Variation of Cost Among Oral Hypoglycaemic Drugs Available in Indian Market in 2020-21

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In the absence of comparative information on hypoglycaemic drug prices, it is difficult for physicians to prescribe most economical treatment. Hence, this study is designed to analyse the percentage variation of cost among different brands of oral hypoglycaemic drugs available in Indian market. Study data was collected from the current index of medical specialities of October 2020 to January 2021. The difference between the maximum and minimum costs was calculated. Then cost ratio and percentage of cost variation were calculated for each drug. In single drug therapy Glimepiride 1 mg tablet showed highest and Vildagliptin 50 mg showed lowest cost variation. In two drugs combination therapy Glimepiride+Metformin (2 mg+500 mg) showed highest and Gliclazide+Metformin (40 mg+500 mg) showed lowest cost variation. In three drugs combination Glimepiride+Metformin+Pioglitazone (2 mg+500 mg+15 mg) showed highest and Glimepiride+Metformin+Pioglitazone (2 mg+500 mg+7.5 mg) showed lowest cost variation. This study showed a wide variation in the prices, cost ratio and in cost variation of oral hypoglycemic drugs.

Key words: Oral hypoglycaemic drugs, cost variation, cost ratio, current index of medical specialities, physicians, prescription

Diabetes Mellitus (DM) is a group of metabolic disorders characterized by a high level of blood sugar over a prolonged period of time in which the body's ability to insulin production or response is impaired and results in abnormal carbohydrates metabolism as well as raised levels of glucose in the blood[1]. DM type-1 is due to the lack of insulin and type-2 is due to cells insulin resistance and DM type-2 is the most common type[2]. One out of six persons (17 %) with diabetes in the world is from India[3]. Prevalence of the DM in the population is about 8.9 %, as per to the International Diabetes Federation (IDF). Also according to IDF data, after the United States second highest number of children with type-1 diabetes found in India[4]. Now a day's DM associated with a number of problems with occurrence seen in younger age group[5-7]. Management of diabetes includes healthy diet, healthy weight, dietary changes, exercise and use of medications (insulin and hypoglycaemic drugs)[8]. Medicines used in the treatments of DM increases the sensitivity of target organs to insulin which increases the amount of insulin secreted by the pancreas and decreases the rate at which glucose is absorbed from the gastrointestinal tract. The main reason for the diabetes treatment is to keep blood sugar levels near to normal. Indian pharmaceutical industry has over 20 000 medicine formulations[9] with different brand names and wide variations in their prices. In year 2013-14 among United States adults with diabetes Cost-related Medication Non-adherence (CRN) prevalence was 16.5 %. Most important determinants of CRN in people aged ≥65 y were depression and household income and people aged <65 y were health insurance and household income[10]. There is also a high expenditure of money due to low health insurance coverage[11,12]. Due to unavailability of comparative information on hypoglycaemic drug prices causes difficulties for physicians to prescribe the most economical treatment[13]. Hence, this study was designed to analyse the cost variation percentage

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among different brands of oral hypoglycaemic drugs available in the market of India. The cost variation study was done in the Department of Pharmacology in a teaching hospital after approval from the Institutional Research Committee (IRC) and Independent Ethics Committee (IEC). Study data was collected from the Current Index of Medical Specialities (CIMS) of October-2020 to January-2021 for the analysis of the prices of oral hypoglycaemic drugs. First drug was selected from different class and then strength and dosage forms were selected. Cost was entered in tablet of each brand. Only strips having same quantity of tablet were selected. For each brand, cost of 1 tablet was calculated in Indian Rupee (INR). Cost of 1 tablet compared for particular drug in same dose and dosage forms which were manufactured by different pharmaceutical companies. Maximum and minimum costs difference was calculated for same drug but manufactured by different pharmaceutical companies. Then cost ratio and percentage of cost variation were calculated each drug[14]. The following formula was used to calculate the cost variation.

Percentage of cost variation=cost of most expensive brand-cost of least expensive brand/ cost of least expensive brand×100

Cost ratio was calculated by ratio of costliest brand to cheapest brand of same drug as it helps to find out how much times costliest brand is costlier to cheapest brand[15,16].

