



# AMERICAN JOURNAL OF PHARMTECH RESEARCH

Journal home page: <http://www.ajptr.com/>

## Prescribing Pattern for Treatment of Diabetes Mellitus Type 2 with Hypertension, An Analysis of Cost Effectiveness

B. Jayanth Kumar<sup>1\*</sup>, Sunil Kumar Reddy<sup>1</sup>

*1.Mamatha Medical College, Police lane, Rotatry nagar, Khammam, Andhra Pradesh*

### ABSTRACT

Management of Diabetes mellitus type 2 with hypertension is very complex process as it is very difficult to find which therapy gives better action in diabetic and hypertensive patients. The patients with Diabetes Mellitus and Hypertension were identified and they are enrolled based on inclusion and exclusion criteria. Data was collected through standard data documentation form. A prospective study was carried out and cost effective analysis of those drugs was done. The scores obtained are evaluated & analyzed using statistical tools and Microsoft Excel software. This study has shown that oral hypoglycemic drugs which are cheap i.e. Is 1.0 rs, per day, per week it costs 7rs, per fifteen days it costs 15 rs, per month it costs 30.5 rs and per year it costs 365 rs. for diabetes and for hypertension Beta blockers were low priced 10.17 rs per day, per week it costs 71.19rs, per fifteen days it costs 152.55rs, per month it is 315.27 rs, per year it is 3712 rs, categorized medication and at the same time it gives better therapeutic action in terms of treatment outcomes. Over all study has shown that combination therapy will attribute to the better treatment outcomes. Use of generic drugs should be encouraged than prescribing brand drugs because of same therapeutic out come and it cause more economic burden to patient and more complications. There is a need of educating patients to motivate them in order to make them realize the risk involved if untreated.

**Keywords:** Prescribing pattern, Cost Effective Analysis, Diabetes Mellitus, Hypertension.

\*Corresponding Author Email: [Jayanthkumar999@gmail.com](mailto:Jayanthkumar999@gmail.com)

Received 12 March 2014, Accepted 21 March 2014

Please cite this article in press as: Jayanth *et al.*, Prescribing Pattern for Treatment of Diabetes Mellitus Type 2 with Hypertension, an Analysis of Cost Effectiveness. American Journal of PharmTech Research 2014.

## INTRODUCTION

The term diabetes mellitus describes a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs.<sup>1</sup> Diabetes mellitus is a metabolic disorder characterized by relative or absolute insufficiency of insulin, and resultant disturbances of carbohydrate metabolism.

Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst), and polyphagia (increased hunger).

There are two main types of diabetes mellitus (DM).

Type 1 Diabetes mellitus results from the body's failure to produce insulin, and currently requires the person to inject insulin or wear an insulin pump. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes".

Type 2 Diabetes mellitus results from insulin resistance, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency. This form was previously referred to as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes"<sup>2</sup>

### **Management:**

Diabetes mellitus is a chronic disease, for which there is no known cure except in very specific situations. Management concentrates on keeping blood sugar levels as close to normal ("euglycemia") as possible, without causing hypoglycemia. This can usually be accomplished with diet, exercise, and use of appropriate medications (insulin in the case of type 1 diabetes; oral medications, as well as possibly insulin, in type 2 diabetes). Patient education, understanding, and participation is vital, since the complications of diabetes are far less common and less severe in people who have well-managed blood sugar levels.<sup>3,4</sup>

### **Medications to treat diabetes:**

Some of the most common types of medication are listed below. They are taken by mouth or injection.

- Alpha-glycosidase inhibitors (such as acarbose)<sup>5,6</sup>

- Biguanides (Metformin) <sup>7</sup>
- Meglitinides (including repaglinide and nateglinide)<sup>8</sup>
- Sulfonylureas (like Glimepride, glyburide, and tolazamide)<sup>9</sup>
- Thiazolidinediones (such as Rosiglitazon and pioglitazone).<sup>10</sup>

**HYPERTENSION:**

Hypertension is sustained high blood pressure ( $\geq 140/90$ mmHg). Blood pressure itself is the pressure exerted by the blood on the walls of the blood vessels. Each time.

The heart beats (about 60-70 times a minute at rest), it pumps blood into the arteries. Blood pressure is at its highest when the heart beats, pumping the blood. This is called systolic blood pressure. When the heart is at rest, between beats, blood pressure falls. This is diastolic pressure. Blood pressure follows a circadian rhythm in a normal individual.<sup>11, 12</sup>

**MANAGEMENT:**

Management of hypertension is mainly divided into 2 types. They are

- Pharmacological hypertension.
- Non-Pharmacological hypertension.

**Non –Pharmacological Management:**

One of the simplest and most effective ways to lower your blood pressure is to eat a healthy diet, such as the DASH diet. A diet rich in nuts, whole grains, fish, poultry, fruits and vegetables lowers blood pressure. A major feature of the plan is limiting intake of sodium, although the diet is also rich in potassium, magnesium, calcium, as well as protein. & Weight loss.<sup>13, 14</sup>

**Pharmacological management:**

Beta blockers, Alpha blockers, Calcium channel blockers, ACE inhibitors, Diuretics, Angiotensin II receptor antagonists.<sup>15</sup>

**MATERIALS AND METHODS:****Study design:**

A prospective Observational study.

