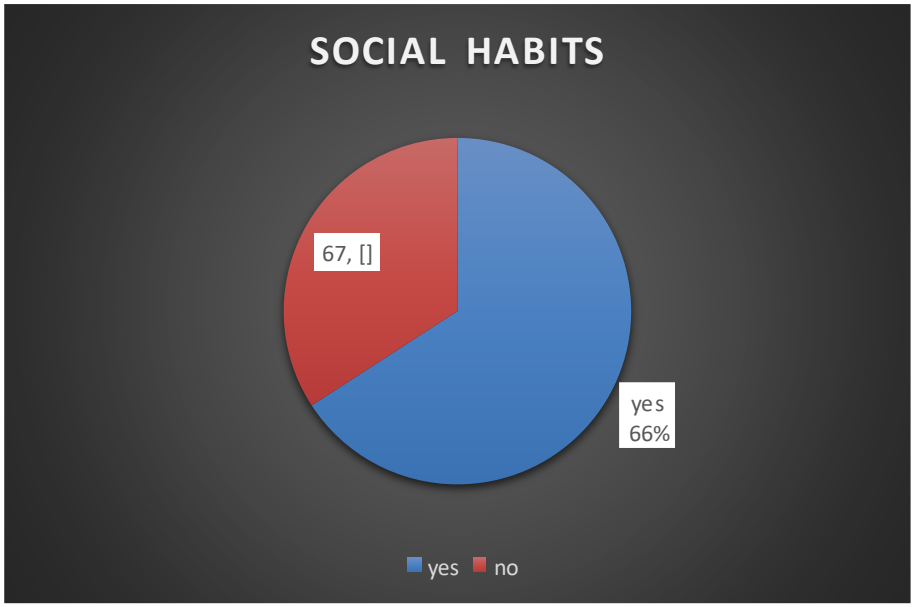

Figure No. 3:- DISTRIBUTION OF PATIENTS BASED ON SOCIAL HABITS

Table No. 5:-CATEGORISING THE PATIENTS WHO HAVE SOCIAL HABITS

SOCIAL HABITS	TOTAL (n=133)	PERCENTAGE
SMOKING	35	26.31%
ALCOHOL	32	24.06%
BOTH	66	49.62%

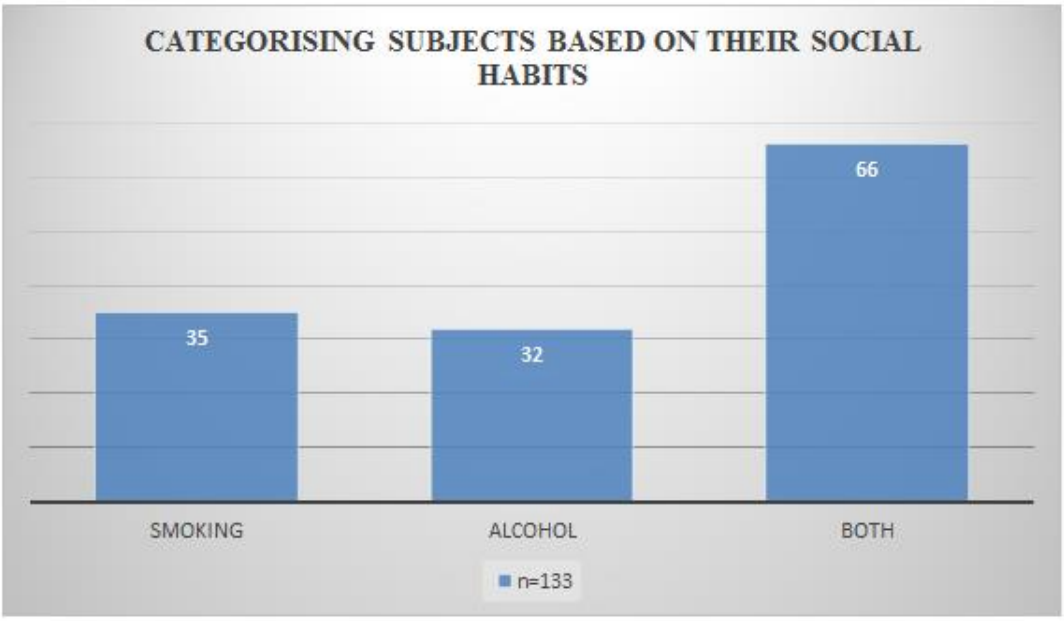

Figure No. 4:- CATEGORISING THE PATIENTS WHO HAVE SOCIAL HABITS(n=133)

Table No. 6:- INCIDENCE OF HYPERTENSION AND DIABETES BASED ON ALCOHOL CONSUMPTION:

ALCOHOL CONSUMPTION	HYPERTENSION (n=156)	DIABETES MELLITUS (n=111)
YES	76 (48.71%)	58(52.25%)
NO	80 (51.28%)	53(47.74%)

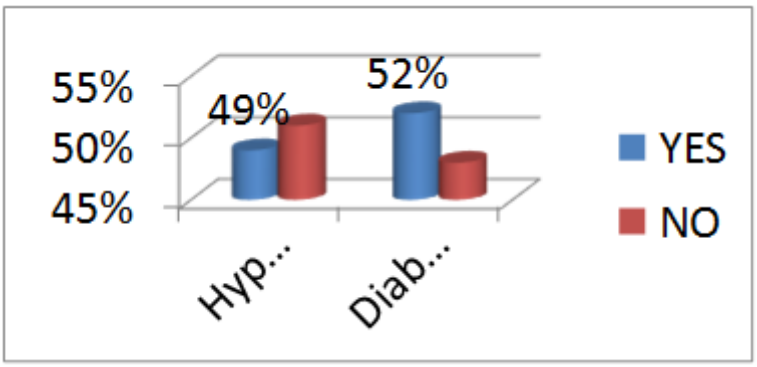

Figure No. 5:- INCIDENCE OF HYPERTENSION AND DIABETES BASED ON ALCOHOL CONSUMPTION

Table No. 7:- INCIDENCE OF HYPERTENSION AND DIABETES BASED ON SMOKING

SMOKING	HYPERTENSION (n=156)	DIABETES MELLITUS (n=111)
YES	80(51.28%)	55(49.54%)
NO	76(48.71%)	56(50.45%)

