ABSTRACT

Introduction: Diabetes Mellitus is one of the major causes of morbidity, mortality and needs lifelong treatment. There is a wide range of variation in the prices of antidiabetic drugs marketed in India and all over the world. Thus a study was planned to find out price variations in the oral hypoglycemic drugs available singly and in combination and to evaluate the difference in cost of same drug.

Goals: To analyse the percentage cost variation of different Oral hypoglycemic drugs available in Indian market either singly or in combinations. Methodology: Cost of a particular drug being manufactured by different companies, in the same strength, number and dosage form was compared (CIMS april-july 2016). The difference in the maximum and minimum price of same drug manufactured by different pharmaceutical companies and the percentage variation in price was calculated. Drugs which are manufactured by one company only or being manufactured by different companies but in different strengths were excluded. Results: Among single drug therapy, Glimepiride (2mg) shows maximum percentage variation in price of 626.90%. Among Sulfonylureas- Glimepiride(2mg) shows maximum price variation of 626.90%. In Meglitinides group - Repaglinide(0.5mg), in Biguanides - Metformin(500mg), in Thiazolidinediones - Pioglitazone(15mg) shows maximum price variation of 118.18%, 504.65% and 483.83% respectively and among the α-glucosidase inhibitors (Fig. 6), Acarbose(50mg) shows maximum price variation of 310.26%. Among combination formulation, Glimepiride(1mg) + Metformin(500mg) shows maximum percentage of price variation of 638.33%. Conclusions: The results of our study showed that there is wide variation in prices of drugs manufactured
by different pharmaceutical companies. So it is very necessary for regulatory authorities to regulate the wide variation in drug prices to maximize the benefits of the treatment by making the new and updated pricing and prescribing policies.

**KEYWORDS:** Diabetes mellitus, price variation, brands, treatment.

**INTRODUCTION**

Diabetes is one of diseases which causes high morbidity and require lifelong treatment. The prevalence of diabetes was estimated to be 9% worldwide among adults in 2014.\[^1\] The prevalence of DM will increase to 300 million worldwide in 2025.\[^2\] Our own country, India has been recognized as the diabetes capital of the world by the international diabetes federation with 40.9 million affected people in 2006. This number will become to approximately 69.9 million by 2025.\[^3\] Management of Type I diabetes mellitus depends mainly on insulin, whereas patients with type II diabetes mellitus requires treatment with mainly oral hypoglycaemic drugs. Patients with DM requires lifelong treatment, Cost of drug is the major hurdle in the treatment of patients with diabetes, which affect the health adversely and increases the risk of morbidity including complications of diabetes mellitus.\[^4\]

The margin in prices of drugs across the same generic class of drug is very high, ranging from 1000% to 4000%.

On an average, a person spends approximately 20% of his or her income for the treatment of diabetes per year.\[^5\] In the developing countries like India, the cost of drugs is one of the major concerns for patient. High cost of drugs affects patient compliance to take drug regularly and for long duration; particularly in case of diseases like diabetes which require lifelong treatment and patient have to take drug to prevent morbidity and mortality and to improve quality of life.\[^6,7,8\] Cost of a drug is an essential part of rational drug therapy also.\[^9\] In spite of government attempt to prevent unjustifiable price rising of drugs by enacting the Drug Price Control Order (DPCO), 1970 and also by incorporating the National List of Essential Medicine (NLEM), huge variation in prices of drugs are still there and going on.\[^10\] Pharmacoeconomic studies play an important role for solving this problem. Pharmacoeconomic consists of various methods of analysis such as: cost benefit analysis (CBA), cost effectiveness analysis (CEA), cost minimization analysis (CMA), cost utility analysis (CUA), and cost of illness analysis (COI).\[^11\] In this study we used only cost-analysis between different brand which have same drug content in same dose and dosage form. Cost-analysis study, compares two or more dosage forms or drugs with same contents available in
market in terms of cost and indicates the variations in cost. It also serves as an important tool for research, policy making such as making the standard treatment guidelines for a particular country or state.  

[12,13]

Even though diabetes is a major metabolic disease in India, very few cost analysis studies on oral anti-diabetic drugs have been done in India and they show gross variation in the results. Hence we have taken this study to estimate the cost variation among the oral anti-diabetic medications.

MATERIALS AND METHODS

This study was an analytical type of study, which was conducted in department of pharmacology, Gandhi Medical College Bhopal (M.P.). In this study a list of antidiabetic drugs were made from the CIMS april-july 2016, then cost of drugs (for 10 tablet strips) were analysed for each drug which were available as different brand names. Costs were analysed for drugs which available either singly or in combination formulation. The drug which were available singly, were further divided into groups like sulfonylurea, biguanide etc. Costs of individual drug being manufactured by all the companies in the same strength, number and dosage form were compared. Drugs which were manufactured by one company only or being manufactured by different companies but in different strengths were excluded. Out of the various prices of different-different brands, minimum and maximum price were found for the calculation of percentage variation for each single drug and for each available combination of drugs.

