



Review Article

REVIEW ON POTENTIAL ANTIDIABETIC DRUGS IN AYURVEDA

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ABSTRACT

Ayurvedic texts are mentioned this *Vedic sastra* as a science of life. Ayurveda mainly targeted lifestyle of human being as well as mentioned number of drugs on various disorders. Among these disorders, diabetes is a major disorder. Due to which people are suffering lot. Diabetes is a major metabolic as well as lifestyle related disease. Anti-diabetic drugs from modern science can treat this disorder but at the cost of heavy side effects. Diabetic patients are using the modern drugs at higher doses plus these drugs are much costlier. Need of today's era is to use alternate therapies for diabetes. Among all alternative therapies Ayurveda gives ray of hope by using the Anti-diabetic drugs as mentioned in ancient texts. Ayurveda uses many drugs for diabetes especially herbal and herbomineral preparations. The review paper focuses on various Ayurvedic drugs herbal, herbomineral either in single or compound preparations studied at several research organizations. The paper focuses on antidiabetic properties of Ayurvedic drugs mentioned in Ayurvedic texts as well as their pharmacological, phytochemical properties and their scientific studies.

KEYWORDS: Diabetes, Ayurveda, Antidiabetic drugs, Herbal, Herbominerals.

INTRODUCTION

Diabetes mellitus is one of the growing major health problems throughout the world. International Diabetes Federation (IDF) given a data that number of people with Diabetes in the year 2011 crossed over 366 million^[1]. Diabetes reported among the ages of 20 and 79 in India at the percentage of 8.31%.^[2] In 21st century India is now becoming diabetic capital. More than 30 million people are having Diabetes in India. The urban areas in India is thought to be 9% of total population while in rural parts, the prevalence is around 3% of the total population. The problem of IGT (Impaired Glucose Tolerance) is also a major issue in India. India is having more number of Diabetes people than Western world. The prevalence of IGT is around to be around 8.7% in urban belt and 7.9 % in rural belt. IGT patients in future are going to develop Type 2 Diabetes. In India Diabetes is also detected in younger patients at much earlier.^[3] Indians are having significantly higher chances of Diabetes as compared with other populations^[4]. Indians Body mass Index displays a higher insulin level which is an early sign of Diabetes. In Indians higher body fat percentage cause the insulin resistance^[5,6]. Diabetes

is characterized by lack of insulin and disturbed carbohydrate metabolism.^[7] Hyperglycaemia in Diabetes cases may cause number of secondary complications affecting the eyes, nerves, and kidneys, vascular system leading to, nephropathy, retinopathy, peripheral vascular disease, and neuropathy. The World Health Organization has given the list of more than 21,000 herbal plants, which are used for health care purposes around the world. Among all these, more than 2000 species are found in India.^[8] Around 800 herbals have been shown to have anti-diabetic properties^[9]. There are number of phytochemicals in Ayurvedic herbal plants having active principles having possible role to treat Diabetes^[10]. Ayurveda termed Diabetes as a *Prameha*. Among all types of *Prameha*, *Madhumeha* is having close resemblance like Diabetes. Ayurveda explained specially lifestyle as well as disturbed metabolism and *Vata dosha* can create *Madhumeha*. There are several Ayurvedic formulations like herbs, herbominerals drugs which are useful to treat the patients of Diabetes (*Madhumeha*). Now days Ayurvedic medicines are gaining popularity worldwide because of their lesser side effects.

Ayurvedic drugs mainly source from herbs and minerals having natural origin. The review paper presents the anti-diabetic effects of some important herbal plants and herbomineral preparations used in Ayurveda for the treatment of type 2 Diabetes mellitus.

Ayurvedic Herbs Most Useful In Diabetes

Tinospora cordifolia (Guduchi)

Tinospora cordifolia root extract by oral administration is studied in alloxan induced diabetic rats, its result shows that there is marked reduction of blood glucose and brain lipids. Change in doses like 400mg/kg can cause great anti-hyperlipidemic effect in rats and the effect was equivalent to one unit/kg of Insulin^[11].