To identify the prescribing patterns of drugs.

**Study population:**

Attendees of both inpatients & outpatients of KIM's hospital.

**STUDY CRITERIA:****Inclusion Criteria:**

- Patients between the age group 30 to 70 years.

- Patients having diabetics and hypertension, irrespective to co-morbid conditions are included in study.
- Patients receiving diabetic, antihypertensive drugs and also combination with any other drugs.

**Exclusion Criteria:**

- Pregnant women.
- Patients with Hepatic and Renal diseases with GFR < 30 ml/min
- Patients below 18 yrs.
- Infectious patients were not included.

**Procedure:**

A field study was conducted on patients with Diabetes Mellitus and Hypertension. Patient Profile forms, consent forms and standard data documentation forms were designed. Obtained permission from ethical committee. Patients with Diabetes Mellitus and Hypertension were identified and they are enrolled based on inclusion and exclusion criteria. Data was collected through the designed patient Performa's and standard data documentation form. A prospective study was carried out cost effective analysis of those drugs was done and the scores obtained are evaluated & analyzed using statistical tools.<sup>3,12</sup>

**RESULTS AND DISCUSSION****Demographic Data Analysis****Table 1 Gender**

<b>Gender</b>	<b>No. of patients</b>	<b>Percentage of patients</b>
Female	60	60%
Male	40	40%

**Male & Female Patients**

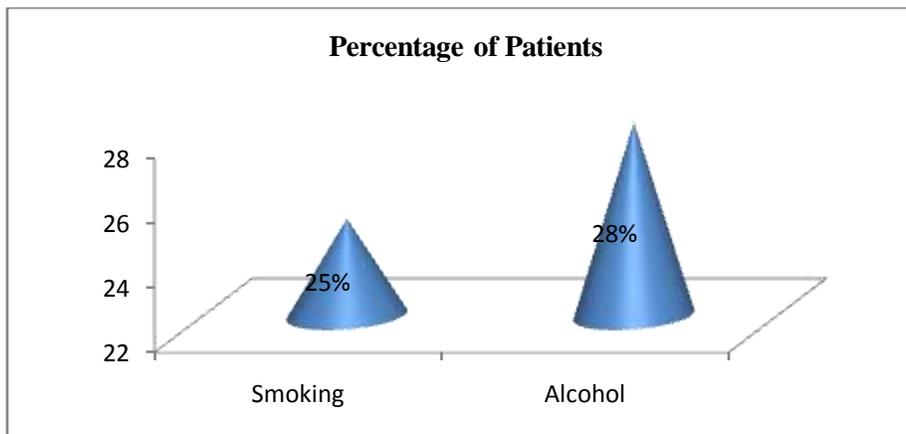
The distribution of study population in which the female patients are more in number than males.

**Social Habitat of Patients**

The distribution of study population, percentage of patients with social habits such as smoking and alcohol.(Figure 1)

**Patients with Body Mass Index More Than 27.4 [ $>27.4$ ]**

The distribution of study population, percentage of patients with body mass index  $>27.4$  i.e. in females Body mass index is found more in number than in males. (Table 2)

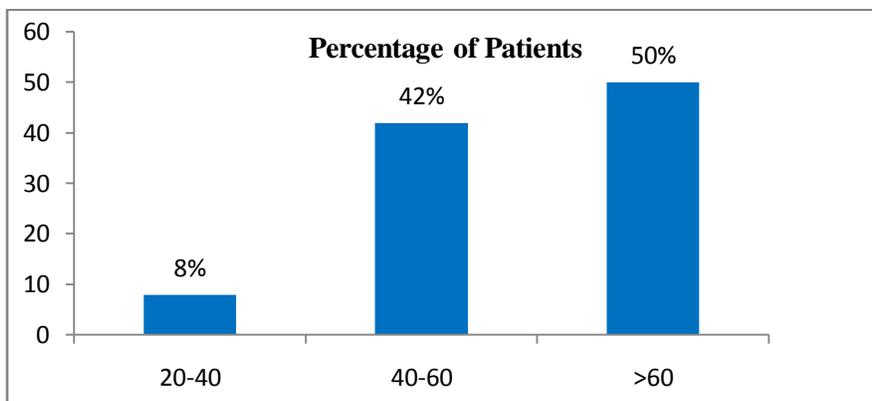


**Figure 1 Patients with habits like Smoking & Alcohol**

**Table : 2 Body Mass Index**

Body Mass Index(>27.4)	No. of Patients	Percentage of Patients
Female	28	28%
Male	19	19%

#### Age wise Distribution of Demographic Data



**Figure: 2 Distributions of the Patients Based on the Age Group**

The distribution of patients among the various age groups. The maximum number of patients are more than 60 age [ $>60$ ].