Cost ratio=cost of most expensive brand/cost of least expensive brand

Inclusion criteria includes drugs manufactured by different companies having same strengths; drugs of same strength of same quantity tablets strip; fixed dose combinations having more than two drugs. Exclusion criteria includes drugs manufactured by only one company; drugs manufactured by different companies in different strengths; drugs without cost information. Findings of the study were entered in both Microsoft Word 2016 and Excel 2016 and were expressed as absolute numbers and the percentages. Percentage of cost variation and cost ratio were calculated using findings. Tables and charts were used for representation of data[14]. In the present study, drugs were selected from six different classes. Among them 11 were single drugs, 9 were two drugs combination and 2 were three drugs

combinations. Among Sulfonylureas costliest drug is Glimepiride (1 mg tablet; 21.25 INR) and cheapest drug is Glipizide (5 mg tablet; 0.455 INR). Cost ratio of Glimepiride 1 mg tablet; 14.66 is highest and of Glipizide 5 mg tablet; 1.62 is lowest. Cost variation of Glimepiride 1 mg tablet; 1365.52 is highest and of Glipizide 5 mg tablet; 62.2 is lowest. Among Repaglinide costliest drug is 2 mg tablet; 12.48 INR and cheapest drug is 0.5 mg tablet; 2.2 INR. Cost ratio of 0.5 mg tablet; 3.09 is highest and of 2 mg tablet; 1.6 is lowest. Cost variation of 0.5 mg tablet; 209.09 is highest and of 2 mg tablet; 60 is lowest. Among Dipeptidyl peptidase-4 (DDP-4) inhibitors costliest drug is Tenegliptin 20 mg tablet; 13 INR and cheapest drug is Tenegliptin 20 mg tablet; 5.5 INR. Cost ratio of Tenegliptin 20 mg tablet; 2.36 is highest and of Vildagliptin 50 mg tablet; 1.16 is lowest. Cost variation of Tenegliptin 20 mg tablet; 136.36 is highest and of Vildagliptin 50 mg tablet; 15.77 is lowest. Among Metformin costliest drug is 1000 mg tablet; 6.115 INR and cheapest drug is 500 mg tablet; 0.44 INR. Cost ratio of 500 mg tablet; 9.09 is highest and of 250 mg tablet; 1.69 is lowest. Cost variation of 500 mg tablet; 809.09 is highest and of 250 mg tablet; 68.83 is lowest. Among Pioglitazone costliest drug is 30 mg tablet; 9.133 INR and cheapest drug is 15 mg tablet; 1.846 INR. Cost ratio of 30 mg tablet; 4.45 is highest and of 7.5 mg tablet; 1.22 is lowest. Cost variation of 30 mg tablet; 345.3 is highest and of 7.5 mg tablet; 21.85 is lowest. Among α-Glucosidase inhibitors costliest drug is Acarbose 50 mg tablet; 14.2 INR and cheapest drug is Voglibose 0.2 mg tablet; 2.1 INR. Cost ratio of Voglibose 0.3 mg tablet; 4.58 is highest and of Acarbose 50 mg tablet; 1.58 is lowest. Cost variation of Voglibose 0.3 mg tablet; 357.63 is highest and of Acarbose 50 mg tablet; 57.78 is lowest. Among Two Drugs Combinations costliest drug is Glimepiride+Metformin 2 mg+1000 mg tablet; 15.95 INR and cheapest drug is Glipizide+Metformin 5 mg+500 mg tablet; 1.164 INR. Cost ratio of Glimepiride 2 mg+Metformin 500 mg tablet; 3.5 is highest and of Gliclazide 40 mg+Metformin 500 mg tablet; 1.11 is lowest. Cost variation of the Glimepiride 2 mg+Metformin 500 mg tablet; 249.56 is highest and of Gliclazide 40 mg+Metformin 500 mg tablet; 11.11 is lowest. Among Three Drugs Combinations costliest drug is Glimepiride+metformin+Pioglitazone 2 mg+500