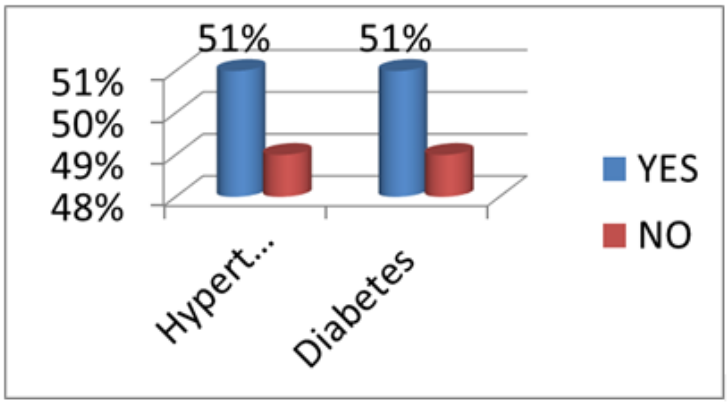

Figure No. 6:- INCIDENCE OF HYPERTENSION AND DIABETES BASED ON SMOKING

Table No. 8 DISTRIBUTION OF PATIENTS BASED ON HTN, DM, BOTH

CONDITION	MALES (n=131)	FEMALE (n=69)	TOTAL (n=200)
Hypertension	57 (43.5%)	19 (27.5%)	76 (38%)
Diabetes	25 (19.08%)	19 (27.5%)	44 (22%)
Hypertension+diabetes	49 (37.4%)	31 (44.9%)	80 (40%)

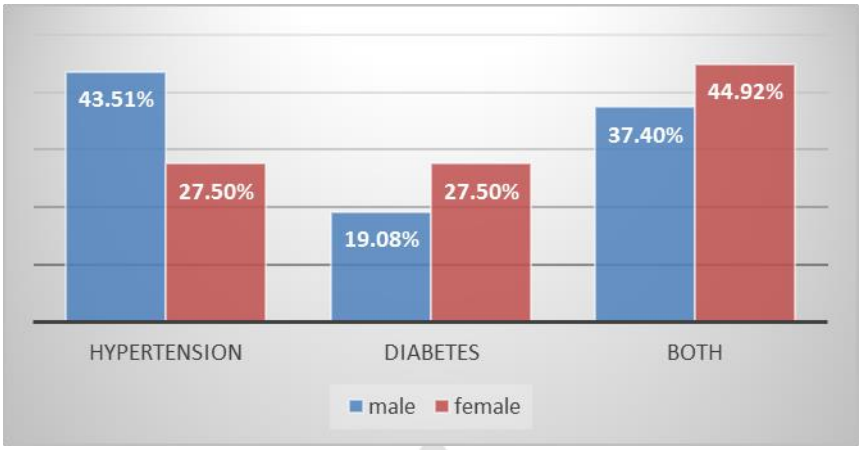

Figure No. 7:-DISTRIBUTION OF PATIENTS BASED ON HTN, DM, BOTH

Table No. 9:- LIST OF ANTIHYPERTENSIVE DRUGS PRESCRIBED DURING STUDY PERIOD:

S. No.	DRUG	FREQUENCY	PERCENTAGE (n=197)
1	Furosemide 40mg	32	16.24%
2	Amiloride 5mg	4	2.03%
3	Enalapril 5mg	1	0.5%
4	Telmisartan 40mg	64	32.48%
5	Amlodipine 5mg	57	28.93%
6	Nefidipine 10mg	13	6.59%
7	Nicardipine 20mg	6	3.04%
8	Atenolol 20mg	2	1.01%
9	Metoprolol 20mg & 40 mg	6	3.04%
10	Chlorthalidone 12.5mg	3	1.52%
11	Mannitol 20mg	2	1.01%
12	Clinidipine 10mg	2	1.01%
13	Hydrochlorothiazide 12.5mg	2	1.01%
14	Ramipril 5mg	1	0.5%
15	Labetalol 20mg	1	0.5%
16	Carvedilol 5mg	1	0.5%
	Total	197	

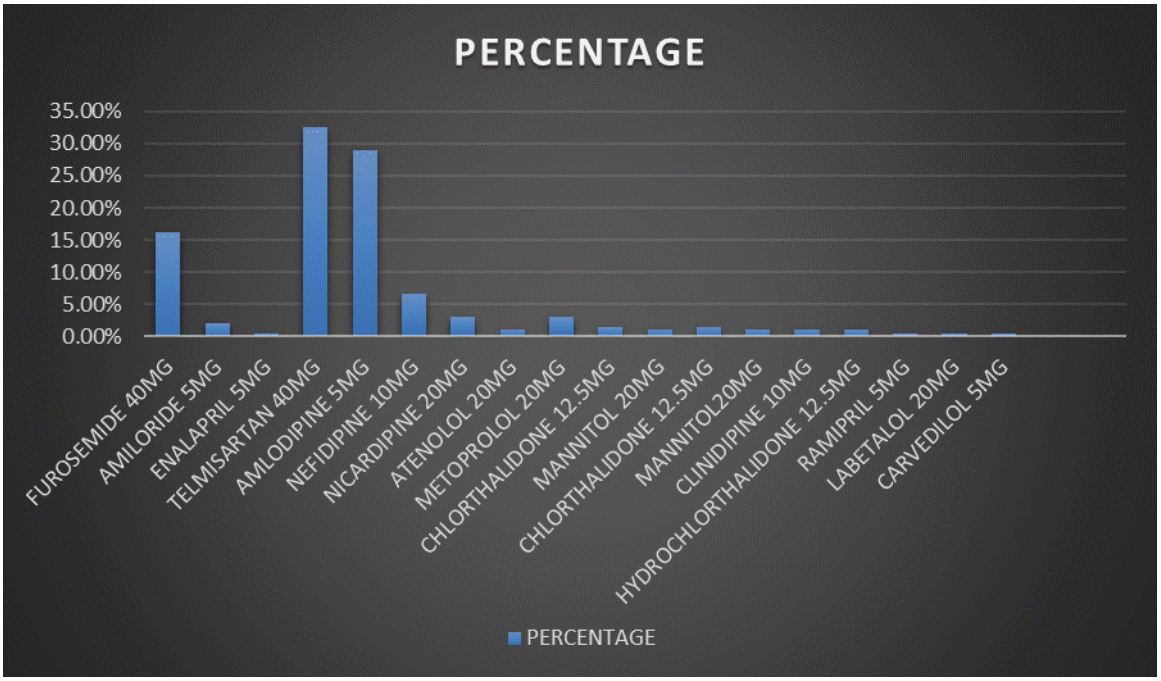

Figure No. 8:- PERCENTAGE OF INDIVIDUAL ANTIHYPERTENSIVE DRUGS PRESCRIBED DURING STUDY PERIOD

TABLE No.10:- ANTI HYPERTENSIVES - COMBINATION THERAPY:-

S.no.	COMBINATION	FREQUENCY	PERCENTAGE (n=41)
1	Chlorthalidone + Telmisartan (12.5+40mg)	6	14.63%
2	Amlodipine + Telmisartan(5+40mg)	13	31.7%
3	Amlodipine + Atenolol (5+50mg)	7	17.07%
4	Telmisartan + Hydrochlorothiazide(40+12.5mg)	8	19.51%
5	Spironolactone + Furosemide(50+20mg)	3	7.31%
6	Hydrochlorothiazide + Amlodipine(12.5+5mg)	1	2.43%
7	Amlodipine + Metoprolol(5+50mg)	1	2.43%
8	Telmisartan+Hydrochlorothiazide+Amlodipine (40+12.5+5mg)	1	2.43%
9	Metoprolol + Ramipril (50+5mg)	1	2.43%
	Total	41	

