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SHORT REVIEW

Role of Medicinal Herbs in the Homeopathic Treatment of Diabetes Mellitus: An Overview

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Abstract

Over the past several decades, diabetes mellitus has spread globally and is now one of the leading causes of mortality. Despite the availability of several contemporary medications, herbal remedies often continue to enjoy widespread acceptance for meeting the essential medical requirements of the world's diabetic population. There is a long history of using herbal therapies and sources of treatment for diabetes mellitus. Some of these are part of the current medical therapeutic toolkit, while people with diabetes employ complementary therapies or dietary supplements. The traditional herbal treatments for diabetes with a focus on scientific studies done on antidiabetic medicinal plants, *polyherbal* blends, isolated chemicals, and their related toxicities. Diabetes Type-1 and Type-2 can benefit from homoeopathic medications. However, in homoeopathy, there is no alternative to insulin. Diabetes is characterised by elevated blood sugar levels. The disease has a significant worldwide effect and affects millions of people. The study of diabetes is ongoing. Sugar does not reach the cells and create energy as it should in those with diabetes, insulin deficiency, or an inability of the body to use it. Instead, it remains in the blood. The excess amount of sugar present causes the blood sugar level to increase over the normal range. A large portion of medicinal plants employed in conventional treatments still need to be researched. Therefore, it is imperative to perform scientific research to clarify the antidiabetic principle(s), isolate antidiabetic chemicals, and evaluate the therapeutic effectiveness of medicinal plant extracts and polyherbal mixes in clinical practice.

Major Findings: The lack of scientific and clinical evidence demonstrating the usefulness and safety of medicinal plants is the main barrier preventing their integration with contemporary therapeutic uses. Examining the therapeutic advantages of medicinal plants and polyherbal mixes used in various traditional medical systems has been the subject of several studies. However, a large portion of medicinal plants employed in conventional treatments still need to be researched.

Keywords: Anti-diabetic Agent Toxicity, Anti-diabetic Medicinal Plants, Anti-diabetic Substances, Diabetes Mellitus, Homeopathic Mother Tincture

1. Introduction

The area of homoeopathic medicine has experienced exponential expansion in recent years, and due to their natural origin and fewer side effects, these medications are becoming more and more popular in both developed and developing nations. Medicinal plants, minerals, and organic materials are the source of many currently used homoeopathic medicines. The majority of medical professionals in Indian systems create and administer their medications. Worldwide, 21,000 plants are utilized for therapeutic reasons, according to the World Health Organisation (WHO). Out of these 2500 species, 150 are employed on a very considerable scale for commercial purposes in India. India is known as the "botanical garden of the world" and is the

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world's greatest producer of medicinal plants which are used in homoeopathic medicines[1]. The present study is on the use of plants and herbal medication formulations in Indian traditional health care systems to treat diabetes mellitus, a significant and debilitating condition worldwide[2]. Hyperglycemia is a symptom of diabetes mellitus, an endocrine condition brought on by problems with insulin function, the inability of the pancreas to produce insulin, or both[1]. Microvascular and macrovascular problems brought on by hyperglycemia cause many organs to fail over time[2]. Although there are several synthetic antidiabetic treatments available, their usage is constrained by undesirable side effects[3]. Because of their low price, wide availability, and lack of side effects, herbal treatments have therefore been in high demand for the control of diabetes. Various plant species that are utilized for a variety of medical reasons are considered medicinal plants[4]. The value of medicinal plants has increased during the past few years on a global scale. According to estimates from the World Health Organization (WHO), 85% of the world's population uses medicinal herbs[5]. Despite the availability of efficient contemporary allopathic medications, herbal remedies continue to be widely used across the world to address basic healthcare requirements. In parallel, a lot of individuals in wealthy nations have started using supplementary or alternative therapies that use medicinal plants. Data from scientific studies on therapeutic plants are, however, scarce.

The pharmacological analysis of many medicinal plants employed in traditional medical systems for the treatment of many chronic ailments has seen major advancements. Importantly, regardless of the age or gender of the patients, therapies with medicinal plants are thought to be safe with no adverse effects. Additionally, it is believed that medicinal plants are a rich source of pharmacophores that can be exploited in the creation of new drugs. Additionally, medicinal herbs are crucial as vital food sources[6].

Over the past several decades, there has been a sharp rise in the prevalence of diabetes[7]. Compared to the general population of healthy people, diabetic patients have a higher risk of morbidity and death. Numerous resources have been used to find and create the best therapeutic medicines for the treatment of diabetes mellitus[8]. Most diabetic patients, especially in underdeveloped nations, choose to employ herbal plant treatments as alternative therapies for the management of diabetes mellitus because of the numerous adverse effects and expensive cost of the currently available oral anti-diabetic medicines[9]. Diabetes is a widespread condition that affects people all over the world. It is a metabolic condition that is recognized by a rise in a person's blood sugar level. Because high blood sugar levels have an impact on how well your body's organs work, diabetes management is crucial. Your eyes, heart, liver, feet, and kidneys may be impacted by diabetes. Diabetes can also result in problems including insomnia, stress, drowsiness, changing blood pressure, and other things. Diabetes is brought on by the body not producing enough or any insulin. The main methods for treating diabetes include changing one's lifestyle and taking medication (allopathic, homoeopathic, or herbal). Thousands of diabetic people have seen success with the diabetes reversal method[10,11].

There are sometimes no early indications of diabetes. However, these diabetic people gradually begin to have difficulties. It is crucial to routinely get your blood sugar tested for this reason. Diabetic symptoms frequently manifest as[12]:

- Frequent urination
- Fatigue
- Nausea
- Blur vision
- Increase in thirst and hunger
- Weight loss
- persistent hunger
- excessive thirst
- dry mouth
- skin sores

2. Traditional Herbal Treatments

To treat diabetes mellitus, many more plant species have been employed ethnopharmacologically[13]. The management of diabetes mellitus has traditionally benefited significantly from the use of traditional medical methods. Generally speaking, civilization has incorporated wide cultural elements that have resulted in the development of several traditional medical systems for more than three thousand years. There are four primary traditional medical systems: Ayurveda, Siddha, Unani, and Deshiya Chikitsa[14].

