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Evaluation of prescription pattern and efficacy of anti-diabetic drugs in Coimbatore, India

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ABSTRACT
In this present study, 1500 Diabetes Mellitus (DM) patients were included from Coimbatore zone, Tamil Nadu, India. The blood glucose levels were monitored to correlate the glycemic control with the antidiabetic drug treatment. This study addressed many variabilities in such treatments including the prescribing pattern of various novel entities along with existing drugs for glycemic control, diabetic vascular complexities on Coimbatore zone, lack of relevant scientific data, occurrences of prescription errors, less awareness of the DM patients, the insufficient number of local hospitals and high cost of the medicine. Data analysis was carried out by segregating the DM patients under study according to their blood glucose level. Results demonstrated that brand names of anti-diabetic drugs were taken more frequently by outpatients when contrasted with inpatients. Also, the number of drugs prescribed under generic names were significantly less than prescribe brand names. Prescribed formulations results indicated that tablets were preferred over other formulations. Frequently prescribed twenty-one brands and their combination results demonstrated the popularity of the insulin human Mixtard® injection 30-40 IU. Moreover, frequently prescribed 21 branded drugs' cost were analyzed. It can be concluded from the current work that appropriate steps should be taken to raise awareness of the DM patients in Coimbatore zone so that they can follow the specialists' instruction for better hyperglycemia control. Finally, it can be suggested that the Tamil Nadu Government should put more effort on improving health care support in Coimbatore zone.

***Key Words*:** Diabetes Mellitus, Glucometer, Glycemic Control, Generic Names, Anti Diabetic Drugs, Insulin and Hyperglycemia.

INTRODUCTION

DM is constant metabolic dearth illness, standout amongst most pervasive sicknesses in the world. Report of International Diabetes Federation indicated 7.6% (40.9 Millions) affected worldwide especially in our assumption to rise the prevalence 8.6% (60.9 Millions) at year of 2025 (Srinivasan, *et al.*, 2017). In our assumption 50% of Indian hospitals not follow the guidelines due to nonpharmacological treatment does not prompt commendable for glycemic control, patients ought to get Oral Hypoglycemic Agents (OHAs), insulin and both (Seema and Cornwall, 2014). The past study indicated India, three pharmacologic classes of accessible formulations in the National List of Essential Medicines such as biguanide (Metformin), sulfonylureas (Glibenclamide and Gliclazide) and insulin derivatives were prescribed drug cost more (48.2%) (Agarwal *et al.*, 2014). Based on the above reasons interested to analyze the current scenario of prescription pattern and efficacy of anti-diabetic drugs on Coimbatore.

MATERIALS AND METHODS

Study design

A few writing overview based to choose Cohort study (Hiroyuki *et al.*, 2010) was utilized to appraise the different parameters of DM patients on different zone of Coimbatore and which incorporates south east west and north zones which includes inpatients and outpatients.

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Sample size

Chosen associate study based to1500 DM patients (Mandavi *et al.*, 2012; Govan *et al.*, 2012) were gathered from Karpagam Medical College-Hospital and different multi-specialty hospitals.

Study Criteria

Inclusion *(Dobesh, 2006; Derosa, 2008)*

1. Patients above 18 years and under 60 years old.
2. Patients with DM with other co-morbidities.
3. Collected data from inside the hospital which includes inpatients and outpatients.
4. Patients able to read and write.
5. Patients regularly consuming diabetic medication.
6. End of the days tallied DM Patients.

Exclusion *(Alvarez et al., 2008)*

1. Patients aged below 18 years or over 60 years.
2. Patients without doctor authorization, attenders and spectators permitted inside branch of diabetology.
3. Bogus information of other classification wellbeing sciences people groups given data were not gathered.
4. Patients, who were in obviousness to be dismisses in our study.

Based on the above criteria to direct patients advising in drug information center.

Observed parameters

As per the guidelines instructions (Coilin and Dejan, 2005; Phil Edwards, 2010) observing some parameters such as glucose level of the patients, (Andreas, *et al.*, 2014), rate of inpatients and outpatients (Chen *et al.*, 2012), analysis of prescription (Which includes monotherapy and polytherapy) (David, *et al.*, 2009) Adverse Drug Reaction Monitoring (Dabhade *et al.*, 2013) and its Cost wise comparison (Adrian *et al.*,2010).