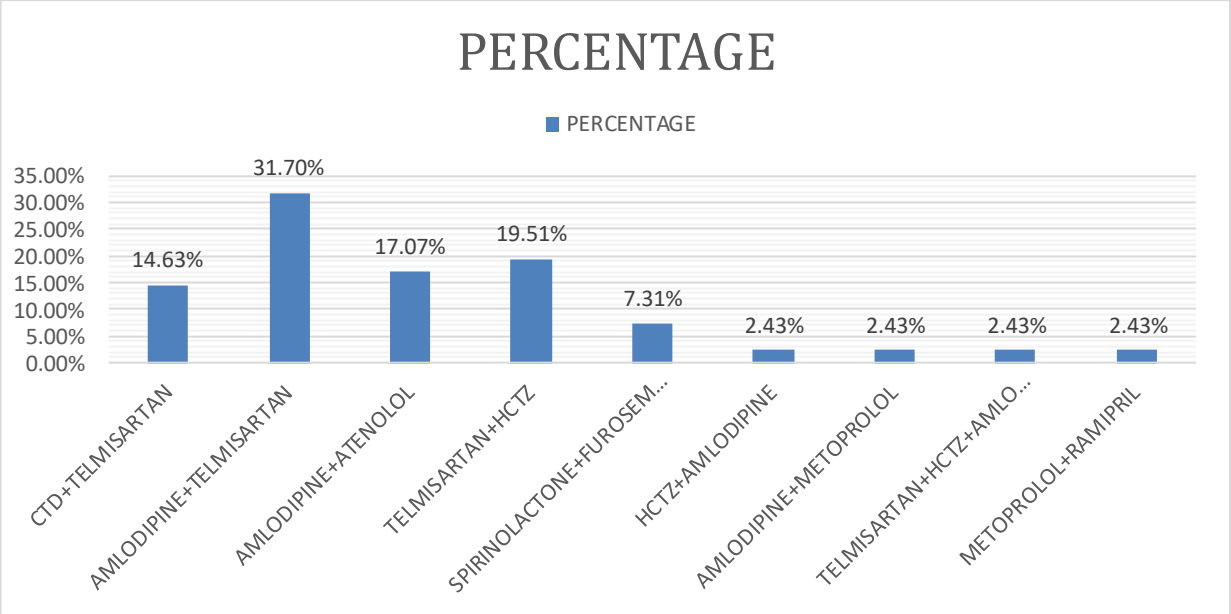

Figure No.9:- PERCENTAGE OF ANTI HYPERTENSIVES - COMBINATION THERAPY

Table No. 11:- LIST OF ORAL HYPOGLYCEMICS PRESCRIBED DURING THE STUDY PERIOD:

S. No.	DRUG	FREQUENCY	PERCENTAGE (n=97)
1	Metformin 500mg	71	73.19%
2	Glimepiride 1mg	14	14.43%
3	Glipizide 5mg	1	1.03%
4	Acarbose 25mg	2	2.06%
5	Repaglinide 500/1000mg	2	2.06%
6	Tenegliptin 25mg	6	6.18%
7	Sitagliptin 1mg	1	1.03%
	Total	97	