mg+15 mg tablet; 17.702 INR and cheapest drug is Glimepiride+metformin+Pioglitazone 1 mg+500 mg+15 mg tablet; 4.9 INR. Cost ratio of Glimepiride 2 mg+metformin 500 mg+Pioglitazone 15 mg tablet; 2.78 is highest and of Glimepiride 2 mg+metformin 500 mg+Pioglitazone 7.5 mg tablet; 1.11 is lowest. Cost variation of Glimepiride 2 mg+metformin 500 mg+Pioglitazone 15 mg tablet; 177.46 is highest and of Glimepiride 2 mg+metformin 500 mg+Pioglitazone 7.5 mg tablet; 10.89 is lowest. Among oral hypoglycaemic drugs in single drug therapy Glimepiride 1 mg tablet; 1365.52 showed highest cost variation, in two drugs combination therapy Glimepiride+Metformin (2 mg+500 mg) tablet; 249.56 showed highest cost variation and in three drugs combination Glimepiride+Metformin+ Pioglitazone (2 mg+500 mg+15 mg) tablet; 177.46 showed highest cost variation (Table 1 and fig. 1). Diabetes is a chronic metabolic disorder requires prolong duration of treatment. From literatures it was evident that increase in diabetes burden can also be due to the high price variation among the different brands of same drug[13,17]. Patients compliance is dependent on cost of the medicines prescribed to them and compliance will be less for high cost medicines[18]. Prices of drugs in Indian market were controlled by the National Pharmaceutical Pricing Authority (NPPA), Government of India. Based on essentiality of a drug NPPA fixes the ceiling price of a drug. Pharmaceutical companies for their products fixes the price which is equal to or below the ceiling price for that formulation and they cannot sell their medicine at a higher price than ceiling price which is given in the Drugs Prices Control Order (DPCO)[19]. The DPCO, 2020 includes only two drugs such as Glimepride and Metformin. Ceiling price for Glimepride 1 mg tablet is 3.58 INR and 2 mg tablet is 5.69 INR. Ceiling price for Metformin 500 mg tablet is 1.91 INR, 750 mg tablet is 3.03 INR and 1000 mg tablet is 3.64 INR. Only two oral hypoglycemic agents were included in the "WHO model list of essential Medicines" such as Gliclazide (30 mg, 60 mg and 80 mg) and Metformin 500 mg[20]. DM was chosen because it is one of the most common disorder in India and world which is major cause of morbidity and mortality requires prolonged prescription. CIMS of October-2020 to January-2021 was selected to collect and analyse the data as it is easily available

and regularly updates. We decided to carry this study because very few studies which compare the cost of different brands of oral hypoglycaemic drug are available. In single drug therapy Glimepiride 1 mg tablet; 14.66 showed highest cost ratio and Vildagliptin 50 mg; 1.158 showed lowest cost ratio, in two drugs combination therapy Glimepiride+Metformin (2 mg+500 mg); 3.5 showed highest cost ratio and Gliclazide+Metformin (40 mg+500 mg); 1.11 showed lowest cost ratio and in three drugs combination Glimepiride+Metformin+Pioglitazone (2 mg+500 mg+15 mg) tablet; 2.78 showed highest cost ratio and Glimepiride+Metformin+Pioglitazone (2 mg+500 mg+7.5 mg) tablet; 1.11 showed lowest cost ratio. In single drug therapy Glimepiride 1 mg tablet; 1365.52 showed highest cost variation and Vildagliptin 50 mg; 15.77 showed lowest cost variation. In two drugs combination therapy Glimepiride+Metformin (2 mg+500 mg); 249.56 showed highest cost variation and Gliclazide+Metformin (40 mg+500 mg); 11.11 showed lowest cost variation. In three drugs combination Glimepiride+Metformin+Pioglitazone (2 mg+500 mg+15 mg) tablet; 177.46 showed highest cost variation and Glimepiride+ Metformin+Pioglitazone (2 mg+500 mg+7.5 mg) tablet; 10.89 showed lowest cost variation. Findings of this study showed that high variation of prices seen in different oral hypoglycaemic drugs. Sometimes pharmacist dispense alternative costly brand instead of brand prescribed by clinician for more profit[13]. Clinicians prescribe costliest branded drugs under the influence of pharmaceutical companies in favour of gifts. Again they mostly prescribe branded drugs instead generic even after Medical Council of India has insistence. Some patients believe that generic and cheap drugs will be less effective and will not cure or control their blood sugar and prefer costliest drugs. Till now is it not proved that costliest brand of same generic drug is more effective than cheap drugs[21]. Thus clinicians must prescribe generic and cheap drugs without coming under influence of pharmaceutical companies. With prescription of cheap drugs patient's compliance may improve. In clinical practice brand names are seen in most of the prescriptions which makes cost variation an important factor[22,23]. When cost of a drug is more than patient hesitate to take medicines results in less compliance[18]. To afford drugs to every

