



A Review on Herbal Drugs for Antidiabetic

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DOI: 10.31080/ASPS.2024.08.1124

Received: October 01, 2024

Published: October 24, 2024

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Abstract

We discuss new progress in producing herbal drugs for controlling diabetes. Herbal medicine is becoming recognized as a promising option for treating diabetes safely and effectively, with different methods of action investigated in experiments on animals and humans. This review aims to outline important discoveries about the effectiveness, safety, and medical uses of innovative herbal treatments for diabetes. Nevertheless, WHO acknowledges the potential of herbal and herbal drugs in treating different health issues, such as diabetes, when utilized correctly and in combination with conventional therapies. It is important to emphasize that although certain herbal treatments have displayed potential in managing diabetes symptoms, they should be approached with care and under the direction of healthcare experts. Furthermore, herbal treatments should not serve as a substitute for regular medical attention or prescribed medications without seeking advice from a healthcare professional.

Keywords: Anti-diabetes; Herbal Drugs; Diabetes Mellitus (DM); Insulin

Introduction

Anti-diabetic medications help control diabetes by reducing blood sugar levels [1]. Diabetes mellitus is a condition that affects the body's metabolism, causing high levels of sugar, lipids, amino acids, and low insulin levels. This results in decreased insulin production and function [2-4]. Diabetes mellitus is a medical condition known as "hyperglycemia," where there is a problem with the body's ability to produce insulin from the pancreas, leading to disrupted glucose levels. When the immune system attacks the beta cells in the pancreas, it can lead to damage or decreased insulin production, causing diabetes. There are two main types of diabetes: Type 1 Diabetes (TD1) and Type 2 Diabetes (TD2). In Type 1 Diabetes, the body's immune system destroys the beta cells in the pancreas as a result of an autoimmune disease. Approximately 85% of people with diabetes have Type 2 diabetes mellitus, a condition that affects the body's ability to metabolize carbohydrates and can lead to low blood sugar levels. Diabetes mellitus is a non-infectious disorder that affects the endocrine system [5]. Several herbal remedies have been used herbally for their potential anti-diabetic properties. It's important to note that while some of these

herbs have shown promise in studies, they should be used with caution and under the guidance of a healthcare professional, especially if you're already taking medications for diabetes like Aloe Vera [6]. Researchers are increasingly interested in using nanocarriers for the treatment and management of diabetes mellitus due to the challenges of pharmacological therapy and the advantages of nanoparticles (NPs) in drug delivery and imaging [7]. Herbal medicines are a popular option with minimal side effects and adverse reactions (Kokar and Mantha, 1998). Research has discovered approximately 800 Indian plants with potential for treating diabetes (Gupta et al, 1986). The herbal formulations were obtained from reputable local suppliers specializing in medicinal plants and operated by Ayurvedic experts as over-the-counter remedies [8].

Herbal drugs

Herbal medicines have long utilized herbal drugs, which are derived from plants or plant extracts and contain active ingredients believed to provide therapeutic benefits. These botanical drugs are seen as natural alternatives to synthetic pharmaceuticals and have a history of use in various herbal medicine systems worldwide. Eg.: Bitter Melon, Cinnamon, Aloe Vera, etc.

