Review Article

Summarizing Abridgment on the Herbal Approach for Treatment of Diabetes Mellitus

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ABSTRACT

Diabetes is a metabolic disorder and many medical plants are used for the treatment in the form of traditional herbal medicines. This approach has fewer side effects. The aim of the present review paper is to provide concise information on diabetes and to abridge an in-depth herbal database for the healing thereby highlighting the approach and thereby prospecting a general framework for upcoming researches. Complementary and alternative medicinal approach becoming popular for treatment of chronic illnesses such as diabetes mellitus. However, various limitations in terms of their application and efficacies exist. Furthermore, there is still much to be done to discover the right herbal medicine for diabetes. Required research and review papers related to herbal approach for diabetes were searched from the databases which included Science direct, PubMed, Wiley, Scopus, and Springer. Despite the presence of anti-diabetic drugs in the pharmaceutical market, emphasis has been laid on the treatment of diabetes with medicinal plants. Herbal medicines and plant components with insignificant toxicity and fewer side effects are noteworthy therapeutic options for the treatment. The herbal active ingredients used in treatment of diabetes are flavonoids, tannins, phenolic, and alkaloids. The subsistence of these compounds implies the importance of medicinal plants in having anti-diabetic properties. It has been revealed, that medical plants possess more reliability with affordable costs and have fewer side effects as compared to synthetic drugs.

Keywords: Medicinal plants, Diabetes mellitus, herbal approach, treatment.

INTRODUCTION

Diabetes mellitus is a general and widespread disease affecting the citizens of developed and developing countries. An estimate says that around 25% of the world population is suffering from Diabetes. Diabetes mellitus is caused due to the abnormality of carbohydrate metabolism which is linked to low blood insulin level or insensitivity of target organs towards insulin[1]. Hunt for newer drugs are in progress for treating Diabetes is in progress despite the use of various oral hypoglycaemic agents.

The herbal drugs with anti-diabetic activity are yet to be commercially formulated, though they have been commended for their curative characteristics in the traditional systems of medicine[2]. The obese individuals are more prone to Type 2 diabetes and are associated with the risk of hypertension and dyslipidemia. Thus, the herbal approach aims lessening of insulin resistance and to kindle insulin secretion.

In Diabetes, human body is unable to make or accurately use insulin, as it is required for converting sugar, starches, and other biomolecules into energy. It is characterized with constant high levels of blood glucose. Human body maintains the blood glucose levels at a very narrow range aided by insulin and glucagon.

The function of glucagon is to facilitate the liver to release glucose from its cells into the blood for energy production. Type 1 Diabetes leads to inability to release insulin leading to low rate of the uptake of glucose into muscles and adipose tissues[3].

Conventional medicines costs high which is the main factor for the population living in developing countries to go for traditional medicinal approac[4]. Hypoglycaemic agents from natural and synthetic sources have been introduced still diabetes and associated snags continue to be a key medical hitch.

Many indigenous Indian medicinal plants have been found to be successful in managing Diabetes. An advantage is being readily available and fewer side effects. Medicinal Plants have constantly been commendable source of drugs, currently many available drugs have been either been derived directly or indirectly. Several herbs have shown the antidiabetic activity when assessed experimentally[5, 6].

In the present review, some medicinal plants possessing antidiabetic activity have been enumerated.

Enlisting medicinal plants possessing anti-diabetic activity

Some medicinal plants which have been experimentally tested and found possessing of the antidiabetic activity, along with the family and plant part used in various ethno phyto-remedies (Table 1). Some studies related to antidiabetic activity of medicinal plants are summarized below.

