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Review Article

AYURVEDIC AND ALLOPATHIC FORMULATIONS FOR DIABETES MELLITUS : A PHARMACO ECONOMIC STUDY

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ABSTRACT

Diabetes mellitus is now one of the most common non communicable diseases. Globally it affects persons of all ages as well as their families, while also placing heavy economic burdens on national economies and healthcare systems. Much of this money goes towards treating the complications of diabetes. These complications are preventable if patients have access to expert healthcare. Implementation of a comprehensive healthcare management program for people with diabetes can lead to substantial improvements in costs and clinical outcomes in the short-term. Economic evaluation of therapy should be encouraged to ensure improved cost effectiveness and efficiency in management. Regularly up-dated drug formulary and evidence-based standard treatment guidelines would ensure better choice of therapeutic options. More importantly, a concerted effort is needed to reduce the incidence of diabetes mellitus in the society. It is expected that improvements will increase over time, with continuing improvements in health status and a reduction in the number of future diabetic complications.

KEYWORD:- Economic Study, diabetes mellitus, product comparison

INTRODUCTION

‘Pharmacoeconomics’ is a new word; but economic interest in drug and other treatments on health problems is much older. Decisions about what treatments should be available within a healthcare system have always been influenced by the resources available to pay for them.

Pharmacoeconomics”can be defined as the branch of economics that uses cost-benefit, cost effectiveness, cost-minimization, cost-of-illness and cost-utility analyses to compare pharmaceutical products and treatment strategies. Pharmacoeconomics is a part of the tool bag, pharmacist can be use to improve the efficiency of his profession.

Pharmacoeconomics adopts and applies the principles and methodology of health economics to the field of pharmaceutical policy. Pharmacoeconomic evaluation therefore makes use of the broad range of techniques used in health economics evaluation to the specific context of medicines management. Pharmacoeconomics is the description and analysis of the costs of drug therapy to healthcare systems and society. The importance of pharmacoeconomic information to healthcare decision makers will depend upon the viewpoint from which the analysis is conducted (i.e., including only costs that are relevant to managed care). Pharmacoeconomic research in the managed care system is growing. It is currently being used to make formulary decisions (complementing clinical data), design disease management programs and measuring the cost effectiveness of interventions and programs in managed care.

Pharmacoeconomics identifies measures and compares the cost and consequences of pharmaceutical products and services and describe the economic relationship involving drug research, drug production distribution, storage, pricing and used by the people. It runs through the thread of our socioeconomic system, which regulates and influences all the sectors involved in pharmaceuticals. Health care funders (governments, social security funds, insurance companies) are struggling to meet their rising costs. They make many efforts to contain drug costs, by price negotiation, patient co-payments or dedicated drug budgets. The term pharmacoeconomics was used in public forum was in 1986, at meeting of pharmacist in Toronto, Canada, when Ray Townsend from the Up john company, used the term in presentation. Ray and few other had been performing studies using the term pharmacoeconomics within the pharmaceutical industry since the early eighties today pharmacoeconomics research is a flourishing industry with many practioners, a large research and application agenda, several journals and flourishing professional societies including the international society for pharmacoeconomics and outcomes research

Historically, the principles of pharmacoeconomics were applied in the field of hospital pharmacy activities. The cost effectiveness data were used to support the addition or deletion of a drug to or from a hospital formulary. At present, the pharmacoeconomic assessment of formulary actions has become a standardized part of many pharmacy and therapeutic commit ¹

Diabetes is a chronic disorder of metabolism of carbohydrates proteins and fat due to absolute or relative deficiency of insulin secretion and with varying degree of insulin resistance which can be characterized by hyperglycemia, glycosuria, hyperlipidaemia and negative nitrogen balance . It has now become an epidemic with worldwide incidence of 5% in the general population. The number of people suffering from diabetes is increasing every year and the disease now kills more people than AIDS. Till date 40.8 million patients were diagnosed with diabetes in India versus 40 million HIV patients all over the world. Up to 171 million people around the globe have diabetes with this figure likely to more than double by 2030. Close to 3.2 million deaths occurring each year are believed to be attributed to problems of diabetes, 6 deaths every minute . The 10 top countries in numbers of people suffering from diabetes are India, USA, China, Japan, Indonesia, Pakistan, Brazil, Russia, Italy and Bangladesh. ²

Allopathic Formulation used for the treatment of diabetes have their own side effect & adverse effect like hypoglycemia, nausea, vomiting, hyponatremia, flatulence, diarrhea or constipation, alcohol flush, headache, weight gain, lactic acidosis, pernicious anemia, dyspepsia, dizziness, joint pain. So instead of allopathic Formulation, herbal Formulation are a great choice which is having more or less no side effect & adverse effects³ . Ayurvedic Medicines derived from medicinal plants are used by about 70% of the world's population. Ayurvedic formulation used for prevention of diabetes mellitus and has good marketed formulations specially in India. ⁴

Ayurvedic formulations have been used by the majority of Indians since ancient times. In recent years, there has been an increased inclination towards the Ayurvedic formulations due to the trend towards the natural sources and a healthy life style. Moreover, the complexity, side effects and costly treatment associated with the allopathic medicines have caused both the health care practitioners and the majority of world populations to turn towards alternative therapies, more likely towards the Ayurvedic medicines, since, these systems are believed to be free from side effects and affordable. Ayurvedic formulations are used to treat a wide variety of diseases including diabetes mellitus described as-madhumeha in ayurvedic texts. Diabetes mellitus is a heterogeneous metabolic disorder, characterized by altered carbohydrate, lipid and protein metabolism. It has been estimated that, about 1.3 % of the world population suffer from this disease. But, most of the hypoglycemic agents and hypolipidemics used in allopathic practice to treat diabetes mellitus and hyperlipidemia are reported to have side effects in long term use. Hence, there is the need to search for effective and safe drugs for these ailments. Pharmaceutical research across the world shows that, natural products are potential sources of novel molecules for drug development. In this regard, a number of Ayurvedic formulations are marketed, claimed to be useful in diabetes mellitus.^{5&6}