Sr. No.	Common name	Plant species	Family	Part used	Active constituent	Mode of action
1	Bael	<i>Aegle marmelos</i>	Rutaceae	Leaves extracts	Aegle marmelosine	Improve functional state of pancreatic β -cells.
2	Onion	<i>Allium cepa</i>	Lilliaceae	Dried powder	Dipropyl disulphide oxide	Stimulating the effects on glucose utilization and antioxidant enzyme .
3	Garlic	<i>Allium sativum</i>	Lilliaceae	Petroleum ether extract of bulbs	Allypropyl disulphide oxide,Allicin	Improve plasma lipid metabolism and plasma antioxidant activity.
4	Ghikanwar	<i>Aloe bor- badensis</i>	Aspho-delaceae	Leaf pulp extract	β - sitosterol, Campesterol	Improvement in impaired glucose tolerance.
5	Kalmegh	<i>Andro-graphis paniculat</i>	Acan-thaceae	Ethanollic extract of plant	Kalmeghin	Increases the glucose utilization and lower plasma glucose.
6	Papaya	<i>Carica papaya</i>	Caricaceae	Aqueous seed extract	Papain, chymopapain	Lowered fasting blood sugar, triglyceride, total cholesterol.
7	Neem	<i>Azadirachta indica</i>	Meliaceae	Leaf extracts	Azadirachitin nimbin	Glycogenolytic effect due to epinephrine action and blocked.
8	Mustard	<i>Brassica juncea</i>	Brassaceae	Aqueous extract	Sulforaphane	Increase activity of glycogen synthetase
9	Cinnamon	<i>Cinna-momum</i>	Lauraceae	Bark	Cinnamal-dehydeeu- genol	Increases the sensitivity of insulin receptor.
10	Turmeric	<i>Curcuma longa</i>	Zingiber- aceae	Powdered form	α -phellantrene, tripi- nolene	Lowers blood sugar, increases glucose metabolism and potentiates insulin activity.
11	Jamun	<i>Eugenia-jambolana</i>	Myrataceae	Pulp of fruit	Oleanolic acid, ellagic acid	nhibited insulinase activity from liver and kidney.
12	Bitter Gourd	<i>Momordica charan- tia</i>	Curcu-bitaceae	Fresh green leaves	Charantin, sterol	Activates PPARs α and γ and lower the plasma apo β -100 in mice fed with high fat diet.
13	Mango	<i>Mangifera indica</i>	Anacar-diaceae	Leaves extract	β -carotene α - carotene	Reduction in the intestinal absorption of glucose.
14	Gudmar	<i>Gymnena sylvestre</i>	Asclepi- daceae	Dried leaves	Dihydroxy gymnemic triacetate	Increase the serum G peptide level which monitor the release of endogenous insulin.
15	Tejpat	<i>Cinnamomum tamala</i>	Lau raceae	Leaf extract	Linalool, β -caryophyllene	Insulin release from pancreatic β - cells.
16	Sharifa	<i>Annona squamosa</i>	Annonaceae	Leaf extract	Liriodenin, moupinamide	Improve glucose tolerance.

Table 1: Herbal used for treatment of diabetic mellitus.

Gymnema sylvestre

Gymnema Sylvestre, commonly known as Gurmar, is a plant whose dried leaves are used for medicinal purposes. It belongs to the Asclepidaceae family and is a woody climbing shrub native to the tropical forests of India, Africa, and Australia. It has been used for centuries in herbal Ayurvedic medicine to treat various ailments, including diabetes. For over two thousand years, it has been used as a natural treatment for diabetes due to its chemical compounds such as gymnemic acid, inositol, hentriacontane, and pentatriacontane. Purdue University's horticultural department states that Gurmar has been utilized in India for diabetes treatment for centuries. These plant compounds play a crucial role in controlling and managing diabetes.



Figure 1: *Gymnema Sylvestre* (Gurmar).

Aloe vera

Aloe vera is a succulent plant species with thick, fleshy leaves containing a gel-like substance. It has been used for centuries in herbal medicine for its various health benefits, including its potential antidiabetic properties. Aloe vera is part of the Asphodelaceae family, also known as the Aloe family. This family consists of different types of succulent plants, many of which are originally from Africa and other dry climates. Aloe vera itself comes from the Arabian Peninsula but is now grown all over the world for its healing properties and as a decorative plant. The gooey substance found inside Aloe vera leaves is commonly known as "Aloe vera gel." This gel is located in the inner parts of the plant's thick, juicy leaves. It is collected by slicing open the leaves and extracting the gel, which can be used for Aloe vera gel is packed with many good-for-you nutrients like vitamins, minerals, amino acids, polysaccharides, and antioxidants that help give it healing properties. which can be used for antidiabetic, anti-inflammatory, antimicrobial, etc.

Tulsi

Tulsi is also referred to as Holy Basil and is part of the Lamiaceae family, also known as the mint family or deadnettle family. This



Figure 2: Aloe Vera.

plant group is known for its aromatic plants with culinary, medicinal, and ornamental properties. Tulsi, scientifically known as *Ocimum tenuiflorum* or *Ocimum sanctum*, is a perennial herb originally from the Indian subcontinent and now grown in different regions globally. It has a rich herbal use in Ayurvedic medicine. The Tulsi plant is a popular choice for herbal remedies, with its leaves, stems, and seeds all being utilized for their medicinal properties. Tulsi leaves contain bioactive compounds like eugenol, rosmarinic acid, and flavonoids, which play a key role in promoting health. One common way to enjoy Tulsi is by brewing it into a tea, allowing the hot water to draw out the beneficial compounds from the leaves. Additionally, Tulsi can be used in its fresh or dried form in cooking, as well as being incorporated into herbal remedies and supplements. Tulsi is famous for its adaptogenic, antidiabetic, antimicrobial, anti-inflammatory, and antioxidant qualities. People have long used it to boost the immune system, reduce stress, enhance respiratory health, and improve overall wellness. Studies have also looked into Tulsi's potential in managing diabetes, such as its ability to regulate blood sugar and increase insulin sensitivity.