Eugenia Jambolana (Indian Gooseberry, Jamun)

Eugenia jambolana (Jamun) related to the family Myrtaceae. The most important plant parts are leaves, seeds, fruits, as well as bark. Jamun used by Ayurved practitioners in various ailments. Jamun is one of the widely used plants in the treatment of Diabetes. The plant is having components like myricetin, anthocyanins, glucoside, ellagic acid, isoquercetin, as well as kaempferol. Jamun acts as a good hypoglycemic agent. It's property is having hypoglycemic activity studied in streptozotocin induced diabetic mice. In the oral administration extract of Jamun pulp resulted in increase in serum insulin levels in diabetic rats. So there is good stimulation of insulin secretion was with isolated islets of Langerhans from normal as well as diabetic animals. The extracts of Jamun also inhibited insulinase activity from liver and kidney.^[12] *Eugenia jambolana* is known to have antioxidative activity due to presence of various phytochemicals present in it. The bark of Jamun is having in several bioactive compounds including quercetin, betulinic acid, B-sitosterol, eugenin, ellagic and gallic acid^[13], bergenin^[14], tannins^[15], and flavonoids. Fruits contain glucose, fructose, raffinose^[16], malic acid^[17], and anthocyanins^[18]; leaves are rich in acylated flavonol glycosides^[19], quercetin, myricetin, and tannins^[20] all of which have hypoglycemic ability.

The hypoglycemic effect of Jamun may be due to increased secretion of insulin from the pancreas^[21]. Additionally *Eugenia jambolana* is having value addition effect of lipid-lowering phenomenon evidence by reduction of blood free fatty acids cholesterol, and triglycerides^[22]. It is all due to the saponins, flavonoids and glycosides in the extract of Jamun.

In the liver, Jamun can decrease the activity of enzyme 3-HMG Co-A reductase.^[23] Jamun seed's ethanolic extract in alloxan-induced diabetic rats

shown to be remarkable reduction in blood sugar level and positive changes in the pancreatic islets^[24].

Gymnema sylvestris (Gurmar)

Gymnema sylvestris (Gurmar) related to the family Asclepiadaceae. It is a native herb to the various forests of India. It have a group of triterpene saponins, known as gymnemic acids and gymnema saponins are found to be present in *G. sylvestris* which are responsible for the reported pharmacological properties and is useful as a anti-diabetic plant used in Ayurvedic preparations. Various studies in animal models proved its anti-diabetic properties.^[25]

G. sylvestris aqueous extract is useful in insulin secretion in animal study and pancreatic β cells of human with type 2 Diabetes.^[26] Gurmar may cause increase the insulin level by the regeneration of the cells in the pancreas^[27]. *G. sylvestris* can cause to prevent adrenal hormones from stimulating the liver in producing the glucose in mice, thereby reducing blood glucose level^[28]. Oral administration of Gurmar is reported to be effective in obesity^[29,30], and pancreatic β cell dysfunction^[31]. *G. sylvestris* suspension in animal study shows that diabetic potential against alloxan-induced diabetic albino male rats^[32]. *G. sylvestris* hypoglycemic effect is due to it's ethanolic extract which can enhance insulin which comes into play by increasing either the pancreatic secretion of insulin from β cells^[33,34]. In one animal study oral administration of *G. sylvestris* was reported to result in lowering of glucose^[32].

Trigonella foenum-graecum-Methi

Trigonella foenum-graecum (fenugreek, methi) related to the family Fabaceae. Leaves and seeds are useful parts of the Methi.

Numerous studies on different animal models have proved that fenugreek is having anti-hyperglycemic property^[35,36]. Clinical studies have also confirmed the lipid-lowering and glucose lowering effect of fenugreek^[37].

Number of studies on fenugreek seed extract and leaves mucilage of seeds can decrease blood cholesterol and glucose levels in clinical studies and in experimental animals as a diabetic^[38, 39].

Fenugreek is having anti-diabetic property due to the presence of saponins^[40], 4-hydroxy-isoleucine^[41], and trigonelline, an alkaloid^[42] and a high-fiber content^[43].

One of the steroid present in Methi was reported to reducing the blood glucose level when given to diabetic rats ^[44].

