



MEDICINAL PLANTS AND THEIR IMPACT ON CONTROLLING DIABETES

Botany

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ABSTRACT

India has more diabetics than any other nation of the world. A common effect of diabetes is Hyperglycemia or increased blood sugar. By the year 2030, over 100 million people in India are likely to suffer from diabetes, say researchers. There are several means of managing and treating diabetes. Thank goodness for nature because several medicinal plants have been identified and proven very effective for treating diabetes mellitus. The present paper discusses different medicinal plants used for controlling diabetes.

KEYWORDS

INTRODUCTION

According to the World Health Organisation (WHO), diabetes is currently one of the biggest health concerns that the world is faced with. WHO defines diabetes as “a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces”. Insulin is a hormone that regulates blood sugar. A common effect of diabetes is Hyperglycemia or increased blood sugar. Diabetes causes some serious health issues including blindness, kidney failure, stroke and heart diseases. According to statistics from the International Diabetes Federation (IDF), India has more diabetics than any other nation of the world. Current estimates peg the number of diabetics in the country at about 62 million – an increase of over 10 million from 2011 when estimates suggested that about 50.8 million people in the country were suffering from the disease. If you think the disease has already reached endemic proportions in the country, consider this. By the year 2030, over 100 million people in India are likely to suffer from diabetes, say researchers.

CURRENT TREATMENT OPTIONS

Diabetes is usually not reversible. It is treated with insulin therapy. Early diabetes may be controlled by oral drugs but high levels of blood glucose require insulin shots to be administered. Diabetes drugs are easily available across the country in government hospitals and rural medical centres. Treatment of other diseases caused by diabetes such as diabetic retinopathy and renal failure can be treated by medicine and surgery. Rural Indians can access these facilities at government health centres and hospitals. The Sankara Foundation Eye Hospital holds camps for screening and surgical treatment of diabetic retinopathy across the country.

MEDICINAL PLANTS FOR TREATING DIABETES

Among the challenging health conditions that are increasingly affecting human beings is diabetes. This is a disease condition caused by a metabolic disorder of the body systems as a result of chronic high blood sugar (hyperglycaemia). This sort of health challenge is often associated with disturbances in the metabolism of fat, carbohydrate and protein thereby causing defects in insulin activities and secretion due to the inability of the pancreas to produce enough insulin. This can also be as a result of the failure of the body cells to respond to already-produced insulin.

This health condition has led to several mortalities and morbidities with highest cases recorded in Asia and Africa. According to World Health Organisation, several actions can be put in place to lower the impact of diabetes on human health. These actions can be through adopting healthy lifestyles such as eating healthy balanced diets, engaging in physical exercises and activities, reducing the marketing of unhealthy food products and putting in place health systems that provide standard care and services for the affected individuals. As diabetes continues to raise, the need to create awareness and adopt plans on how to reduce someone's risk of being affected, recognise the onset of the disease and determine the best mode of treatment are becoming highly important. There are several means of managing and treating diabetes, however, researchers reveal that natural remedies are more viable unlike the synthetic drugs and oral medications that may

pose undesirable side effects to the body. Thank goodness for nature because several medicinal plants have been identified and proven very effective for treating diabetes mellitus. Even though herbal medicines produced from plants can be used as an anti-diabetic remedy alone, yet they can also be used alongside with other synthetic drugs such as insulin. The truth is that plant extracts from medicinal plants had been used over several years for treating numerous health disorders and diabetes is not an exception. Some key active components present in certain medicinal plants play significant roles in treating diseases and such powerful components continue to show promising effects in treating diabetes mellitus and any complications associated with it. Discussed below are some powerful 18 medicinal plants for treating diabetes.

Okra (*Abelmoschus esculentus*)

Okra is a plant crop that contains anti-hyperglycemic properties. Several studies have supported the efficacy of fresh okra, soaked okra juice and powdered okra in tackling diabetes. Ben-Chioma et al., (2013) investigated the anti-hyperglycaemic activity of okra (*Abelmoschus esculentus*) fruits in alloxan-induced diabetic Wistar rats. The researchers grouped the animals into five; A, B, C, D, and E groups and they induced Diabetic Mellitus in groups B to E by single intravenous injection of alloxan, 65mg/kg body weight. However, group A was used as the control group (non-diabetic). Group C and group D diabetic rats were administered with dried powdered form and aqueous extracts of okra fruit respectively while group E was given a standard anti-diabetic drug (glibenclamide). The trial period was for 14 days after which, blood samples were taken and the fasting blood glucose (FBS) levels measured at days 3, 7, and 14 respectively. The study showed that both the dried powdered and aqueous form of okra significantly reduced the blood glucose levels of the animals at $p < 0.05$. Therefore their results support the therapeutic use of okra as an anti-diabetic plant for managing and treating diabetes mellitus. Read more about the other remarkable benefits of okra