Figure 3: Tulsi

Garlic

Garlic belongs to the Alliaceae sativum family, also called the onion or Allium family, which includes many plants used in cooking and medicine. Known for its strong smell and unique taste,

garlic contains allicin as a main active component that gives it its distinct odor and offers various health benefits. In addition, garlic also contains sulfur compounds like diallyl sulfide, diallyl disulfide, and diallyl trisulfide, enhancing its healing properties. Studies have shown that garlic may have potential antidiabetic effects by helping to lower blood sugar levels by increasing insulin sensitivity and reducing insulin resistance. Garlic has been utilized as an herbal remedy in herbal medicine for centuries dating back thousands of years to ancient civilizations such as the Egyptians, Greeks, Romans, and Chinese who valued its therapeutic qualities for treating various ailments. Garlic has been utilized for centuries in herbal medicine for a multitude of health benefits. It is commonly used to manage and ward off ailments like high blood pressure, high cholesterol, heart disease, and infections. Furthermore, garlic has immune-boosting, antioxidant, and anti-inflammatory properties.



Figure 4: Garlic

Sugar apple

The sugar apple, also known as custard apple or sweetsop, is part of the Annonaceae family, commonly referred to as the custard apple family or the Annona family. Derived from the *Annona squamosa* tree, a tropical fruit tree native to the Caribbean, Central America, and parts of South America, the sugar apple is now extensively grown in tropical and subtropical regions globally. The sugar apple fruit is round to heart-shaped, with a green, scaly skin. Inside, the fruit is packed with sweet, creamy pulp that has many black seeds. The pulp is soft, and white, and tastes like a mix of banana, pineapple, and vanilla. It's like a tropical flavor explosion in your mouth, Sugar apples are usually eaten fresh by scooping out the pulp with a spoon or blending it into smoothies or desserts. They contain vitamins, minerals, and dietary fiber, making them a healthy choice to add to your diet. Different parts of the sugar apple tree, such as the leaves, bark, and roots, have been utilized for their potential medicinal benefits in herbal medicine practices. Despite limited scientific research on the health advantages of sugar apple, its use in herbal remedies is not as popular compared to other plants. However, people around the globe still enjoy the fruit for its tasty flavor and nutritious qualities, and green apple is mainly used to reduce blood sugar levels.



Figure 5: Sugar apple.

Acacia

The Acacia family is also known as Fabaceae or Leguminosae, and it is among the largest families of flowering plants. Commonly referred to as the legume, pea, or bean family, Acacia is a genus within this family that encompasses a wide range of species including trees, shrubs, and herbaceous plants. The Acacia trees are recognized for their unique bipinnate leaves, thorn-like stipules, and frequently fragrant flowers. They can be spotted in a range of environments across the globe, including tropical and subtropical regions. A popular substance derived from Acacia trees is Acacia gum, also referred to as gum Arabic. This natural gum is produced from the hardened sap of certain Acacia tree species, such as *Acacia senegal* and *Acacia seyal*. Acacia gum is obtained by making cuts in the bark of Acacia trees, causing sap to seep out and solidify into resinous tears or lumps. These lumps are gathered and transformed into different forms like powder or liquid. In the food industry, Acacia gum is commonly used as a stabilizer, thickening agent, and emulsifier in items such as candies, fizzy drinks, and baked goods. Acacia trees have long been utilized for a variety of purposes, such as timber, tannin production, and providing fodder for livestock, in addition to their herbal use of Acacia gum. Certain species of Acacia also possess medicinal qualities, being employed in herbal medicine for addressing conditions like diarrhea, inflammation, respiratory problems, and diabetes.



Figure 6: Acacia

Nigella sativa

Nigella sativa, also known as black cumin or black seed, is part of the Ranunculaceae family, also called the buttercup family, which has various flowering plants. Black cumin seeds from the *Nigella sativa* plant have been utilized in herbal medicine for centuries, especially in Middle Eastern, South Asian, and North African traditions. These seeds are tiny, black, and angular, with a unique peppery taste and scent. *Nigella sativa* seeds are packed with bioactive compounds like thymoquinone, thymohydroquinone, and thymoquinone, which are thought to be the reason for their many health benefits. These seeds are commonly used in cooking to add flavor to bread, curries, pickles, and other dishes. Research has indicated that black cumin seeds could potentially help lower blood sugar levels and enhance insulin sensitivity, particularly for those with diabetes.