According to Allopathic

Diabetes Mellitus:

Diabetes mellitus is a metabolic disorder in the endocrine system. Diabetes is a chronic disorder in metabolism of carbohydrate, proteins, and fat due to absolute or relative deficiency of insulin secretion with / without varying degree of insulin resistance. Also, it may be defined as a disease where the body produces little insulin / ceases to produce insulin, or becomes progressive resistance to its actions. Diabetes occurs world-wide and the incidences of both type 1 and type 2 diabetes are rising; it is estimated that, in the year 2000, 171 million people had diabetes, and this is expected to double by 2030.

TYPES OF DIABETES:

There are three main types of diabetes:^{7&8}

Type 1 diabetes:

Insulin-dependent diabetes (IDDM; Type I diabetes) is one of the most serious metabolic disorders, It has an autoimmune basis and is characterized by destruction of the pancreatic beta cells. Genetic and environmental factors play a part and it is no surprise that HLADR3 and HLA- DR4 confer susceptibility to Type 1 Diabetes Mellitus.

Type 2 diabetes:

It formerly referred to as non-insulin-dependent diabetes mellitus, NIDDM for short, and adult-onset diabetes. Type 2 diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia and resulting from the combination of resistance to insulin action, inadequate insulin secretion, and excessive or inappropriate glucagon secretion. Gestational diabetes :

Gestational diabetes mellitus (GDM) affects 7% of all pregnancies and is defined as carbohydrate intolerance during gestation. It is crucial to detect women with GDM because the condition can be associated with several maternal and fetal complications, such as macrosomia, birth trauma, cesarean section, and hypocalcemia, hypoglycemia, and hyperbilirubinemia in newborns.

DIABETES DIAGNOSIS:

The blood glucose levels of a healthy man are 80mg / dL on fasting and up to 160 mg / dl in the postprandial state. A number of laboratory tests are available to confirm the diagnosis of diabetes.

1. FINGER STICK BLOOD GLUCOSE.

2. FASTING PLASMA GLUCOSE.

3. ORAL GLUCOSE TOLERANCE TEST.

4. GLYCOSYLATED HEMOGLOBIN OR HEMOGL

DIABETES MEDICATIONS:

Many different types of medications are available to help lower blood sugar levels in people with type 2 diabetes. Each type works in a different way. It is very common to combine two or more types to get the best effect with fewest side effects.

Sulfonylurea: These drugs stimulate the pancreas to make more insulin.

Biguanides: These agents decrease the amount of glucose produced by the liver.

Alpha-glucosidase inhibitors: These agents slow absorption of the starches and glucose.

Thiazolidinediones: These agents increase sensitivity to insulin.

Meglitinides: These agents stimulate the pancreas to make more insulin.

D-phenylalanine derivatives: These agents stimulate the pancreas to produce more insulin more quickly.

Amylin synthetic derivatives: Amylin is a naturally occurring hormone secreted by the pancreas along with insulin. An amylin derivative, such as pramlintide is indicated when blood sugar control is not achieved despite optimal insulin therapy.

Incretin mimetics: Exenatide (Byetta) was the first incretin mimetic agent approved in the United States. It is indicated for diabetes mellitus type 2 in addition to metformin or a sulfonylurea when these agents have not attained blood sugar level control alone.

Insulin: Synthetic human insulin is now the only type of insulin. It is less likely to cause allergic reactions than animal-derived varieties of insulin used in the past. Different types of insulin are available and categorized according to their times of action onset and duration.

According to Ayurved

Ayurvedic remedies for Madhumeha (diabetes mellitus) are the oldest among all the available therapies, which

includes in the prameha category. Pramehas are a list of urinary disorders, especially characterized by profuse urination with several abnormal qualities due to doshic imbalances. The main causes of prameha are lack of exercise and improper food habits in excess food intake which falls in the category of ushna, snigdha and guru are the primal cause of this disease - Fish, curd are good example. Foods that increase kapha, medhas and moothra are the etiological factors for prameha. The word Prameha is derived from, "Pra – means excess, Meha – ksharane - passing of urine. So Prameha is passing excessive urine and turbid in color .

Madhu meha which has been correlated with Diabetes Mellitus has become a global problem in spite of advances in modern science. Diabetes Mellitus is also a maharoga (major disease) because it affects most part of the body and every cell of the human physiology. The ancient Indian physicians described not only the sweetness of urine as one of the major symptoms but also the relationship of the disease with disturbance of the 5 sheaths of the body – annamaya kosha (Food sheath), pranamaya kosha (Energy sheath), manomaya kosha (Mind Sheath), vijñāna maya kosha (Intellectual Sheath) and anandamaya kosha (Bliss Sheath).

All classical texts describes prameha. The word prameha derived from the root mih sechane meaning watering that means dilution of everything in the body not only urine.^{9,10}

CLASSIFICATION

1. Prameha is classified aetiologically in to Sahaja (Hereditary) and Apathya nimittaja (Unwholesome things – food and exercise etc). Sahaja means due to Matapitabheejadoshakruit (Chromosomal defect from parents).