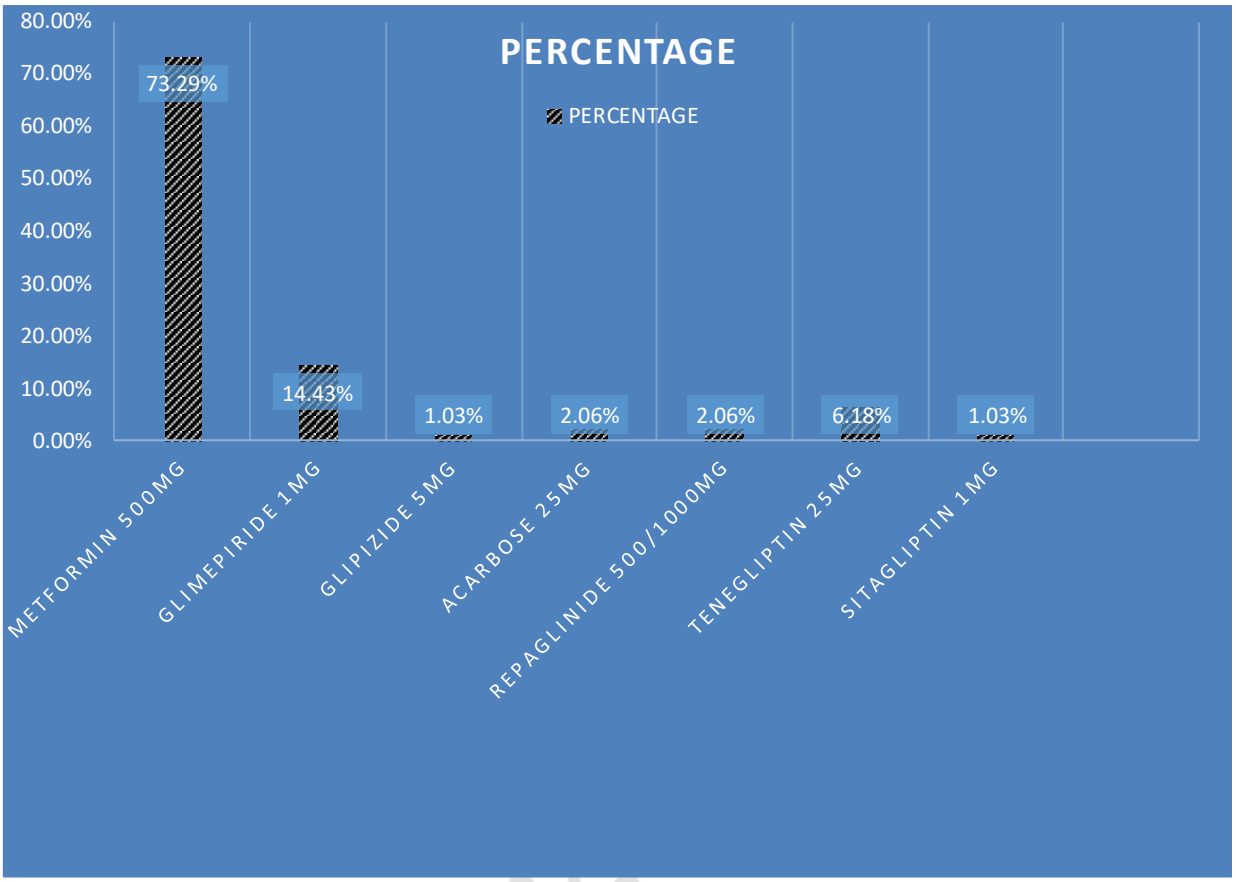

Figure No. 10: PERCENTAGE OF ORAL HYPOGLYCEMICS PRESCRIBED DURING THE STUDY PERIOD

Table No. 12:- ORAL-HYPOGLYCEMICS – COMBINATION THERAPY

S. No.	COMBINATION	FREQUENCY	PERCENTAGE (n=39)
1	Metformin + Glimepiride (500+1mg)	35	89.74%
2	Metformin + Glipizide (500+15mg)	1	2.56%
3	Metformin + Voglibose (500+15mg)	3	7.69%
	Total	39	

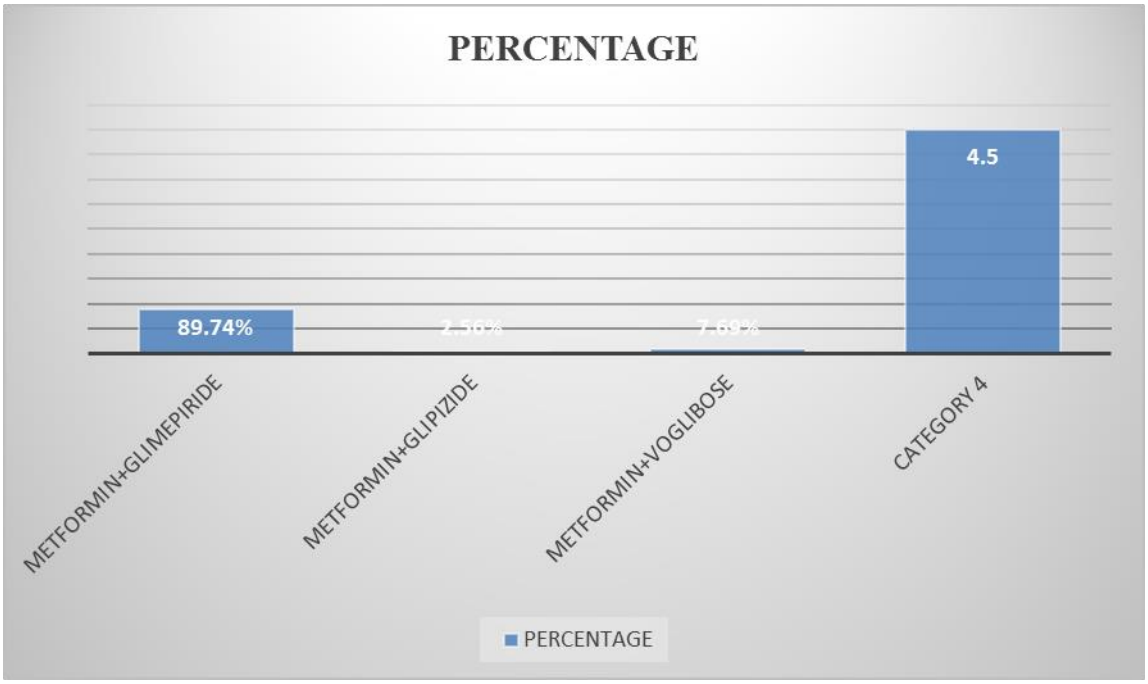

Figure No. 11:- PERCENTAGE OF ORAL-HYPOGLYCEMICS - COMBINATION THERAPY

Table No. 13:- PATTERN OF ANTIHYPERTENSIVE USED BASED ON AGE:

ANTIHYPERTENSIVE DRUG CLASS	18-64years (n=144)	>65years (n=55)	CHI SQUARE VALUE	P VALUE
CCB's	59 (40.97%)	21 (38.18%)	0.781287	0.978217
ARB's	46 (31.94%)	18 (32.72%)	0.930605	0.967967
Diuretics	30 (20.83%)	13 (23.63%)	0.703638	0.982771
Alpha+beta blockers	1 (0.69%)	1 (1.81%)	0.479467	0.99865
Beta blocker	7 (4.86%)	1 (1.81%)	0.338348	0.99686
ACE inhibitors	1 (0.69%)	1 (1.81%	0.479467	0.982771

Table No.14:- PATTERNS OF ANTI HYPERTENSIVES BASED ON MONO, 2 DRUG AND COMBINATION THERAPIES:

CLASS OF DRUGS	MONO THERAPY (n=153)	2 DRUG THERAPY (n=82)	COMBINATION THERAPY (n-=82)	CHI SQUARE VALUE	P VALUE
Diuretics	27 (17.64%)	16 (36.36%)	22 (26.82%)	0.202927219	0.9999
ARBS	55 (35.94%)	9 (20.45%)	28 (34.14%)	0.273883102	0.999964
CCBS	64 (41.83%)	14 (31.81%)	23 (28.04%)	7.43578E-14	0.68377069
β BLOCKERS	6 (3.92%)	2 (4.54%)	9 (10.97%)	0.000312743	0.9221
ACE inhibitors	-	1 (2.27%)	-		
α + β BLOCKERS	-	2 (4.54%)	-		

Table No. 15:- PATTERNS OF ORAL HYPOGLYCEMICS BASED ON AGE

ORAL HYPOGLYCEMICS	18-64 YEARS (N = 74)	> 65 YEARS (N = 23)	CHI SQUARE VALUE	P VALUE
Biguanides	52 (70.27%)	19 (82.6%)	1.680404573	0.7942
Sulfonylureas	12 (16.21%)	3 (13.04%)	1.318745523	0.8581
Meglitinides	2 (2.7%)	0	1.03264095	0.9048
Alpha glucosidase inhibitor	2 (2.7%)	0	1.03264095	0.9048
DPP 4	6 (8.1%)	1 (4.34%)	1.217759814	0.8751

