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A Review on Antidiabetic Potential of Herbals in Siddha Medicine

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ABSTRACT
Diabetes Mellitus, commonly referred to as diabetes is one of the world's major diseases. As of 2015, it affects an estimated 415 million people worldwide. 46% of the people with diabetes are undiagnosed. The figure is expected to rise to 642 million people worldwide by 2040. This review discusses the Siddha methodology of antidiabetic herbals and their usage, phytochemical constituents and in-vitro and in-vivo studies. The present review aims to compile some medicinal plants such as sirukurinjan (Gymnemasylvestre), Vendhayam (Trigonella foenum graecum), Avarai (Cassia auriculata), kondrai (Cassia fistula), Naval (Eugenia jambolana), Vilvam (Aegle marmelos) having antidiabetic properties.
Keywords-*Siddha literature, Antidiabetic, Diabetes Mellitus, Gymnemasylvestre, Trigonella foenum graecum, Cassiaauriculata, Cassia fistula, Eugenia jambolana, Aegle marmelos*

Introduction

Plants that possess therapeutic properties or beneficial pharmacological effects on animal body are generally classified as Medicinal Plants. These medicinal plants have been used in traditional folk medication as efficacious remedies for hundreds of years. In the traditional medication system, nearly every plants and herbs growing in the country have been assumed that they carry some medicinal virtues, and they are used in the preparation of medicine either as principle therapeutic agent or necessary associate to increase the potency of the main agent as well as to make it more stable.

Diabetes Mellitus is a complex chronic illness associated with a state of high blood glucose level or hyperglycaemia, occurring from deficiencies in insulin secretion, action or both. The effects of diabetes mellitus include long term damage, dysfunction and failure of various organs. People with diabetes are at increased risk of cardiovascular, peripheral, vascular and cerebrovascular disease.

Diabetes Mellitus is referred by different names in Siddha Medicine, such as Neerizhivu and Madhumegham. According to Siddha Literature, a decoction made from equal proportion of Cassia auriculata, Cassia fistula, Eugenia jambolana, Terminalia arjuna, Cyprus rotandus and Costusspeciosus is a good medicine for diabetes.

1.1 Gymnema Sylvestre

Tamil Name: Sirukurinjan
English Name: Cow plant, Gurmar
Botanical Name: Gymnemasylvestre
Family: Apocynaceae

According to Siddha literature, 500 mg -1gm of powdered leaves of Gymnema sylvestre is a good remedy for diabetes[1]. The Hindi name Gurmar, Sanskrit Madhunashini, Urdu Gurmar, Malayalam Chakkarakolli and Telugu Podapatri, literally mean "sugar destroyer". G. sylvestre has been used in traditional system to treat diabetes for centuries.

Early research suggests when a specific gymnema extract (GS4) is taken orally along with insulin or diabetes medications, blood sugar reduction in people with type 1 or type 2 diabetes is enhanced. The primary chemical constituents are gymnemic acid, tartaric acid, gurmarin, calcium oxalate, innosital, stigmasterol, belaine and choline. The extract of G. sylvestre has been shown to reduce blood glucose. Its action involves insulin secretion and regeneration of pancreatic β cells in rodents [3, 4]. G.sylvestre increased plasma insulin and C-peptide levels and decreased blood glucose concentrations in Type 2 Diabetes patients[5]. Collectively this plant exerts its antidiabetic effect via regulation of β cell function.

1.2 Trigonella foenum graecum

Tamil Name: Vendhayam
English Name: Fenugreek
Botanical Name: Trigonella foenum graecum
Family: Fabacea

Fenugreek is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. In traditional medicine, fenugreek is thought to promote digestion, induce labour, and reduce blood sugar levels in diabetics.