2. According to physical management

- i. Apatharpana uthaja prameha describing the lean diabetic
- ii. Santharpana uthaja prameha relating the obese diabetic

3. According to the doshic causes, these pramehas are classified as twenty types :

- i. Vataja pramehas – There are totally four vataja pramehas.
- ii. Pittaja pramehas – There are totally six pittaja pramehas.
- iii. Kaphaja pramehas – There are totally ten kaphaja pramehas.

Out of these, diabetes mellitus is termed as madhumeha. It is one of the four Vataja pramehas.

Samprapthighatakas : (favorable things for disease)^{11,12}

- Dosha (humur) – vata, pitta, kapha
- Dushya – meda, mamsa, kleda, rakta, vasa, majja, lasika, rasa and ojas
- Srotas (channel) – mootravaha

- Srotodusti – atipravrutti
- Srotodusti – atipravrutti
- Agni – dhatvagni
- Udhbhavasthana – kostha
- Vyaktasthana – mootravaha srotas (urinary tract)

Samprapthi: (Pathogenesis)

Kapha undergoing increase by the etiological factors, reaches various dooshyas like rasa (plasma), rakta (blood) etc., As there is a shaithilyata (looseness) in the body and it being fluid predominant, spreads all over the body and gets vitiated, while spreading it gets mixed with medas (fat – adipose tissue), mamsa (muscle) and kleda (body fluids). Body fluids which got vitiated draw them to the urinary bladder and produces prameha; similarly the Pitta affects them, Vata also brings about vitiation in them and produce prameha.

Premonitory symptoms

In Ayurveda we can find the described of early symptoms of the disease. They are accumulation of dirt on the teeth (mouth, eyes, nose, and ears), a feeling of burning sensation in the palms and soles, stickiness of the skin all over the body, thirst and a sweet taste in the mouth etc., and moothra madhuryam (sweetness of urine).

Clinical symptoms

Prabhootha mutrata (Poly uria), prameha . Avila mutrata (Turbid Urine)Medo dushti lakshanas are the main symptoms of prameha.

Component of pharmaeconomic studies:

COST

Costs involved in pharmacoeconomic evaluation can be mainly divided into financial cost (mandatory cost) and economic cost (resource for which no mandatory payment is made) opportunity cost is the benefit foregone when selecting one therapy alternative over the next best alternative. Measuring cost: several costs can be measured when weighing up the cost of any invention. This cost may be,

- Direct:** paid by the health service (including staff costs, capital costs, and drug acquisition costs).
- Indirect:** cost experienced by patient (family, friends).

The cost can be measured in following ways,

- Cost / unit (cost/tab, cost/vial)
- Cost / treatment
- Cost / person • Cost / person / year
- Cost / case prevented
- Cost / life saved
- Cost / DALY (disability-adjusted life year)

Outcomes (benefits)

The second fundamental component of a pharmacoeconomic study is outcomes. What is the effect of alternative drug therapies on disease progression, survival, quality of life? In assessing outcomes, it is also important to take into account both positive and negative outcomes. Positive outcome is a measure of the drug's efficacy. Negative outcomes include side effects, treatment failure, and the development of drug resistance.¹³

Methods of pharmaeconomic evaluation:^{14,15}

There are fundamentally 4 categories of pharmacoeconomic studies.

- Cost-effectiveness analysis (CEA)
- Cost-minimization analysis (CMA)
- Cost-benefit analysis (CBA)
- Cost-utility analysis (CUA)

Cost effectiveness analysis (CEA):-

This involves measuring only costs, usually only to the health service, and is applicable only where the outcomes are identical and need not be considered separately. An example would be prescribing a generic preparation instead of the brand leader (lower cost but same health outcomes).¹⁶

Cost minimization analysis (CMA): This involves measuring only costs, usually only to the health service, and is applicable only where the outcomes are identical and need not be considered separately. An example would be prescribing a generic preparation instead of the brand leader.

Cost benefit analysis (CBA): The benefit is measured as the associated economic benefit of an intervention, and hence both costs and benefits are expressed in money. CBA may ignore many intangible but very important benefits not measurable in money terms. However the virtue of this analysis is that it may allow

comparisons to be made between very different areas, and not just medical, e.g. cost benefits of expanding university education (benefits of improved education and hence productivity) compared to establishing a back pain service (enhancing productivity by returning patients to work).

Cost utility analysis (CUA): This is similar to cost effectiveness in that the costs are measured in money and there is a defined outcome. But here the outcome is a unit of utility. Handling The Results Of Economic Evaluations : Consider the four possible results arising in a CEA. First, if costs are lesser and health benefits higher for one drug comparative to another, the former is said to control and would be the preferred treatment . Second, the opposite applies, i.e. the new drug is more expensive and less effective, and thus is considered inferior and not recommended . The third and most common case is where the new drug is both more effective and more expensive than the standard (quadrant I); on the basis of ICERs, a judgment must be made regarding whether the additional benefits are worth the extra costs of the new drug and, therefore, whether it is 'cost-effective'. This might be defined by a previously agreed ICER threshold value. The fourth case is similar to the third, with the roles of the new therapy and the standard reversed. The question now is whether the extra benefits provided by the standard justify the additional costs of retaining it as the preferred treatment when the option of a new, cheaper but less effective drug exists.¹⁷

MATERIAL & METHOD :

CIMS (current index of medical stores) & IDR (Indian drug review) were reviewed for the prices of drugs used in the management of diabetes mellitus.

1. The retail cost of a particular drug being manufactured by different companies, in the same strength, number and dosage form was compared.
2. The difference in the maximum and minimum price of the same drug manufactured by different pharmaceutical companies was calculated.
3. The percentage variation in price was calculated.
4. The drugs being manufactured by only one company or being manufactured by different companies however, in different strengths were excluded.