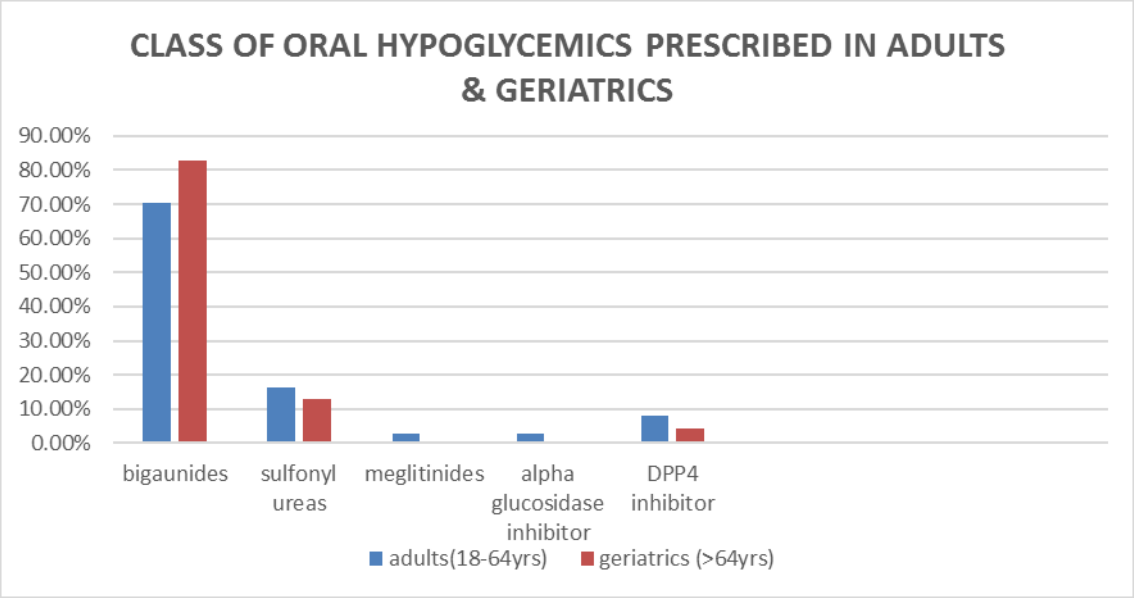

Figure No. 12:- PATTERNS OF ORAL HYPOGLYCEMICS BASED ON AGE

Table No. 16:- PATTERNS OF ORAL HYPOGLYCEMICS BASED ON MONO, 2 DRUG AND COMBINATION

ORAL HYPOGLYCEMIC CLASSES	MONO THERAPY (N=80)	2 DRUG (N=17)	COMBINATION THERAPY (N=80)	CHI-SQUARE VALUE	P VALUE
Biguanides	65 (81.25%)	6 (35.29%)	40 (50%)	0.1947935862	0.9999
Sulfonylureas	6 (35.29%)	9 (52.94%)	37 (46.25%)	31.87742557	0.0001
Megliytinides	2 (2.5%)	0	0	1.03264095	0.9908
Alpha glucosidase	1 (1.25%)	1 (5.88%)	3 (3.75%)	1.499263276	0.9927
DPP 4	6 (7.5%)	1 (5.88%)	0	3.614243323	0.8901

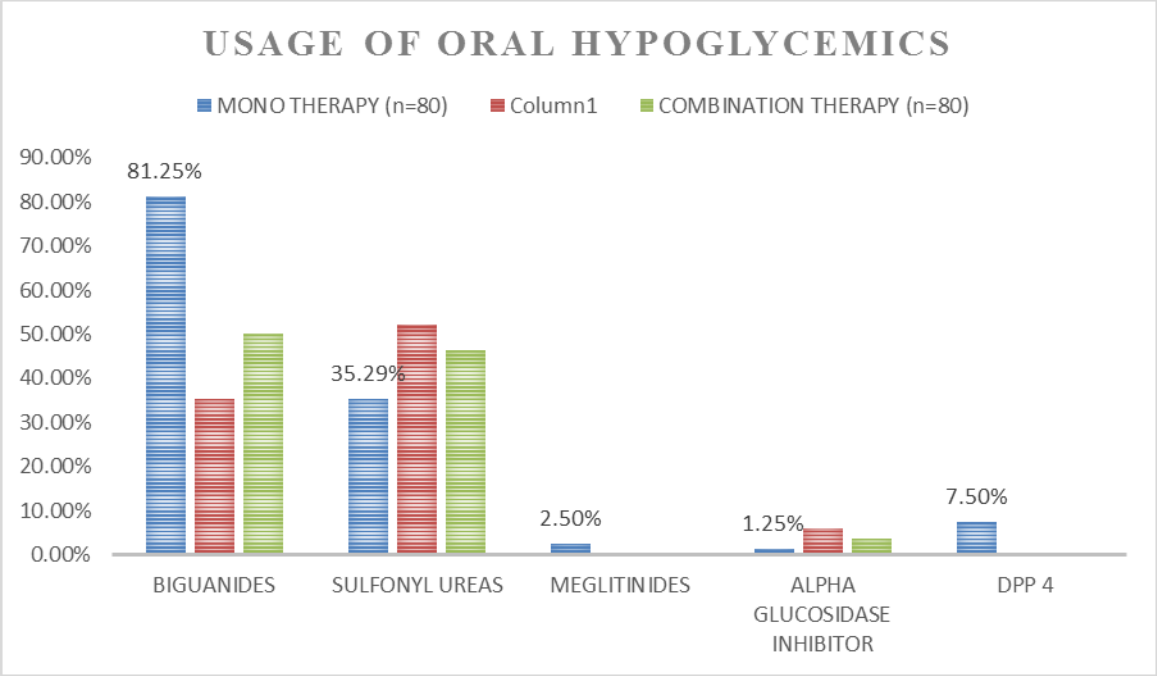

Figure No.13:- PATTERNS OF ORAL HYPOGLYCEMICS BASED ON MONO, 2 DRUG AND COMBINATION

Table No. 17:- CATEGORISING ANTIHYPERTENSIVE DRUGS BASED ON ATC AND DDD

DRUGS	ATC CODES	WHO RECOMMENDED DDD	DRUG USAGE (IN DDD'S)
Furosemide	C03CA01	40 mg	40
Amiloride	C03DB01	10 mg	3
Telmisartan	C09CA07	40 mg	68
Amlodipine	C08CA01	5 mg	59
Nifedipine	C08CA05	30 mg	21
Nicardipine	C08CA05	90 mg	9
Atenolol	C07AB03	75 mg	2
Metoprolol	C07AB02	0.15 mg	9.4
Chlorthalidone	C03BA04	25 mg	1.5
Mannitol	BO5BC01	800mg	0.075
Clinidipine	C08CA14	10 mg	3
Enalapril	C09AA02	10 mg	0.5
Hydrochlorthiazide	C03AA03	25 mg	2
Ramipril	C09AA05	2.5 mg	2
Carvedilol	C07AG02	37.5 mg	2.4
Labetalol	C07AG01	0.6 mg	0.03

