AVOWED ASSORTMENT OF FLORA AS EFFICACIOUS REMEDY FOR DIABETES

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ABSTRACT

Diabetes mellitus is one of the common metabolic disorders and 2.8% of the population suffers from this disease throughout the world which may cross 5.4% by the year 2025. Oral hypoglycemic agents like sulphonylureas and biguanides are the major players in the management of the disease but there is growing interest in herbal remedies due to the side effects associated with the oral hypoglycemic agents. Plants have been the highly esteemed source of medicine since prehistoric period because of their invaluable advantages though a number of potential synthetic compounds were introduced to replace them. The present review discusses some of the familiar plants which play a crucial role in the management of diabetes mellitus.

Key words: Diabetes mellitus, sulphonylureas, biguanides.

INTRODUCTION

The word “diabetes” (a Greek word that means “to pass through”) was first used by Aretaeous of Cappadocia in the 2nd century AD to describe a condition that is characterized by excess of sugar in blood and urine, hunger and thirst and the adjective “mellitus” (a Latin Greek word that means “honey”) was introduced by the English physician John Rollo so as to distinguish the conditions from other polyuric disease, in which glycosuria does not occur. [1]

Diabetes Mellitus is a spectrum of common metabolic disorders, arising from a variety of pathogenic mechanisms, all resulting in hyperglycaemia. India is facing a diabetic explosion, according to the World Health Organization (WHO) estimates, India had 32 million diabetic subjects in the year 2000 and this number would increased to 80 million by the year 2030.
The International Diabetes Federation (IDF) also reported that the total number of diabetic subjects in India is 41 million in 2006 and that this would rise to 70 million by the year 2025. The major sources of morbidity of diabetes are chronic complications that arise from prolonged hyperglycemia, including retinopathy, neuropathy, nephropathy and cardiovascular disorders. Fortunately these chronic complications can be reduced in many cases by sustained control of blood glucose. There are three types of diabetes mellitus out of which Type 2 Diabetes mellitus is most common type, which was known earlier as Non-Insulin Dependent Diabetes Mellitus (NIDDM), accounts for about 90% of all the diabetes among different populations of the world. Currently used most of the oral hypoglycemic agents produce serious side effects like hypoglycemic coma and hepatorenal disturbances. Hence search for safer and more effective hypoglycemic agents. [2]

The medicinal use of plants is very old. The writings indicate that therapeutic use of plants is as old as 4000–5000 B.C. and Chinese used first the natural herbal preparations as medicines [3]. A rich heritage of knowledge on preventive and curative medicines was available in ancient scholastic work included in the Atharvaveda (an Indian religious book), Ayurveda (Indian traditional system of medicine) and so on. An estimate suggests that about 13000 plant species worldwide are known to have been used as drugs. [4] Plant-based natural constituents can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds and so on, that is any part of the plant may contain active components. The beneficial medicinal effects of plant materials typically result from the combinations of secondary products present in the plant. Many of them are used to treat highly prevalent disorder diabetes mellitus. [5] Some of the herbal drug which is used in our regular life style having anti diabetic activity. Some of them are briefed here.

1. **Zingiber officinale** (Ginger)

Ginger root is the rhizome of the plant consumed as a delicacy, medicine, or spice. Because of its pungent taste and interesting aroma, ginger has been used since the ancient times as cooking spice around the world. Many investigations have recently reported that ginger is rich in gingerols that can increase uptake of glucose into muscle cells without using insulin, and may therefore assist in the management of high blood sugar levels. Two ginger extracts spissum and an oily extract interact with serotonin receptors to reverse their effect on insulin secretion. Treatment led to a 35% drop in blood glucose levels and a 10 per cent increase in plasma insulin levels. [6]
2. *Curcuma longa* (Turmeric)

Turmeric is a rhizomatous herbaceous perennial plant of family Zingiberaceae and has been used in Indian and Chinese traditional medicine for various diseases. Turmeric and turmeric products have been widely prescribed for diabetic treatment in traditional methods. Turmeric is an important herb in most Ayurvedic treatments of diabetes as it lowers blood sugar, increases glucose metabolism and potentiates insulin activity more than three-fold. It serves both diabetics and those of us who binge on sweets. Part of the action might be due to its chromium content \[7\].

3. *Allium cepa*: (onion)

Onion is highly valued for its therapeutic properties. It has been used as a food remedy from time immemorial. Research shows that onions may guard against many chronic diseases. That's probably because onions contain generous amounts of the flavonoid quercetin. Various ether soluble fractions as well as insoluble fractions of dried onion powder show anti-hyperglycemic activity in diabetic rabbits. *Allium cepa* is also known to have antioxidant and hypolipidaemic activity \[8\].