Commonly referred to as Amla, *Phyllanthus emblica* L. a member of the Euphorbiaceous family, is regarded as a very significant medicinal plant in homoeopathic medicine. This plant's high polyphenol content, which primarily consists of flavonoids and tannins, is responsible for its principal bioactivities. The *E. officinalis* (*P. emblica*) has anti-inflammatory, anti-cancer, immunomodulatory, and anti-hyperglycemic qualities[6,7]. It is also recognized to preserve glucose homeostasis and enhance glucose metabolism. One of the most widely used spices worldwide is *Cinnamomum verum* J. Presl, a member of the *Lauraceae* family. Vital oils and active ingredients including cinnamic acid, cinnamaldehyde, and cinnamate, which are linked to several health advantages, are found in cinnamon[10]. Cinnamon has a variety of medicinal benefits, including anti-inflammatory, anti-cancer, anti-diabetic, anti-microbial, and antioxidant properties. It is also known to have anti-neurological effects. Because of its biological qualities, including immunomodulation, hepatoprotection, anti-diabetes, anti-tumour, and antioxidant, *Momordica charantia* L., a member of the *Cucurbitaceae* family, has been used as a herbal remedy for several years. Commonly referred to as tulsi or holy basil, *Ocimum tenuiflorum* L. is a member of the *Lamiaceae* family and is revered as a significant medicinal herb in India[12]. Garlic, or *Allium sativum* L., is a member of the *Allium* genus within the *Alliaceae*

Table 1. Lists of several commonly used antidiabetic medicinal plants that have lately been subjected to scientific scrutiny[7]

S. No.	Botanical name	Family name	Parts used for the study	Common name(s)
1	*Picrorhiza kurroa* Royle ex Benth.	*Plantaginaceae*	Rhizome	Yellow gentian
2	*Capparis decidua* (Forssk.) Edgew.	*Capparidaceae*	Fruit, flowers, bark	Karira
3	*Catharanthus roseus* (L.) G.Don	*Apocynaceae*	Leaves	Madagascar periwinkle
4	*Berberis vulgaris* L.	*Berberidaceae*	Root, fruit	Barberry
5	*Ficus benghalensis* L.	*Moraceae*	Bark, aerial roots	Banyan tree
6	*Symplocos cochinchinensis* (Lour.) S. Moore	*Symplocaceae*	Leaves	Laurel sapphire berry
7	*Boerhavia diffusa* L.	*Nyctaginaceae*	Leaves	Spreading hogweed
8	*Helicteres isora* L.	*Sterculiaceae*	Root	Indian screw tree
9	*Mucuna pruriens* (L.) DC.	*Fabaceae*	Seeds	Velvet bean
10	*Memecylon umbellatum* Burm. f.	*Melastomataceae*	Leaves	Ironwood
11	*Dillenia indica* L.	*Dilleniaceae*	Leaves	Elephant apple
12	*Salacia reticulata* Wight	*Celastraceae*	Root, stem, leaves	Marking nut tree, kotalahimbatu
13	*Ficus religiosa* L.	*Moraceae*	Bark	Sacred fig
14	*Curcuma longa* L.	*Zingiberaceae*	Rhizome	Turmeric
15	*Hibiscus rosa-sinensis* L.	*Malvaceae*	Flower, leaves	Chinese hibiscus, shoe black plant
16	*Swertia chirayita* (Roxb.) Buch.-Ham. ex C.B.Clarke	*Gentianaceae*	Whole plant	Clearing nut tree, bitter stick
17	*Mangifera indica* L.	*Anacardiaceae*	Leaves, fruit	Mango
18	*Embelia ribes* Burm.f.	*Myrsinaceae*	Berries	False black pepper
19	*Musa paradisiaca* L.	*Musaceae*	Stem, leaves, infructescence stalks, fruit	Plantain
20	*Ophiopogon japonicus* (Thunb.) Ker Gawl.	*Asparagaceae*	Root	Dwarf lilyturf
21	*Phyllanthus niruri* L.	*Phyllanthaceae*	Aerial parts	Stonebreaker
22	*Prosopis glandulosa* Torr.	*Fabaceae*	Pods	Honey mesquite
23	*Punica granatum* L.	*Punicaceae*	Leaves, fruit	Pomegranate

family. Its therapeutic properties are attributed to its high concentration of sulfur amino acids that are not proteins[13].

For the treatment of diabetic mellitus, the Ayurvedic and Deshiya Chikitsa systems mostly employ single plants or plant mixes. Many anti-diabetic herbs, *Allium cepa* (onion), including *Momordi cacharantia* (bitter melon), *Allium sativum* (garlic), *Gymnema sylvestre* (gymnea), *Annona squamosa* (sugar apple), *Syzygium cumini* (malabar plum), etc[7].

Natural remedies made from healing plants are valuable resources for pharmacological research on the treatment of diabetes mellitus[15]. Researchers have shown that the presence of phenolic compounds, terpenoids, flavonoids, coumarins, and other substances that exhibit hypoglycaemic action is what gives medicinal plants their antidiabetic properties[16]. The precise mechanisms of action of several commonly used antidiabetic herbs are either unclear or undetermined[17]. As a result, several investigations are being carried out to clarify the mechanisms of action of various plants and natural substances[18]. The major way that medicinal plant extracts restore the function of pancreatic tissues is by increasing insulin production or decreasing intestine absorption. Inhibiting intestinal glucose absorption, increasing insulin production, or enabling metabolites in insulin-dependent activities are the major ways whereby medicinal plant extracts restore the function of pancreatic tissues[17]. The lists several commonly used antidiabetic medicinal plants that have lately been subjected to scientific scrutiny as shown in Table 1.