The percentage variation in price was calculated using the following formula .

$$= \frac{\text{Price of most expensive brand} - \text{Price of list expensive brand}}{\text{Price of list expensive brand}}$$

Table 1: The price varice b/w of sulfonylurea group of drugs:

Drug	Formulation	Dose (mg)	Manufacturing Companies	Min. Price(Rs)	Max. Price(Rs)	% Price Variation
Glipizide	3	2.5	2	4.93	5.00	1.41
		5	3	4.74	8.96	89.02
		10	3	17.50	19.00	8.57
Glimperide	4	1	4	16.50	58.00	251.15
		2	4	28.00	112.50	301.78
		3	2	45.00	74.00	64.44
		4	2	44.00	93.00	111.36
Gliclazide	5	40	3	17.00	21.84	28.47
		80	5	25.00	80.00	220
Glibenclamide	4	2.5	2	2.60	3.70	42.30
		5	3	6.30	7.30	15.87

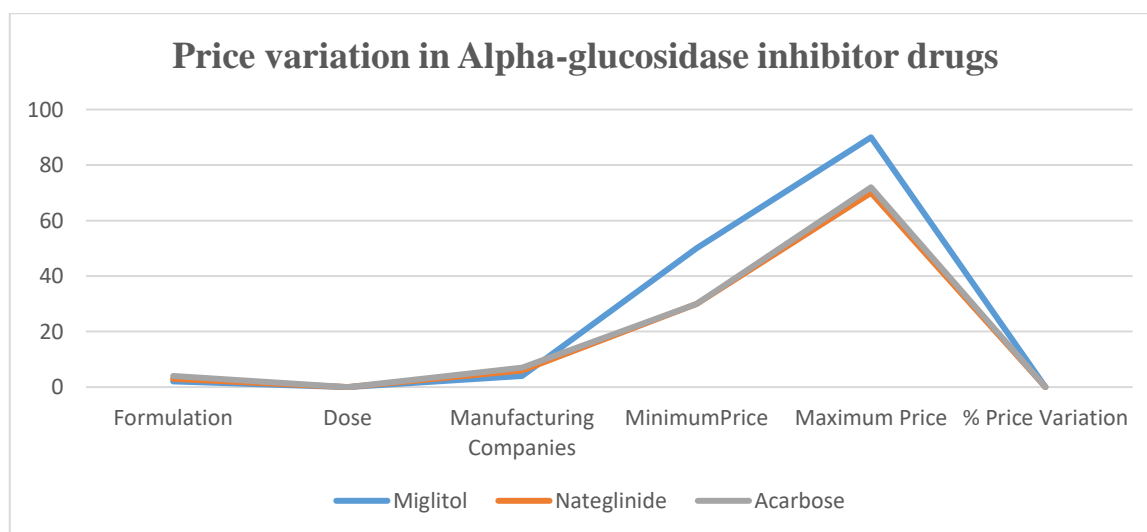
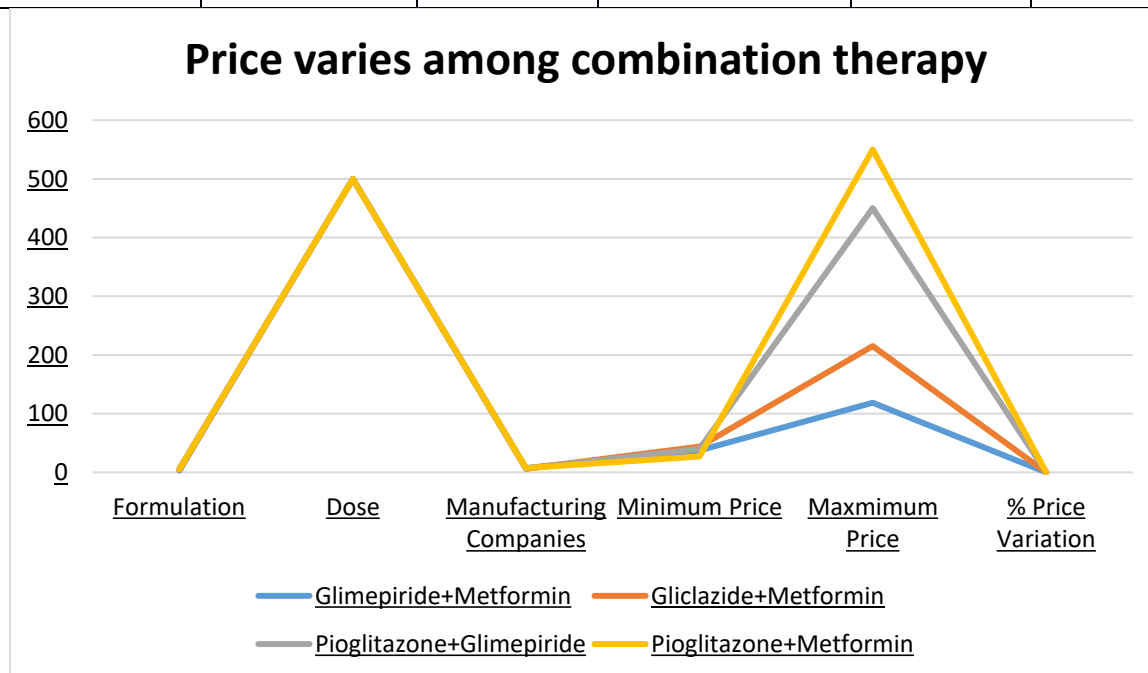
**Graph-1**