4. *Allium sativum*: (garlic)

Garlic is a perennial herb cultivated throughout India. Based on report of WHO, garlic can be used for helping treatment of hyperglycemia. According to a report by Ryan, one-third of diabetic patients take alternative medications that they consider efficacious, of which garlic is the most commonly used. Garlic and garlic constituents prepared by various means have been shown to have antidiabetic actions. Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from
pancreatic beta cells and/or insulin sparing effect. Apart from this, *Allium sativum* exhibits antimicrobial, anticancer and cardioprotective activities. [9]

5. *Aloe vera* and *Aloe barbadensis*: (kalabanda)

*Aloe*, a popular house plant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. *Aloe vera* gel is the leaf pulp or mucilage, *aloe* latex, commonly referred to as “*aloe juice*,” is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of *aloe* gum effectively increases glucose tolerance in both normal and diabetic rats. Treatment of chronic but not single dose of exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats [10].

6. *Azadirachta indica*: (Neem)

*Neem* is the most useful traditional medicinal plant in India. Each part of the *neem* tree has some medicinal property. During the last five decades, apart from the chemistry of the *neem* compounds, considerable progress has been achieved regarding the biological activity and medicinal applications of *neem*. It is now considered as a valuable source of unique natural products for development of medicines against various diseases and also for the development of industrial products. Hydro alcoholic extracts of this plant showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects [11].

7. *Caesalpinia bonducella*: (Gray Nicker)

*Caesalpinia bonducella* is widely distributed throughout the coastal region of India and used
ethnically by the tribal people of India for controlling blood sugar. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. These extracts also increased glycogenesis thereby increasing liver glycogen content. The antihyperglycemic action of the seed extracts may be due to the blocking of glucose absorption. The drug has the potential to act as antidiabetic as well as antihyperlipidemic \[12\].

8. *Aegle marmelos*: (Maredu, Bel or Bilva)
The Bael tree is considered as a sacred tree by the Hindus. They offer its leaves to Lord Shiva during worship. The essence of its fruits and leaves possess an evaporating oil which is very good for human system. Administration of aqueous extract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol. Leaf extract has been used in Ayurveda as a medicine for diabetes. It enhances the ability to utilize the external glucose load in the body by stimulation of glucose uptake similar to insulin. Juice of leaves is employed as anti diabetic drug in unani system of medicine also. \[13\]

9. *Coccinia indica*: (kanduri, donakaya)
*Coccinia indica* (Bimba, kanduri, Cucurbitaceae) is famous for its hypoglycemic and antidiabetic properties in Ayurvedic system of medicine. Other applications include the therapy of various conditions such as skin diseases and gonorrhoea. Dried extracts of *Coccinia indica* (*C. indica*) (500 mg/kg body weight) were administered to diabetic patients for 6 weeks. These extracts restored the activities of enzyme lipoprotein lipase (LPL) that was reduced and glucose-6-phosphatase and lactate dehydrogenase, which were raised in untreated diabetics. \[14\]

10. *Eugenia jambolana*: (Indian gooseberry, jamun)
*Eugenia jambolana* commonly known as black plum or Jamun is a plant native to India. In
India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes.

This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. Jamun is a plant with known ethnomedicinal uses. Before the discovery of insulin, Jamun was useful in the treatment of diabetes and is an integral part in the various alternative systems of medicine. Its seed contains jamboline, which controls the excessive conversion of starch to sugar. Seed powder can be used with water or buttermilk. It reduces the quantity of sugar in urine and allays the unquenchable thirst [15].

![Figure 4: Jamun, Mango, Bitter gourd](image)

### 11. *Mangifera indica*: (Mango)

*Mangifera indica* (MI), also known as mango, aam, it has been an important herb in the Ayurvedic and indigenous medical systems for over 4000 years. According to Ayurveda, varied medicinal properties are attributed to different parts of mango tree. The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of *Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose [16].

### 12. *Momordica charantia*: (bitter gourd)

*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 hypoglycemic effect in various animal models. Polypeptide p, isolated from
fruit, seeds and tissues of *M. charantia* showed significant hypoglycemic effect when administered subcutaneously to langurs and humans. Bitter melon has a host of bitter chemicals, which are hypoglycemic in action. It also has at least one substance that is like the insulin secreted by the human pancreatic glands. Hence, bitter melon is extremely effective in the treatment of diabetes mellitus. Doctors all over the world prescribe having either bitter melon juice early in the morning or to include it in some other fashion in the daily diet. Regular use of bitter melon over a period of time helps to bring the blood sugar level down.

13. *Ocimum sanctum*: (holly basil)

*Ocimum sanctum* is commonly known as Tulsi. Tulsi, the Queen of herbs, the legendary ‘Incomparable one’ of India, is one of the holiest and most cherished of the many healing and healthy giving herb of the orient. Since ancient times, this plant is known for its medicinal properties. Tulsi has been used for thousands of years in Ayurveda for its diverse healing properties. It is mentioned by Charaka in the Charaka Samhita; an Ayurvedic text. Tulsi is considered to be an adaptogen, balancing different processes in the body, and helpful for adapting to stress. Marked by its strong aroma and astringent taste, it is regarded in Ayurveda as a kind of ‘elixir of life’ and believed to promote longevity. The aqueous extract of leaves of *Ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats This plant also showed antiasthmatic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulant activities[18].

