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Review Article

A REVIEW ON HERBAL MEDICINES ANTI DIABETIC AGENTS AND THEIR THERAPEUTIC EFFICACY

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ABSTRACT

The Therapeutic possibilities of plant-based treatments the management of diabetes's of mechanism of the action. Diabetes mellitus is a common chronic illness that serious danger at around the entire world. the properties of following plants are *Alstonia scholaris*, *Annona squamosa*, *Momordica charantia*, cinnamon, fenugreek, *Allium sativum*, *Neem*, *Ocimum sanctum*, Ginseng berry, *Aloe vera* this data process is identified potential phytoconstituents for treatment of diabetes mellitus. Herbal drugs are controlling diabetes safely effectively and different methods of action experiments on animals and humans. This review Important discoveries and medicinal uses herbal treatment for diabetes WHO acknowledges the potential of herbal drugs in treating different health issues, such as diabetes, utilized conventional therapies. It is important to emphasize that herbal treatments are displayed potential diabetes they should be healthcare experts. Herbal remedies have been traditionally treating to diabetes. The parts used test models hypoglycaemic [blood-sugar-lowering] active compounds of 20 plant species for 12 family's crucial role of plant diabetes. The plants can delay complications from diabetes and metabolic imbalance. This review can attempt to cover for herbal plants like melon, ginseng cinnamon, garlic, *Gymnema* managing blood glucose level due to saponin, terpenoids, flavonoids useful controlling diabetes description of *Gymnema gumarin* possible mechanism the gumarin helps manage taste buds' receptors TIR1, TIR3 both β -cells and islets, PPAR γ (peroxisome proliferator activated receptor gamma) β -cells is stimulated by *Gymnema*. Plant culture methods *Gymnema* acid production Diabetes mellitus affecting over 537 million people poses health challenges prevalence and complications like Neuropathy, cardiovascular *syvestre*, *Momordica charantia*, *Trigonella*, *foenum-graecum* *Cinnamomum veum*, *Aloe vera* and clinical efficacy through results vary due to standardization issues.

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I. INTRODUCTION

Diabetes mellitus, a common chronic illness, is characterized by an elevated level of blood glucose for an extended period of time due to impaired insulin secretion or insulin resistance. According to International Diabetes Federation (2021), approximately 537 million adults lived with diabetes worldwide in 2021, and it will surpass 700 million by 2045. Diabetes, particularly type 2 diabetes (T2D), is a major risk factor for the majority of complications like cardiovascular diseases, neuropathy, nephropathy, and retinopathy, which have profound implications for quality of life and health system use [1]. Diabetes mellitus is a metabolic disorder char-

acterized by hyperglycaemia, glycosuria, hyperlipidaemia, negative nitrogen balance and sometimes ketonemia [2]. Diabetes is caused by the body's inability to produce or respond to the pancreatic hormone insulin. One of the important physiological actions of insulin is to control blood glucose levels [3]. Antidiabetic drug, any drug that works to lower abnormally high glucose (sugar) levels in the blood, which are characteristic of the endocrine system disorder known as diabetes mellitus. The most common side effects of most diabetes drugs are gastrointestinal disturbances, which include constipation, vomiting, nausea, diarrhoea, and indigestion. headache, vertigo, and trembling rash that is itchy

and allergic joint pain and swelling, soreness in the muscles, A rare yet serious consequence is acute pancreatitis. Additional rare adverse effects include low platelets, lung disease, liver inflammation and jaundice, bruising, and bleeding [4]. Diabetes mellitus is a medical condition known as "hyperglycaemia," 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]. T2D is characterized by impaired insulin signaling, reducing glucose uptake via glucose transporter 4 (GLUT4) in muscle and adipose tissues [6]. Risk factors include obesity, physical inactivity, and genetic predisposition, with prevalence rising fastest in low- and middle-income countries [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].

2. MEDICINAL PLANT WITH EFFICACIOUS ANTIBIOTIC POTENTIAL

2.1 ALOE VERA

Botanical Name: *Aloe barbadensis miller*

Family Name: Asphodelaceae

Active Constituents:

- Polysaccharides Acemannan, mannose-6-phosphate, and glucomannans, which are major factors responsible for immunomodulation, anti-inflammatory goods, and towel mending.
- Anthraquinones/ Anthrones Compounds like alonin A & B, aloe-emodin, and emodinact as natural laxatives, anaesthetics, and antiviral agents.