Table 2. Price variation in Alpha-glucosidase inhibitor drugs

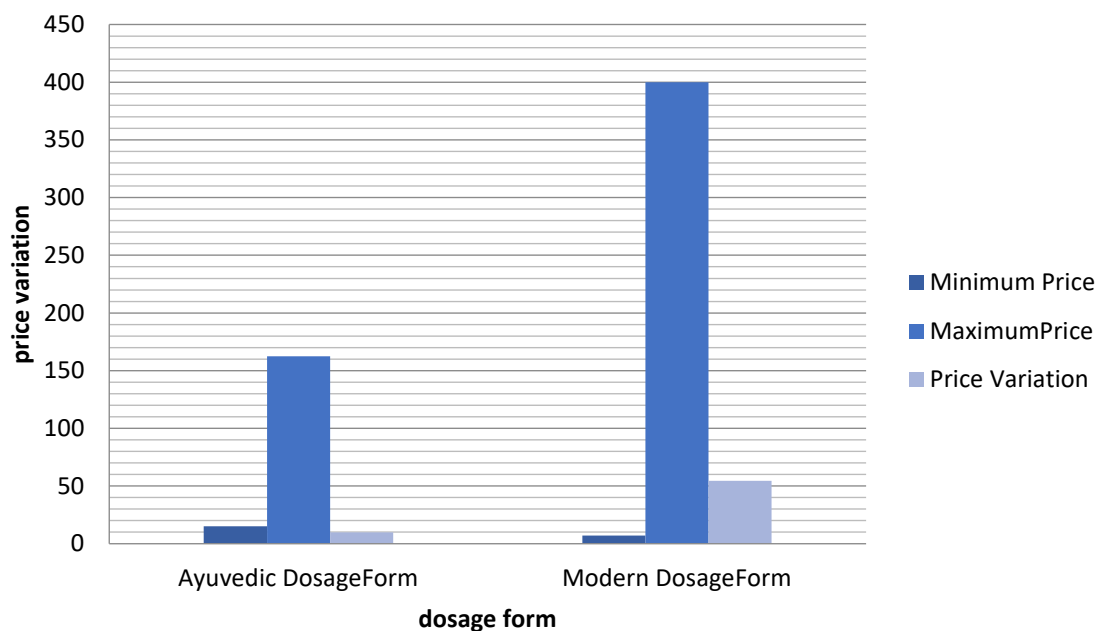
Drug	Formulation	Dose(mg)	Manufacturing companies	Min.Price (Rs)	Max.Price (Rs)	%Price Variation
Miglitol	2	25	2	50.00	50.30	0.6
		50	2	50.30	90.00	78.92
Nateglinide	3	60	3	30.00	45.00	50
		120	3	50.00	70.00	40
Acarbose	4	25	3	30.00	39.50	31.66
		50	4	58.00	72.70	25.34



Graph-2

Table 3: Price varies among combination therapy

Drug	Formulation	Dose(mg)	Manufacturing Companies	Min.Price (Rs)	Max.Price (Rs)	% Price variation
Glimepiride + Metformin	3	1 + 500	3	37.12	65.20	75.64
		2 + 500	4	48.00	118.60	147.08
Gliclazide + Metformin	4	30+500	2	44.00	80.00	81.81
		60+500	2	59.00	129.00	118.64
		80+500	2	38.60	215.00	456.99
Pioglitazone + Glimepiride	6	15+1	2	40.00	500.00	1150
		15+2	4	50.00	450.00	800
Pioglitazon e + Metformin	5	15+500	4	27.00	350.00	1196.29
		30+500	3	37.00	550.00	1386.48



Graph-3

Result

The prices on a total of 10 drugs (6 single and 4 combination preparations), available in 43 different formulations were analyzed. These 43 formulations are manufactured by different pharmaceutical companies.

In single drug therapy:-

Table1. Graph show the price variation between a sulphonylurea group of drug. In this group Glimperide (2mg) show maximum price variation of 301.78%, while Glipizide (2.5mg) show variation of 1.41%.

Table2. Graph show price variation in alpha glycosidase inhibitors group of drug. In this group Miglitol (50mg) show maximum price variation of 78.92 and Miglitol (25mg) show minimum price variation of 0.6%.

In combination therapy:-

Table3. Show price variation in combination therapy. In combination therapy total 4 combination therapy were analyzed. In this Pioglitazone + Metformin (30mg+500mg) combination show the maximum variation up to 1386.48%. Glimperide+Metformin(1mg+500mg) combination show the minimum variation i.e 75.64%.