2.1 Medicinal Plants with Antidiabetic Activity

The *Myrtaceae* family includes *Syzygium cumini* (L.) Skeels, often called Jamun in India, which is widely distributed over the Indian subcontinent, eastern Africa, and Southeast Asia. Tribes in India's Sikkim and Darjeeling Himalayas use a decoction of stem bark to treat diabetes mellitus. Curry leaf, or *Murraya koenigii* (L.) Spreng. is a significant medicinal plant that is indigenous to India and has a variety of biological functions. It belongs to the *Rutaceae* family. The tribes of Theni district, Tamil Nadu, India, employ a leaf decoction combined with rice flour as a remedy for eye issues and dyspepsia. In streptozotocin-induced diabetic rats, koenidine, a metabolically stable carbazole alkaloid that was extracted from the leaves of *M. koenigii*, significantly decreased the postprandial blood glucose level and enhanced insulin sensitivity[6,7].

Gymnema sylvestre, a member of the *Apocynaceae* family, is a significant medicinal plant with several pharmacological characteristics, including neuroprotective, anti-carcinogenic, and anti-diabetic actions. Tribes in Tamil Nadu, India's southern Western Ghats use the plant's dried and powdered leaves to treat the symptoms of diabetes mellitus by consuming them orally with milk. Gymnemic acids, triterpenes, gymnema saponins, and gurmarin are among the phytoconstituents of *G. sylvestre*, commonly referred to as gurmar, which are responsible for its sweet-destroying properties. The plant's active ingredients gymnemic acid, stigmasterol, gurmarin, glucose, tartaric acid, calcium oxalate, betaine, and choline are what give *G. sylvestre* its anti-inflammatory, anti-diabetic and anti-obesity effects. Its capacity to prevent intestinal glucose absorption and repair islet cells may be the mechanism behind its hypoglycemic effects. Additionally, it increases the body's use of glucose and the activity of the enzymes that are in charge of this process[5,11].

To control their diabetes, a sizable percentage of persons with diabetes mellitus commonly utilize herbal medicines[19]. Only a small number of scientific investigations, meanwhile, have examined the precise antidiabetic processes of medicinal herbs. Studies on *P. embelica, P. marsupium,* and *C. auriculata* supported the antihyperglycemic benefits of the chosen plant extracts by delaying the activity of enzymes that break down carbohydrates[20]. Lab animals have responded favourably to the decoctions of medicinal herbs such as *Momordica charantia* (*Cucurbitaceae*), *Aegle marmelos* (*Rutaceae*), and *Salacia reticulata* (*Celastraceae*)[21].

The hypoglycaemic action of a few plants, such as *Artocarpus heterophyllus, Bambusa oulgaris*, and *Osbeckia octandra*, was investigated by Fernando *et al.* in 1991[22]. The aforementioned plant extracts showed significant in vivo anti-diabetic efficacy. Attanayake *et al.,* also assessed the antihyperglycemic effect of the stem bark of *Gmelina arborea*, *Sida alnifolia, Syzygium caryophyllatum, Kokoona zeylanica*, roots of Languasgalanga, *Spondias pinnata*, arial portions of *Scoparia dulcis*, and leaves of *Coccinia grandis*[23,24]. Additionally, closely examined the anti-diabetic effects of Piper betel leaf extracts in Wistar rats[25]. The hypoglycaemic

and antihyperglycemic effects of *Alpiniacalcarata rhizome* extracts in rats[26,27].

The hypoglycaemic and hypolipidaemic effects of *Passiflora suberosa* aqueous leaf extract. Zeorin, methyl-orcinol carboxylate, and methyl orsellinate have been extracted from the lichen Cladonia species in addition to the research on the higher medicinal plants[28,29].

2.2 Identified Anti-diabetic Substances from Medicinal Plants

Due to their wide availability, effectiveness, and lack of negative side effects, bioactive chemicals derived from medicinal plants are far more sought after as antidiabetic therapeutic leads than synthetic molecules. 50% of the medications used to treat diabetes that have been authorized in the previous 10 years come from plants[30]. Scientists from around the world have found many more anti-diabetic chemicals in medicinal plants[31]. Based on the mechanisms of their effects for decreasing glucose levels, such as the blockage of glucose absorption, improvement in insulin resistance, and pancreatic functions, isolated substances' antidiabetic properties may differ[32]. The Anti-diabetic active compounds isolated from medicinal plants are shown in Table 2.

2.3 Variety of Herbs for the Treatment of Type 2 Diabetes

The therapeutic potential of medicinal plants having ethnomedicinal value is now being investigated[33-36]. The notion of polyherbal and blended plant extracts rather than single ones are chosen for the treatment of diabetes in the homoeopathic literature "*Sarangdhar Samhita*," according to the conventional medical system[37,38]. Due to the incredible therapeutic effectiveness of polyherbal formulations, Unani medicine has also attained widespread acclaim[39]. Due to their potent synergism and lack of negative effects, polyherbal combinations rather than single herbs have been used to treat diabetes in the majority of traditional systems[40].

In comparison to a single medicine, combinations frequently produce promising results in the therapy of disorders. Herbal remedies made from naturally existing herbs and substances are arranged into specific combinations that may interact in ways like mutually enhancing, assisting, restraint, and antagonistic ways[41]. In comparison to individual plant extracts, polyherbal combinations have been shown in several scientific investigations to have a stronger impact. Additionally, combined plant extracts target numerous sites simultaneously to increase efficacy[42]. Compared to a single herbal preparation, the number of individual plants utilized in the manufacture of polyherbal mixes is smaller to achieve the desired pharmacological activity. Thus, it lowers the possibility of negative side effects.