Various studies have shown the positive effect of fenugreek seed extract in curbing symptoms of diabetes mellitus. Siddha medicine system suggests 250-500 mg of powdered fenugreek seeds or 60-100ml decoction of fenugreek seeds to be taken twice daily to control Diabetes [2]. It is found that, Fenugreek seeds lower blood glucose levels [6,7]. It is considered a promising agent for diabetes and its complications. The glucose lowering action of this plant involves reduction of insulin resistance[8]. Diosgenin G11, galactomannan, trigoneosides and 4-hydroxyisoleucine have been identified as the active anti-diabetic compounds in fenugreek. Diosgenin is a steroid found in fenugreek that alleviates symptoms related to diabetes mellitus, inflammation, oxidative stress, cardiovascular disease and cancer [23]. Diosgenin was shown to reduce adipocyte differentiation and inflammation, implying its action in reduction of insulin resistance [9]. A clinical study indicated that fenugreek exerts hypoglycemic control by increasing insulin sensitivity [10].

1.3 Cassia auriculata

Tamil Name: Avarai
English Name: Tanner's cassia
Botanical Name: Cassia auriculata Linn
Sub-Family: caesalpiniaceae

Cassia auriculata has been widely used in traditional medicine in the treatment of diabetes. 60-100 ml of decoction of whole plant is recommended in Siddha literature to reduce hyperglycemia[1]. This plant contains auricuosides, nonacosane and nonacosan – 6 –one, chrysophanol, emodin, rubiadin, βsitosterol, polysaccharides, flavonoids, anthracene derivatives, some dimeric procyanidins, saponins and tannins etc. Oral administration of 0.45g/kg body weight of the aqueous extract of the flower for 30 days resulted in a significant reduction in blood glucose and an increase in plasma insulin [11].

1.4 Cassia fistula

Tamil Name: Kondrai
English Name: Golden shower, Indian laburnum
Botanical Name: Cassia fistula Linn
Sub-Family: caesalpiniaceae

60 -100 ml of decoction made from bark and leaves of this tree have the potential to control Diabetes [1]. Oral administration of ethanolic extract of cassia leaves to diabetic rat brought back the status of blood glucose, urinary sugar, glycosylated haemoglobin and liver glycogen to near normal range. Thus we can infer that the anti-hyperglycaemic effect of cassia fistula may be due

to stimulation of insulin secretion from remnant pancreatic β cells [12]. Cassia fistula also has the capacity to correct the carbohydrate metabolic alterations occurred during diabetes Mellitus.

1.5 Eugenia jambolana

Tamil Name: Naval
English Name: Jamun
Botanical Name: Eugenia jambolana
Family: Myrtaceae

Eugenia jambolana, which belongs to the family, Myrtaceae, is a large evergreen tree growing up to 30 m height, found widely in India and the Asian subcontinent. The seeds of this plant have been reported to possess many medicinal properties in the traditional system of medicine.

Siddha literature suggests 60-100ml of decoction of jamun's bark and seed for reducing hyperglycemia [1]. The primary constituents of jamun are anthocyanin, kaemferol, isoquercentin, ellagic acid, jambosine and antimelin. E.jambolana seeds have hypoglycemic, anti-inflammatory, anti-bacterial and anti-diarrheal effects[14]. The jambolana seed contains several biologically active constituents such as flavonoids, gallic acid, ellagic acid, glycosides, triterpenoids, and saponins. The fresh seeds are most effective in diabetes, as they quickly reduce sugar in urine[15]. Study conducted on extract of E.jambolana seed and leaf extracts of Aegle marmelos for hyperglycemia showed they increase the serum insulin level and reduces the hyperglycemia and hyperlipidemia and also it restores β cells of islets of langerhans[16].

1.6 Aegle Marmelos

Tamil Name: Vilvam
English Name: Bael tree
Botanical Name: Aegle marmelos Linn
Family: Rutaceae

The Aegle marmelos is indigenous to India and its leaves, bark, roots and fruit have been used for over 5000 years in the Indian traditional system of medicine, and in various folk medicines to treat various diseases. Even though all the parts of the plants are useful, the leaves and fruits are mostly used as important drug in the ancient system of medicine to cure almost all the common ailments.