Allium cepa

Allium cepa, which is popularly known as an onion is a spice plant that belongs to the Liliaceae family. From time immemorial, onion has been used for treating various types of diseases of which diabetes is part of them. Allium cepa helps to regulate the hypoglycemic activity which is associated with diabetes mellitus. This is as a result of the present of flavonoids (quercetin) and sulphur compounds (S-methylcysteine) in Allium cepa which helps to reduce the level of blood glucose, lipid peroxidation, serum lipids as well as oxidative stress. These compounds also aid in insulin secretion as well as boost the antioxidant enzyme activities taking place in the body. Onion extracts also aid in hypolipidemic activities. The hypolipidemic and hypoglycemic effects of onion is due to its ability to normalise the activities of HMG coenzyme-A reductase, liver hexokinase and glucose 6-phosphatase. Some preliminary clinical trials carried out reveal that glucose levels can be reduced by taking Allium cepa aqueous extracts. The hypoglycaemic and hypolipidemic abilities of Allium cepa are highly protective against the onset of hyperglycaemia, hyperlipidaemia and atherosclerosis are associated with diabetes mellitus.

Milk Thistle

Milk thistle is originally from the Mediterranean before spreading to other parts of the world. When the leaves are squeezed, they produce milky sap which suggests its name. Milk thistle belongs to the daisy family and it contains a polyphenol antioxidant compound known as silymarin that helps to control the blood sugar level. Scientific studies reveal that milk thistle can be used for treating Type 2 diabetes. A scientific study carried out showed that diabetic patients who took silymarin for up to 4 months showed significant improvement in their glycemic profile. This also includes a significant decrease in fasting blood glucose, LDL cholesterol, glycosylated hemoglobin and triglycerides when compared to individuals taking only placebo.

Guggul

Guggul is another name for *Oleogum resin* or *Commiphora mukul* and this is popularly used in Asia for producing herbal medicine for treating diabetes. *Oleogum resin* is a yellowish substance that is characterised by balsamic odour and each tree produces up to 900 g of resin. Guggul tree is originally from Bangladesh, Pakistan and India where it is mainly used in folk medicines. Guggulsterones are the active ingredient present in guggul. Guggul extracts are highly effective in controlling the blood sugar level due to its role in glucose and lipid metabolism. Besides, guggul has a protective effect on pancreas which assists in the natural production of insulin in the body. Commiphoric acid and guggulipid present in guggul help to activate the peroxisome proliferator-activated receptor gamma (PPAR γ) hormone that regulates the overall development and functioning of fat cells which are vital for the healthy metabolism of cholesterol and glucose.

Loquat

Loquat is botanically known as *Eriobotrya japonica* and belongs to the rose family. The loquat tree grows up to thirty feet with evergreen leaves that are between three to four inches wide and five to twelve inches long. Researchers reveal that the loquat leaf comprises of beneficial properties that can significantly influence the blood sugar level thus drinking loquat tea has been recommended as an ideal way of balancing the blood sugar level. Loquat leaf contains polysaccharides and triterpenes chemicals especially tormentic acid that has been proven effective for boosting insulin production which significantly helps to lower the symptoms of diabetes.

Banaba

Banaba which is botanically known as *Lagerstroemia speciosa* (L.), belongs to the family of Lythraceae. Banaba is also known as queen's crape myrtle, the pride of India or queen's flower. Banaba is more common in the Philippines, India and Southeast Asia, where it is often used as an herbal medicine for treating diabetic patients. Aqueous banaba leaf extracts can be used for lowering the blood sugar level and it's blood sugar lowering effect is sort of synonymous to that of insulin. Banaba leaf extracts help to transport glucose from the blood to the body cells. But despite the beneficial impacts of banaba on blood sugar, diabetic patients are advised to be cautious when taking herbal medicines or supplements made with banaba. Pregnant women or breastfeeding mothers are advised not to take banaba due to lack of scientific proofs