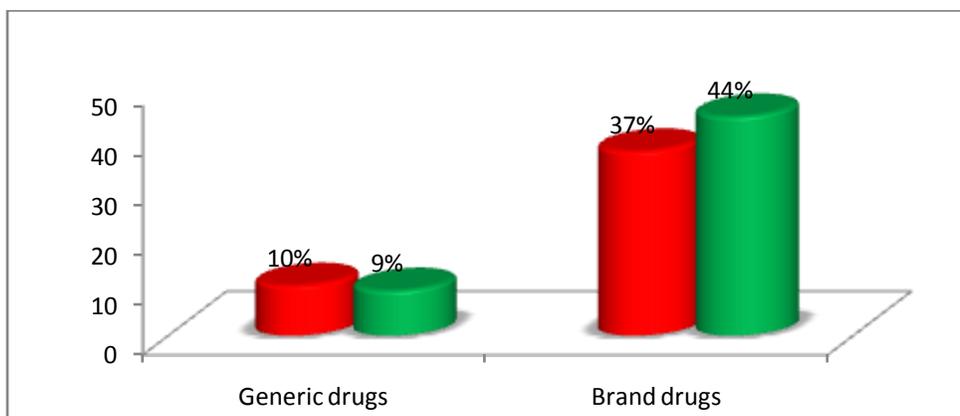
**Table: 3 Gender wise Distribution of Mono Therapy & Combination Therapy**

	Female		Male	
	No. of Patients	Percentage of Patients	No. of Patients	Percentage of Patients
Mono therapy	33	33%	25	25%
Combination therapy	24	24%	18	18%

#### Therapy given to Male and Female Patients

The gender wise distribution of mono therapy and combination therapy in females & males. Females are more in usage of mono therapy & combination therapy.

### Demographic Data based on Generic Drugs and Brand Drugs



**Figure 3: Use of Generic Drugs & Brand Drugs in Male and Female Patients.**

It shows the gender wise prescribed generic and brand drugs in females and males. Generic drugs are prescribed more in females where as in males brand drugs are prescribed more.

**Table 4: Mono therapy drugs prescribed to diabetes patients:**

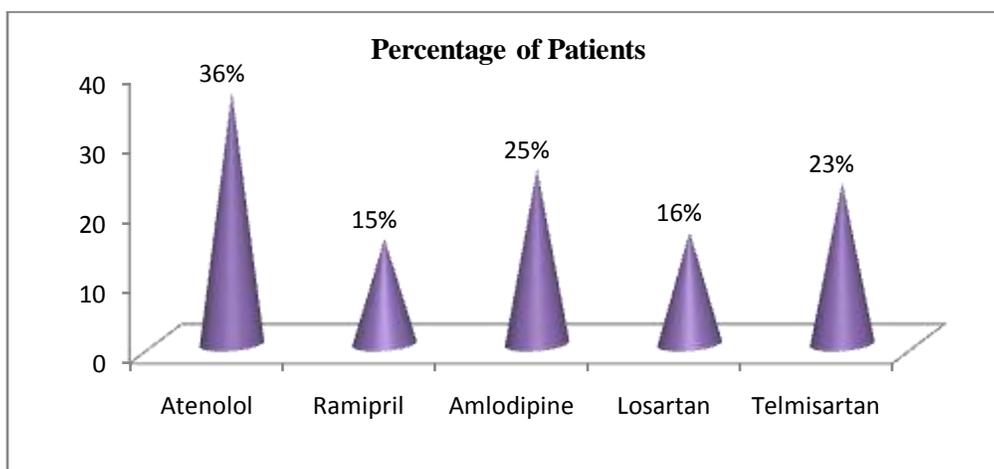
Drugs	No. of Patients	Percentage of Patients
Metformin	35	35%
Humainsuman	22	22%
Glizid	43	43%
Rosiglitazon	2	2%
Glimepride	17	17%

### Drugs Prescribed for Diabetic Patients

The Monotherapy drugs Prescribed to diabetic patients are calculated by individual prescription of the patient.

### Mono therapy drugs prescribed to hypertension patients:

The Monotherapy drugs Prescribed to hypertensive patients are calculated by individual prescription of the patient.



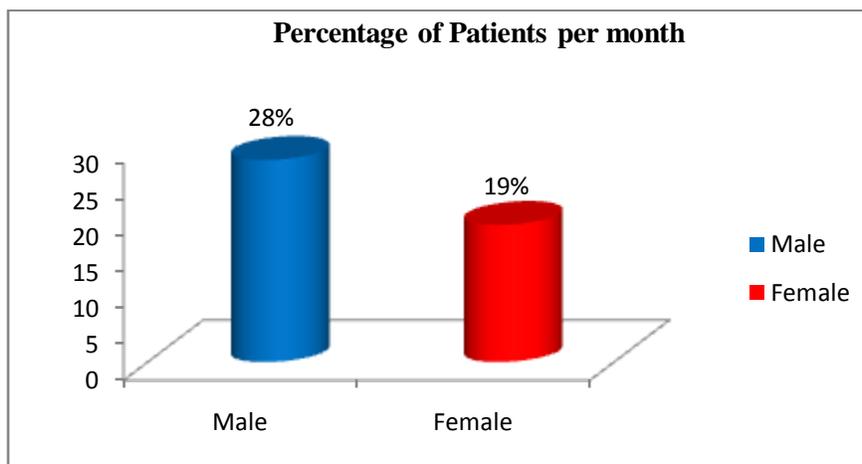
**Figure 4: Drugs Prescribed for Hypertensive Patients**