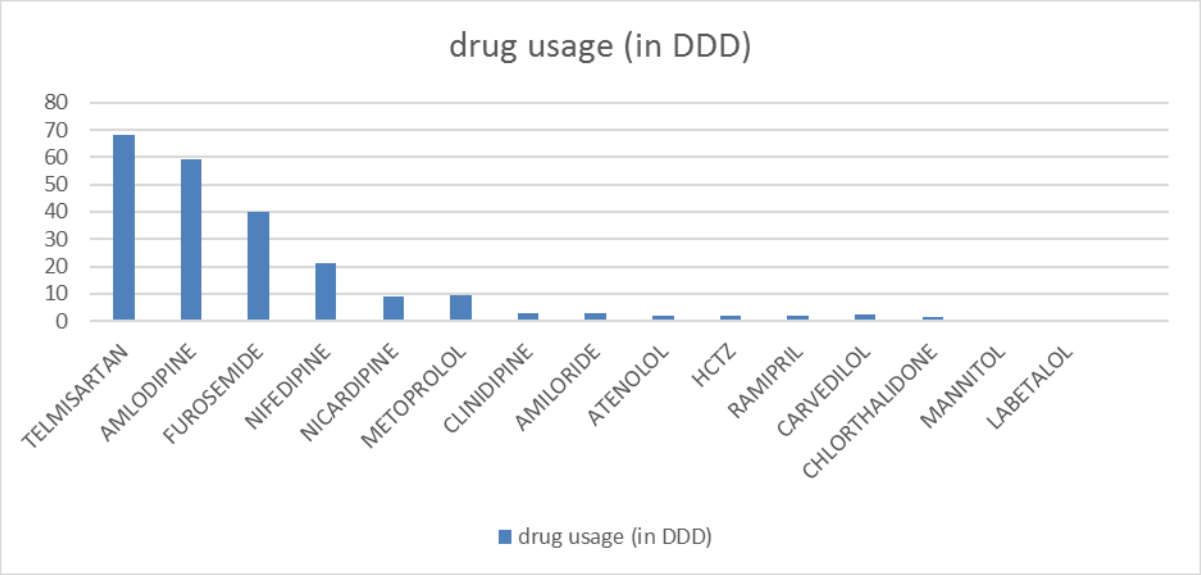

Figure No. 14:- CATEGORISING ANTIHYPERTENSIVE DRUGS BASED ON ATC AND DDD

Table No. 18:- CATEGORISING ORAL HYPOGLYCEMICS BASED ON ATC AND DDD:

DRUG	ATC CODE	WHO RECOMMENDED DDD	DRUG USAGE (IN DDD'S)
Metformin 500mg	A10BA02	2g (2000mg)	27
Glimepiride 1mg	A10BB12	2 mg	8.5
Glipizide 5mg	A10BB07	10 mg	0.5
Acarbose 25mg	A10BF01	0.3 mg	0.16
Repaglinide 500mg	A10BX02	4 mg	0.38
Sitagliptin 1mg	A10BH01	0.1 mg	1

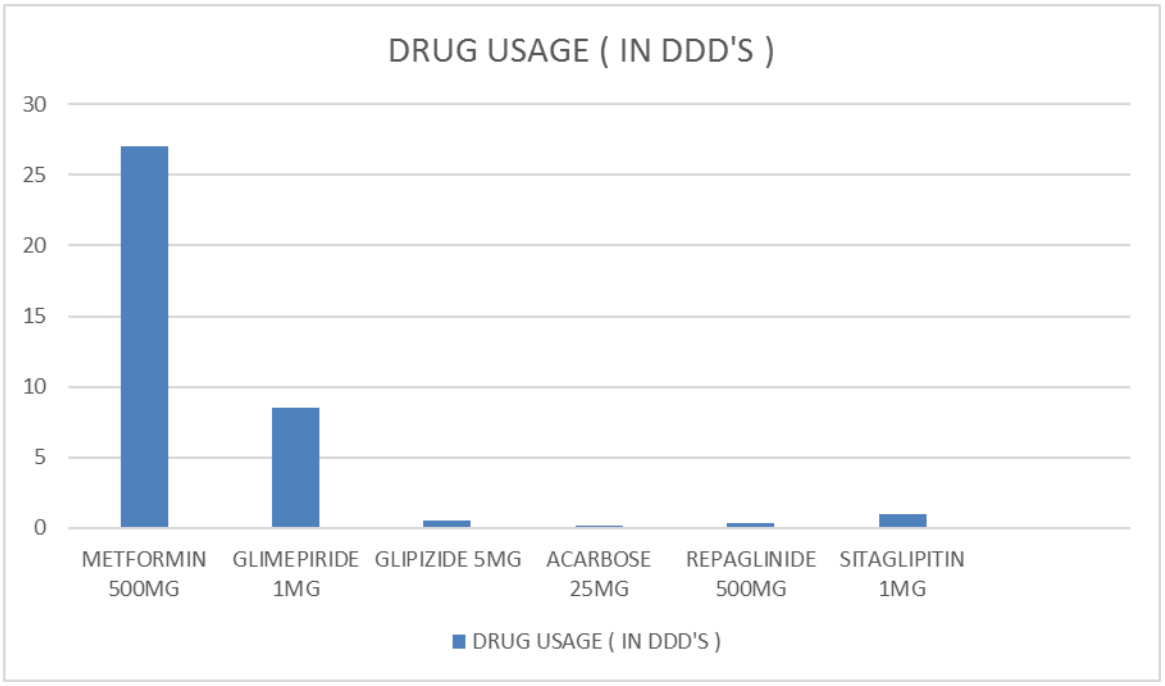

Figure No. 15:- CATEGORISING ORAL HYPOGLYCEMICS BASED ON ATC AND DDD

Table No. 19:- CATEGORIZATION OF POTENCY OF ANTI HYPERTENSIVES IN HYPERTENSION PATIENTS:

STAGE AT DISCHARGE	NO. OF PATIENTS (n=156)	PERCENTAGE
Reduced to normal	81 (120/80mmHg)	51.92%
Reduced to pre-hypertension stage	52(140/90mmHg)	33.33%
Remained same	23	14.74%