RESULTS AND DISCUSSION

Clinical condition

The Table 1 and Figure 1, have been indicated deliberate glucose levels help to separate the DM Patients. The DM patients' glucose level alterations were indicated that the increased Glucose levels such as slightly increased glucose level with DM (19.1 ± 0.0), DM Type-I (74.5 ± 2.74) DM Type-II (173.5 ± 6.85) when compared to normal healthy volunteer (125.7 ± 2.73).

Prescription pattern analysis for inpatients and out patients

The aggregate number of medicines took care of 1500 patients, which incorporates inpatients and outpatients comes about demonstrated (Table 2 and Figure 3) that the out patients were more taken care of (1078 Numbers and 71.9%) when contrasted with inpatients (422 Numbers and 28.1%). The aftereffect of inpatients showed that the type- I DM solutions (228 Numbers and 15.2%) were progressively when thought about type II DM remedies (788 Numbers and 52.5%) furthermore out patients of type II DM medicine (788 Numbers and 52.5%) were more contrasted with type- I DM remedies (290 Numbers and 19.4%).

Analysis of prescriptions

The results (Table 3 and Figure 4) of drugs prescribed under generic names (1405 Numbers 32.1%) were less drugs when compared to prescribe brand names (2839 Numbers and 65%) for DM associated diseases. The prescription containing different brands of anti-diabetic drugs results indicated that the drugs prescribed under brand names 127 Numbers and 2.6%) when compared to prescribed brand names (2839 Numbers and 65%) for DM associated diseases. The single drugs are prescribed under the guidelines (768 Numbers and 17.5%) were comparatively increased to prescribe combinations under the guidelines (668 Numbers and 15.3). The guidelines based prescribed drugs and authenticated prescriptions reports indicated that the based on the guidelines to prescribed drugs (4265 Numbers and 97.6%) and prescriptions (1388 Numbers and 92.5%) were more when compared to randomly prescribed drugs (106 Numbers and 2.4%) and prescriptions (112 Numbers and 7.5%).

Mono therapy of prescriptions

The recommended drugs example of mono treatment comes about showed (Table 4 and Figure 6) that the aggregate quantities of single medications endorsed in the 345 medicines and Type-I DM endorsed tranquilizes in the solutions were more numbers and rate (184 Numbers and 53.3%) when contrasted with Type-II and Severe Diabetes Mellitus. The extreme state of DM to recommend tranquilizes in the solutions were more (107 numbers and 31%) when contrasted and Type-II DM remedies (54 numbers and 15.7%).

Analysis different formulations

In our study different formulations prescribed (Table 5 and Figure 7-8) by the doctors, which expressed that the totally 4371 numbers of formulations were used for the treatment of DM and its associated diseases in Coimbatore zone which includes tablets, capsules, injections, ointments, syrups, creams, jelly, aersol and suppositories. The results of prescribed formulations tablets were present in the more numbers in the prescriptions when compared to capsules (967 Numbers and 22.1%), injections (512 Numbers and 11.7%), ointments (15 Numbers and 0.3%), syrups (64 Numbers and 1.5%), creams (13 Numbers and 0.3%), jelly (18 Numbers and 0.4%), aersol (5 Numbers and 0.1%) and suppositories (8 Numbers and 0.2%).

Analysis of different branded drugs

The FDA approved drugs were prescribed (Table 6 and Figure 9) (2839 Numbers and 65%) when compared with total number of drugs (4371 Numbers) and also FDA un approved drugs were very less to prescribed (22 Numbers and 0.5%) and (22 Numbers and 1.5%) when compared to total number of drugs (4371 Numbers) and FDA approved drugs and (Numbers and 7.5%). Twenty-two brands were frequently prescribed drugs in the prescriptions which indicated that the 2819 Numbers and 34.6% and 2819 Numbers and 99.3% were not frequently prescribed brands when compared to total number of drugs (4371 Numbers) and FDA approved drugs (23 Numbers and 0.5%) and (23 Numbers and 1.5%).

