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Review Article

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A review on novel herbal drugs for antidiabetic activity

Shivdeep Dubey[1], Pankaj Kumar Patel[2], Anurag Kumar*[3], Dr. Esha Yadav[4]

[1,2,3,4] Axis Institute of Pharmacy, Axis Colleges, Rooma, Kanpur, Uttar Pradesh, India.

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Corresponding Author:
Email id:
anurag.kumar485@gmail.com

Abstract

Diabetes mellitus (DM) is still a major health issue worldwide, with the number of cases increasing. While using insulin is an important part of managing DM, there is also interest in exploring other options like herbal drugs to improve treatment results and reduce the side effects that come with long-term insulin use. This article aims to analyze recent studies on how effective and safe different anti-diabetic herbal drugs are in managing DM, as well as how they work. We reviewed various sources to find out which herbal drugs are known for their anti-diabetic properties, such as gurmar, tulsi, garlic, neem, bitter melon, fenugreek, cinnamon, and ginseng. We looked into the chemical components and actions of these herbs to understand how they might help regulate blood sugar levels, increase insulin sensitivity, and protect pancreatic β-cells. We also discussed clinical trials that looked at how well these herbal drugs worked on their own or when used alongside insulin, focusing on their effects on blood sugar control, cholesterol levels, and insulin dosage in diabetic patients. Additionally, we explored safety concerns like possible interactions between herbs and drugs and any adverse effects they might have. The goal is to give doctors and patients a complete overview of these herbal anti-diabetic drugs so they can make informed decisions. Based on our findings, using herbal anti-diabetic drugs along with conventional treatment shows promise in managing DM better. It also suggests areas where more research is needed and how these drugs can be integrated into current medical practices to improve treatment results and quality of life for people with diabetes.

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 due to 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. Research has discovered approximately 800 Indian plants with potential for treating diabetes. The herbal formulations were obtained from reputable local suppliers specializing in medicinal plants and operated by Ayurvedic experts as over-the-counter remedies.(4-8)

Herbal Drugs:

Herbal drugs, also known as botanical medicine or phytotherapy, are medicinal products made from plants or plant extracts. They use different parts of plants like leaves, roots, stems, flowers, or seeds for their healing properties. Herbal drugs have been used for centuries in traditional medicine systems worldwide and remain popular because they are believed to be natural and offer potential health advantages. 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.(9-11)

1. Gymnema Sylvestre:

Gymnema Sylvestre is part of the Apocynaceae family, also known as the dogbane family. This family consists of various plants, several of which have healing properties. Gymnema Sylvestre, commonly known as Gurmar, is a plant whose dried leaves are used for medicinal purposes and 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 elements, 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. (12)

Figure1: Gymnema Sylvestre (Gurmar)

2. Aloe Vera:

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 is a succulent plant species with thick, fleshy leaves containing a gel-like substance. It has been used for centuries in herbal drugs for its various health benefits, including its potential anti-diabetic properties. 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.(13)

Figure2: Aloe Vera

3. 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 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. Tulsi is a versatile herb with numerous properties that make it valuable for promoting overall health and well-being. It has been used for centuries in herbal medicine systems such as Ayurveda for its medicinal benefits, and modern due to show activity.(14)

Figure3: Tulsi

4. 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 drugs 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. Garlic is a very useful herb with many healing benefits. It can help protect the heart, boost the immune system, fight infections, reduce inflammation, and act as an antioxidant.(15)

Figure4: Garlic

5.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. Sugar apples are sweet, but they impact blood sugar levels slowly. This is good for people with diabetes who need to keep their blood sugar stable.(16)

Figure5: Sugar Apple

6. 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. Acacia extracts or parts from Acacia plants could help with diabetes. They found that these extracts might lower blood sugar levels by making insulin work better, helping cells take in sugar, or stopping sugar from being absorbed in the gut. 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.(17)

Figure6: Acacia

7. 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, thymol hydroquinone, 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. it protects against diabetes problems like kidney damage, nerve damage, and retina damage. This happens because it has antioxidants and fights inflammation, which reduces stress and inflammation linked to diabetes.(18)

Figure7: Nigella Sativa

8. 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. Oxygen stress is big in causing diabetes and related problems. Mango stuff, like mangiferin, may help decrease oxygen stress and swelling, and then help control sugar and improve health for people with diabetes. 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. The parts of the mango plant, such as the leaves or seeds, may possess anti-diabetic properties.(19)

Figure8: Mango

9. 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 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. Neem can help reduce sugar in the blood. Elements in neem leaves like flavonoids, triterpenoids, and glycosides work to lower blood sugar. Neem helps the body use insulin better, so cells can take in glucose. This could help control blood sugar. Some studies show neem can help make new beta cells in the pancreas. These cells make insulin, so more of them means better insulin release and glucose control.(20)

Figure9: Neem

10. 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. Fenugreek seeds have stuff like soluble fiber, trigonelline, and galactomannan. They can help bring down blood sugar levels by slowing how the body takes in carbohydrates and sugars from food. This might make it easier to control blood sugar, especially after meals. It's suggested that fenugreek may make cells more sensitive to insulin, which can help them take in glucose from the blood. This may help bring down blood sugar levels and make it easier for the body to use insulin, which is a big problem in type 2 diabetes.(21)

Figure10: Fenugreek

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.