Additionally, polyherbal preparations eliminate the requirement for taking more than one distinct herbal preparation at a time. Because of all these advantages, polyherbal blends are becoming increasingly popular among diabetic patients. Numerous studies have been

Table 2. An anti-diabetic active compound isolated from medicinal plants[6,17]

Plant	Used part	Active compound
Artemisia pallens	Aerial parts	Hypoglycemic
Beta vulgaris L.	Leaves, fruit	Anti-hyperglycemic, hypoglycemic
Capsicum annuum L.	Fruit	Insulinotropic
Murraya koenigii	Leaves	Mahanibine
Swertia punicea	Whole plant	Bellidifolin, Methylswertianin
Bauhinia forficata	Leaves, flower	Kaempferol-3 -neohesperidoside
Piper retrofractum	*Fruits*	Piperidine alkaloids: piperine, pipernonaline, dehydropipernonaline
Capparis moonii	Fruits	Gallotannins
Salacia oblonga	Root, stem, leaves	Mangiferin, Kotalanol, Salacinol
Curcuma longa	Rhizome	Demethoxycurcumin, Curcumin, bisdemethoxycurcumin,
Eleutherine americana	Bulb	Eleutherinoside A
Acacia pennata	Shoot tips	Caffeic acid, Polyphenols
Eugenia uniflora L.	Fruit	Antidyslipidemic
Macaran gatanarius	Seeds	Ellagitannins (corilagin, chebulagic acid)
Syzygium cumini	Leaves, seeds	Mycaminose

conducted on polyherbal blends to see if they are useful for both short-term and long-term therapies. These investigations have shown that the inclusion of various phytochemicals gives mixed plant mixes a broad therapeutic spectrum. The majority of herbal combinations have demonstrated efficacy in both low and high dosages without any negative side effects[43]. The overview of current studies on polyherbal formulations used to treat diabetes mellitus is shown in Table 3.

2.4 Medicinal Plants and Herbal Combinations' Toxicity

Science's field of toxicology studies harmful compounds and their consequences. For the creation of novel, safe pharmaceuticals as well as the expansion of the therapeutic potential of currently available drugs, toxicological investigations are crucial[44]. Despite the important role that medicinal plants play in the treatment of illnesses, several harmful and deadly side effects have also been described[45]. These hazardous consequences may be brought about by contaminants, allergic responses, medication interactions, and herbal interactions, among other things[46]. The International Conference on Harmonization (ICH) and the Organization for Economic Co-operation and Development (OECD) have developed the standards for toxicity research of pharmaceutical drugs, including herbal combinations, isolated chemicals, and medicinal plant extracts[47].

Toxicological research examines whether or not a plant extract may be used clinically. Even though many phytochemicals are frequently utilized for their positive effects on health, some of them have also been implicated in harmful effects and may be found in some foods and herbal treatments. According to Arseculeratne and colleagues[48], several medicinal herbs that are well-known in Ayurvedic medicine, such as Terminaliachebula, displayed severe toxic effects. However numerous antidiabetic plant extracts, including Cocciniagrandis, have been shown in recent scientific studies to be toxic-free extracts[49].

We've never consumed as much sugar as we do right now. This is a contributing factor in the rising worry about diabetes mellitus. Even young children are affected by type 2 diabetes, an acquired insulin deficit that frequently results from poor dietary choices. The alteration in lifestyle is an additional significant aspect. The majority of wealthy and emerging nations have managed to control communicable illnesses, which until recently were the main cause of high mortality. In 1990, infectious illnesses made up 56% of the global disease burden, while non-communicable diseases made up 29%. By 2020, it is anticipated that communicable diseases will make up 24% of the global disease burden and non-communicable

Table 3. Provides an overview of current studies on polyherbal formulations used to treat diabetes mellitus[6,17]

Formulation with scientific names	The outcome of the study
Allium cepa L., *Xylopia aethiopica, Stachytarpheta angustifolia, Alstonia congensis, Aloe vera* (L.) Burm.f., *Annona squamosa* L., *Azadirachta indica* A. Juss, *Biophytum sensitivum* (L.) DC.	Strongly lowering blood sugar levels and improving cardiovascular risk factors
Abelmoschus esculentus (L.) *Moench, Thymus vulgaris, Achillea millefolium, Acacia nilotica* (L.) *Delile, Salvia officinalis, Agathosma betulina, Trigonella foenum-graecum, Urtica urens, Taraxacum officinalis*	Strong antioxidant and antidiabetic activity
Vaccinium arctostaphylos, Allium sativum, Urtica dioica, Cinnamomum zeylanicum, Citrullus colocynthis, Teucrium polium, Juglans regia, Trigonella foenum, Olea europaea, Nigella sativa, Punica granatum, Salvia officinalis,	Favorable effects on lipid profiles and blood sugar levels, and it may be utilized as a dietary supplement to treat diabetes.
Zingiber officinale, Allium sativum, Capsicum frutescens, Musa paradisiaca L., *Mucuna pruriens* (L.) DC., *Memecylon umbellatum* Burm. f., *Mangifera indica* L., *Helicteres isora* L.	Suggested for the management of diabetes
Tridax procumbens, Glycosmis pentaphylla, Mangifera indica, Symplocos cochinchinensis (Lour.) S. Moore, Picrorhiza kurroa Royle ex Benth., *Phyllanthus niruri* L.	Substantial antidiabetic effects
Gymnema sylvestre, Eugenia jambolana, Myristica fragrans, Momordica charantia and *Andrographis paniculata*	A markedly lower blood glucose level
Ficus bengalenesis, Gymnema sylvestre, Artemisia pallens, Terminalia chebula, Annona squamosal, Coccinia indica, Eugenia uniflora, Caesalpinia bonducella etc.	Hypoglycemic

diseases will make up 57%. One of the most prevalent non-communicable illnesses is diabetes[50]. The list of Indian medicinal plants for antidiabetic as well as hypoglycemic and other beneficial effects is indexed in Table 4.