Analysis of frequently prescribed brands

The frequently prescribed twenty-one brands to the DM Patients results expressed that (Table 7 and Figure 11-12) the insulin human Mixtard injection 30-40 IU injection were prescribed (Numbers 142 and 17.1%) more for Type-I DM patients when compared to each other brands. The Glycomet (Metformin, 500mg) brand of drugs prescribed more (135 Numbers 16.1%) for Type-II DM when compared to other brands except insulin human Mixtard injection 30-40 IU injection were prescribed (Numbers 142 and 17.1%). The Gemer (Glimipride 2mg/Metformin 500mg) brand of drugs prescribed more (113 Numbers 13.5%) for Type-II DM patients when compaered to other brands not included insulin human Mixtard injection 30-40 IU injection were prescribed (Numbers 142 and 17.1%) and Glycomet (Metformin,500mg) (135 Numbers 16.1%). The reports of Diapride (Glimipride 2mg) (109 Numbers 13%) brand of drugs prescribed for Type-II DM patients when compared to K-glim (Glimipride1mg/ Metformin 500mg) (32 Numbers 3.9%), Janumet (Metformin 50mg and Sitagliptin1000mg) (31 Numbers 3.8%), Istamet (Metformin50mg and Sitagliptin 1000mg) (31 Numbers 3.8%), Glvus Met (Metformin 50mg and Vitagliptin 1000mg) (21 Numbers 2.5%), Glimy -M(Glimipride 2mg/ Metformin 500mg) (20 Numbers 2.4%), Gluconorm (Glimipride 2mg / Metformin 500mg), (22 Numbers 2.6%), Ppg (Voglibose 0.3mg) (24 Numbers 2.9%), Diamicron XR (Gliclazide 60mg) (15 Numbers 1.8%), Tenglyn (Teneligliptin 20 mg) (14 Numbers 1.7%), Trejenta (Linagliptin 5mg) (15 Numbers 1.8%), Glimy (Glimipride1mg / Metformin 500mg) (135 Numbers 16.1%), Glimisave – M (Glimipride 1mg / Metformin 500mg) (21 Numbers 2.5%), Glizid (Gliclazide 40mg) (10 Numbers 1.2%), K-Gem (Gliclazide 80 mg / Metformin 50mg) (13 Numbers 1.6%) and Blisto (Glimipride 4mgv/ Metformin 1000mg) (135 Numbers 16.1%) brands but except insulin human Mixtard injection 30-40 IU injection were prescribed (Numbers 142 and 17.1%) and Glycomet (Metformin,500mg) (135 Numbers 16.1%).

Analysis of cost wise comparison

The cost wise analysis of frequently prescribed twenty-one branded drugs (Table 8 and Figure 12) total cost Rs. 29882.55/-. The human Mixtard insulin 30-40 IU has been prescribed for the treatment of Type-II DM Patients more cost Rs. 22436.00/- for 142 drugs when compared to each other brands of drugs. The Glimy-M single tablet is RS. 53, our finding collected prescriptions 20 Numbers, which total cost Rs.1060/- but when compared to single tablet more economic when compared to each other drugs except human Mixtard insulin 30-40 IU. Same combinations but cost

Figure. No : 1, **Glucose Variability includes Mean and SEM**

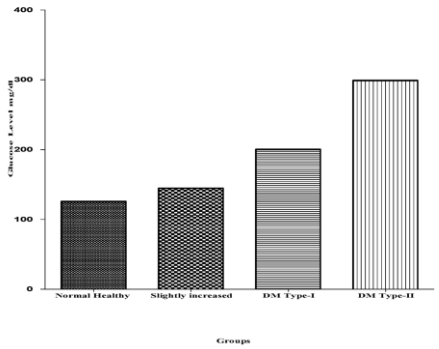

Figure.No:2, **Prescription pattern analysis for inpatients and out patients**

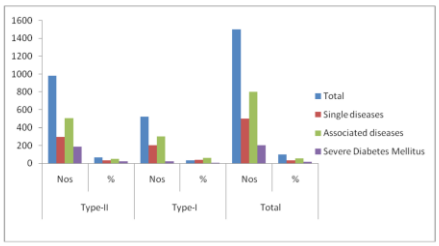

Figure.No:3, **Prescription pattern analysis of anti diabetic drugs on percentage and numbers**