Cinnamon

Cinnamon is a spice from the inner bark of many trees of the genus *Cinnamomum* which is widely used in food preparations. It has a characteristic golden-yellow colour with a hot aromatic taste, however, the pungent taste and scent are as a result of the presence of a cinnamic aldehyde or cinnamaldehyde and reaction with oxygen. It is a popular worldwide spice and many studies have been carried out to unravel the impact of cinnamon in reducing the blood glucose of diabetic patients. Cinnamon does not contribute to caloric intake thus individuals with elevated glucose level or those with type 2 diabetes can benefit from the regular consumption of cinnamon. Moreover, those with high triglyceride or cholesterol levels can benefit tremendously from the daily consumption of cinnamon as it aids in minimising inflammation and infection. However, some other researchers have contradictory claims that suggest that cinnamon is not truly effective in treating diabetes. Read more about cinnamon

Garcinia Kola

Garcinia kola is a flowering plant that belongs to the Guttiferae or Clusiaceae family. *Garcinia kola* which is also known as adi, Heckel, namijin, agbilu, orogbo, gworo, aki ilu, or bitter kola is an angiosp

ermace that belongs to the family of Guttiferae. *Garcinia* extract is highly nutritional and medicinal which suggests its wide usage in folk medicines for herbal medicines production. *Garcinia* possesses hypoglycaemic properties thus its aqueous extracts can be used for lowering blood sugar level. However, its hypoglycaemic effect is dependent on the dosage taken. The hypoglycaemic properties of *Garcinia* are due to flavonoid and other phytochemical compounds such as tannins, saponin and glycosides in *Garcinia kola*.

Garlic

Many researchers agree that garlic has hypoglycemic effects on blood glucose, however, this claim is still disputable. Some experimental studies reveal that garlic and metformin treatment in diabetic patients for a period of 12 weeks lowered fasting blood glucose. Regular consumption of garlic extracts significantly reduces the blood glucose level. The hypoglycemic effects of garlic on diabetes are as a result of the presence of volatile sulphur compounds, such as allyl mercaptan, alliin, allicin, ajoene, diallyl disulfide, diallyl trisulfide, S-allyl cysteine and diallyl sulfide in garlic. Garlic aqueous extracts are very effective for lowering insulin resistance in diabetic patients. Read more about garlic

Green Tea

The green tea leaves are very rich in antioxidants unlike other types of tea due to the way they are produced. Green teas are produced from the *Camellia sinensis* plant by steaming the fresh leaves from the plant. Green tea is a common Asian beverage which has been reported to reduce or prevent the risk of type 2 diabetes mellitus as well as reduces insulin resistance. Green tea contains a high amount of polyphenols and Epigallocatechin-3-gallate that have strong anti-inflammatory and antioxidant effects on oxidative stress and inflammation associated with diabetes.

Licorice

Licorice is the root of *Glycyrrhiza glabra* as well as an herbaceous perennial legume. The licorice root is an ancient traditional herbal remedy for tackling several ailments. Scientists reveal that licorice roots from the papilionaceae family may be effective for treating type 2 diabetes which is more common with overweight or obese individuals thus leading to insulin resistance. Licorice roots contain anti-diabetic substances known as amorfrutins, which are capable of reducing the blood sugar levels as well as preventing inflammation associated with diabetes. The name amorfrutins was derived from the *Amorpha fruticosa*, which is a flowering plant belonging to the leguminous family.

Gymnema Sylvestre

Gymnema sylvestre is a tropical tree that belongs to the family of Apocynaceae and genus *Gymnema*. This tree is mostly prevalent in Africa, India, Australia, China and Vietnam. The leaf extract of *Gymnemasylvestre* is a powerful herbal medicine for tackling diabetes. This is due to the presence of chemical components such as dihydroxy gymnemic triacetate, gymnemic acids I-VII, conduritol A and triterpenoid saponins (gymnemosides A-F and gymnemoside W1-2) in this plant. The effect of the *Gymnema sylvestre* leaf extracts is synonymous to 4 unit/kg of insulin thus highly beneficial for individuals suffering from diabetes mellitus.

