

A REVIEW ON ANTIDIABETIC POTENTIAL OF TRADITIONAL MEDICINAL PLANTS

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ABSTRACT:

The present study of review is to explore the antidiabetic activity of various medicinal plants. Diabetes mellitus is a metabolic disease in an individual due to absolute or relative insulin deficiency that results in too much of sugar in a blood. It occurs in such conditions where the β cells of the Islets of Langerhans in the pancreas which control the level of glucose in the blood is no longer able to synthesis the insulin. Glucose is the main source of energy that comes from the food, for example: Carbohydrate, Protein, Fat. Since last few decades there are great value in aspect of herbal medicine. In this brief review, we highlight, that the use of herbal medicine can treat and control the diabetes mellitus with their active principles.

Keywords: Diabetes mellitus, Insulin, Antidiabetic activity, Medicinal plants.

I. INTRODUCTION

Diabetes mellitus is a group of metabolic disorder which are characterized by chronic hyperglycemia, resulting from defects in insulin secretion [1]. Diabetes is the most common endocrine disorder in men and women. It is occurred when there is no proper insulin production or low level of insulin secretion in our body which results in the increasing level of blood glucose. Diabetes occurred when there is an irregularity of carbohydrate, protein, fat metabolism that leads to high level of blood glucose and secondary lack of hormone insulin [2]. Blood glucose is the main source of our body to make energy that comes from the food. Insulin is a peptide hormone produced from the β cells which regulates the amount of glucose in the blood. Insulin inability is due to the degenerative changes in β cells. Diabetes may also cause long term damage, dysfunction, failure of various organ. Deficiency of insulin leads to diabetes where glucose gets accumulated in the blood, leads to various complication such as polydipsia, polyphagia, polyuria, blurred vision, excessive weight loss [3]. There are three types of diabetes

mellitus and they are Insulin Dependent Diabetes Mellitus, Non Insulin Dependent Diabetes Mellitus and Gestational Diabetes. The causes of diabetes may be the family history, genetic makeup, ethnicity, life style, stress, no physical exercise, health and environmental factors during pregnancy [4,5]. During both, ancient and modern time, medicinal plants played an important role in the diabetes treatment.

Different parts of medicinal plants such as leaf, root, flower and seed are used as extracts and they are used to produce drugs [6]. Medicinal herb parts contain natural active agents. Herbal plants can control and treat the diabetes because they contain many phytochemicals like flavonoids, tannins, phenolics, alkaloids, stilbenes, curcuminoids, coumarins, lignans, quinones [7]. For example, Flavonoids protect the plants from different biotic and abiotic stress and it is unique UV filters [8]. Tannins or tannoids is a compound that play a role in protection from predation including pesticides and it helps the regulation of plant growth [9]. Phenolic role in these plants are mainly lignin and pigment biosynthesis. Other than these unique features of phytochemicals, they have a vital role in the management of diseases naturally. Up to date, over 400 traditional plants have been reported to treat diabetes, in which some of them are discussed below.

II. MEDICINAL PLANTS WITH ANTIDIABETIC PROPERTY

Plants which shows the anti diabetic activity are attributed to their ability to restore the pancreatic function [10]. Medicinal plants are most important therapeutic aid and in last few decades, traditional systems of medicine were in use. This way of using traditional medicine is still continued at present too.

Achyranthes aspera:

Achyranthes aspera belongs to the family, Amaranthaceae. It is said to be a common weed. The seeds are rich in carbohydrates, proteins, tannins, flavonoids and saponins. The oral administration of seed extract (600 mg/kg) to the diabetic rats for 28 days significantly reduced the blood glucose level. These seed extracts also possess antioxidant properties [11].

Acorus calamus:

Acorus calamus belongs to the family, Acoraceae. It is also known as vacha or sweet flag and used to prepare ayurvedic medicine. It is also used to treat the psychoneurosis, sleeping disorder, mania, epilepsy and loss of memory [12-14]. It also has antidiabetic property which are very effective in type 2 diabetes mellitus.

Aegle marmelos:

Aegle marmelos belongs to the family Rutaceae and is medium sized and deciduous tree. It is commonly known as bael, also Bengal quince, golden apple, Japanese bitter orange, stone apple or wood apple, is a species of tree native to the Indian subcontinent and Southeast Asia. It is present in Sri Lanka, Tamilnadu, Thailand, and Malesia as a naturalized species. It is more effective with oral hypoglycemic therapy. Bael leaves with oral hypoglycemic agent bring the glucose to normal levels [15]. It also contains antioxidant property.