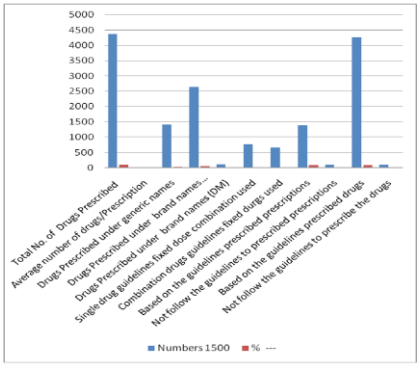

Figure.No:4, **Prescription pattern analysis of DM mono therapy of prescriptions in percentage and numbers**

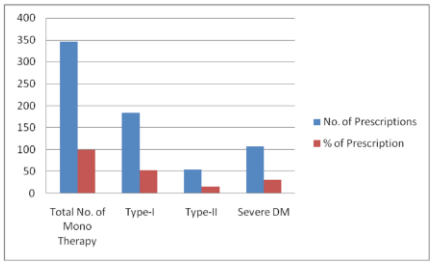

Figure.No:5, **Number of Formulations Prescribed**

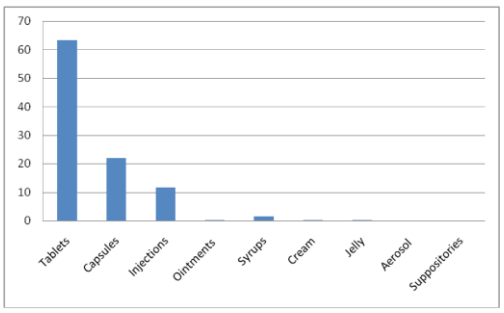

Figure.No:6, **Percentage of Formulations Prescribed**

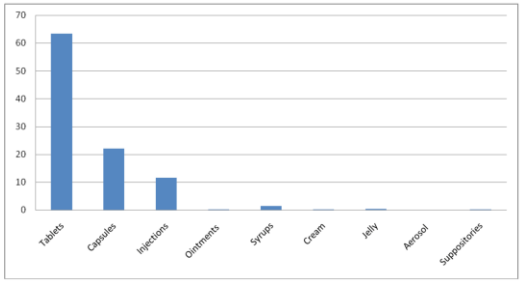

Figure.No:7, **Detailed Comparison of Branded Drugs**

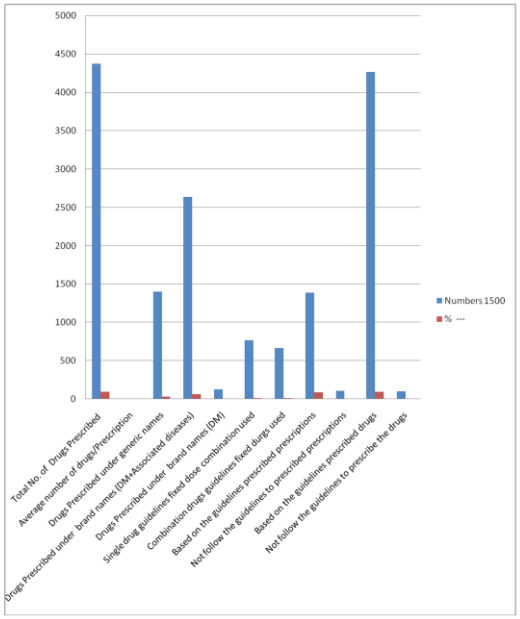

Figure.No:8, **Prescription Pattern Analysis Prescribed Drugs and Its Combinations in Numbers**