**Table 5: combination drugs prescribed to diabetic & hypertensive patients:**

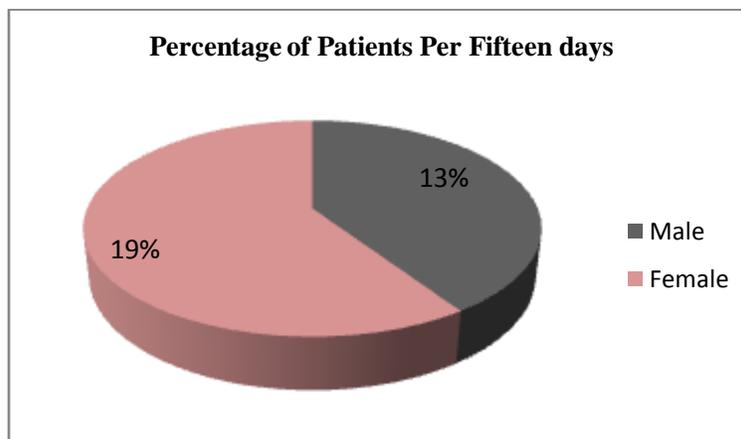
Drugs	No. of Patients	Percentage of Patients
Gemer	25	25%
Cetapin	22	22%
Pinom	18	18%
Biguanides+ Beta blockers	28	28%
Sulfonylureas+ ACE inhibitors	20	20%

**Drugs Prescribed for Diabetic & Hypertensive Patients**

The Combination drugs prescribed to Diabetic & Hypertensive patients are calculated by individual prescription of the patient.

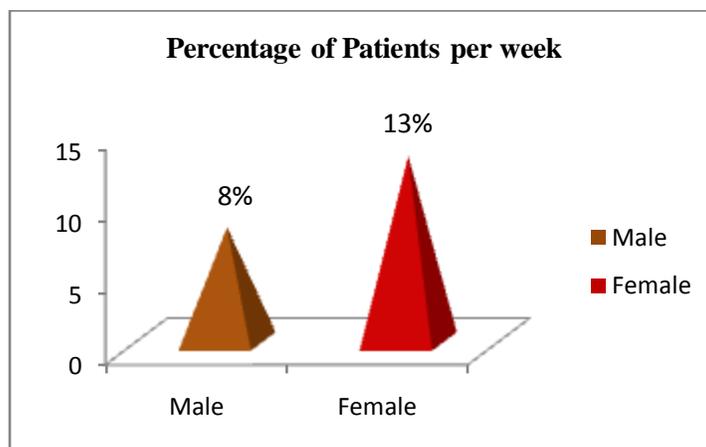
**Medication Prescribed to Patients per Month****Figure 5: Monthly Dosage of Drugs Prescribed to the Patients**

Drugs prescribed per monthly to the patients are more in males than females.

**Medication prescribed to Patients per fifteen day****Figure 6: Dosages of drugs prescribed per fifteen days**

Drugs prescribed per fifteen days are more in females than in males.

### Medication Prescribed to Patients per Week



**Figure 7** Dosages of drugs prescribed per week days

Drugs prescribed per week are more in females than in males.

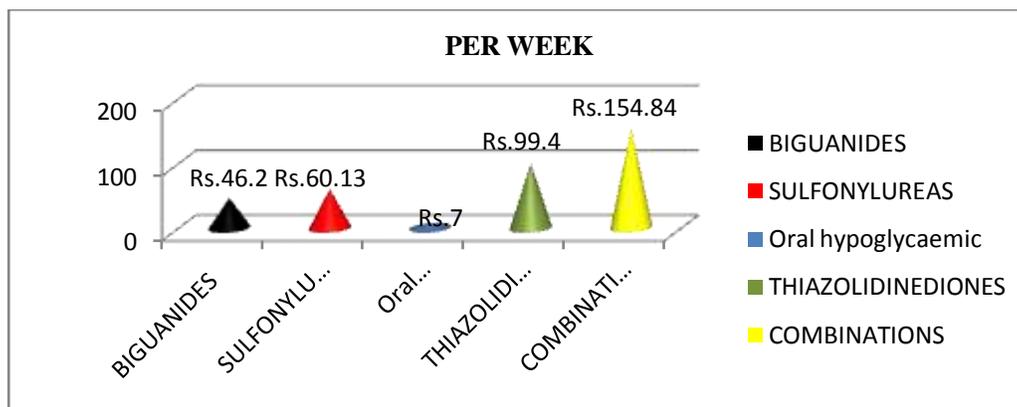
**Table 6** Drug acquisition cost of different anti diabetic drugs prescribed in hospital