It is due to increment of the area of insulin-immunoreactive β cells^[45]. The anti-hyperglycemic effect is due to increase glucagon level^[46]. The anti-

diabetic effect of *Methi* is due to peripheral utilization of glucose and the increase in insulin sensitivity^[47].

In STZ induced diabetic rats, the result was excellent showing reducing the maltase activity hence could be good antidiabetic^[48].

Momordica Charantia (Karela)

Momordica charantia called as bitter gourd or *Karela* come under the family of Cucurbitaceae. Fruit as well as seeds are frequently useful parts for therapeutic benefits. *Momordica charantia* is useful for the treatment of Diabetes, cardiovascular diseases and many clinical conditions. Some of the preclinical studies have reported that it is anti-diabetic and potent hypoglycaemic agent.^[49] *Karela* acts as an antioxidant as well as contains various bioactive substances with antidiabetic potential like triterpenoids vicine, charantin.^[50]

Several animal studies proved *Karela* can reduce the metabolic syndrome, which is key factor for creation of Diabetes.^[51-52]

Studies on *Momordica charantia* shows that it can repair damaged β -cells and it can stimulate insulin level^[53] and also improve sensitivity/signaling of insulin.^[54] *Momordica charantia* can inhibit the absorption of glucose by inhibition of glucosidase and suppressing the activity of disaccharidases in the intestine^[55]. In streptozotocin diabetic rats it can show anti-hyperglycemic effect^[56].

Scientific Studies on Polyherbal Ayurvedic Medicines as an antidiabetic,

Laghu Malini Vasanta Rasa when given at a dose of 250mg twice daily for 8 weeks showed maximum relief in symptoms of Diabetes along with marked reduction in post meal blood sugar while insignificant anti-hyperglycemic activity was reported in experimental animals.^[57]

Mehamudgara Vati when given at the doses of 750mg thrice daily for 3 months along with controlled exercises and diet were shown significant results^[58].

Asanadiyoga Vati and *Shilajitwadi Vati* was given at a dose of 4gm/day with water for 8 weeks providing encouraging results. *Asanadiyoga Vati* reported 68% improvement, while *Shilajitwadi Vati* 63% in all signs and symptoms^[59].

The drugs like *Nyagrodhadi Vati* and *Gokshuradi Guggulu* was given at the dose of 6gm/day with water for 8 weeks showed mild

reduction in glycemic levels. In this study *Nyagrodhadi Vati* were reported to be more effective against signs and symptoms of Diabetes.^[60]

The clinical study on *Saptarangyadi Ghanavati* given at the dose of 1gm thrice daily with lukewarm water has shown significant reduction in Fasting Blood Sugar, Post Prandial Blood Sugar and HbA1c levels. As compared to glibenclamide the drug is significantly worked as an antidiabetic.^[61]

The study on *Triphaladi Vati* and *Shilajitwadi Vati* at the dose of 750mg/day in three divided doses with lukewarm water was given for 8 weeks given better results for blood glucose level. The Diabetes symptoms were significantly improved by *Triphaladi Vati* as compared to *Shilajitwadi Vati*^[62].

Medoghna Rasayana Vati is one of the good polyherbal formulation given at the dose of 1gm twice daily with Lukewarm water for 60days, then it was reported to be effective on Diabetes Mellitus. Post prandial blood sugar was significantly reduced when the drug was administered along with modern antidiabetic drug.^[63]

The study was done in between *Guduchi Ghana* and *Guduchi satva*. In this study *Guduchi Ghana* was reported significant antihyper-glycaemic activity and mild hypoglycaemic. *Guduchi Satva* has shown mild hypoglycaemic and insignificant antihyper glycaemic activities^[64].

Role of Bhasma as an Antidiabetic

In a clinical study *Nag bhasma* along with modern antidiabetic drug shown good response in decrease in blood sugar level^[65].

Swarnamakshik bhasma in comparison along with drug Glibenclamide for streptozocin induced diabetic rats. So *Swarnamakshik bhasma* shown to lowered blood sugar level significantly^[66].

Abhrak bhasma shown to be potent in improvement in glucose tolerance test in glucose loaded hyperglycemic rats^[67].