The formula which was used to calculate the percentage variation in price is:

\[
\text{Cost of brand with highest price} - \text{Cost of brand with lowest price} \times \frac{100}{\text{Cost of brand with lowest price}}.
\]

RESULT

Among single drug therapy, Glimepiride (2mg) shows maximum percentage variation in price of 626.90%, followed by Glimepiride-1mg, Glimepiride-3mg, and Metformin-500mg, which showed by Fig. 1. Among Sulfonylureas- Glimepiride(2mg) shows maximum price variation of 626.90% (Fig. 2). In Meglitinides group (Fig. 3)- Repaglinide(0.5mg), in Biguanides (Fig. 4)- Metformin(500mg), in Thiazolidinediones (Fig. 5)- Pioglitazone(15mg) shows maximum price variation of 118.18%, 504.65% and 483.83% respectively and among
the α-glucosidase inhibitors (Fig. 6), Acarbose(50mg) shows maximum price variation of 310.26%.

Among combination formulation, Glimepiride(1mg) + Metformin(500mg) shows maximum percentage of price variation of 638.33%, followed by Glimepiride(2mg) + Metformin(500mg) with a price variation of about 470%, which showed by Fig. 7.

Figure-1

Figure-2
Figure-3

Meglitinides
Percentage variation in cost

<table>
<thead>
<tr>
<th>Repaglinide</th>
<th>Percentage</th>
<th>Series 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 mg</td>
<td>118.18%</td>
<td>79.32%</td>
</tr>
<tr>
<td>1 mg</td>
<td>60%</td>
<td></td>
</tr>
</tbody>
</table>

Figure-4

Biguanides
Percentage variation in cost

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Percentage</th>
<th>Series 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 mg</td>
<td>504.65%</td>
<td>137.94%</td>
</tr>
<tr>
<td>850 mg</td>
<td>236.41%</td>
<td></td>
</tr>
<tr>
<td>1000 mg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure-5

Thiazolidinediones
Percentage variation in cost

<table>
<thead>
<tr>
<th>Pioglitazone</th>
<th>Percentage</th>
<th>Series 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5 mg</td>
<td>27.76%</td>
<td></td>
</tr>
<tr>
<td>15 mg</td>
<td>483.33%</td>
<td></td>
</tr>
<tr>
<td>30 mg</td>
<td>446.34%</td>
<td></td>
</tr>
</tbody>
</table>
**α-Glucosidase Inhibitors**

Percentage variation in cost

- acarbose 25 mg
- acarbose 50 mg
- miglitol 25 mg
- miglitol 50 mg
- voglibose 0.2 mg
- voglibose 0.3 mg

Figure-6

**Oral Hypoglycemic Drugs in Combination**

Percentage variation in cost

- Glimepiride + Metformin 1 mg + 500 mg
- Glimepiride + Metformin 2 mg + 1000 mg
- Glimepiride + Metformin 3 mg + 1500 mg
- Pioglitazone + Metformin 7.5 mg + 500 mg
- Pioglitazone + Metformin 15 mg + 500 mg
- Pioglitazone + Metformin 30 mg + 500 mg
- Voglibose + Metformin 0.3 mg + 500 mg
- Voglibose + Metformin 0.6 mg + 500 mg
- Glimepiride + Metformin 1.25 mg + 500 mg
- Glimepiride + Metformin 2.5 mg + 500 mg
- Glimepiride + Metformin 5 mg + 500 mg
- Pioglitazone + Metformin 7.5 mg + 500 mg
- Pioglitazone + Metformin 15 mg + 500 mg
- Pioglitazone + Metformin 30 mg + 500 mg
- Voglibose + Metformin 0.3 mg + 500 mg
- Voglibose + Metformin 0.6 mg + 500 mg

Figure-7
DISCUSSION

This study was carried out with the objective to compare the percentage price variation among all oral hypoglycaemic agents which present either singly or in combination across the different brands available in the Indian market according to CIMS. Our study showed a very wide variation in the prices of oral hypoglycaemic agents which is being manufactured by various pharmaceutical companies as a different different brands. In our study Glimepiride 2mg shows maximum variation of 626.90%. However, in a study conducted by Jadhav et al Glimepride 1mg showed maximum price variation of about 650%,\textsuperscript{14} and in another study conducted by Date et al also showed that Glimepride 2mg (830%) has the highest price variation.\textsuperscript{15} According to our study among the combinations Glimepride 1mg and Metformin 500mg combination showed the highest price variation of 638.33% among all available combinations. However in a study done by Jadhav et al, combination of Glipizide 2.5mg and Metformin 400 mg showed maximum price variation of 400%,\textsuperscript{14} and in study of Date et al, combination of Glimepride 1mg and Metformin 500mg has variation of 360% only.\textsuperscript{15}

Following reasons could be present behind this huge variation in the prices:\textsuperscript{16-19}

1. The existing marketing structure of the pharmaceutical industry.
2. Asymmetry of information or imperfect or improper information.
4. Government regulations and policies for pricing of drugs.
5. To provide better quality of medication, clinicians prescribe medication from reputed companies even though the cost is high.

There is a need for concerted action from regulatory authorities, doctors, pharmacists and general public at large to address this issue of antidiabetic drugs price variation.

Government should bring all life saving and essential drugs under price control of National Pharmaceutical Pricing Authority (NPPA). And government also has to notify all the prescribers to prescribe drug only by the generic name.

CONCLUSION

It is observed from our results that there is wide variation in prices of drugs manufactured by different pharmaceutical companies. So it is very necessary for regulatory authorities to regulate the wide variation in drug prices to maximize the benefits of the treatment.

The situation can be improved by incorporating an analysis of prescription costs in the medical curriculum. And clinicians should keep the cost in mind at the time of prescribing the
drug. At the hospital level authorities and concerned committees have to make policies by keeping the cost as a major issue, so that patient can afford the drug treatment.

REFERENCES