Drugs	Daily dose	Drug acquisition cost(Indian rupees)		
		Per day	Per month	Per year
<b>Biguanides</b>		<b>6.6</b>	<b>200.5</b>	<b>2409</b>
Metadoze(metformin)	850mg	3.6	109	1314
Phenformin	25mg	3.0	91.5	1095
<b>Sulfonylureas</b>		<b>8.59</b>	<b>261.995</b>	<b>2409</b>
Glizid(Gliclazide)	40mg	3.1	94.55	1131.5
Gilbenclamide	25-50mg	3.50	106.75	1277.5
Glimepiride	2-6mg	1.99	60.695	726.35
<b>Oral hypoglycaemic</b>		<b>1.0</b>	<b>30.5</b>	<b>365</b>
Barvocot(huminsulin)	650mg	1.0	30.5	365
<b>Thiazolidinediones</b>		<b>14.2</b>	<b>433.1</b>	<b>5223</b>
Rosiglitazone	4-8mg	6.2	189.1	2263
Pioglitazone	15-45mg	8.0	244	2920`
<b>Combinations</b>		<b>22.12</b>	<b>674.66</b>	<b>8073.8</b>
Cetapin-pioglitazone+metformin	500mg	8.2	250.1	2993
Gemer-glimepiride+metformin	850mg	7.3	222.65	2664.5
Amaryl-M	500mg	6.62	201.91	2416.3
Glimepiride+metformin				

### Cost of anti diabetic drugs prescribed per day, per month, per year

Drug Acquisition Cost of anti diabetic drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per day, per month, per year.

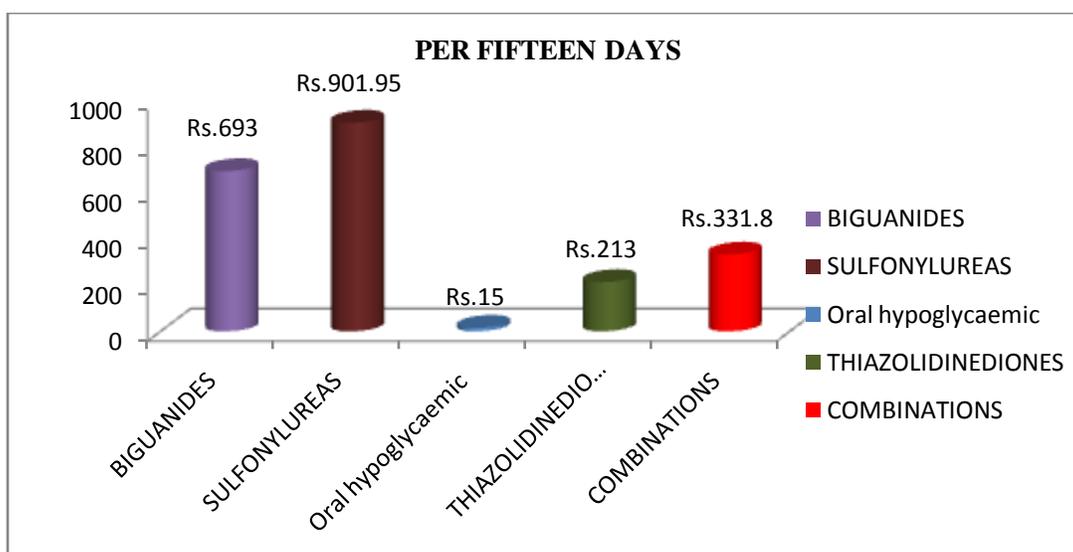
### Drug Acquisition cost of Different Anti Diabetic Drugs Prescribed in Hospital per Week



**Figure 8: cost of anti diabetic drugs prescribed per week**

Drug Acquisition Cost of anti diabetic drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per week.

**Drug acquisition cost of different anti diabetic drugs prescribed in hospital per fifteen days**



**Figure 9 Cost of anti diabetic drugs prescribed per fifteen days**

Drug Acquisition Cost of anti diabetic drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) Per Fifteen days.

**Table 7 Drug acquisition cost of different anti hypertensive drugs prescribed in hospital per week & per fifteen days.**

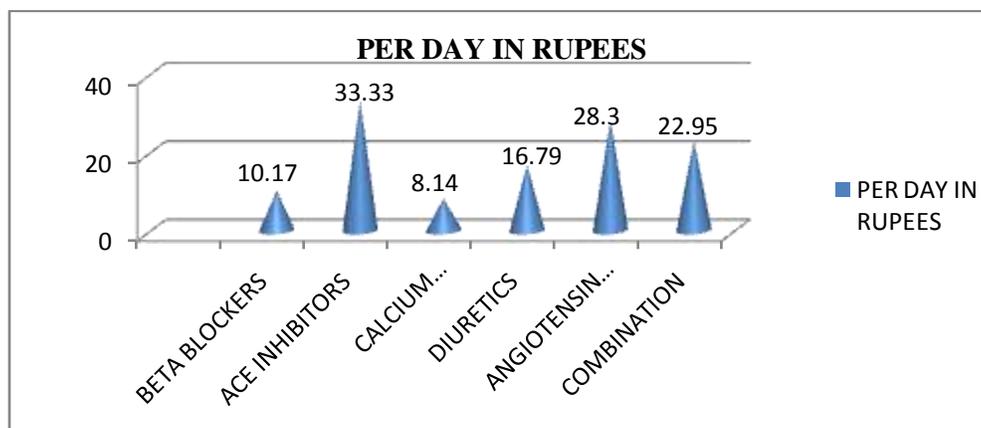
Drugs	Daily dose	Drug acquisition cost (Indian rupees)	
		Per Week	Per 15 days
Beta Blockers		71.19	152.55
Atenolol	50mg o.d	10.08	21.6
Metoprolol	50mg o.d	20.65	44.25
Propranolol	40mg o.d	6.58	14.1
Carvedilol	12.5mg o.d	33.88	72.6