In rats having normal blood glucose level *Jasad Bhasma* can decrease fasting blood glucose level^[68].

Nag bhasma at the doses of 11. 25mg/kg body weight along with *Nishaamalki* showed prominent in decreasing blood sugar level of alloxan induced mice. One more advantage is that it can increase beta cells of pancreas upto 75%.^[69]

Ayurvedic herbs mentioned as a antidiabetic

Table 1: Herbal Drugs used in Diabetes [70]

S. No.	Sanskrit Name	Latin Name	Part use	Action
1.	<i>Amalaki</i>	<i>Amblica officinalis</i>	Fruit	<i>Pramehaghna, Raktapitta</i>
2.	<i>Haridra</i>	<i>Curcuma longa</i>	Bark	<i>Pramehaghna, Kusthaghna</i>
3.	<i>Indravarini</i>	<i>Citrullus colocynthis</i>	Fruit, Root	<i>Kamala, Prameha</i>
4.	<i>Devdar</i>	<i>Cedrus deodara</i>	Bark, Oil	<i>Prameha, Pinas, Kasa</i>
5.	<i>Musta</i>	<i>Cyperus rotandus</i>	Root	<i>Atisar, Prameghna</i>
6.	<i>Shal</i>	<i>Shoerea robusta</i>	Bark, Gum	<i>Kasa, Shwas, Pramehaghna</i>
7.	<i>Kampillak</i>	<i>Mallotus philippinesis</i>	Fruit	<i>Prameha, Visha, Ashmari</i>
8.	<i>Kutaj</i>	<i>Halarrhena antidysenterica</i>	Bark, Seed	<i>Prameha, Atisara</i>
9.	<i>Kapitthya</i>	<i>Feronia limonia</i>	Fruit, Flower, Seed	<i>Vranaropana, Visha</i>
10.	<i>Rohitak</i>	<i>Tecomella undulata</i>	Bark	<i>Prameha</i>
11.	<i>Bibhitak</i>	<i>Terminalia bellirica</i>	Fruit	<i>Netraroga, Prameha</i>
12.	<i>Saptaparni</i>	<i>Alstonia scholaris</i>	Bark	<i>Prameha, Kushta</i>
13.	<i>Nimba</i>	<i>Azadirachta indica</i>	Bark, Leaves, Seed	<i>Prameha, Kushta</i>
14.	<i>Aragvadh</i>	<i>Cassia fistula</i>	Fruit	<i>Prameha, Prameha, Hrudrog</i>
15.	<i>Durva</i>	<i>Cynodon dactylon</i>	All Parts	<i>Prameha, Ashmari</i>
16.	<i>Som</i>	<i>Ephedra gerardiana</i>	All parts	<i>Prameha, Kushta</i>
17.	<i>Palash</i>	<i>Butea monosperma</i>	Flower, Bark, root	<i>Prameha, Kusta,</i>
18.	<i>Priyangu</i>	<i>Callicarpa macrophylla</i>	Flower, Root	<i>Prameha, Twacha Rog</i>
19.	<i>Anatmool</i>	<i>Tylophora, asthamatica</i>	Leaves, Root	<i>Prameha, Shwashar</i>
20.	<i>Yuthika</i>	<i>Jasminum auriculata</i>	Root	<i>Prameha, Visha</i>
21.	<i>Bhargi</i>	<i>Clerodendrum serratum</i>	Root	<i>Prameha, Gulma, Pinas</i>
22.	<i>Manjista</i>	<i>Rubia cordifolia</i>	Root	<i>Prameha, Visha, Visarpa</i>
23.	<i>Dadhimtvak</i>	<i>Punica granatum</i>	Fruit	<i>Prameha, Hrudrog</i>
24.	<i>Shalparni</i>	<i>Desmodium gangeticum</i>	All parts	<i>Krumihar, Prameha</i>
25.	<i>Padmak</i>	<i>Prynus cyrasoidus</i>	Bark	<i>Hrudrog, Prameha, Ashmari</i>
26.	<i>Nagkeshar</i>	<i>Mesua ferrea</i>	Flower	<i>Prameha</i>
27.	<i>Punnag</i>	<i>Calophyllum inophyllum</i>	Bark, Seed	<i>Arsha, Pittahar</i>
28.	<i>Dhataki</i>	<i>Woodfordia fruticosa</i>	Flower	<i>Prameha, Trushna,</i>
29.	<i>Bakul</i>	<i>mimusops</i>	Bark, Flower	<i>Prameha, Krumi,</i>
30.	<i>Shalmali</i>	<i>Salmalia malabarica</i>	Root Flower, Gum	<i>Prameha, Rasayan, Vrushya</i>
31.	<i>Mocharasa</i>	<i>Salmalia malabarica</i>	Gum	<i>Prameha, Raktapitta</i>
32.	<i>Shrungatak</i>	<i>Trapanatum bispinosa</i>	Seed	<i>Prameha, Grahani</i>
33.	<i>Giloy</i>	<i>Tinospora cordifolia</i>	Bark	<i>Prameha, Vrushya, Rasayan</i>
34.	<i>Kaas</i>	<i>Saccharum sponatanum</i>	Root	<i>Prameha, Raktatar</i>
35.	<i>Madhuk</i>	<i>Madhuca indica</i>	Bark	<i>Prameha, Trushna</i>
36.	<i>Aamra</i>	<i>Mangifera indica</i>	All parts	<i>Prameha, Raktatar</i>
37.	<i>Jambu</i>	<i>Syzygium cumini</i>	Fruit	<i>Prameha, Mutrasangrahaniya</i>
38.	<i>Aasan</i>	<i>Pterocarpus marsupium</i>	Bark	<i>Prameha, Pandu.</i>