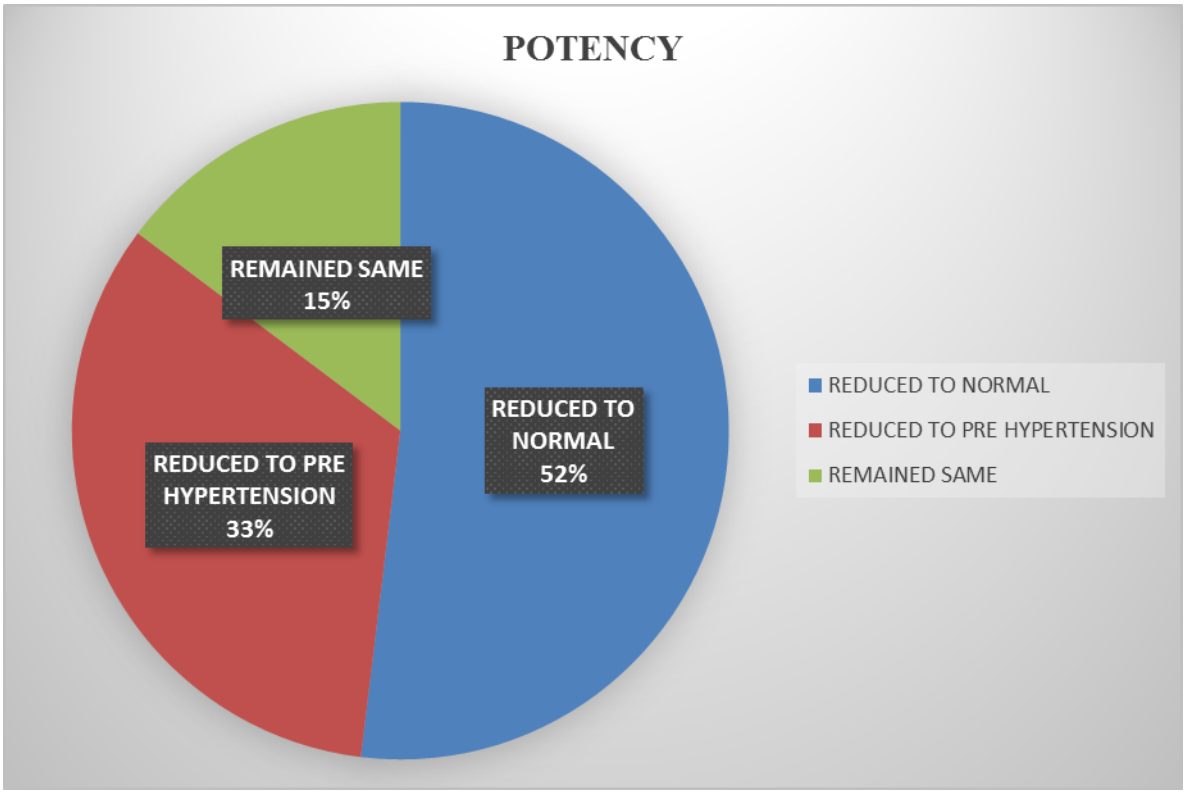

Figure No. 16:- CATEGORIZATION OF POTENCY OF ANTI HYPERTENSIVES IN HYPERTENSION PATIENTS

Table No. 20:- CATEGORIZATION OF POTENCY OF ORAL HYPOGLYCEMICS IN DIABETIC PATIENTS:

STAGE AT DISCHARGE	RBS (mg/dl)	NO. OF PATIENTS (n=124)	PERCENTAGE
REDUCED TO NORMAL	<140mg/dl	44	35.48%
REDUCED TO PRE DIABETIC RANGE	140-160mg/dl	48	38.48%
REDUCED TO MODERATE RANGE	160-210mg/dl	11	8.87%
REMAINED SAME	-	21	16.93%

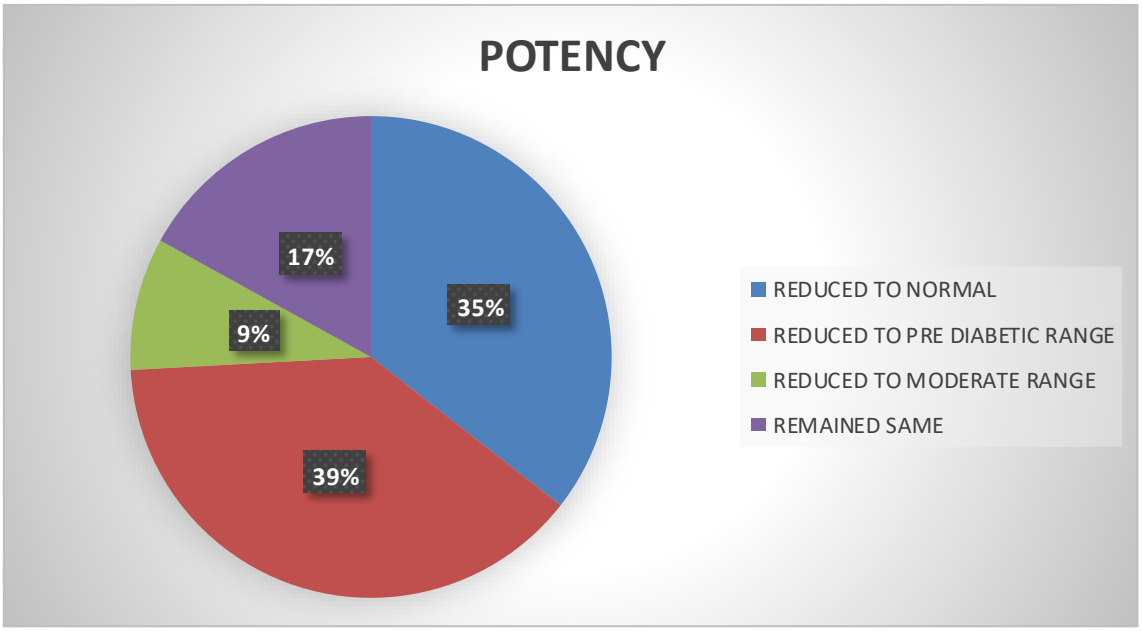

Figure No. 17:- CATEGORIZATION OF POTENCY OF ORAL HYPOGLYCEMICS IN DIABETIC PATIENTS

DISCUSSION

The present study is considered to be a good prescription based evaluation study and the study is used as one of the systemic ways for rationality and assessment of drug utilization, aiming to measure the rationality which can reduce morbidity and mortality.

According to WHO, Drug utilization is defined as "the marketing, distribution, prescription, and use of drugs in the society, with special emphasis on the resulting medical, social and economic consequences". Regular evaluation of prescribing patterns of antihypertensives and oral hypoglycemics is essential these days due to the growing epidemic of hypertension and diabetes as there is increase in number of new antihypertensive and oral hypoglycemic drugs and the drug combinations that are introduced into the market each year with the alteration in the guidelines. At present, physicians have different options to manage hypertension and diabetes as there are numerous pharmacological agents.