Siddha literature recommends 60-100 ml decoction of leaves and fruits of Aegle marmelos to lower hyperglycemia [1]. Compounds isolated from Aegle Marmelos have been proven to be biologically effective against several major diseases including cancer, diabetes and cardiovascular diseases [26]. Extensive experimental and clinical studies prove that Aegle marmelos possesses anti-diarrhoeal, anti-diabetic, antimicrobial, antiviral, radio protective, anticancer, chemo preventive, antipyretic, ulcer healing, anti-genotoxic, diuretic, antifertility and anti-inflammatory properties [25], which help it to be useful in prevention and treatment of many diseases. Aegle marmelos leaves contain γ-sitosterol, aegelin, lupeol, rutin, marmesinin, β-sitosterol, flavone, glycoside, o-isopentenylhalfordiol, marmeline and phenylethylcinn amides [17]. Marmesin was established as a new compound from leaves [18]. α-phelladrene, Limonene[19] are also main constituents. The study of Phuwapraisirisan et al [20] reported a series of phenyl ethyl cinnamides, where anhydroaegeline revealed the most potent inhibitory effect against α- glucosidase. The aqueous fruit extract reduced the blood glucose level [21]. The fruit extract improved functional state of pancreatic β-cells and partially reversed the damage [22]. The combined extracts of Eugenia jambolana seed and Aegle marmelos leaf had synergetic hypoglycemic effect [16].

Conclusions

The most important pharmacological activity of the leaves of Aegle marmelos has been found to be its antidiabetic activity but the mechanism of hypoglycaemic action of leaves is not clear and may be the result of improvement in the functional status of beta cells, and by reversing the histologic and ultra-structural changes in the pancreas. [26]

A study by Gong et al. found that fenugreek lactone helps in reversing the erratic function of insulin secretion in pancreatic NIT- 1 β-cells by triggering

oxidative stress. Additional research may find the link between oxidative stress and fenugreek lactone, further advancing the field of diabetic research and alternative remedies. (24)

Studies found that the combined extract of E. Jambolana and A. marmelos had synergetic hypoglycemic effect revealed by increased serum insulin levels, decreased serum lipid levels and therefore attribute to therapeutic value of the combined plant extracts of E. jambolana and A. marmelos to combat the diabetic condition in rats. (16)

Studies indicate that the ethanolic extract of Cassia fistula leaves have potent glucose lowering effect in streptozotocin induced diabetic rats. (12)

L.Pari & M.Latha have reported that, Oral administration of 0.45 g/kg body weight of the aqueous extract of Cassia auriculata for 30 days resulted in a significant reduction in blood glucose and an increase in plasma insulin, but in the case of 0.15 and 0.30 g/kg, was not significant. (11)

Diabetes is a multifactorial disease leading to several complications, and therefore demands a multiple therapeutic approach. Medicinal plants are being looked upon once again for the treatment of diabetes. Though there are various approaches to reduce the ill effects of diabetes and its secondary complications, herbal formulations are preferred due to lesser side effects and low cost. Many conve-ntional drugs have been derived from prototypic molecules in medicinal plants. Traditional Medicines derived from medicinal plants are used by about 60% of the world's population.

According to WHO Traditional Medicine Strategy 2014-2023, Traditional and Complimentary Medicine is found in almost every country in the world and the demand for its services is increasing.

A vast number of herbals having anti-diabetic effect are found in Siddha system of medicine. Many single herbal remedies and herbal formulations are cited in Siddha Literature.

Lack of scientific and clinical data proving the efficacy and safety of herbal medicine is a major barrier in uniting herbal medicine in modern medical practices. There is a need for conducting clinical research in herbal drugs, developing simple bioassays for biological standardization, pharmacological and toxicological evaluation, and developing various animal models for toxicity and safety evaluation.

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