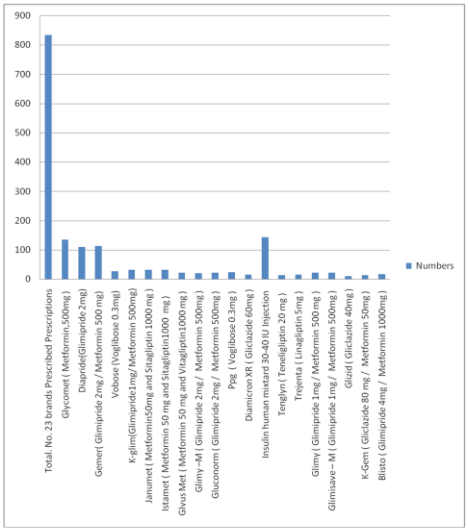

Figure.No:9, **Prescription pattern analysis prescribed drugs and its combinations in %**

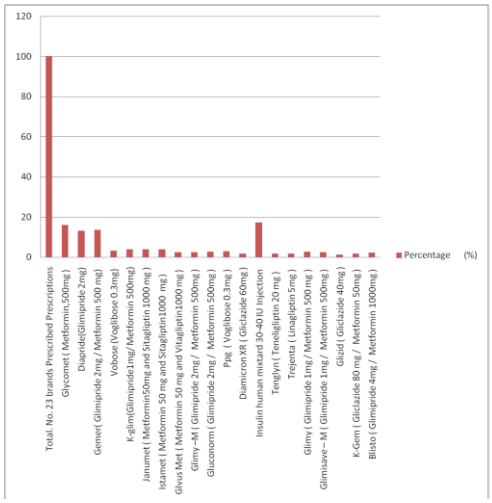

Figure.No:10, **Details of cost wise comparison for prescribed drugs**

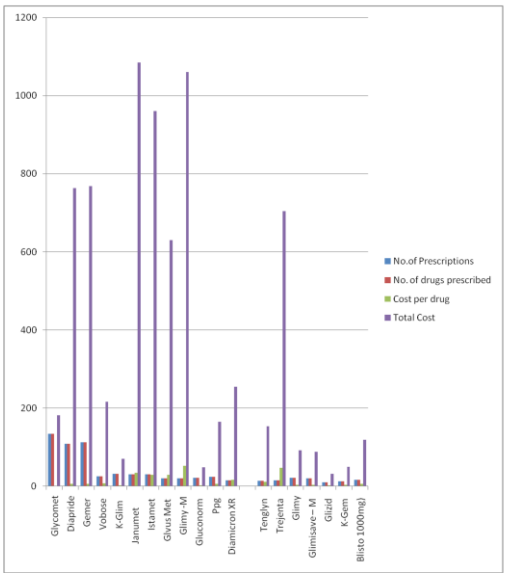

Table 1: Clinical Condition of the DM patients.

S. No	Disease	Glucose level (mg/dL)
1	Normal Healthy Volunteers	125.7 ± 2.73
2	Slightly increased Glucose level with DM	144.6 ± 2.73
3	DM Type-I	200.2 ± 5.47***
4	DM Type-II	299 ± 9.58***

Above glucose level were expressed (N=30) Mean ± SEM and indication (P<0.05)*, (P<0.001)** and (P<0.0001)***

Table 2: Prescription pattern analysis for in-patients and out-patients.

S. No	Different types of Prescription	Type-II		Type-I		Total	
		No	%	No	%	No	%
1	Total	982	65.5	518	34.5	1500	100
2	In Patients	194	12.9	228	15.2	422	28.1
3	Out Patients	788	52.5	290	19.4	1078	71.9

Table 3: Analysis of Prescriptions.

S. No	Particulars	No.	%
1	Total No. of Prescription	1500	-
2	Total No. of Drugs Prescribed	4371	100
3	Average number of drugs/Prescription	2.9	-
4	Drugs Prescribed under generic names	1405	32.1
5	Drugs Prescribed under brand names (DM +Associated diseases)	2638	65
6	Drugs Prescribed under brand names(DM)	127	2.9
7	Single drug guidelines fixed dose combination used	768	17.5
8	Combination drugs guidelines fixed drugs used	668	15.3
9	Based on the guidelines prescribed prescriptions	1388	92.5
10	Not follow the guidelines to prescribed prescriptions	112	7.5
11	Based on the guidelines prescribed drugs	4265	97.6
12	Not follow the guidelines to prescribe the drugs	106	2.4

Table 4: Analysis Mono Therapy of Prescribed medication for DM.