3. Diabetes Comes in Two Different Forms

When the body is unable to produce enough insulin, type 1 diabetes is also known as juvenile diabetes or insulin-dependent diabetes. The human body uses sugar from the food eats as a source of energy with the aid of insulin. Although type 1 diabetes is more common in children and young people, it only makes up 5–10 % of all instances of diabetes in the country.

When insulin production is compromised and tissue insulin sensitivity increases, type 2 diabetes is the outcome. Many people with Type-2 diabetes do not need regular insulin supplementation. Modest dietary and activity adjustments can help control diabetes. Roughly all (16.9 million) of the nearly 16 million Americans who have diabetes have Type-2 diabetes. One of the most prevalent non-communicable illnesses is diabetes. One-third of them do not know they have the illness.

4. Homeopathic Approach to Diabetes

Diabetes is a chronic condition that may be managed using a variety of drug-delivery methods. Through

Table 4. Indian medicinal plants for antidiabetic as well as hypoglycemic and other beneficial effects[6,7]

Medicinal Plant Name	Indian Herbal name	Antidiabetic as well as Hypoglycemic and other beneficial effects
Ficus bengalenesis	Bur	Antioxidant and hypoglycemic
Gymnema sylvestre	Merasingi or Gudmar	Hypolipidemic and anti-hyperglycemic effect
Camellia sinensis	Tea	Antioxidant and Anti-hyperglycemic activity
Artemisia pallens	Davana	Hypoglycemic properties with increased peripheral glucose utilization
Terminalia chebula	Hirda	Hypoglycemic and antibacterial
Areca catechu	Supari	Hypoglycemic
Swertia chirayita	Chirata	Stimulates insulin release from islets
Enicostema littorale	krimihrita	Enhance hexokinase activity
Bombax ceiba	Semul	Hypoglycemic
Phaseolus vulgaris	Hulga	Antioxidant, hypoglycemic and hypolipidemic
Musa sapientum	Banana	Antioxidant and antihyperglycemic
Annona squamosa	Sugar apple	Hypoglycemic and antihyperglycemic activities
Salacia reticulata	Vairi	α-glucosidase inhibitor
Capparis decidua	Pinju or Karir	Hypolipidaemic, Hypoglycemic and antioxidant
Vinca rosea	Sadabahar	Anti-hyperglycemic
Caesalpinia bonducella	Sagarghota or Fevernut	Hypoglycemic and hypolipidemic
Punica granatum	Anar	Antioxidant and anti-hyperglycemic
Beta vulgaris	Chukkander	Enhance glucose tolerance in OGTT
Emblica officinalis	Amla	Antioxidant, reduce lipid peroxidation and hypoglycemic
Eugenia uniflora	Pitanga	Hypoglycemic and inhibits lipase activity
Boerhavia diffusa	punarnava	Antioxidant, enhance in hexokinase activity and plasma insulin level
Terminalia belerica	Behada	Antibacterial and hypoglycemic
Butea monosperma	palasa	Antihyperglycemic
Syzygium alternifolium	Shahajire	Antihyperglycemic and hypoglycemic
Coccinia indica	Kanturi or Bimb	Hypoglycemic

constitutional repairs, homoeopathy has a beneficial role in instances that are detected early. In addition to using homoeopathic medicines, many homoeopaths also practice yoga and naturopathy. Priority should be given to lowering the raised blood sugar if it is high to prevent potentially fatal consequences. There are homoeopathic treatments, sometimes known as organopathic treatments, that may lower the sugar. Uranium nitrate, *G. sylvestre*, phosphoric acid, *Syzygium jambolanum*, and *Cephalandra indica* are among the most often utilized. Depending on the patient's needs and the level of blood sugar, they are used in physiologically active amounts as Mother Tincture or 3x[51].

Another strategy is to take a thorough case history, do pathophysiological profiling to understand the patient's profile, and then choose a constitutional remedy. This idea is distinct from homoeopathy. To determine the patient's individualising characteristics, a thorough history of the patient must be gathered, including his personal, family, and prior histories, emotions, preferences, likes, dislikes sleep patterns, and physical and mental reactions. Individualization is the process, and a treatment option is chosen that is more closely aligned with this disease's profile (Similia principle). Homeopathy differs from other medicinal systems in this way. Diagnostics or customized medicine is the term used by contemporary scientists to describe this idea.

To manage the increased sugar, certain pharmaceutical companies have created their exclusive formulations. Few people also often utilize a bio-chemic medication that is a component of homoeopathy to treat high blood sugar. One such medication that homoeopaths use to treat digestive issues and attempt to lower blood sugar is Natrum Phos 3x. Numerous homeopaths use Bio combination No. 7 with different medications. Some herbal items used to reduce blood sugar with some success include fenugreek or methi seeds, bitter gourd (*karela*), pterocarpus (*vijaysar*), gymnema (*gurmar*), and *guduchi* (*amrit*). Each strategy has its range and restrictions. The doctor must decide the course of action to pursue with a certain patient. This depends on the patient's overall health, the disease's course, any complications, the organs involved, their age, the length of their sickness, other systemic involvement, etc.

To treat retinopathy, which is damage to the eyes brought on by diabetes, a therapy including lachesis, arnica, belladonna, and phosphorus is utilised. Diabetics may lament their tremendous, disabling frailty. Carbo Veg, Phosphoric acid, Phosphorus, and Arsenic Album are suggested to increase energy and general health. *Syzygium jambolanum* and *Secale cornutum* are used together to heal skin ulcers, a major issue among diabetics. Diabetics who have kidney impairment (nephropathy) are treated with a combination of serum anguillae, arsenic album, and lycopodium. The best medications for persons with diabetes-related constipation include Natrum Sulph, Defloratum, and Carlsbad. To treat neuropathy or nerve issues like numbness in the hands and feet, helonias, sulphur, and phosphoric acid are administered. Phosphoric acid, NuxVom, and Kali Phos are the finest treatments for diabetics to strengthen their memory[51].

