



OVERVIEW ON SELECTED MEDICINAL PLANTS USED IN THE MANAGEMENT OF DIABETES MELLITUS

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ABSTRACT

Diabetes is a heterogeneous metabolic disorder characterized by altered carbohydrate, lipid, and protein metabolism which causes hyperglycaemia resulting from insufficient insulin secretion, insulin action or both. Diabetes caused 5.1 million deaths in 2013; every six seconds a person dies from diabetes. More than 79,000 children developed type 1 diabetes in 2013. More than 21 million live births were affected by diabetes during pregnancy in 2013. The symptoms of Diabetes Mellitus are correlated with Madhumegam in siddha system of medicine. The medicinal plants discussed in this review article are widely used in the treatment of diabetes mellitus in siddha system of

medicine. All the herbal plants discussed in the review exhibit significant clinical & pharmacological activity.

KEYWORDS: Diabetes Mellitus, Madhumegham, Siddha.

INTRODUCTION

Diabetes is a heterogeneous metabolic disorder characterized by altered carbohydrate, lipid, and protein metabolism which causes hyperglycaemia resulting from insufficient insulin secretion, insulin action or both.^[1]

It is one of the refractory diseases identified by Indian Council of Medical Research for which an alternative medicine is a need for the treatment. Diabetes mellitus has become a

growing problem in the contemporary world. India has today become the diabetic capital of the world with over 20 million with diabetes and this number is likely to increase to 57 million by 2025.^[2]

According to International Diabetes Federation (IDF) Report 2013, 382 million people have diabetes; by 2035 this will rise to 592 million 175 million people with diabetes are undiagnosed. Diabetes caused 5.1 million deaths in 2013; every six seconds a person dies from diabetes. More than 79,000 children developed type 1 diabetes in 2013. More than 21 million live births were affected by diabetes during pregnancy in 2013.^[3] The reasons behind this projected increase in prevalence rate are due to the sudden spurt in life style modification, ethical susceptibility and vast urbanization increase in life expectancy at birth, physical inactivity and obesity and possibly a genetic predisposition.^[4]

Allopathic drugs used for the treatment of diabetes have their own side effect & adverse effect like hypoglycaemia, nausea, vomiting, hyponatremia, flatulence, diarrhoea or constipation, alcohol flush, headache, weight gain, lactic acidosis, pernicious anaemia, dyspepsia, dizziness, joint pain. So instead of allopathic drugs, herbal drugs are a great choice which is having more or less no side effect & adverse effects. Ethno botanical information identified about 800 Indian plants which may have anti-diabetic potential.^[5, 6]

Several herbs are often used together to enhance effectiveness and synergistic actions and to reduce toxicity^[7] Whole herbs contain many ingredients, and it is likely that they work together to produce the desired medicinal effect. The type of environment (climate, bugs, soil quality) in which a plant grew will affect its components, as will how and when it was harvested and processed.^[8] Several plant species being a major source of terpenoids, flavonoids, phenolics, coumarins, and other bioactive constituents have shown reduction in blood glucose levels.^[9, 10]

Diabetes mellitus

Diabetes mellitus is a syndrome of disordered metabolism, usually due to a combination of hereditary and environmental causes, resulting in abnormally high blood sugar levels (hyperglycemia). Blood glucose levels are controlled by a complex interaction of multiple chemicals and hormones in the body, including the hormone insulin made in the beta cells of the pancreas. Diabetes mellitus refers to the group of diseases that lead to high blood glucose levels due to defects in either insulin secretion or insulin action.^[11]

SIDDHA ASPECT OF THE DISEASE^[12]

The symptoms of Diabetes Mellitus are correlated with Madhumeagam in siddha system of medicine.

MADHUMEGHAM

Mega Neer, VeguMoothiram, EnnipuNeer, Neerizhivu, ThithippuNeer, Pramegham. Madhumeagam is a clinical condition characterized by frequent urination resulting in deterioration and diminution of seven thathus and loss of weight.

Types

According to Siddha, this disease is subdivided into 3: Vatham, Pitham and Kabam.

- ❖ Vatha again subdivided into 4,
- ❖ Pitham as 6 types
- ❖ Kabam as 10 Types.

Aetiology

- Diet habits
- Sexual indulgence
- Obesity
- Psychosomatic cause
- Hereditary
- Excess stimulation of moolatharam

Clinical features: Polyuria, Polyphagia, Polydipsia, Perspiration, Exhaustion, Insomnia, Giddiness and Loss of Weight even at normal consumption Of Food.