ACE Inhibitors		233.31	499.95
Enalapril	5mg o.d	10.5	22.5
Ramipril	2.5mg o.d	19.25	41.25
Lisinopril	10mg o.d	40.6	87
Benazapril	10mg o.d	163.31	349.95
Calcium Channel Blockers		56.98	122.1
Amlodipine	5mg o.d	12.6	27
Nifedipine SR	20mg o.d	8.68	18.6
Diltiazem SR	90mg o.d	35.7	76.5
Diuretics		117.53	251.85
Furosemide	40mg o.d	9.52	20.4
Losartan	50mg o.d	64.75	138.75
Prazosin	1mg o.d	15.96	34.2
Angiotensin II receptor Antagonist.		198.1	424.5
Telmisartan	40 mg o.d	49.7	106.5
Olmesartan	20 mg o.d	46.2	99
Valsartan	80 mg o.d	65.8	141
Losartan	50 mg o.d	36.4	78
Combination		160.65	344.25
Pinom(Amlodipine+Atenolol)	1 tab o.d	17.15	36.75
Olmesartan+Medoxomil	1 tab o.d	21.35	45.75
Amiloride+Chlorthiazide	1 tab o.d	24.64	52.8
Amilodipine+lisinopril	1 tab o.d	36.61	78.45

### Cost of anti hypertensive drugs prescribed per week & per fifteen days

Drug Acquisition Cost of anti Hypertensive drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per week, & per fifteen days.

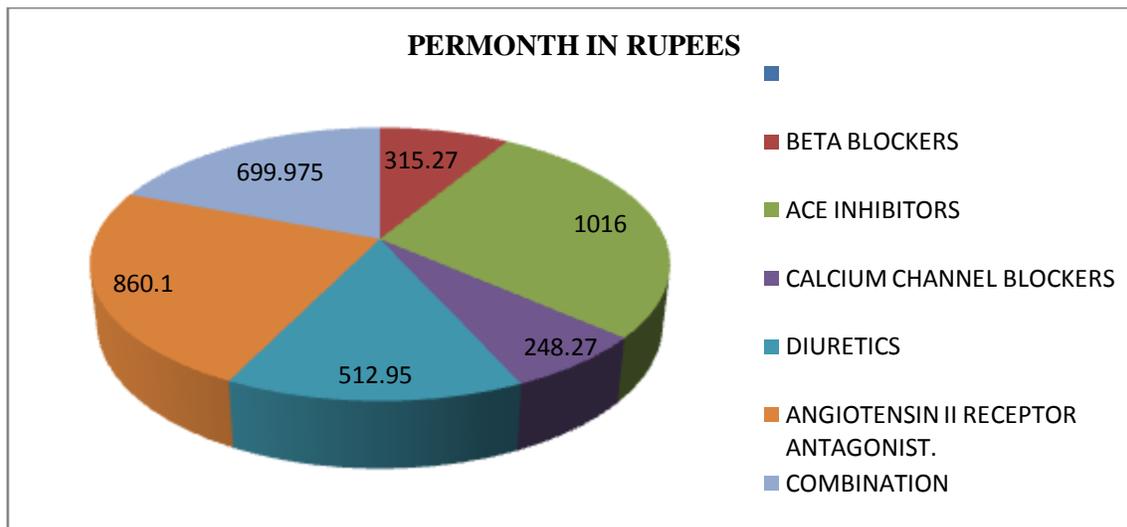
### Drug acquisition cost of different anti hypertensive drugs prescribed in hospital per day.



**Figure 10 Cost of anti hypertensive drugs prescribed per day**

Drug Acquisition Cost of anti Hypertensive drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per day.