Table 1: Medicinal plants possessing anti-diabetic activity

S. No.	Plant name	Family	Parts used	References
1	*Alangium lamarckii*	Alangiaceae	Leaves	[11]
2	*Semecarpus anacardium*	Anacardiaceae	Nut	[28]
3	*Catharanthus roseus*	Apocynaceae	Leaves	[12]
4	*Cocos nucifera*	Arecaceae	Leaves	[16]
5	*Ophiopogon japonicus*	Asparagaceae	Root	[30]
6	*Berberis vulgaris*	Berberidaceae	Root	[10]
7	*Opuntia streptacantha*	Cactaceae	Leaves	[26]
8	*Cassia auriculata*	Caesalpiniacae	Leaves	[33]
9	*Costus speciosus*	Costaceae	Rhizome	[21]
10	*Brassssica juncea*	Cruciferae	Seed	[7]
11	*Cyclocarya paliurus*	Cyclocaryaceae	Bark	[18]
12	*Dillenia indica*	Dilleniaceae	Leaves	[19]
13	*Vaccinium arctostaphylos*	Ericaceae	Fruit	[39]
14	*Caesalpinia digyna*	Fabaceae	Root	[8]
15	*Prosopis glandulosa*	Fabaceae	Whole plant	[33]
16	*Lithocarpus polystachyus*	Fagaceae	Leaves	[29]
17	*Centaurium erythrea*	Gentianaceae	Leaves	[13]
18	*Enicostemma littorale*	Gentianaceae	Whole plant	[38]
19	*Marrubium vulgare*	Lamiaceae	Aerial part	[24]
20	*Ocimum sanctum*	Lamiaceae	Aerial part	[25]
21	*Vitex negundo*	Lamiaceae	Leaves	[31]
22	*Albizia odoratissima*	Mimosaceae	Bark	[11]
23	*Embelia ribes*	Myrsinaceae	Berries	[20]
24	*Psidium guajava*	Myrtaceae	Fruits	[27]
25	*Axonopus compressus*	Poaceae	Leaves	[9]
26	*Setaria italica*	Poaceae	Seed	[31]
27	*Chaenomeles sinensis*	Rosaceae	Fruits	[14]
28	*Solanum torvum*	Solanaceae	Fruits	[32]
29	*Solanum xanthocarpum*	Solanaceae	Leaves	[40]
30	*Symplocos cochinchinensis*	Symplocaceae	Leaves	[37]
31	*Lippa nodiflora*	Verbenaceae	Whole plant	[22]
32	*Hybanthus enneaspermus*	Violaceae	Whole plant	[21]
33	*Viscum schimperi*	Viscaceae	Aerial parts	[36]
34	*Zygophyllum album*	Zygophyllaceae	Whole plant	[34]

***Allium cepa* L.**

Wild species of *Allium cepa* occuring in Central Asia, show antihyperglycemic activity in diabetic rabbits using various ether soluble fractions as well as insoluble fractions of dried onion powder. It is known to have antioxidant and hypolipidemic activity. S-methyl cysteine sulphoxide (SMCS) with a dose of 200 mg/kg for 45 days appreciably inhibited blood glucose as well as lipids in serum and tissues when administered to alloxan induced diabetic rats. It normalizes the performance of liver hexokinase, glucose 6-phosphatase and HMG Co A reductase[41].

***Pterocarpus marsupium* Roxb.**

It is widely cited in '*Ayurveda*' as '*Rasayana*' for managing various metabolic disorders. An aqueous extract which when administered orally with a dose of 250 mg/kg has shown noteworthy hypoglycemic activity. The active principle has been found to be insulinogenic, which enhanced the insulin release and conversion of proinsulin to insulin in vitro[41].

***Allium sativum* L.**

Upon Oral administration of the garlic extract decrease in serum glucose level was observed, along with total cholesterol, triglycerides, urea, uric acid, creatinine, AST and ALT levels. While increases serum insulin level was increased in diabetic rats, unlike normal rats when compared with glibenclamide, the effect of the extract was more effective[42].

***Artemis sphaerocephala* Krasch**

Increased levels of serum and liver tissue thiobarbituric acid reactive substances (TBARS) and +OH was observed in STZ induced rat. The decreased activity levels of liver and serum tissue superoxide dismutase was observed along with TBARS and +OH. The significant increments in the levels of liver and serum SOD was observed[42].

***Mangifera indica* L.**

The aqueous extract produced reduction in blood glucose level in normoglycemic and glucose-induced hyperglycemia. But absolutely no effect was observed on streptozotocin-induced diabetic mice under the same conditions, in comparison with that of an oral dose of chlorpropamide. The result also indicated that the aqueous extract of the leaves possess hypoglycemic activity[43].