Humoral pathology: The three Humors Vatha, Pittaham And Kabam which controls the body and maintains the health of the body without any diseases. An imbalance in Iyam does imply an imbalance in other two kutrams (Vatham and Pittham) too and causes derangement of Dasavayu and Seven Udal Thathukkal (Body Constituents) which causes the disease and other complications.

Glucose Levels

Blood test	Normal	Pre-Diabetics	Diabetics
Fasting	80-100 mg/dl	110-125 mg/dl	Above 126 mg/dl
2 hours after meal (PPBS)	below 140 mg/dl	140-160 mg/dl	Above 180 mg/dl;
HbA1C	4%-6%	5.7%-6.4%	Above 6.5%

Selected medicinal plants: There are many medicinal plants used in the treatment of diabetes mellitus. These medicinal plants possess phytochemicals and biochemical ingredients and many other active ingredients. The synergistic effects of these are responsible for their medicinal value. The following are the selected medicinal plants used in the management of diabetes mellitus. They describe the pharmacological activity of the plant in animal model and medicinal quality of the particular plant.

Activity

1.1 *Cassia auriculata*: Aavarai (*Cassia auriculata*) Flower extract of *Cassia auriculata*, increased plasma insulin and improved specific insulin binding in streptozotocin induced diabetic rats¹ (L. Pari et al.) n-butanol fraction² (S. J. Surana et al) and ethanol extract of *C.auriculata* exhibited significant reduction ($p < 0.001$) in blood glucose levels in Alloxan induced rats with remarkable increase in plasma insulin.^[13, 14, 15]

1.2 *Gymnema Sylvestre*: *G. sylvestre* R.Br. is a perennial, woody climber belonging to family Asclepiadaceae or the “milk weed” family.^[16] When *Gymnema* leaf extract is administered to a diabetic patient, there is stimulation of the pancreas by virtue of which there is an increase in insulin release.^[17] In an animal study, investigated the sakkarakkolli leaf powder had positive and encouraging effects over blood glucose levels. No adverse effect was observed on the health status of subjects and thus, it can thus be concluded that the sakkarakkolli powder is effective in lowering the fasting as well as post prandial blood glucose levels. Moreover, antihyperglycemic action of a crude saponin fraction and five triterpene glycosides derived from methanol extracts of *G. sylvestre* has also been investigated.^[18, 19]

1.3 *Emblica officinalis*: Ethanolic extract of *P.emblica* showed dose dependent reduction in blood glucose level, also the cholesterol, triglyceride and other hepatic markers are reduced in alloxan induced diabetic rats. Aqueous fruit extract, of *Phyllanthusemblica* Linn significantly decreased the blood glucose level, also induced hypotriglyceridemia by decreasing TG levels, the extract was also found to improve liver function by normalizing the activity of liver specific enzyme alanine transaminase (ALT). The aqueous extracts of *Phyllanthusemblica* fruits significantly ($P < 0.05$) reduced serum glucose, glycosylated hemoglobin, cholesterol, triglycerides, urea and creatinine but increased serum insulin, HDL cholesterol and protein in alloxan-induced diabetes mellitus in rats^[20, 21, 22] Oral administration of ethanolic extract of seed powder of *E. officinalis* decreased the blood glucose level and serum cholesterol level in alloxan induced diabetic rats.^[23]

1.4 *Trigonella foenum-graecum*: Seeds of fenugreek have been shown to have multiple benefits in patients with diabetes such as reduction of blood glucose level and its complications 18-21. Ethanolic extract of *T. Foenum graecum* seed significantly decreased the blood glucose, serum cholesterol, SGOT and SGPT levels of alloxan induced diabetic rats 20-21. Neveen *et al* 22 reported that alkaloid extract of fenugreek dried seeds significantly increased serum insulin level of STZ induced hyperglycemic rats.^[24, 25, 26, 27,]

1.5 *Aegle marmelos*: The methanolic extract of leaf and callus powder of *A. marmelos* significantly decreased. The blood sugar level of STZ induced diabetic rabbits⁴⁴. *A. marmelos* would act like insulin in the restoration of blood sugar and body weight to normal levels in rat and was therefore recommended as a potential hypoglycaemic agent reported that the leaves of *A. marmelos* are used by Tribals of Kolli Hills as an important ingredient in the poly herbal diabetic drug formulations.^[28,29,30]

1.6 *Acacia arabica*: It is found all over India mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagogue to release insulin. It induces hypoglycaemia in control rats but not in alloxanized animals. Powdered seeds of *Acacia arabica* when administered (2, 3 and 4 g/kg body weight) to normal rabbits induced hypoglycaemic effect by initiating release of insulin from pancreatic beta cells.^[31]