S. No	Clinical condition	No. of prescriptions	% of prescriptions
1	Total No. of Mono Therapy	345	100
2	Type-I	184	53.3
3	Type-II	54	15.7
4	Severe DM	107	31.0

Table 5: Analysis different formulations by the help of collected prescriptions.

S. No	Formulations	No. of formulations	% of formulations
1	Tablets	2769	63.4
2	Capsules	967	22.1
3	Injections	512	11.7
4	Ointments	15	0.3
5	Syrups	64	1.5
6	Cream	13	0.3
7	Jelly	18	0.4
8	Aerosol	5	0.1
9	Suppositories	8	0.2
	Total No. of prescribed drugs	4371	

Table 6: Analysis of different branded drugs.

S. No	Particulars	Numbers	%	
1	Total No. of Prescription	1500	-	
2	Total No. of Drugs Prescribed	4371	100	
3	Prescribed branded drugs (FDA Approved)	2839	65.0	100
4	Prescribed branded drugs (Not FDA Approved)	1532	35	54
5	Frequently prescribed brands	22 brands for anti-diabetic drugs / 833 times for repeatedly prescribed in the prescriptions / Out of 1500 prescription	0.5	1.5
6	Not frequently prescribed brands	2819	34.6	99.3

Table 7: Analysis of frequently prescribed brands.

Frequently Prescribed Brands in prescription	No.	%
Total 21 brands Prescribed Prescriptions	833	100
Glycomet (Metformin, 500mg)	135	16.1
Diapride(Glimipride 2mg)	109	13.0
Gemer(Glimipride 2mg / Metformin 500 mg)	113	13.5
Vobose (Voglibose 0.3mg)	26	3.1
K-glim(Glimipride1mg/ Metformin 500mg)	32	3.9
Janumet (Metformin50mg and Sitagliptin 1000 mg)	31	3.8
Istamet (Metformin 50 mg and Sitagliptin 1000 mg)	31	3.8
Glvus Met (Metformin 50 mg and Vitagliptin 1000 mg)	21	2.5
Glimy –M (Glimipride 2mg / Metformin 500mg)	20	2.4
Gluconorm (Glimipride 2mg / Metformin 500mg)	22	2.6
Ppg (Voglibose 0.3mg)	24	2.9
Diamicron XR (Gliclazide 60mg)	15	1.8
Insulin human mixtard 30-40 IU Injection	142	17.1
Tenglyn (Teneligliptin 20 mg)	14	1.7
Trejenta (Linagliptin 5mg)	15	1.8
Glimy (Glimipride 1mg / Metformin 500 mg)	22	2.6
Glimisave – M (Glimipride 1mg / Metformin 500mg)	21	2.5
Glizid (Gliclazide 40mg)	10	1.2
K-Gem (Gliclazide 80 mg / Metformin 50mg)	13	1.6
Blisto (Glimipride 4mg / Metformin 1000mg)	17	2.1

Table 8: Analysis of cost wise comparison.

S. No	Frequently prescribed brands	No. of prescriptions	No. of drugs prescribed	Cost per drug	Total Cost
1	Glycomet	135	135	1.35	182.25
2	Diapride	109	109	7	763.00
3	Gemer	113	113	6.8	768.40
4	Vobose	26	26	8.3	215.80
5	K-Glim	32	32	2.2	70.40
6	Janumet	31	31	35	1085.00
7	Istamet	31	31	30	960.00
8	Glvus Met	21	21	30	630.00
9	Glimy -M	20	20	53	1060.00
10	Gluconorm	22	22	2.2	48.40
11	Ppg	24	24	6.9	165.60
12	Diamicron XR	15	15	17	255.00
13	Insulin human mixtard 30-40 IU Injection	142	142	158	22436.00
14	Tenglyn	14	14	11	154.00
15	Trejenta	15	15	47	705.00
16	Glimy	22	22	4.2	92.40
17	Glimisave – M	21	21	4.2	88.20
18	Glizid	10	10	3.2	32.00
19	K-Gem	13	13	3.8	49.40
20	Blisto (1000mg)	17	17	7	119.00
	Total				29882.55