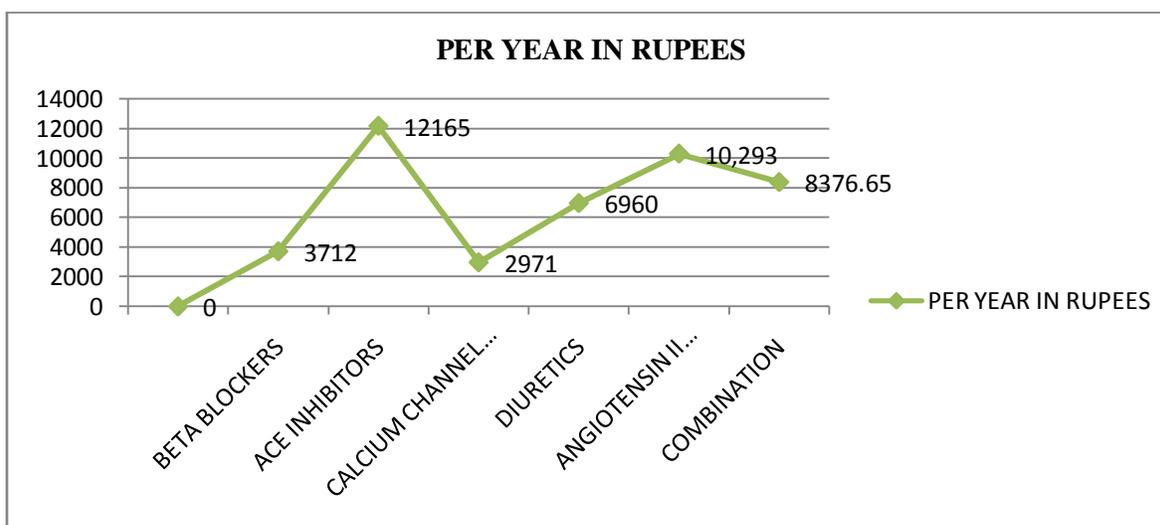
### Drug Acquisition Cost of Different Anti Hypertensive Drugs Prescribed in Hospital Per Month



**Figure 11 Cost of Anti Hypertensive Drugs Prescribed per Month**

Drug Acquisition Cost of anti Hypertensive drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per month.

#### **Drug Acquisition Cost of Different Anti Hypertensive Drugs Prescribed in Hospital Per Year**



**Figure : 12 Cost of anti Hypertensive Drugs Prescribed per year**

Drug Acquisition Cost of anti Hypertensive drugs is taken from the minimum dose of the drug & the average cost of the drug (in INDIAN RUPEES) per year.

#### **DISCUSSION:**

- A total of 100 prescriptions were received during the study period November 2012 to April 2013. The present study observed that DIABETES MILLETUS TYPE 2 WITH HYPERTENSION was found to be more prevalent in Females than in Males among them 50% of patients were found to be more than 60 years.

- Among these patients 25% are smokers and 28% are found to be alcoholic and 28% of Females and 19% Males are overweight.
- Monotherapy was used at a rate of 33% in females and 25% in males, Combination therapy was also used in at a rate of 24% in females and 18% in males.
- Patients using Metformin were found to be 35%, Human insulin 22%, Glizid 43%, Rosiglitazon 2% and Glimepride 17% & Atenolol 36%, Ramipril 15% , Amlodipine 25% Losartan 16% and Telmisartan 23% .
- Patients using combination drugs were found to be Gemer 25%, Cetapin 22% , Pinom 18%, Biguanides+ Beta blockers 28%, Sulfonylurea +A CE inhibitors 20% .

### **Cost Effective Analysis Of Anti Diabetic Drugs**

- Biguanides cost per day is 6.6 rs, per week it is 46.2 rs, per fifteen days it is 693rs, per month it is 200.5 rs and per year it is 2409 rs ,
- Sulfonyl urea's cost per day is 8.59 rs, per week it is 60.13 rs, per fifteen days it is 693 rs, per month it is 261.95 rs and per year it is 2409 rs ,
- Oral hypoglycemic drugs cost per day is 1.0 rs, per week it is 7 rs, per fifteen days it is 15 rs, Per month it is 30.5 rs, and per year it is 365 rs,
- Thiazolidinediones cost per day is 14.2 rs, per week days it is 99.4 rs, per fifteen days it is 213 rs, per month it is 433.1 rs, per year it is 5223 rs,
- Combination drug cost per day is 22.12 rs, per week days it is 154.84 rs, per fifteen days it is 331.8 rs, per month it is 674.66 rs and per year it is 8073.8 rs....
- Medication given to patients per week, per fifteen days, and per month the percentage of patients given per week is Males 8% and Females 13%.
- Medication given to patient for fifteen days is Males 13% and Females 19% and per month the medication given is Males 28% and in Females it was found to be 19%

### **Cost analysis of anti hypertensive drugs:**

- Cost of Beta blockers drugs per day is 10.17 rs, per week it is 71.19rs, per fifteen days it is 152.55rs, per month is 315.27 rs, and per year is 3712 rs, ,
- Cost of ACE inhibitors per day is 33.33 rs, per week it is 233.31rs, per fifteen days it is 499.95rs, per month is 1016 rs ,and per year is 12165 rs,
- Cost of calcium channel blockers per day is 8.14 rs, per week it is 56.98rs, per fifteen days 122.1rs, per month is 248.27 rs, per year is 2971 rs,
- Cost of Diuretics per day is 16.75 rs, per week it is 117.53rs, per fifteen days it is 251.85rs, per month is 512.95rs, and per year is 6960 rs,