Table 4 Marketed Allopathic Formulation for Diabetes mellitus

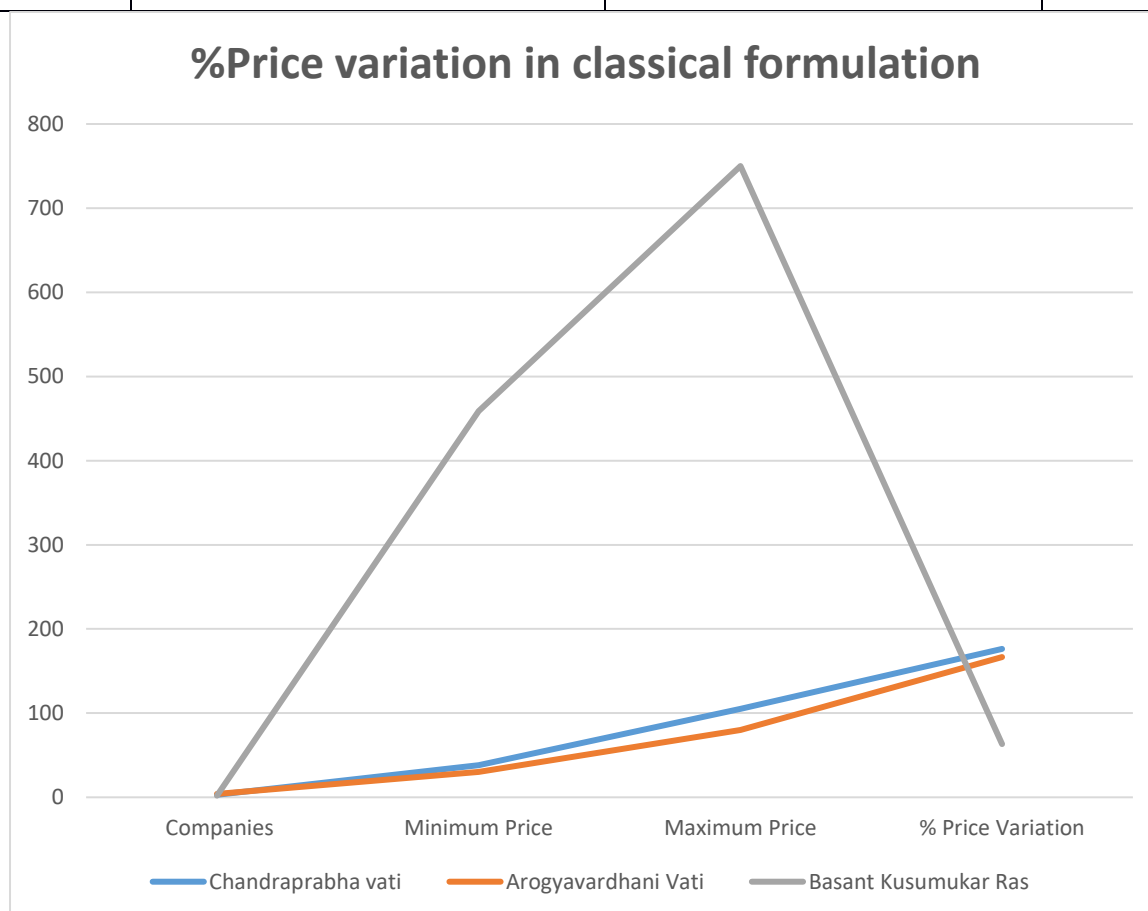
Sr.No.	Formulation Name	Company Name	Price
1.	Diabetrol Tab	NPIL	Rs.17.00/-
2.	Diolin-M Tab	Aristo	Rs.12.90/-

3.	Diaglip-M Tab	Cipla	Rs.7.28/-
4.	Diabend-M Tab	Bal Pharma	Rs.38.60/-
5.	Glyred-M Tab	Novartis(Sandoz)	Rs.400.00/-
6.	Path Tab	Lupin	Rs.380.20/-
7.	Path-G capsule	Lupin	Rs.600.00/-
8.	Glutide-CR capsule	Lupin	Rs.550.00/-
9.	Tgmet-g capsule	Trigenesis	Rs.48.00/-
10.	Glimepiride Tab	Cipla	Rs.35.00/-
11.	Voglidib Tab	Helios	Rs.87.00/-
12.	Voglinid-M-3 Tab	Olcare	Rs.105.00/-
13.	Acarbose	Biochem	Rs.95.30/-
14.	Gzide Tab	Elder	Rs.40.00/-
15.	Okamet Tab	Cipla	Rs.16.00/-
16.	Glymat Tab	Ind Swift	Rs.34.00/-

Table-5 Marketed Ayurvedic formulation for Diabetes mellitus:

Sr.No.	Formulation Name	Company Name	Price
1.	Diabecon Tablets 60	Himalya Drug Company	Rs.90.00/-
2.	Diabecon(DS) Tablets 60	Himalya Drug Company	Rs.125.00/-
3.	Dabur Madhu Rakshak Tab.	Dabur Drug Company	Rs.475.00/-
4.	Dabur vasant kusumakar Ras Tab.	Dabur Drug Company	Rs.975.00/-
5.	Kerala capsule	Himalya Drug Company	Rs.100.00/-
6.	Vijaysar Diabetes control cap.	Himalya Drug Company	Rs.630.00/-
7.	Dia-beta plus 60 veggi capsule	Jiva ayurveda	Rs.837.00/-
8.	Diabeta plus capsule	Jiva ayurveda	Rs.494.00/-
9.	Natures Valvet jamun pure extract,60 capsule	Jiva Ayurveda	Rs.527.00 /-

10.	Tansukh Madhumeha mantra granules	Jiva ayurveda	Rs.312.00 /-
11.	Shivalik Diabetacure capsules 60	Shivalik Herbals	Rs.345.00/-
12.	Chandraprabha vati(60gm)	Divya pharmacy	Rs.120.00/-
13.	Arogyavardhani vati(40gm)	Divya pharmacy	Rs.80.00/-
14.	Insorex capsule	Vopec Divine Herbs	Rs.385.00/-
15.	Healthvit Diavita capsules	Jiva Ayurved	Rs.240.00/-



Result:

This graph show the Price variation of marketed allopathic & ayurvedic formulations. Allopathic formulation of Diabetes mellitus has maximum Price variation as compare to Ayurvedic formulation. Same classical formulation manufactured by different companies and varies in prices of Formulation like-