1.7 *Allium sativum*: This is a perennial herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycaemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect. Aqueous homogenate of garlic (10 ml/kg/day) administered orally to sucrose fed rabbits (10 g/kg/day in water for two months) significantly increased hepatic glycogen and free amino acid content, decreased fasting blood glucose, and triglyceride levels in serum in comparison to sucrose controls.^[32, 33] (Liliaceae) It is a perennial herb cultivated throughout India. Oral administration of the garlic extract significantly decreases serum glucose, total cholesterol, triglycerides, urea, uric acid, creatinine, AST and ALT levels, while increases serum insulin in diabetic rats but not in normal rats when compared with anti-diabetic drug glibenclamide. The antidiabetic effect of the extract was more effective than glibenclamide.^[34]

1.8 *Azadirachta indica*: Hydro alcoholic extracts of this plant showed anti-hyperglycaemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake

and glycogen deposition in isolated rat hemi diaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects.^[35]

1.9 *Momordica charantia*: Family: Cucurbitaceae. Local Name: Kaattupagar-kai. The plant is commonly known as Bitter guard and has many varieties *Momordica charantia* is commonly used as an antidiabetic and antihyperglycemic agent in India as well as other Asian countries. Extracts of fruit pulp, seed, leaves and whole plant was shown to have hypoglycaemic effect in various animal models. Polypeptide p, isolated from fruit, seeds and tissues of *M. charantia* showed significant hypoglycaemic effect when administered subcutaneously to langurs and humans. Ethanolic extracts of *M. charantia* (200 mg/kg) showed an antihyperglycemic and also hypoglycaemic effect in normal and STZ diabetic rats. This may be because of inhibition of glucose-6-phosphatase besides fructose-1, 6-biphosphatase in the liver and stimulation of hepatic glucose-6-phosphate dehydrogenase activities.^[4] The plant is climbing shrub and generally cultivated everywhere in India. Unripe fruits are taken orally along with food. Dosage: 2-3 fresh unripe fruits are taken at any time per day for three months.^[36]

1.10 *Naaval*

Naaval (*Syzygium cumini*) Water extract of pulp of *S. cumini* stimulates release of insulin and inhibition of insulinase activity. A glycoside in the seed, jamboline, is considered to have antidiabetic properties.^[37] Seed kernel (aqueous suspension) was screened for its anti-diabetic activity at the dose levels of 1g, 2g, 4g and 6 g/kg body weight of rabbit. 4g/kg dose level was found to reveal utmost hypoglycemic effect (42.64%) in rabbits, 3hr. after medication. Like to lbutamide, the drug may also be promoting endogenous release of insulin.

Additional pancreatic site of action of the drug cannot be ruled out, since it produced a significant decrease in the blood sugar level (17.04%) in alloxan diabetic rats.^[38] The present study evaluated the hypoglycemic activity of different parts of *Eugenia jambolanaseeds* such as whole seed, kernel, and seed coat on streptozotocin-induced diabetic rats. Administration of the ethanolic extract of kernel at a concentration of 100 mg/kg of body weight significantly decreased the levels of blood glucose, blood urea, and cholesterol, increased glucose tolerance and levels of total proteins and liver glycogen, and decreased the activities of glutamate oxaloacetate transaminase and glutamate pyruvate transaminase in experimental diabetic rats. Whole seed showed a moderate hypoglycemic effect, and seed

coat did not show any hypoglycemic effect. The hypoglycemic efficacy was compared with that of glibenclamide, a standard hypoglycemic drug.^[39]

1.11 Seenthil: Seenthil (*Tinosporacordifolia*) The treatment of *Tinosporacordifolia* methanolic extract significantly ($P < 0.01$) decreased the blood glucose level, also prevented ($P < 0.01$) the elevation of glycosylated haemoglobin and cholesterol levels in diabetic rats which could be due to the result of improved glycaemic control proved by *Tinosporacordifolia*. The same extract also improved the activity of liver hexokinase ($P < 0.01$) and the activity of fructose 1, 6- bi- phosphatase and glucose 6 phosphatase were found to be restored to normal ($P < 0.01$) level.^[40]

CONCLUSION

The medicinal plants discussed in this review article are widely used in the treatment of diabetes mellitus in siddha system of medicine. All the herbal drugs discussed in the review exhibit significant clinical & pharmacological activity. The potency of herbal drugs is significant & they have negligible side effects than the synthetic anti diabetic drugs. Thus I conclude that still wider aspect of detailed research is necessary to establish the exact principle of action.

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