Aframomum melegueta:

Aframomum melegueta belongs to the family Zingiberaceae which is closely related to cardamom. Its seeds are used as a spice; it imparts a pungent, black-pepper-like flavor with hints of citrus. It is usually called as guinea grains, grains of paradise, alligator pepper and melegueta pepper, Crude leaf extract of *Aframomum melegueta* are widely used in West Africa, as an anti diabetic drug. It significantly reduces blood glucose level [16]. It can be effective for type 2 diabetes.

Allium cepa:

Allium cepa belongs to the family of Amaryllidaceae. It is herbaceous biennial plant in the Amaryllidaceae, grown for its edible bulb. The onion is likely native to south-western Asia but is now grown throughout the world. Soluble and insoluble extraction of dried onion powder shows a antihyperglycemic activity in diabetic rabbits. Alloxan induced diabetic rats treated with onion extracts significantly control blood glucose and also lipid in serum and tissues. 50g of onion juice significantly controlled post – prandial glucose level [17].

Allium sativum:

Allium sativum belongs to the family of Amaryllidaceae. The aqueous and ethanolic extract shows a significant role in anti diabetic activity. Raw garlic played a major role in reducing blood sugar, cholesterol and triglycerides in diabetic rats [18]. Methanolic extract also shows a anti hyperglycemic effect on alloxan induced diabetic rats [19].

Argemone mexicana (L.):

Argemone mexicana L. belongs to the family, Papaveraceae and it is commonly known as prickly poppy. In Rajasthan, the herbal is mainly used for the medicinal purpose. They are rich in alkaloids including berberine, protopine, sarguinarine, optisine, chelerythrine etc. They were widely used in both traditional and modern medicines. The aqueous and ethanolic plant extract shows an good hypoglycemic effect [20].

Azadirachta indica:

Azadirachta indica, indigenous plant widely available in India and Burma that belongs to the family Meliaceae. Neem leaves contain the phytochemicals such as flavonoids, triterpenoid, antiviral compounds and glycosides which help to manage blood sugar levels. Many parts of Neem tree are used as a traditional medicine. The compounds found in Neem is found to be beneficial in controlling type 2 diabetes. It also contains the anti inflammatory, antipyretic, antimicrobial and diverse pharmacological properties [21].

Bambusa arundinacea:

Bambusa arundinacea is a member of Poaceae family. The ethanol extract of leaves shows a significant role in hypoglycemic effect [22].

Brassica juncea:

Brassica juncea, traditional medicinal plant belongs to the family Cruciferae. *Brassica juncea*, is a species of mustard plant, commonly called as leaf mustard, brown mustard, Indian mustard, Chinese mustard, vegetable mustard and Oriental mustard. The aqueous seed extract shows a hypoglycemic activity in STZ induced diabetic male albino rat. It has a beneficial effect in the treatment of diabetic rat. This can also act as cardio protective [23].

Butea monosperma:

Butea monosperma belongs to the family Fabaceae and its common name is Flame of the forest. The aqueous extract of fruit has a potential flavonoid property and it helps in controlling the type 2 diabetes [24].

Chaenomeles sinensis:

Chaenomeles sinensis belongs to the family, Rosaceae. The ethyl acetate extract of *Chaenomeles sinensis* fruit shows a significant antidiabetic property [25].

Datura innoxia Mill.:

Datura innoxia belongs to Solanaceae family and its common name is Datura. It is a low growing medicinal plant which is widely used in traditional and modern medicines, and reported to have antidiabetic activity. Each and every part of plant acts as an effective medicines for insanity, rabies and leprosy. Leaf extract contains flavonoids, phenolic compounds, cardiac glycosides and sugar. Seed extract of Datura was found to possess anti oxidant activity [26].

Eugenia jambolana:

Eugenia jambolana (*Syzygium cumini*) belongs to the family, Myrtaceae. It is commonly known as black plum or jamun. It is widely used as a traditional medicine to treat the diabetes. The seed extract shows antidiabetic activity manifested by the reduction in high blood glucose level. It also contains chemical compound that are rich in flavonoids [27].

Feronia elephantum CORREA (Limonia acidissima L.):

Feronia elephantum belongs to the family of Rutaceae. It is commonly known as Bela, Billin which is used to treat various disorder including diabetes mellitus. The aqueous fruit extract shows a significant anti diabetic effect in alloxan rat. It's active compounds are Bioflavonoid, triterpenoid, stigmasterol and Bergapten [24,28-33].

Ficus racemosa:

Ficus racemosa belongs to the family of Moraceae. *Ficus racemosa* is used as traditional medicine for the several treatments including diabetes mellitus. The ethanolic extract has anti

hyperglycemic and hypolipidemic activity in alloxan induced diabetic rats [34]. The tree bark contains a healing power.