common citizen government has to take some action to regulate prices of drugs. Thus it is duty of doctors to prescribe cheaper drugs, Pharmacist to dispense cheaper prescribed drugs, common people to ask for affordable drug and authority to control prices of drugs. Compare to develop countries people from developing countries pay the price of drug out-of-pocket[17]. Study done by Dupaguntla *et al.*[14], showed a wide variation in the prices of the most of the oral hypoglycemic drugs which are available in India such as Glimepride 2 mg (892 %) showed highest price variation followed by Metformin 500 mg (492 %) among oral hypoglycemic agents and a the most commonly used fixed dose combination Glimepride (1 mg) and Metformin (500 mg) showed high price variation 346 % and high cost ratio of 4.46[14]. Mehani *et al.*[15], found a high variation among the pricing of oral anti-diabetic agents such as Glimepiride 2 mg (562 %) showed the highest price variation followed by Metformin 500 mg (492 %) and a the most commonly used fixed dose combination Glimepiride (1 mg) and Metformin (500 mg) showed high price variation 233 % and high cost ratio of 3.33[15]. In Jadhav *et al.*[13] study observed that Glipizide (2.5 mg) and Metformin (400 mg) combination showed the maximum variation up to 399.04 %[13]. Results of Sanjay *et al.*[24], showed in single drug therapy Glibenclamide

(5 mg) showed maximum cost variation of 400 % and in the combination drug therapy Glimepiride and Metformin combination (2+500 mg) showed the maximum cost variation up to 352.8 %. Thus this study can help to understand price variation among different oral hypoglycaemic drugs and will be helpful to clinicians and policymaker to aware about the cost variations among drugs and decide prices which will be affordable to a patient not able to purchase costly drugs. We got very few references and it creates a limitation to our study. Another limitation of this study is only CIMS was used for cost variation. Further studies need to be carried out to explore the cost variation of oral hypoglycaemic drugs. The need of the hour is to understand why there is high cost variation among oral hypoglycaemic drugs and how best to control. Pharmacoeconomics topic must be included in Medical education curriculum to understand cost of drugs for economical health care services. This study finding shows a wide variation in the prices, cost ratio's and in cost variation of oral hypoglycemic drugs. This study can help to understand price variation among different oral hypoglycaemic drugs and will be helpful to clinicians and policymaker to aware about the cost variations among drugs and decide prices which will be affordable to a patient not able to purchase costly drugs.

TABLE 1: MAXIMUM COST VARIATION AMONG ORAL HYPOGLYCAEMIC DRUGS

Drug	Strength	Dosage form	Maximum cost/ tablet (in INR)	Minimum cost/ tablet (in INR)	Cost ratio	Cost variation
Glimepiride	1 mg	Tablet	21.25	1.45	14.66	1365.52
Repaglinide	0.5 mg	Tablet	6.8	2.2	3.09	209.09
Tenegliptin	20 mg	Tablet	13	5.5	2.36	136.36
Metformin	500 mg	Tablet	4	0.44	9.09	809.09
Pioglitazone	30 mg	Tablet	9.13	2.05	4.45	345.3
Voglibose	0.3 mg	Tablet	13.5	2.95	4.58	357.63
Glimepiride+ Metformin	2 mg+500 mg	Tablet	15.73	4.5	3.5	249.56
Glimepiride+ Metformin+ Pioglitazone	2 mg+500 mg+15 mg	Tablet	17.7	6.38	2.78	177.46
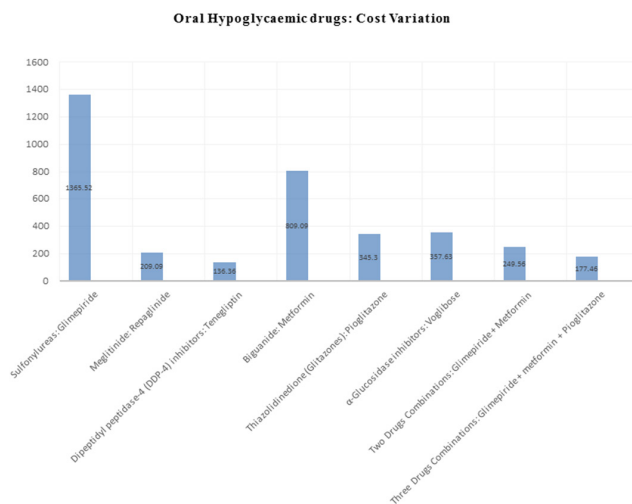
Fig. 1: Maximum cost variation among oral hypoglycaemic drugs

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The authors declared no conflict of interest.

Recommendations:

This study can help to understand price variation among different oral hypoglycaemic drugs and will be helpful to clinicians and policymaker to aware about the cost variations among drugs and decide prices which will be affordable to a patient not able to purchase costly drugs.

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