***Aloe vera* (L) Burm**

It is widely distributed over arid areas such as Africa, India etc. Dose of 200 mg/kg of gel results in noteworthy antidiabetic and cardioprotective activity. Increased TBARS is reduced to maintain the Superoxide dismutase and Catalase activity and reduced glutathione is increased four folds in diabetic rats[43, 44].

Elephantopus scaber

It is an ethnomedicnal plant, with potential to reduce the blood glucose levels in streptozotocin induced diabetic rats. It is commonly known as Elephant's foot, and belongs to Asteraceae family. An aromatic herb widely distributed in the moist deciduous forests of the central Western Ghats, India. Previous studies suggested that, the roots are used as an antipyretic, cardiotonic, diuretic, dysuria, diarrhoea, dysentery and stomach pain in the form of decoction. Its aqueous extract is used for treating eczema and ulcers[45].

***Bidens pilosa* L**

It is recognized as Spanish Needle. The butanol extract of prevent diabetes via suppressing the differentiation of ThO cells into Thl cells. Also conversion of ThO cells into Th2 cells, which prevents autoimmune diabetes in non-obese diabetic mice[46].

Chaenomeles sinensis

Chaenomeles sinensis is belongs to family Rosaceae. Ethyl acetate extract of *Chaenomeles sinensis*, commomnly known as Koehne fruits has produced very excellent antidiabetic effect with doses of 50 and 100 mg/kg body weight[47].

DISCUSSION

Diabetes is a metabolic disorder that is due to either defects in insulin secretion, insulin action, or both. It can lead to serious problems affecting human health. Long term, effects includes micro and macro vascular problems. Chronic complications in case of uncontrolled diabetes include blindness, heart disease, and renal failure. Considerable change occurs in the structure and metabolism of lipid in diabetes. Lipid peroxidation is associated with hyperlipidemia. The liver plays a vital role in glucose, lipid homeostasis, and therefore has an imperative effect on diabetes. The liver and kidneys partake in the absorption, oxidation, and metabolism of free fatty acids and synthesize cholesterol, phospholipids, and triglycerides. Despite the presence of anti-diabetic drugs in the pharmaceutical market, emphasis has been laid on the treatment of diabetes with medicinal plants. Herbal medicines and plant components with insignificant toxicity and fewer side effects are noteworthy therapeutic options for the treatment. On the whole tests have confirmed the profit of medicinal plants bearing hypoglycemic properties in diabetes management. The herbal active ingredients used in treatment of diabetes are flavonoids, tannins, phenolic, and alkaloids. The subsistence of these compounds implies the importance of medicinal plants in having anti-diabetic properties. For example, tannin improves the function of pancreatic β-cells and thereby increases the secretion of insulin. Quercetin is an antioxidant that acts in a number of mechanisms linked with the removal of oxygen radicals, thereby preventing the lipid peroxidation and metal ion chelation. In fact, the mechanisms of action for hypoglycemic plants include:

1. Increasing of insulin secretion
2. Increasing of glucoses absorption by muscle and fat tissues
3. Prevention of glucose absorption from the intestine
4. Prevention of glucose production from liver cells.

These factors are mostly accountable for the either reduction or elimination of diabetes.

CONCLUSIONS

A. Medicinal plants have accepted natural antioxidants and effective phyto-remedies, in part due to presence of anti-diabetic compounds, such as flavonoids, tannins, phenolic, and alkaloids. These improve the performance of pancreatic tissues by increasing the insulin secretion (or decreasing the intestinal absorption of glucose).

B. In this review discussion has been about folklore medicinal plants for the treatment of Diabetes mellitus. Folklore medicinal plants are mostly used for rural areas; because the availability of lavish amount of medicinal plants those areas. More researches are obligatory in order to separate the bioactive phytomolecules(s) from plants and the phyto-remedies for analysis of their curative properties.

C. An attempt has therefore been made to investigate the antidiabetic medicinal plants which may be useful to the health professionals, scientists and scholars to develop antidiabetic drugs.

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