The drug utilization study is being conducted widely and it is being carried out in different health care setups. Such studies are helpful to determine the behavior of the use of medicines in the society.

The present study was undertaken to obtain data on current prescribing patterns and drug utilization patterns of anti hypertensives and oral hypoglycemics in a tertiary care hospital with ultimate goal to promote rational drug use.

AGE FACTOR: 200 patients were evaluated of which most of the patients were males 131(67%) and females were 69 (33%) with mean age group of 49.7 ± 8.75 in adults and 69.6 ± 6 in geriatrics which was in accordance with a study conducted by Juno J. Joel, Nittu Daneal.

SOCIAL HABITS:

Out of 200 patients, 50% were having both alcohol & smoking together, 26% were smokers and 24% were alcoholics.

AVERAGE HOSPITAL STAY:

Average length of hospital stay noted was 8.1 ± 5.2 days which is usually required for management of these patients. This shows similarity with study conducted by Juno J Joel, NittuDaneal [(14)].

Results indicated that the incidence of hypertension was higher in males (43.5%) than in females (27.5%) and the incidence of Diabetes was higher in females (27.5%) than in males (19.08%). The incidence of Hypertension and Diabetes together is more in females (44.92%) than in males (37.4%).

This is similar to the study conducted by Jainaf Nachiya, Parimalakrishnan S.[(15)]

OVERALL PRESCRIBING PATTERNS IN HYPERTENSION:

From this study, we found that the most commonly prescribed class of antihypertensive drugs was calcium channel blockers (36.82%) followed by angiotensin receptor blockers (28.19%) and diuretics (27%) followed by beta blockers (4%) as in accordance with study conducted by Georgy M. Varghese, Md.Imran. [(16)]

MONOTHERAPY AND COMBINATION THERAPY IN HYPERTENSION: The most commonly prescribed monotherapy in ARB's was Telmisartan 40 mg(32.4%), Amlodipine 5mg (29%) in CCB's, Furosemide 20mg(16.4%) in Diuretics. The most commonly prescribed combination therapy was Amlodipine + Telmisartan(31.7%).

OVERALL PRESCRIBING PATTERNS IN DIABETES:

The most commonly prescribed class of oral hypoglycemics was Biguanides (81.25%) followed by Sulfonyl Ureas (35.29%) as in the case of study conducted by Sharma s, Tandon VR.[17]

MONOTHERAPY AND COMBINATION THERAPY IN DIABETES:

Among biguanides, Metformin (73.19%) was most commonly prescribed monotherapy as in the case of study conducted by Sharma s, Tandon VR. And mostly Glimepiride (14.4%) was more prescribed in sulfonylureas as monotherapy. The most prescribed combination therapy was Metformin + Glimepiride (90%) as in accordance with the study conducted by Satpathy SV, Datta S, Upreti B.[18]

TOTAL CONSUMPTION OF ANTI HYPERTENSIVES IN DDD:
Among total number of anti hypertensives prescribed, the drug usage was more for telmisartan which was 68 in terms of DDD, followed by amlodipine (59 DDD) and furosemide (40 DDD) and then for nifedipine 21 in terms of DDD with in accordance with study conducted by jainaif. Nachiya [15] where they found high utilized drug was amlodipine with 55DDD.

TOTAL CONSUMPTION OF ORAL HYPOGLYCEMICS IN DDD:

Among total number of oral hypoglycemics prescribed, the drug usage of metformin was more i.e., 27 (DDD) and glimepiride was 8.5 in terms of DDD which was in accordance with the study conducted with altiaparna, seemapushpa[19] where they found metformin was highly prescribed with 21.4 DDD.

POTENCY OF ANTI HYPERTENSIVE DRUGS:

Potency of various prescribed anti hypertensives as calculated based on the blood pressure levels those were recorded pre and post usage of the respective drugs. The potency of anti hypertensives was appropriate as 85% of the hypertension patients got improvement in their condition and only 15% remained same.

POTENCY OF ORAL HYPOGLYCEMIC DRUGS:

Potency of various prescribed oral hypoglycemic was calculated based on the FBS levels in the blood those were noted pre and post usage of the respective drugs. The potency of oral hypoglycemics was appropriate as 83% of diabetic patients got improvement in their condition and 17% remained same.

CONCLUSION

The present study involves drug utilization patterns of anti hypertensives and oral hypoglycemics in general medicine department from this study it was found that majority of the patients with hypertension and/or diabetes have social habits of smoking and alcohol, of which more than half of them have both alcohol and smoking together, which shows that the patients with habits of smoking and alcohol consumption were found to be at high risk to Hypertension and Diabetes Mellitus. According to our study, the risk of hypertension and diabetes with alcohol was found to be 3 times and 4.5 times respectively. Similarly, the risk of hypertension and diabetes in smokers was found to be 2 times and 1 time respectively. Males were mostly affected with Hypertension than with Diabetes, and females were mostly affected with Diabetes. Females were found to have high rate of hypertension with diabetes cases. Our results of the study demonstrate that the prescriptions were in accordance to WHO guidelines. Monotherapy and combination therapy achieved similar effectiveness in reducing blood pressure and blood glucose to normal. Our present study concluded that most commonly prescribed class of antihypertensive drugs was calcium channel blockers, in monotherapy telmisartan and amlodipine, and in combination was telmisartan+amlodipine. In oral hypoglycemics, metformin was mostly prescribed with least adverse effects and in combination metformin+glimepiride. In our study, the use of CCB's was more in age group of 18-64 adults than in age group of >65 geriatrics. The use of biguanides was more in adults (18-64 years) than in geriatrics (>65 years). The use of sulfonylureas was preferred next to biguanides in adults in diabetic patients. Many of the prescriptions were rational and in accordance with WHO guidelines. Similar results were found in terms of effectiveness of the therapy in monotherapy or two drug therapy and combination therapy in patients having hypertension and/or diabetes. The drug usage was determined in terms of DDD and it was found that Telmisartan was mostly used in overall anti-hypertension prescriptions. Similarly, the drug usage of oral hypoglycemics was determined in terms of DDD and it showed that Metformin was most utilized oral hypoglycemic drug. The potency of antihypertensive agents

was determined based on the data collected at the time of admission and discharge and it was found that more than 85% patients got improvement in their condition and therefore the quality of life of the patients was improved which shows that the treatment was effective in almost all the patients. The potency of oral hypoglycemics was determined similarly and it was found that 83% of the patients got improvement in their condition and therefore the quality of life was improved which shows the effectiveness of the therapy given.

CONFLICT OF INTEREST

The Author(s) declare(s) that they have no conflicts of interest to disclose.

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