Momordica charantia

Momordica charantia which is also known as karela, bitter melon, balsam pear or bitter melon is a tendrill-bearing vine used mainly for treating diabetes especially in India, the Caribbean, South America and East Africa. *Momordica charantia* belongs to the family of Cucurbitaceae. Both the leaf extracts, fruit and seeds of bitter melon have hypoglycemic effects on diabetic patients. The key components of bitter melon which are responsible for its hypoglycemic effects are momordicin, stearic acid, charantin, eleostearic acid, insulin-like peptide [plant-(p)-insulin], oleanolic acids and cucurbitanoids. It is worthy to note that individuals who are allergic to the Cucurbitaceae family such as melons and gourds should apply caution when taking bitter melon fruit, seeds or leaf extracts.

Juniper berry

Juniper berries contain natural insulin and due to its ability to release insulin from the pancreas, researchers claim that it can alleviate hunger thus serves as a remedy for diet-controlled diabetes. Juniper berry was reported to have antidiabetic and antihyperlipidemic effects on streptozotocin (STZ) nicotinamide induced diabetic rats. Moreover,

the methanolic extract of this fruit showed a remarkable reduction in blood glucose levels in diabetic rats. Having undergone several experimental studies, researchers agree that this fruit has hypoglycemic effects on diabetic patients.

Pterocarpus Marsupium

Pterocarpus marsupium is a large deciduous tree that belongs to the family of fabaceae (Leguminosae). Parts of the *Pterocarpus marsupium* plant such as flowers, heartwood and leaves are used in Ayurveda due to the high medicinal properties present in this plant. *Pterocarpus marsupium* which is also known as Bijasar, honne, kempu honne, Malabar Kino or Indian Kino is among the many powerful medicinal plants used for treating diabetes. The wood, bark and leaf extracts of *P. marsupium* possess anti-diabetic effects thus are used in folk medicine for treating diabetic patients.

Valeriana Wallichii

Valeriana wallichii is a perennial herb that measures from 14 to 45cm height. This plant is a rhizome herb, a vital substitute for the European *V. officinalis* as well as belongs to the Valerianaceae family. It thrives very well mainly in the mountainous areas of the Himalayas. The word *Valeriana* originated from *Valere* which connotes "to be in good health". This herb is very useful in Ayurvedic medicine as an antispasmodic, carminative, sedative, analeptic, nervine and stimulant. The *Valeriana wallichii* plant also possesses anti-diabetic properties thus can be used for treating individuals suffering from diabetes.

Yarrow flower

Yarrow flower which is botanically known as *Achillea millefolium* is a flower with white petals that usually produces distinctive and pleasant odour. It is originally from Asia and Europe before spreading to other parts of the world. Yarrow flower contains insulin that produces fructose as a source of energy rather than glucose. It is essential for diabetic patients because it doesn't cause a spike in blood glucose level after consumption. Due to its fibre effect, insulin helps to regulate bowel movement and aids in the elimination of waste products.

Cayenne Pepper

Over the past years, cayenne pepper has been used traditionally for treating diabetes. A past study discovered that mice injected with capsaicin were healed of type 1 diabetes. Type 1 diabetes, which is a more serious diabetic condition that starts in childhood due to the body's immune system attacking itself can be tackled with cayenne pepper. The study further revealed that injected capsaicin destroyed the pancreatic pain nerves thereby causing the body to start producing insulin normally. But being that cayenne is not a scientifically proven treatment of diabetes, no recommended dosage for consumption exists. Because diabetes is a critical health condition, it is noteworthy for diabetic patients to continue taking cayenne alongside their prescribed medication in order to avoid complications. Some people are allergic to cayenne thus such individuals should desist from taking it. Excessive consumption of cayenne pepper can cause stomach irritation in some people. Cayenne supplements can interact with certain types of medications such as blood thinners and aspirin.

Fenugreek

Fenugreek is botanically known as *Trigonella foenumgraecum* and it is an annual plant that belongs to the family of Fabaceae, whose seeds are widely used as a spice for culinary purposes. Fenugreek is multipurposeful as it can be used both as a spice (seeds), vegetable (microgreens, fresh leaves, sprouts), herb (dry/fresh leaves) or even for medicinal purposes. This spice is highly medicinal and contains hypoglycemic properties thus can be used for preparing herbal medicines for treating diabetes.

CONCLUSION

The prevalence of diabetes is on a steady increase worldwide and it is now identified as one of the main threats to human health in the 21st century. Diabetes is currently one of the biggest health concerns that the world is faced with. The paper provided a useful resource to enable a thorough assessment of the profile of plants used in diabetes management so as to ensure a more rational use. By anticipating potential toxicities or possible herb-drug interactions, significant risks which would otherwise represent a burden on the country's healthcare system can be avoided.

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