Figure 7: Nigella Sativa.

Mango

Mango is a member of the Anacardiaceae family, also known as the cashew family, which consists of a variety of plants that produce edible fruits and nuts. The mango tree, scientifically named *Mangifera indica*, is originally from South Asia but is now grown in tropical and subtropical areas around the world. It is highly sought after for its deliciously sweet and juicy flesh, making it one of the most popular fruits globally. The mango fruit comes from the mango tree and is usually oval or kidney-shaped with nutrients like vitamins, minerals, antioxidants, and fiber. They are rich in vitamins A, C, and E, along with potassium, magnesium, and phytonutrients that offer numerous health benefits. Additionally, different parts of the mango tree, such as leaves, bark, and roots, have been used in herbal medicine for various purposes. In herbal medicine, these parts are believed to have medicinal properties and are used to treat conditions like diabetes, diarrhea, dysentery, fever, etc.

Neem

Neem is a member of the Meliaceae family, also known as the mahogany family, which consists of different trees and shrubs appreciated for their timber, ornamental, and medicinal qualities. The neem tree, scientifically labeled as *Azadirachta indica*, is originally from the Indian subcontinent but is now grown in tropical and subtropical areas worldwide. Neem is commonly called "the village



Figure 8: Mango.

pharmacy" because of its wide range of herbal uses in Ayurvedic medicine and other native healing practices. Neem is commonly utilized in diverse cultures for its potential healing qualities, particularly its alleged anti-diabetic benefits. Despite ongoing studies and conflicting results regarding neem's impact on diabetes treatment, there is some indication that neem could have advantages for individuals dealing with diabetes. Other activity shows like blood sugar regulation, antioxidant, anti-inflammatory, antimicrobial activity, etc.



Figure 9: Neem.

Fenugreek

Fenugreek is part of the family Fabaceae, also known as the Leguminosae or pea family, which encompasses a diverse range of plants with culinary, medicinal, and agricultural uses. The annual herb Fenugreek (*Trigonella foenum-graecum*) is indigenous to the Mediterranean region, Western Asia, and South Asia. Its aromatic seeds and leaves have been utilized for cooking, herbal medicine, and herbal customs for centuries. Fenugreek seeds are commonly used in cooking and are taken from the pods of the fenugreek plant. They have a unique bitter taste and a strong scent, sometimes compared to maple syrup or celery. These seeds are popular in different cuisines like Indian, Middle Eastern, and North African. They can be used whole or ground as a spice in dishes such as curries, soups, and stews. Fenugreek seeds are also added to bread, pickles, and various other foods to enhance their flavor. Fenugreek has been

used in herbal medicine systems like Ayurveda, Herbal Chinese Medicine, and Arabic medicine, in addition to its culinary uses. It is believed to have health benefits such as regulating blood sugar.



Figure 10: Fenugreek.

Papaya

It is known as *Carica papaya* which belongs to family *caricaceae*. Seed and leaves extract shows lowering of blood sugar level, lowering of lipid in the body and healing of wound activities in alloxan induced diabetic rates and Papaya leaf extract and glibenclamide have antidiabetic activity against alloxan-induced mice. Glibenclamide is an oral hypoglycemic antidiabetic drug, a sulfonyl urea derivative, which works actively to lower blood sugar levels. The ethanol extract of papaya leaves has chemical content in the form of saponins, flavonoids, terpenoids, tannins and alkaloids which have a hypoglycemic effect. Flavonoids, terpenoids, saponins and tannins have activity as antioxidants which can capture free radicals resulting from the alloxan oxidation reaction and reduce the oxidative stress that occurs. Alkaloids and saponins can stimulate insulin secretion from pancreatic beta cells.



Figure 11: Papaya.

Conclusion

Overall, several novel herbal medications look promising for their ability to help with diabetes. They provide different options to the herbal methods of managing diabetes. Herbal medicines work in various ways, such as regulating insulin, modulating glucose metabolism, and providing antioxidant and anti-inflammatory

benefits. Although studies are ongoing to confirm their effectiveness and safety, these natural remedies show great potential for managing diabetes. It is important to seek advice from a healthcare provider before using herbal drugs, especially to avoid any interactions with other medications and address individual health needs.

Conflict of Interest

The authors have no conflict of interest regarding this survey.

Acknowledgement

The authors would like to thank the Institute for their kind support during this survey.

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