Medicinal Uses:

- Crack mending- promotes briskly mending of cuts, becks, and ulcers
- Anti-inflammatory – Reduces swelling. Greenish Ness, and pain in skin diseases.
- Skin conditions Used in eczema, psoriasis, acne, dermatitis, and sunburn.

2.2 CINNAMON

Botanical Name: *Cinnamomum*

Family Name: Lauraceae

Active constituents:

- Eugenol: A major component in cinnamon leaves, providing antioxidant and antimicrobial benefits. Medicinal Plants used in the treatment of Diabetes Mellitus 7

- Chemical acid & Cinnamyl Acetate: Important compounds contributing to its medicinal properties

Medicinal Uses:

- Diabetes Management: Improves glucose uptake and lowers blood sugar levels in type 2 diabetes.
- Anti-Inflammatory & Pain Relief: Contains cinnamaldehyde and eugenol, which help reduce arthritis pain, joint aches, and muscle soreness.

2.3 FENUGREEK

Botanical Name: *Trigonella foenum-graecum*

Family Name: Fabaceae

Active constituents:

- Flavonoids: Quercetin, rutin, and vitexin contribute to its antioxidant power.
- Fiber & Mucilage: High fibre content, including mucilage (around 28%).

Medicinal Uses:

- Helps lower fasting blood glucose levels
- Improves insulin sensitivity
- Often used as a supportive herb for people with type 2 diabetes

2.4 ALLIUM SATIVUM

Botanical Name: *Allium sativum L.*

Family Name: Amaryllidaceae

Active constituents: Allicin-The main bioactive compound produced when the enzyme alliinase converts Alliin upon tissue damage (cutting/crushing). Alliin - A stable precursor found in intact

Medicinal Uses:

- Cholesterol & Blood Pressure: Helps lower bad LDL cholesterol, prevents platelet aggregation (reducing clots), and supports heart health.
- Circulation: Stimulates circulation and may prevent artery hardening. Antimicrobial & Antiviral Effects

2.5 NEEM

Family Name: mahogany family

Active Constituents: azadirachtin and the others are nimbolinin, nimbin, nimbi din, nimbidol, sodium nimbinate, gaduin, salannin, and quercetin.

Medicinal Uses: Skin Health: Creams, shampoos, and oils for acne, dandruff, psoriasis, athlete's foot, and general skin infections.

- Anti-inflammatory: Reduces inflammation in conditions like edema and supports gastric ulcer healing.

2.6: OCIMUM SANCTUM

Botanical Name: *Ocimum tenuiflorum*

Family Name: Lamiaceae

Active Constituents: Eugenol, carvacrol, Rosmarinus acid, and flavonoids (orientin, apigenin), along with ursolic acid, terpenoids, phenolics, and neolignanes, contributing to its antioxidant, anti-inflammatory

Medicinal uses: Respiratory Health: Helps with coughs, colds, bronchitis, asthma, and viral infections due to

expectorant, anti-inflammatory, and antimicrobial properties.

- Stress & Mental Health: Acts as an adaptogen, reducing stress, anxiety, and depression, while sharpening memory and improving cognitive function.
- Immune Support: Protects against viruses, bacteria, fungi, and protozoa, boosting overall immunity and fighting infections

2.7 Ginseng Berry

Ginseng berry is the fruit of the ginseng plant, mainly *Panax ginseng*. It contains high levels of **ginsenosides**, antioxidants, flavonoids, and polysaccharides, which contribute to its medicinal properties.

Benefits

- Strong antioxidant activity
- Helps regulate blood glucose levels
- Reduces inflammation
- Supports cardiovascular health
- Enhances cognitive function and immunity

Applications

- Herbal medicines
- Nutraceuticals and dietary supplements
- Functional foods and beverages

2.8 Alstonia Schloaris

Botanical Name: *Alstonia scholaris*

Family Name: Apocynaceae

Active Constituents: echitamine, ditamine, strict amine, and picrinine. These compounds possess significant antimicrobial, anti-inflammatory, hepatoprotective, and antioxidant properties

Medicinal uses: Fever & Malaria: Decoctions from bark and leaves are used as antipyretics (fever reducers) and antimalarials, with specific formulas like 'Ayush-64' showing efficacy.