4.1 *Syzygium jambolanum*

Due to its fast action when the patient has elevated blood sugar levels, this homoeopathic medicine is used to reduce the quantities of sugar discharged in urine. Patients with diabetes who develop skin ulcers are also given this medicine. This drug lessens the thirst, weakness, skin ulcers, and increased urination that are symptoms of diabetes and is used at lesser dosages to lower urine sugar levels. 15 drops of the tincture version of the drug should be diluted in half a cup of water and taken twice a day. The medication is recommended for those who have prickly heat in the upper portion of their bodies, which produces excruciating itching, little red eruptions, a constant want to pee, and increased thirs[6,51,52].

4.2 Helonias

When a patient urinates frequently, a homoeopathic medicine is recommended. Due to albumin's presence, the urine appears white and transparent. This medicine is typically used for patients who have poor memory, are melancholy or severely depressed, and feel better when they engage in any activity. Irritable patients cannot stand even the slightest conflict. Usually, a 30c form is recommended[51,52].

4.3 Iodum

Even if they are exceedingly hungry, this drug is administered to people who are severely skinny. These individuals experience anxiety and are unable to remain motionless, therefore they constantly move or walk. These individuals frequently experience fatigue

easily, which causes them to begin perspiring profusely even after mild physical activity. Low-potency doses of the medicine are available in 6, 12, or 30c[52,53].

5. Antidiabetic Mechanism Activity of Medicinal Herbs

5.1 *Urtica dioica*

The shape and/or function of beta cells are improved by the aqueous UD extract, which has a significant impact. One of the modes of action of the extract of this plant is to prevent damage to beta-cell cells, heal damaged beta cells, regenerate new cells, and increase insulin release in functioning cells[51,52].

5.2 *Trigonella foenum graecum*

Fenugreek seed's ability to treat diabetes is at least partially a result of an amino acid called hydroxysolecuine-4, which directly stimulates beta cells' production of the hormone insulin. Following cell injury, the Ca ATPase and Na/K ATPase pumps' function lowers the need for fenugreek seeds by lowering the production of free radicals, which cures these diseases[51].

5.3 *Carthamus tinctorius*

Its antioxidant and hypoglycemic properties are attributed to the flavonoid content, which includes quercetin and camphorol[51].

5.4 *Ferula assafoetida*

Gum can increase the manufacture and release of insulin or hyperplasia of the remaining beta cells in the pancreas because it contains antioxidant chemicals that can lessen the quantity of intracellular free radicals. By encouraging the production and release of insulin as well as the hyperplasia of the remaining beta-pancreatic cells, anthoczone gum may lower blood sugar levels[51,52].

5.5 *Bauhinia forficate*

It contains a lot of flavonoids, which are polyphenolic antioxidants that lower blood sugar by boosting insulin production and causing glucose to transfer through insulin-dependent pathways[18].

5.6 *Gymnema sylvestre*

Gymnemic acid molecules bind to a receptor on the outer layers of the gut, preventing the intestine from absorbing sugar molecules, which lowers blood sugar levels[51].

5.7 *Swertia punicea*

The *Swertia punicea* glucose-reducing effect works by enhancing insulin resistance, which boosts insulin absorption and secretion[51].

5.8 *Combretum micranthum*

Stimulates the production and release of insulin or the pancreatic beta cells' residual beta cell hyperplasia[51].

5.9 *Sarcopoterium spinosum*

Insulin-like action may be seen in the blue extract from the *Sarcopoterium spinosum* plant's root[51].

5.10 *Liriope spicata*

Enhances body glucose tolerance and increases insulin secretion and absorption[51].

5.11 *Caesalpinia bonducella*

Increases pancreatic islet production of insulin. The plant's extracts may have an anti-hyperglycaemic effect because they prevent glucose absorption[51].

5.12 *Coccinia indica*

These extracts restored glucose 6-phosphatase and lactate dehydrogenase, which increased in diabetes patients without therapy and reduced the activity of the lipoprotein lipase (LPL) enzyme[51].

5.13 *Syzygium cumini*

Higher langerhansis a result of the cAMP concentration, and increased insulin production is a result. Through enhanced cathepsin activity, this function contributes to the conversion of proinsulin to insulin. It boosts insulin action while decreasing the patient's erythrocytes' Na/K ATPase activity[51].

5.14 *Mangifera indica*

The reduced intestinal absorption of glucose may be the cause of this[6,7].

5.15 *Momordica charantia*

It promotes glucose 6-phosphate dehydrogenase while inhibiting glucose 6-phosphatase and fructose-1, 6-bis-sepsfatase in the liver[51].

6. Preventive and Promotive approach to Diabetes

Treatment for diabetes aims to reduce symptoms and stop or at least delay the onset of complications. It is possible to reduce the risk of microvascular diseases (such as kidney and eye disease) by controlling blood pressure and glycemia; macrovascular diseases (such as coronary, peripheral vascular, cerebrovascular and diseases) by controlling lipids and hypertension; and neurological as well as metabolic diseases by controlling glycemia.

Every patient in preventive and promotional care must take personal, dietary, and homoeopathic care to minimise problems and preserve quality of life. Lifestyle changes can prevent type 2 diabetes. Some simple pointers are[10] given below.

Eat frequent, little meals every 2-3 hours as opposed to huge ones. Instead of frying the vegetables, steam them. Reduce your diet's intake of fatty foods, sweets, and alcohol. Eat meals high in fibre, such as whole grains and pulses, and cut back on your oil consumption. Skip the fried meals.