- Cost of Angiotensin receptor II Per day 28.3 rs, per week is 198.1rs, per fifteen days is 424.5rs, , per month is 860.1rs, and per year is 10,293 rs
- Cost of combinations drugs per day is 22.95 rs, per week it is 160.65 rs per fifteen days it is 344.25 rs, per month is 699.975 rs and per year is 8376.65 rs .
- In Cost analysis of ANTI DIABETIC AND ANTI HYPERTENSIVE Drugs, Diabetic drugs were found to be Thiazolidinediones were costly 14.2 rs per day, per week days 99.4 rs, per fifteen days it is 213rs, per month it costs 433.1 rs , and per year it costs 5223 rs ,
- Oral hypoglycemic drugs were cheap i.e is 1.0 rs,per day , per week days it is 7 rs, per fifteen days it is 15 rs, per month it costs 30.5 rs and per year it costs 365 rs ..
- Hypertensive drugs were found to be Angiotensin receptor II costly i.e. Per day 28.3 rs, per week is 198.1rs, per fifteen days is 424.5rs, , per month is 860.1rs, and per year is 10,293 rs
- . Beta blockers were cheap 10.17 rs, per day , per week days it is 71.19rs, per fifteen days it is 152.55 rs, per month it is 315.27 rs, per year it is 3712 rs,

## CONCLUSION:

Management of DIABETES MILETUS TYPE 2 WITH HYPERTENSION is very complex process as it is very difficult to find which therapy gives better action in diabetic and hypertensive patients. Over all this study concludes that combination therapy will attribute to the better treatment outcomes..This study concludes that Oral hypoglycemic drugs which are cheap for diabetes and for hypertension Beta blockers were low priced, categorized medication and at the same time it gives better therapeutic action in terms of treatment outcomes..Use of generic drugs should be encouraged than prescribing brand drugs because it cause more economic burden to patient and more complications. generic drugs and brand drugs has same therapeutic out come. The use of expensive anti diabetic and anti hypertensive agents is shown to be beneficial in certain patients group especially with end organ damage, but in view of use of these medications for long time therapy and the resulting expenditure incurred, monitoring their use and their correlation with clinical outcomes and quality of life is important to ensure optimal use of health care resource. There is a need of educating patients so as to motivate and empower them in order to make them realize the risk involved if untreated.

## REFERENCE

1. [www.who.int/entity/diabetes/action\\_online/basics/en/index.html](http://www.who.int/entity/diabetes/action_online/basics/en/index.html).

2. Shoback, edited by David G. Gardner, Dolores (2011). Greenspan's basic & clinical endocrinology (9th Ed.).New York: McGraw-Hill Medical. pp. Chapter 17. ISBN 0-07-162243-8.
3. Nathan DM, Cleary PA, Backlund JY, Genuth SM, Lachin JM, Orchard TJ, Raskin P, Zinman B; Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. *The New Eng J Medicine* 2005;353 (25): 2643–53.
4. The effect of intensive diabetes therapy on the development and progression of neuropathy. The Diabetes Control and Complications Trial Research Group. *Annals of Internal Medicine* 122 (8): 561–8.
5. Konno; Tortorelis, DG; Fullerton, SA; Samadi, AA; Hettiarachchi, J; Tazaki, H. A possible hypoglycaemic effect of mistake mushroom on type 2 diabetic patients. *Diabetic Medicine* 2001;18 (12): 1010.
6. Hong; Xun, M; Wutong, W. Anti-diabetic effect of an alpha-glucan from fruit body of maitake (*Grifola frondosa*) on KK-Ay mice. *The J Pharm Pharmacol* 2007;59 (4): 575–82.
7. Ripsin CM, Kang, H, Urban, RJ. Management of blood glucose in type 2 diabetes mellitus. *American family physician* 2009;79 (1): 29–36.
8. Rendell. Advances in diabetes for the millennium: drug therapy of type 2 diabetes. *Med Gen Med: Medscape general medicine* 2004; 6 (3 Suppl):9.
9. <http://news.yahoo.com/metformin-outperforms-common-class-diabetes-drugs-study-160405357.html>.
10. European Medicines Agency, "European Medicines Agency recommends suspension of Avandia, Avandamet and Avaglim", EMA, 23 September 2009
11. Millar-Craig M et al. Circadian variation of blood pressure. *Lancet* 1978; 1:795–797
12. Mancia G et al. Blood pressure and heart rate variability in normotensive and hypertensive human beings. *Circ Res* 1983; 53:96–104
13. You're Guide to Lowering Your Blood Pressure with DASH" (PDF). Retrieved 8 June 2009.

14. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension*. 2003; 42:1206–52.
15. A Textbook of pharmacology by Dr. Uma Bhandari associate professor of Deptt. Of pharmacology faculty of pharmacy Hamdard University: 341-344...

***AJPTR is***

- Peer-reviewed
- bimonthly
- Rapid publication

Submit your manuscript at: [editor@ajptr.com](mailto:editor@ajptr.com)