Helicteres isora L.:

Helicteres isora L belongs to the family of Malvaceae. Hot water extract of *Helicteres isora* fruit shows an antioxidant and antidiabetic activities. The ethanolic extract contain a hypolipidemic activity which has a vital role in type 2 diabetes [35].

Ipomoea sepiaria (Koenig Ex Roxb):

Ipomoea sepiaria belongs to the family, Convolvulaceae. It is commonly known as Lakshmana (Purple heart glory). It is a highly potent ayurvedic herb and mainly used to cure infertility in women. It rejuvenates the body and improves strength. The oral administration of the leaves extract (200 mg/kg) to diabetic rats for 14 days has shown significant decrease in blood glucose levels [36]. One of the compound in the leaves was identified as best bioactive compound against type 2 diabetes based on molecular docking analysis [37].

Juglans regia:

Juglans regia belongs to the family of Juglandaceae. It is one of the traditional medicinal plant which is used to treat diabetes. The ethanolic extract of leaves shows a anti diabetic activity in type 2 diabetes induced rats [38].

Lodoicea seychellarum:

Lodoicea seychellarum is commonly known as sea coconut which belongs to the palm family. The fruit extract of *Lodoicea seychellarum* plays a major role in type 2 diabetes and its one of the active compound is carbohydrate which does not increase the blood glucose level [24].

Ocimum sanctum:

Ocimum sanctum L. is known as Tulsi which belongs to the family Labiateae or Lamiaceae. Tulsi is common plant that can be found anywhere. In ancient period, tulsi are used for its medicinal properties. Ethanolic extract of leaves shows significant reduction in blood sugar level in streptozocin induced diabetic rats [39,40]. Tulsi also contains antioxidant, antibacterial, antifungal, antiviral, antiasthmatic, antistress, antitumor, gastric antiulcer activity,

antimutagenic and immunostimulant activities [41]. Tulsi can help to manage high blood sugar level in people with type 2 diabetes.

Ougeinia oojeinense:

Ougeinia oojeinense, the only species in the genus *Ougeinia*, which is a flowering tree that are native to India and Nepal. It is also known as the Ujjain desmodium tree or sandan. It usually grows 6–12 meters tall. Its leaves are quite large and trifoliate, with rigid, leathery leaflets. It belongs to the family, Fabaceae. The *Ougeinia oojeinense* bark part contains the hypoglycemic and hypolipidemic property which was evaluated on alloxan induced diabetic rats [42].

Psidium guajava:

Psidium guajava belongs to the family of Myrtaceae and its common name is Guava. It is rich in B1, B2, B6, C Vitamins, glucose, sucrose and carotene. The aqueous extract of leaf shows a beneficial effect in reducing the blood glucose level in the hyperglycemic rat induced by alloxan. Ethanol extract of the bark shows a hypoglycemic effect [43].

Semecarpus anacardium:

Semecarpus anacardium belongs to family of Anacardiaceae. The milk extract of nut of *Semecarpus anacardium* shows antidiabetic activity and it is effective in type 2 diabetes [44].

Tamarindus indica:

Tamarind is a leguminous tree which belongs to Fabaceae family. Methanolic extract of seed and fruit shows a reduction in blood sugar level and its active compound is fagomine, 4-0-beta-D-glucopyranosylfagomine, castanispermene [45-49].

Terminalia arjuna:

Terminalia arjuna is a tree of the genus *Terminalia*. It is commonly known as arjuna in English, marudha maram in Tamil. It belongs to the family Combretaceae. The stem bark of *Terminalia arjuna* has a antidiabetic activity on alloxan induced diabetic rats. Ethanol extract of bark of *Terminalia arjuna* significantly decrease the blood glucose level [50].

Tinospora cordifolia:

Tinospora cordifolia which belongs to the family of Menispermaceae. It's common name is heart-leaved moonseed, giloy and guduchi. It is an ayurvedic medicine for treating diabetes mellitus. The oral administration of root extract shows a significant reduction in blood and urine glucose level in alloxan induced diabetic rats. The extract administered rat groups maintained the body weight. Alcoholic or aqueous extract of *Tinospora cordifolia* decrease the blood glucose level [51].

III. CONCLUSION

In ancient period, many herbal medicines in different oral formulation have been recommended for the diabetes mellitus. This review evaluated some medicinal plants that can treat and control the diabetes mellitus. Diabetes mellitus cannot be cured but some medicinal plants can control the disorder. Plant drugs and herbal formulation were very less or non toxic and free from side effects than synthetic ones. Hence the traditional medicinal plants played and plays an essential part in human life in all the era.

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