Regular exercise for at least 30 minutes is one change in lifestyle that everybody can make. Unless the patients have a cardiac condition, prefer to use the steps than an elevator or an escalator. At your jobs, try to avoid staying in the same position for extended periods. Pause for a moment. If it's not feasible to go outside and engage in domestic tasks, practice yoga at home to maintain your fitness[36].

Serious problems can be avoided and the condition can be kept under control even in Type 2 diabetic people who adhere to tight supervision from a licensed homeopath and take frequent medication. Wake up before it's too late, is the advice given to persons who have diabetes or other illnesses. Get out of your sedentary behaviours and lives. Exercise outside by walking, swimming, running, working out at the gym, or playing sports. The key to a healthy future is proper exercise and nutrition control[11].

7. Homeopathic Treatment of Diabetes

Different bodily organs are susceptible to serious problems from diabetes. Diabetes is treated holistically using homoeopathic medicine. It is a non-invasive treatment for the management of diabetes. A thorough physical and psychological examination of the patient often aids in the prescription of the best medication. However, very few other diabetic treatments take these assessments into account. Before beginning homoeopathic therapy, the patient must have access to wholesome knowledge[52,53].

7.1 Work of Homeopathy in Treating Diabetes

A sickness, in the view of homoeopathy, is a reflection of a disturbance of vital energy. This force controls the interior energy of your body, which sustains and guides life. It permits the body to self-heal by adapting to environmental illness Therefore, severe abnormalities in the vital force's flow are what lead to sickness or illness symptoms. Diabetes is brought on by issues including weakened immunity or hereditary causes. A comprehensive strategy for therapy is required[52,53].

7.2 Not a Quick Treatment for Diabetes Patients

Homoeopathic therapies are not a suitable choice if the patients need immediate treatment or immediate blood sugar management. The effects of homoeopathic treatments on a patient's health condition take time to manifest. It could take a while for diabetes to fully recover or reverse. In these situations, homoeopathic treatments aid in preventing diabetic complications. The patients can anticipate seeing the outcome in a few weeks to a few months. If the patients want to speed up the process of reversing diabetes, patients can combine homoeopathic pills with a diabetes reversal programme if the patients are anticipating speedy results from the treatment[15].

8. Homeopathic Diabetes Treatments

Homeopathic treatments are all-natural since they are made from minerals, plants, and animal extracts. The homoeopathic principle states that a substance retains the majority of its medicinal potency when it is diluted. Therefore, following dilution, doctors suggest the majority of homoeopathic medications to diabetic patients. The natural ingredient used in homoeopathic treatments is diluted until only a very small amount remains of the original natural ingredient. Following

that, the concentrations of various chemicals provide as following[19]:

- Sugar Pallets
- Tablet
- Oil
- Drops
- Ointment
- Creams

Diabetes Type-1 and Type-2 can benefit from homoeopathic medications. But with homoeopathy, there is no alternative to insulin. However, diabetic patients who get homoeopathic therapy can manage their metabolic condition with both dietary and medical interventions. Homeopathic medicine recognizes that no two diabetic individuals have the same issues. Not all drugs are appropriate for all diabetic patients since each patient has a different condition. Some persons who choose the diabetes reversal method stopped using insulin. Many people don't require medication, while others were able to cut back on their doses by 70% or more[52,53].

8.1 *Abroma augusta*

In homoeopathy, it is the most often used treatment for diabetes. Patients with diabetes who experience significant weakness owing to a loss of muscle mass are given *Abroma augusta* by the doctor. Even though walking is crucial, strengthening your muscles can help reverse your diabetes. A personal fitness coach and a diet coach can assist in gaining muscle mass by offering the ideal diet and exercise program that are both tailored to individual needs and won't interfere with regular activities. Patients who experience frequent urination increased hunger, and thirst with dry mouth might also benefit from it. Numerous diabetic patients experience sleep problems as a result of elevated blood sugar levels. Additionally useful to them is *Abroma augusta*[51].

8.2 *Argentum metallicum*

Patients with diabetes who urinate often and excessively receive a prescription for *Argentum metallicum*. Patients with sugar who could unintentionally pass urine get relief after taking *Argentum metallicum*. Three times each day, mix five drops in a half cup of water. The granules can be medicated, and it should be them three times, or as per the doctor's instructs[51].

8.3 *Cephalandra indica*

Another effective homoeopathic treatment for diabetic patients is *Cephalandra indica*. It controls blood sugar levels and cures blood urea. Patients with diabetes who are experiencing the negative consequences of their diabetic symptoms may find some alleviation by taking this medicine. The alleviating symptoms of diabetes, however, could not appear for some time. In addition to detoxifying the body, it also treats renal problems. Smoothies that help to cleanse can speed up the process of reversing diabetes[51].

8.4 Conium

Conium helps cure nerve damage brought on by high blood sugar levels, including numbness in the hands and feet. It also addresses muscle asymmetry in the lower body. Conium is often referred to as deadly hemlock. It is quite poisonous. Although conium does not affect the brain, it has a weak effect on the spinal cord. As a result, it aids in the treatment of neuromuscular issues brought on by high glucose levels. It encourages deeper sleep and aids in reducing neuropathy-related discomfort[51].

8.5 Jambolanum or *Syzygium cumini* (Black Plum)

The greatest homoeopathic treatment for lowering blood sugar levels is this one. It manages diabetic symptoms including thirst, weakness, and frequent urination. Use this medication as prescribed and manage blood sugar levels in check. It aids in reducing urine sugar levels and repairing old skin ulcers brought on by diabetes. Every meal should be preceded with 15 drops of *Syzygium jambolanum* mother tincture in a half-glass of water[51].

8.6 *Natrum Mur*

A fluid imbalance in the body can also cause high blood sugar. A healthy equilibrium in the body is promoted and maintained with the aid of *Natrum Mur*. As a result, the kidneys efficiently remove extra glucose from the body, maintaining stable blood sugar levels. It is offered as a pill or tincture. Take 3-5 drops of a diluted mother tincture in a half cup of water three times per day if you're taking one[51,52].