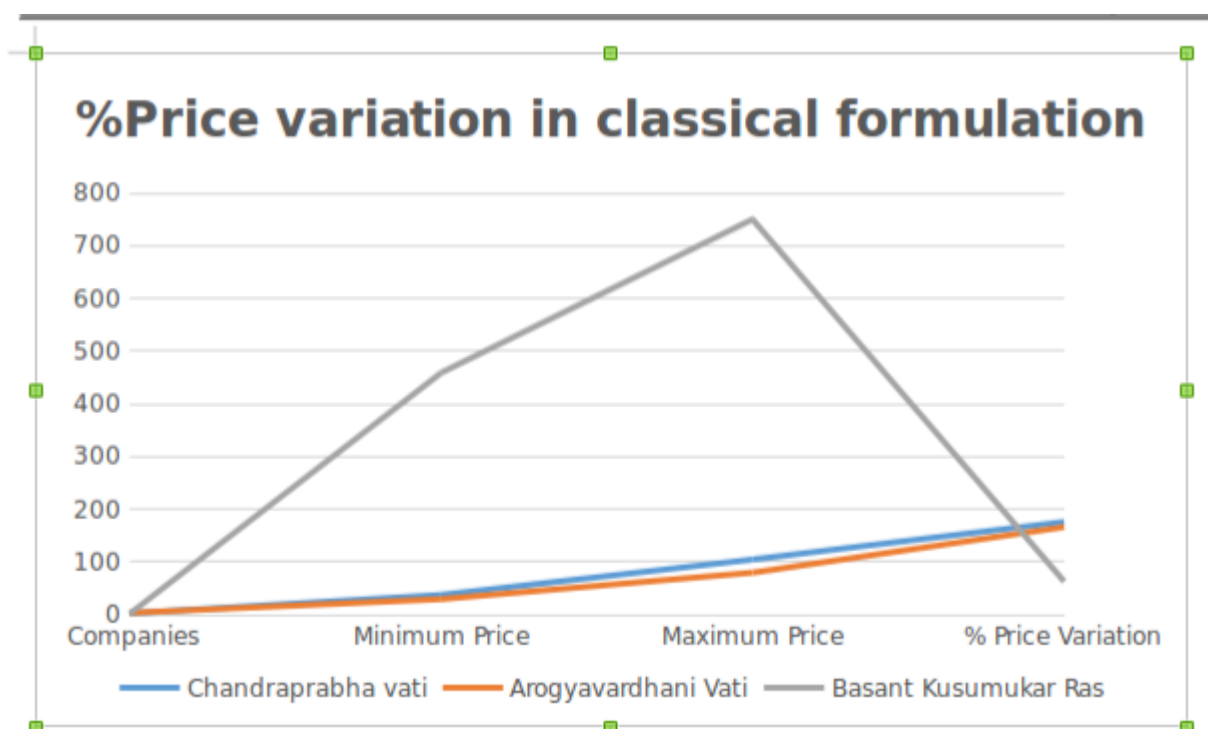
Table-6 classical formulation manufactured by different companies

Formulation Name	Manufacturing companies	Total manufacturing company	Price(Rs.)
Chandraprabha vatti	Dabur	3	50.00
	Zandu		38.00
	Divya pharmacy		105.00
Arogyavardhini Guttika	Dabur	4	30.00
	Diya pharmacy		80.00
	Zandu		55.00
	Sanjeevika		70.00
Basantkusuma -kar Ras	Baidyanath	2	459.00
	Zandu		750.00

Table-7 Percentage Price variation in classical formulation-

Formulation Name	Manufacturing Companies	Minimum price	Maximum Price	%Price variation
Chandraprabha Vatti	3	38	105	176.31
Arogyavardhini Vatti	4	30	80	166.66
Basant kusumukar ras	2	459	750	63.39

Result:-The prices on a total of 3 ayurvedic formulations were analyzed. These 3 formulations are manufactured by different pharmaceutical companies. Chandraprabha Vatti show maximum price variation of 173.31 & Basant kusumukar ras show minimum price variation of 63.39.

Table-7. Graph show price variation of classical formulation group for diabetes mellitus. In this

Chandraprabha Vati show maximum price variation of 176.31 and Basant Kusumukar Rasa show minimum price variation of 66.39.

DISCUSSION

Pharmaco-economics plays an important role in practice of medicine. High cost of medicines has economic implications for the patients and patient compliance may be significantly dependent on the cost of medicines prescribed; in addition to the confusing brand names of various medicines in the Indian market.

The prices of drugs have a high level of economic implication also for the nation. India follows a competitive market system where both domestic and foreign manufacturers compete. Competition can lead to increase efficiency and lower prices if there are large number of providers who compete with each other and information on prices, quality and likely benefit of the products are widely available to consumers. Different nations have different regulatory systems for the control of prices of drugs. In India, in 1979, 80-85% of the drugs in the market were under price control. The number has slowly decreased and by 2002 only 15-20% drugs were under price control.

The price of medicine is considered one of the most important obstacles to avail the medication. In developing countries, studies and data on medicine prices are scanty. Measuring and understanding the reasons for the price of medicines is the first stage in developing drug pricing policies that would ensure the

affordability of medicines. Diabetes mellitus is on alarming rise in India.

Diabetes mellitus is one of the most common endocrine disorders affecting 6% of the world's population. According to report of the International Diabetes Federation in 2001, the number of diabetic patients will reach 300 million in 2025. Indian market has over 100,000 formulations and there is no system of registration of medicines. The drugs are mainly sold under brand names. Current trend in epidemiology of diabetes is very disturbing and may make India, A Diabetic Capital of the World by year 2025. Government of India, is likely to consider issuing compulsory licenses for some patented diabetes management drugs sold in the country in an effort to make them affordable.

The Indian pharmaceutical industry has become a cornucopia of medicines with wide variation in prices for the same molecule marketed under different brand names. This creates lot of problems for physician in deciding the drug of choice for individual patient. A study in the United States found drug prices to be high and that price discrimination occurred across the industry. But very few studies are available in our scenarios which compare the cost of drugs of different brands. Therefore we decided to carry out the study which compares the cost of various anti-diabetics of different brands (mostly branded- generics) compared with the same molecule by calculating percentage variation of cost.