14. *Phyllanthus amarus*: (bhumi amla, nella usiri)

Bhumi amla is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly
known as nelauisiri in Telugu. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. *P. amarus* is an important plant of Indian Ayurvedic system of medicine. It is bitter, astringent, stomachic, diuretic, febrifuge and antiseptic. The whole plant is used in gonorrhea, menorrhagia and other genital affections. It is useful in gastropathy, diarrhoea, dysentery, intermittent fevers, ophthalmopathy, scabies, ulcers and wounds. Phyllanthus amarus is an indigenous medicinal plant, which has a folk reputation in central and southern India as hypoglycemic agent. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats.  

15. *Cinnamomum zeylanicum*: (Dalchini)

Dalchini is the ever green tree of tropical area, a member of family lauraceae has been used in day to day routine as a spice and condiment in India. *C. cassia*is safe when used in small amounts as in foods and medicinal doses. The whole plants is medicinally important in Indian traditional system of medicine, particularly in Ayurveda. Results from a clinical study published in the Diabetes Care journal in 2003 suggest that cinnamon bark improves blood glucose and cholesterol levels in people with type 2 diabetes and may reduce risk factors associated with diabetes and cardiovascular disease.

16. *Trigonella foenum graecum*: (fenugreek)

Fenugreek is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. It has great medicinal value in Indian homes and proved to serve as good hypoglycemic. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans. A study in India involving insulin-dependent diabetics on low doses of insulin, pulverized fenugreek seeds were shown to reduce blood sugar and other harmful fats. The galactomannan-rich soluble fiber fraction of fenugreek may be responsible for the antidiabetic activities of the seeds are high in soluble fibre, which help lower blood sugar by slowing down digestion and absorption of carbohydrates. Several clinical trials showed that fenugreek seeds can improve most metabolic symptoms associated with both type 1 and type 2 diabetes in humans by lowering blood glucose levels and improving glucose tolerance. It contains trigonelline, which is known to reduce blood sugar level. Take the seeds after soaking them in water overnight or powdered form with buttermilk.
17. *Abelmoschus esculentus* (Okra)

In India Ladies Finger (Okra) is more commonly used vegetable in both south and north India. It is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani. In Ayurvedha which is an old traditional medicinal treatment also said the Okra is more useful to so many diseases. The fiber in okra helps to stabilize blood sugar by regulating the rate at which sugar is absorbed from the intestinal tract\(^\text{[22]}\).

18. *Musa Sapientum* (banana)

*Musa sapientum* L. (Musaceae) are mainly grown in the tropical and subtropical countries and are widely used for its nutritional values all over the world. The fruits as well as the other parts of the plant are used to treat different diseases in humans in traditional medicine. The banana plant spread to India by about 600BC and later on its spread all over the tropical world. It is possibly the world’s oldest cultivated crop. Musa sapientum showed antihyperglycemic effect in hyperglycemic rabbit. Isolated pectin from the juice of the inflorescence stalk of *M. sapientum* increases the glycogen synthesis, decreases glycogenolysis and gluconeogenesis.\(^\text{[23]}\)

19. *Murraya koenigii* (curry leaves)

It is an aromatic herb of South India which has many herbal medicinal properties. It is an inevitable ingredient of South Indian cooking, spicing up cuisine in a myriad of ways and is also most prominently used in Ayurveda, Siddha and Unani medical systems. To prevent diabetes of a hereditary origin, just eat 10 fresh and fully grown curry leaves every morning for three months.\(^\text{[24]}\) The minerals found in curry leaf extract are important for maintaining normoglycemia, or the normal glucose content of the blood. This is done by the activation of
pancreatic beta cells, which are responsible for the creation of insulin.

![Pancreatic Beta Cells Image]

**Figure 7: Curry Leaves  Cucumber  Tomato**

20. *Cucumis sativus L.*: (Cucumber)

Cucumber is a popular vegetable crop used in Indian traditional medicine since ancient times. This vegetable is very high in water content and very low in calories. It has potential antidiabetic, lipid lowering and antioxidant activity. It has a prominent place in alternative systems of medicine like Ayurveda and Siddha due to its various pharmacological activities like antidiabetic, hepatoprotective, anti-inflammatory and antiulcer property. [25]

21. *Solanum lycopersicum*: (tomato)

Tomato is the edible, often red fruit/berry of the nightshade *Solanum lycopersicum*, commonly known as a tomato plant. The species originated in the South American Andes, and its use as a food originated in Mexico, and spread throughout the world following the Spanish colonization of the Americas. Its many varieties are now widely grown, sometimes in greenhouses in cooler climates. Tomatoes are packed full of the valuable mineral known as chromium. It works effectively to help diabetics keep their blood sugar levels under better control. [26]

**CONCLUSION**

Plants were inextricably associated with humans from the time immemorial. Earlier the treatment of diabetes was done using the herbal preparations as well as the raw herbs. With the advancement of technology and introduction of allopathic formulation, herbal products have lost their significance. But in the last decade biological, economical, nutraceutical and therapeutic benefits of herbal preparations have attracted the world pharmaceutical market in the treatment of diseases like diabetes. Now, once again plants are emerging as time worn invaluable therapeutic agents, with their efficacious healing properties.
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