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Reference:

1. Dwivedi Chandraprakash, Daspaul Swarnali; ; JPHYTO 2013; 2(3): 44-51, ISSN 2230-480X; Antidiabetic herbal drugs and polyherbal formulations used for diabetes.

2. Rao M. Upendra**,** Sreenivasulu M., Chengaiah B., Reddy K. Jaganmohan, Chetty C. Madhusudhana; IJPRIF vol.2, No.3, pp 1883-1892, ISSN: 0974-4304;

Herbal medicines for diabetes mellitus.
3. Kumar Devendra, Trivedi Neerja, Dixit

Rakesh Kumar; World Journal of Pharmacy and Pharmaceutical Science (SJIF), Vol.4, Issue 04, 2015; Herbal medicines used in the traditional Indian medicinal system as a treatment option for diabetes management.
4. Anisetti N. Ravinder, Rajesham V.V., Bikshapathi D.; IJPRIF 2012:2(10), ISSN 2231-6876; A review on medicinal plant and drug formulation used in diabetes mellitus.
5. Dhonde Satish Madhukar, Hase Mayur Vasant, Garde Pragati Shivaji, Ingale Shraddha Kailas, Jadhav Meghraj Dnyaneshwar and Ghumare Komal Laxman; Vol.11, Issue8, 165-177, SJIF, impact factor 7.632, ISSN 2278-4357; Review on herbal medicines used in the treatment of antidiabetic.
6. Kumar Kapil, Verma Bipin, Fateh V., and Pandey S.; Aug.-Sept. 2014, vol.3, No.5, pp 1116-1120, ISSN 2278-0238; Some herbal drugs used for the treatment of diabetes.
7. Mr. Borhade Mayur Somnath, Dr. Dukre Tushar Pradip; IJCRT, vol.11, Issue 12 Dec. 2023 ISSN 2320-2882; A review on recent developments in novel herbal drug delivery system.
8. Mishra Rakhi, Shuaib Mohd., Shravan and Mishra Prem Shanker; JAPS 01(06); 2011:235-237 ISSN 2231-3354; A review on herbal antidiabetic drugs.
9. Patel Pritesh, Harde Pinal, Pillai Jagath, Darji Nilesh, and Patel Bhagirath; Pharmacophore (An international research journal), 2012, vol.3(1), 18-29 ISSN 2229-5402; Antidiabetic herbal drugs.
10. Saravanamuttu Shivani, Sudarsanam D.; IJPSR (2012), vol.3, Issue 10: 3639-3650 ISSN 0975-8232; Antidiabetic plants and their active ingredients.
11. Aggarwal Niidhi, and Shishu; Nutrition Ther (JNDT) 2011, 1:1; A review of recent investigations on medicinal herbs possessing anti-diabetic activity.
12. Arulselvan Palanisamy, Hasfar Amynurliyana Abdul Ghofar, Karthivashan Govindarajan, Mohd Firdaus Abdul Halim, Muhammad Syafiq Abdul Ghafar, Fakurazi Sharida; ELSEVIER G Modal BIONUT-248 (2014); Antidiabetic therapeutics from natural source: A systematic review.
13. Praaful A. Talaviya, Shaival. Rao, Bhavesh M. Vyas, Shashipal P. Indoria, Rakesh K. Suman, Vishal P. Suvagiya; . IJPSR, 2014; Vol. 5(2): 302-319; Potential antidiabetic herbal medicines.
14. Recent Updates in chemistry of quinoline analogs as potential antimalarial agent with utilization of Chem3D software. IJPHI [Internet]. 2023 Dec. 2 [cited 2024 May 4];1(1).
15. The Promise of Progress: Emerging Drug Targets and Advanced Therapies. IJPHI [Internet]. 2023 Dec. 12 [cited 2024 May 4];1(1).
16. Modak Manisha, Dixit Priyanjali, Saroj Ghaskadbi, Thomas Paul A. Devasagayam; 2007,40, 163-173; Indian herbs and herbal drugs used for the diabetes treatment.
17. Zohreh Bakhtiuary; 2011, 3(2).Herbal medicines in diabetes; Iranian Journal of diabetes and obesity.
18. Madhukar Dhonde Satish, Vasant Hase Mayur, Shivaji Gorde Pragati, Ingale Shraddha Kailas, Jadhav Meghraj Dnyaneshwer, Laxman Ghumare Komal; Vol.11, Issue 8, 2022; herbal medicines used in the treatment of antidiabetic.
19. Nabarun Mukhopadhyay, Sampath V., Sameer Pai, U.V. Babu, Richard Lobo; 2019, 10(2); Antidiabetic plants.
20. Garg Preeti, Akash Deep; ; Hygeia J.D.Med.7(2) Oct. 2015; 42-50; Anti-diabetic profile of herbal drugs.
21. Foundations of HPLC: Exploring the Basics of High-Performance Liquid Chromatography Techniques. IJPHI [Internet]. 2023 Dec. 12 [cited 2024 May 4];1(1)..