CONCLUSION

It is observed from our results that there is a wide variation in prices of formulation manufactured by different pharmaceutical companies. The reason of this price variation is the existing market structure of the pharmaceutical industry, Industrial cost, Asymmetry of information or imperfect information. From our study it is also clear that, price variation was directly related to the number of companies manufacturing a particular drug. So it can be concluded that the price variation increases because of the increase in competition among the manufacturing companies. Our findings reveal that the prices of various antidiabetic formulations ayurvedic as well as allopathic show great variation. Diabetes is a chronic morbid condition which requires lifelong treatment. So the cost of antidiabetic drugs is the major deciding factor for the patients compliance. In the absence of information on comparative drug prices and quality, it is difficult for doctors to prescribe the most economical treatment. 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.

The average percentage price variation of different brands of the same drug manufactured in India is very wide and hence the treating physician must keep this factor in mind while prescribing appropriate brand/generic drugs considering the financial background of the patient since the drug treatment may extend for a long time; most often even lifelong. In case of many medicines ayurvedic as well as modern there is a wide difference in the prices between different brands that can be seen in above graphs and tables. India is

known to export medicines to various countries at low cost, but faces the challenge of access to affordable and quality medicines for its own population. Indian generics have of late come under US FDA scanner for quality related issues of their drug formulations involving big pharmaceutical companies. The important quality issues found are sanitation at manufacturing site and resultant microbial count in the medication and failing bioequivalence. Same is true for many brands/generics sold in India.

As the healthcare sector progressing day by day the need to develop pharmaeconomics area is must. Currently, very few formulation under drug price control order. Hence it is desired that the Government should bring all life saving and essential medicines under price control. The average percentage price variation of allopathic & ayurvedic formulation of different brands of the same

drug manufactured in India is very wide. So it is recommended that the appraisal and management of marketing drugs should be directed toward maximizing the benefits of therapy and minimizing negative personal and economic consequences. Market structure and subsequent market segmentation provide a basis for prescription agent pricing policies leading to wide variation in price of drug in which Allopathic formulation graph show more price variation as compare to Ayurvedic formulation. Allopathic formulations have more costly operational procedure to manufacture the formulation as compare to the ayurvedic formulations.

References

1. Surendra G.Gattani, Pharmaeconomics: A review, Vol.2 Issue 3, July-September 2009,AJPCR ,pp.17-26.
2. P.V.Power,A.Nagare,R.B.Ambikar,P.H,Sharma,N.S.Vyawahare.Pharmaeconomics-an aid to better decision-making,JEADV(2005)19(Suppl.1)pp.34-39.
3. Rakhi Mishra, Mohd Shuaib, Shraavan and Prem Shanker Mishra, A review on herbal antidiabetic drugs, JAPS 01 (06); 2011: 235-237.
4. Das Surya Narayan, Patra V.J., Dinda S.C, Diabetes And Indian Traditional Medicines A Overview, Int.J pharma pharm S, Vol 4, Issue 3,2012,43-45.
5. Zaman.Z.A, Singh.G.P,Assessment of antihyperglycemic and antihyperlipidemic activity of common ayurvedic formulation in alloxan- induced diabetic rabbits. JDMS,Volume 2, Issue 2 (Nov-Dec. 2012), pp 2-20
6. Blumenschein K, Johannesson M. Economic evaluation in healthcare. A brief history and future directions, Pharmacoeconomics. 1996; 10 (2):114-22
7. Maninder Kaur , Vandana Valecha, Diabetes and Antidiabetic Herbal Formulations: An alternative to Allopathy EJM, Vol. 6, No. 4, pp. 226-240, 2014 pp.227-231.
8. Tripathi KD, Essentials of medical pharmacology.6th ed. Jaypee Publishers;2008 : Pp.254.

9. P Srinivas, K Prameela Devi, B Shailja, Diabetes Mellitus (Madhumeha)-an ayurvedic review, Int. J Pharma Pharm S, Vol 6, Suppl 1, 2014,Pp.107-110
10. Ashtanga Hridayam- Nidanasthanam; Vagbhata, Translated into English by Dr. K. R. Srikantha Murthy; Chaukamba Oriental Pub4553lisher & Distributor, Varanasi; Krishnadas Academy; 1992; Vlo -II; Chapter – 10; Page No.- 92-99; Prameha - Sankya, Nidana, Rupas, Samanya Lakshanas, Upadravas etc.
11. Yogaratnakaram- Pramehaprakaranam, By Dr. Inderdev Thripathi & Dr. Dayashanker Thripathi, Krishnadas Ayurveda Series 54, Chaukamba Krishnadas Academy, Varanasi –1998; Chapter - Primghar Nidana; Pp 622 to 641.
12. Evaluation of Antidiabetic Prescriptions from Medical Reimbursement Applications at Bana-ras Hindu University Health Care Facility,pp .1-2
13. P. V. Powar, A Nagare, R.B. Ambikar, P. H. Sharma, N.S.Vyawahare.Pharmacoeconomics- Costs of Drug Therapy to Healthcare Systems.
14. Tom Walley, M.D., Chapter 9. Pharmacoeconomics and Economic Evaluation of Drug Therapies,Pp 68-70.
15. Sule NS, Nerurkar RP, Kamath SA.Pharmacoeconomics. J Assoc Physicians India 2002; 50: 1057-62.
16. Ankur Rohilla et al, Pharmaeconomics: an overview, Int. JRPC,pp.64-67
17. T Walley, P Davey, Pharmacoeconomics: a challenge for clinical pharmacologists, Br J Clin. Pharmacol. 40(1995)199-202.