- Digestive Issues: Used for dysentery, diarrhoea, intestinal worms (helminthiasis), and to improve appetite and digestion.
- Skin Conditions: Bark paste applied to ulcers, wounds, and skin diseases like leprosy; also used for itching and Respiratory Problems

2.9 Annona Squamosa

Botanical Name: *Annona squamosa* L

Family Name: Annonaceae

Active Constituents: Acerogenins: Highly active in leaves and seeds, including squamosin, ansamycin, and various squamation's.

Alkaloids: Anonaine, aporphine, and coreximine, particularly concentrated in the bark and leaves.

Phenolics & Flavonoids: Rutin, quercetin, and other antioxidants, with high levels in the leaves.

Fatty acids: The seeds contain high levels of oleic, linoleic, palmitic, and stearic acids.

Medicinal uses: *Annona squamosa* is used in traditional medicine for its potential anti-diabetic, anti-inflammatory, anti-cancer, and insecticidal properties, with different parts offering various

- Remedies: leaves treat skin issues, hysteria, and diabetes; seeds target lice and inflammation; fruit

- acts as a stimulant and coolant; and bark helps with diarrhoea and tumours, though scientific validation for many uses is ongoing.

3. INTERACTIONS AND LIMITATIONS

Conventional anti-diabetic drugs, such as metformin, sulfonylureas, and DPP-4 inhibitors, are cornerstones of diabetes management but have notable limitations. Metformin, the first-line therapy for T2D, reduces hepatic glucose production but causes gastrointestinal side effects in 20-30% of patients [9]. Sulfonylureas, which stimulate insulin release, risk hypoglycaemia, particularly in elderly patients [10]. Thiazolidinediones improve insulin sensitivity but are associated with weight gain and cardiovascular concerns [11].

4. CHALLENGES OF HERBAL MEDICINE

Despite the benefits of herbal medicines, there are some enterprises. These include issues with consistency, as there is often no exact dosage prescribed, and patients may not take the dose at the correct times. Additionally, because manufacturing methods aren't standardized, the amount of active ingredients can vary from one batch to another. To address these issues and improve herbal medicines to better compete with pharmaceutical drugs, further research is needed. This would involve isolating and categorizing the active ingredients in medicinal plants. Both herbal and conventional medicines currently don't fully cure many diseases, so it's essential to explore alternative treatments. This could be achieved through deeper studies of plants and their potential benefits in medicine [12].

5. FUTURE PERSPECTIVES

Many people use herbal medicines, and new herbal remedies are regularly being added to modern healthcare. In developing countries, especially in rural areas, about 80% of people depend on traditional remedies for healthcare. In developed countries, there's also a renewed interest in herbal medicines because of the preference for natural products. It's important to distinguish between herbal medicines provided by healthcare professionals and those that people use for self-treatment. Diabetes is a growing health issue worldwide, and recently, new plant-based medicines have shown strong anti-diabetic effects, sometimes even more effective than standard diabetes medications. This has increased interest in finding plants with anti-diabetic properties, which could lead to new, effective oral treatments for diabetes [13]. Diabetes therapy is being transformed by the theory of personalized medicine, in which therapeutic Medicinal Plants used in the treatment of Diabetes Mellitus 31 strategies are determined by an individual's genetic, metabolic, and lifestyle variables. Pharmacogenomics in diabetes therapy has led to improved therapeutic outcomes via patient specific drug reaction. For instance, genetic variation in drug metabolizing enzyme genes influences the reaction to metformin and sulfonylureas and demands individualized dose regimens. The integration of herbal medi-

cine into personalized treatment regimens holds the promise to achieve optimal glycemic control with fewer side effects. Future studies need to focus on the identification of patient subsets likely to gain maximum advantage from herb-drug regimens for simplifying diabetes management [14].

6. CONCLUSION

Medicinal plants offer a promising alternative for the management of diabetes mellitus. Their multiple mechanisms of action, safety profile, and affordability make them valuable in modern therapeutics. However, scientific validation, quality control, and clinical studies are essential for their effective use in healthcare systems.

7. AUTHOR CONTRIBUTIONS

All authors are contributed equally.

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None

9. DECLARATION COMPETING INTEREST

The authors have no conflicts of interest to declare.

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