39.	<i>Tinish</i>	<i>Ougeinia dalbergioides</i>	Bark	<i>Prameha, Pandu</i>
40.	<i>Kakubh</i>	<i>Terminalia arjuna</i>	Bark	<i>Prameha, Hrudhya</i>
41.	<i>Shonyak</i>	<i>Oroxylum indicum</i>	Root	<i>Prameha, Aamvat</i>
42.	<i>Bhallatak</i>	<i>Semicarpus anacardium</i>	Fruit, Seed,	<i>Prameha, Shukral</i>
43.	<i>Palash</i>	<i>Butea, monosperma</i>	Flower, Seed	<i>Prameha, Krimighna</i>
44.	<i>Aparajita</i>	<i>Clitoria ternatea</i>	Root, Seed	<i>Prameha, Galganda, Visarpa</i>
45.	<i>Karpura</i>	<i>Cinnamomum camphora</i>	Fruit	<i>Prameha, Hrudhya</i>
46.	<i>Jatvetas</i>	<i>Salix terrasperma</i>	Leaves, Root	<i>Prameha</i>
47.	<i>Ajakarna</i>	<i>Vateria indica</i>	Bark, Gum	<i>Prameha, Krimi, Vidhradhi</i>
48.	<i>Kutaj</i>	<i>Holarrhena antidysentrica</i>	Bark, Seed	<i>Prameha, Upshoshak</i>

DISCUSSION

Ayurveda described number of Ayurvedic drugs as an anti-diabetic. The drugs are having excellent potential as anti-diabetic. Number of clinical and animal trials have given significant data that Ayurvedic drugs can be used as a antidiabetic agent. The drugs may be single, poyherbal, or herbomineral preparations. The Ayurvedic drugs are having excellent anti-hyperglacmice effect, anti-glucose tolerance effect plus regeneration beta cells of langerhans, so this could be value addition in biology of diabetic patients.

CONCLUSION

Ayurvedic medicines are found to be more effective and clinically safe as no adverse episodes of adverse drug reactions were reported during treatment regimen. Diet and lifestyle plans play key role in affected patients. We can use Ayurvedic antidiabetic drug along with modern drug without any drug-drug interactions. Ayurvedic drugs are giving upper hand in treatment part on modern allopathic medicines on every aspects. We can use these drugs not only in primary condition but there is scope to use to these drugs in secondary complications of Diabetes. So use of these drugs should be increase in diabetic patients all over the world.

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