8.7 *Natrum Phos* 3x

Another homeopathic treatment for diabetics is *Natrum Phos* 3x. It lowers blood sugar levels by assisting in the

treatment of digestive issues. For diabetic patients, NatrumPhos 3x works well either on its own or in conjunction with other homoeopathic treatments. The product is offered as a biological tablet. By adopting good eating practices and consuming wholesome foods that are conveniently available in the kitchen, one can overcome digestive issues. A personal diet coach creates a diet plan that contains staple foods, and they continuously track and encourage the patients[51,52].

8.8 Phosphorus

Patients with pancreatic disorders, particularly TB, and high blood sugar levels should take phosphorus. Phosphorus is beneficial for diabetic people who have symptoms including dry mouth, restlessness, and dry and watery stools[51].

8.9 Phosphoric Acid

Another all-natural homoeopathic treatment for diabetes is phosphoric acid. If diabetes has a nerve origin, it is usually treated by this. When diabetic patients experience frequent urination, the homoeopathic practitioner may give phosphoric acid. In addition, a milky urine hue suggests a high level of sugar in the urine. Diabetes can be treated with phosphoric acid when it is in its early stages[51].

8.10 *Uranium nitricum*

It is a key diuretic homoeopathic diabetic treatment. Incontinence of urine, enuresis, and burning in the urethra brought on by an increase in blood glucose levels can all be treated with it. Homoeopathic uranium nitrate is used to treat fatty liver, high blood pressure, and excessive blood sugar. Only take the *Uranium nitricum* dose as directed by a physician. A change in the eating and sleeping patterns might also do wonders for controlling the blood sugar[51].

9. Risk Factors

Without any assurances that they are secure, the FDA permits the sale of over-the-counter homoeopathic medications from Trusted Sources. If these items are manufactured improperly, there may be a health risk. The FDA has begun tightening its controls on homoeopathic medicines.

By definition, homoeopathic medicines only contain a trace quantity of an ingredient. Adverse reactions and side effects are uncommon. However, there is still a slight chance of experiencing a severe allergic reaction to a drug. There is also a chance that it will interfere with one or more of the prescription drugs. The possibility that someone would quit taking the prescription medications they require to maintain their diabetes poses perhaps the largest risk of adopting a homoeopathic therapy for the condition. Their health can deteriorate significantly as they wait to learn if the homoeopathic treatment is effective. Additionally, they can experience major difficulties. Possible complications of diabetes include:

- Kidney failure
- Heart attack
- Leg amputation
- Stroke
- Diabetic neuropathy
- Vision loss

10. Discussion

Homoeopathy seeks to enhance traditional therapy and advance general health by taking into account particular symptoms, traits, and imbalances. It's critical to include homoeopathy in a comprehensive diabetes treatment plan and collaborate with medical professionals to receive tailored guidance as researchers continue to examine the relationship between homoeopathy and diabetes. As you work toward the best possible treatment for your diabetes, investigate the possible advantages of homoeopathy. Diabetes is characterised by elevated blood sugar levels. The disease has a significant worldwide effect and affects millions of people. The study of diabetes is ongoing. Sugar does not reach the cells and create energy as it should in those with diabetes, insulin deficiency, or an inability of the body to use it. Instead, it remains in the blood. The excess amount of sugar present causes the blood sugar level to increase over the normal range. Before the development of insulin and hypoglycemic medications, diabetes patients were managed with herbal remedies and conventional therapies. Over 1200 herbal medicines have been found to have good benefits so far in lowering blood sugar levels or issues brought on by hyperglycemia. Each plant could have a unique active ingredient that might lower hyperglycemia. However, it has been discovered that certain plants

contain antioxidant properties. Diabetes and many other disorders are influenced by oxidative stress. As a result, this process is how these plants, at least in part, impose their anti-diabetic actions. These plants may have therapeutic effects on other ailments as well because oxidative stress is the root of a wide range of other diseases and they contain antioxidant action. It is noted that these plants can lessen the harmful effects of other medications or hazardous substances due to their antioxidant activity and other mechanisms. However, they might be utilized with caution as they could be harmful. More significantly, several other strategies can act as antioxidants.

11. Conclusion

With an emphasis on scientific studies on antidiabetic medicinal plants, polyherbal mixes, isolated chemicals, and their related toxicities, we reviewed traditional antidiabetic herbal remedies in the present review. Since ancient times, many people with diabetes mellitus have employed herbal medications. To create antidiabetic compounds that may be employed in the management of diabetes mellitus, it is possible to successfully combine the indigenous knowledge of herbal remedies with contemporary scientific understanding. The lack of scientific and clinical evidence demonstrating the usefulness and safety of medicinal plants is the main barrier preventing their integration with contemporary therapeutic uses. Examining the therapeutic advantages of medicinal plants and polyherbal mixes used in various traditional medical systems has been the subject of several studies. However, a large portion of medicinal plants employed in conventional treatments still need to be researched. Therefore, it is imperative to perform scientific research to clarify the antidiabetic principle(s), isolate antidiabetic chemicals, and evaluate the therapeutic effectiveness of medicinal plant extracts and polyherbal mixes in clinical practice.

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13. Authors Contribution

Komal Sharma: Ideas; formulation or evolution of overarching research goals and aims; PS Rawat and BS Rawat: development or design of methodology; Kanika Dulta: verification of results. Pooja Rawat: investigation process, data/evidence collection; Junaid Aman: provision of study materials, reagents, materials; Daksh Negi: management and maintain research data; Pawan Joshi, Ashish Rayal: Preparation of the initial draft; AK Verma and Ajay Kumar: visualization and data presentation; Narinder Kumar: Oversight and leadership including mentorship. Sanjeev Kimothi: Management and coordination. All authors have read and agreed to the published version of the manuscript.

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