wise differ from brand to brand report indicated that the Glimy–M (Glimipride 2mg / Metformin 500mg) Rs. 1060.00/- for 20 tablets but single tablet Rs.53/- brand more expensive when compared to each other brands such as Gemer (Glimipride 2mg / Metformin 500mg) Rs.768.40/- for 113 tablets but single tablet Rs.6.8/- , Blisto (Glimipride 4mg / Metformin 1000mg), Rs.119 /- for 17 tablets but single tablet Rs.17/-, Glimy (Glimipride 1mg / Metformin 500 mg)) Rs.92.40 /- for 22 tablets but single tablet Rs.4.2/- , Glimisave – M (Glimipride 1mg / Metformin 500mg) Rs.88.20/- for 21 tablets but single tablet Rs.4.2/-, , K-glim(Glimipride1mg / Metformin 500mg) Rs.70.40/- for 32 tablets but single tablet Rs.2.2/- and Gluconorm (Glimipride 2mg / Metformin 500mg) Rs.48.40 /- for 32 tablets but single tablet Rs.2.2/-. Single drug same moiety (working mechainism same) but differ the cost comparison statement indicated that the Diapride (Glimipride 2mg) Rs.763/- for 109 tablets but single tablet Rs.7/- have more economic when compared to Glizid (Gliclazide, 40mg) Rs.32/- for 10 tablets but single tablet Rs.3.2/-, Glycomet (Metformin, 500mg) Rs.182.25/- for 135 tablets but single tablet Rs.1.35/-and Diamicron XR (Gliclazide 60mg) Rs.255/- for 15 tablets but single tablet Rs.17/-. Single drug same dose different brands to change the cost Vobose (Voglibose 0.3mg) Rs.215.80/- for 26 tablets but single tablet Rs.8.3 /- were comparatively less expensive to Ppg (Voglibose 0.3mg) Rs.165.60/- for 24 tablets but single tablet Rs.6.9/- and also Glizid (Gliclazide 40mg) Rs.32/- for 10 tablets but single tablet Rs.3.2/- were moderately less luxurious to Diamicron XR (Gliclazide 60mg) Rs.255/- for 15 tablets but single tablet Rs.17/-. Single drug new moiety comparison report indicated that the Trejenta (Linagliptin 5mg), Rs.705 /- for 15 tablets but single tablet Rs.15/-, have more expensive when compared to Tenglyn (Teneligliptin 20 mg) Rs.154 /- for 14 tablets but single tablet Rs.11/- but above drugs working mechanism is same.

CONCLUSION

The recommending practices of our study signs were not tasteful, to be proposed by medications of poly pharmacy, over remedy of against diabetic medications and absence of awareness of essential medications list. The endeavor of the enrolled drug specialist has the capacity to be effective and understanding fulfillment can be accomplished just if the patient gets objective treatment for lessen pervasiveness of Diabetes Me and related maladies in Coimbatore zone. This study will be demonstrated input to the enlisted drug specialist for make readiness about sane utilization of against diabetic medications. The clinic models ought to be molded according to the nearby prerequisite, for the most part important hostile to diabetic medications were kept up, recommended and put away by determined in standard rules. The enlisted drug specialist must be certain to endorse the counter diabetic medications by the assistance of standard rules. In view of the above articulation predetermined number of hostile to diabetic medications will be recommended by the enrolled drug specialist and specialists for decrease of unnecessary use on exorbitant medications. Specialists and drug specialist ought to recommend on account of social perspective, which will be valuable for country development and decrease of financial issues. To create the awareness to DM patients that the fixed goals are not suitable for all patients, particularly age group of DM patients will follow the pharmacist instruction to control the hyperglycemia and prevent vascular complications in type-II and I Diabetes Mellitus.

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