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Review Article

**HERBAL MEDICINE IN THE TREATMENT OF DIABETES  
MELLITUS****Sanket V. Kayande<sup>1</sup>, Mr. Pramod M. Bhosale<sup>2</sup>**\*<sup>1</sup>Student, Ojas College of Pharmacy, Jalna-431203, Maharashtra, India.\*<sup>2</sup> Assistant Professor, Department of Pharmaceutics, Ojas College of Pharmacy, Jalna-431203, Maharashtra, India.**Article Received:** January 2023**Accepted:** February 2023**Published:** March 2023**Abstract:**

*Diabetes is currently the illness with the greatest spread. Experts and physicians are currently looking at many natural ways to manage diabetes in a world that is changing quickly. Inadvertent adverse effects from long-term usage of insulin and other oral hypoglycemic medications include uncontrolled blood sugar increases and heart disease issues. Additionally, diabetes makes people more vulnerable to various microorganisms, which compromises the body's immune system. Herbal treatments have more benefits for preventing such issues. It is advantageous to employ Ayurvedic formulations for better control of diabetes mellitus rather than these kinds of allopathic formulations. The most prevalent endocrine illness, diabetes mellitus (DM), affects more than 100 million individuals globally (6% of the population). It is brought on by the pancreas' inability or failure to produce enough insulin, which causes fluctuations in blood glucose levels. Both insulin-dependent DM (IDDM) and non-insulin dependent DM (NIDDM) are widespread and significant metabolic disorders that have been discovered to harm many of the body's systems, including the blood vessels and neurons. Diabetes has long been recognised in India, however not all of the subcontinent has the same level of prevalence.*

**KEYWORD:** Diabetes mellitus, Herbal remedies, Antidiabetic medicines, Insulin.**Corresponding author:****Sanket V. Kayande,**

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**INTRODUCTION:**

Diabetes mellitus (DM) is a common endocrine disorder characterized by hyperglycemia manifesting often with symptoms and signs of osmotic diuresis such as polyuria, polydipsia, calorie loss, generalized weakness, polyphagia and weight loss resulting from either an absolute deficiency (Type 1) or a relative deficiency (Type 2) of the hormone, Insulin. Type 1 diabetes which formerly known as insulin dependent DM which usually occurred in childhood or in early adult age is caused by  $\beta$ -cell destruction, with absolute deficiency in insulin which is multifactorial causes such as genetic predisposition resulting from an autoimmune reaction to proteins of the islets cells of the pancreas. The other type of DM is Type 2 diabetes, also referred to as non- insulin dependent DM usually occur in people >40 years of age occurs with intact beta islet cell but there is peripheral tissue resistance to insulin<sup>1,2</sup>. These disorders associated with reversible and acute complication such as ketoacidosis become fatal if treatment is delayed [1].

**WHAT IS DIABETES ?**

Millions of people have diabetes. Even children suffer from this disease. That is why I feel that you are fortunate that your disease has been diagnosed at right time. This is one of the most widely studied, researched and advance areas in the medical field. At present there is no cure in any of the pathies for this disease. But with modern medical advancement you can definitely live near normal healthy life. We are here to add life to your life. We care for you and for your diabetes. Your cooperation is mandatory because a diabetic who knows the most about his disease faces least problems. In any disease it is said that half the battle is won by confidence and I intend to give you confidence in this booklet, confidence to live with the disease gracefully and confidence to tackle your problems intelligently.

- 1) Cells cannot adequately utilize glucose, so
- 2) Body tries to produce more glucose (gluconeogenesis).

**Types and differences of diabetes:**

There are several forms of diabetes. Scientists are still defining and categorizing some of these variations and establishing their prevalence in the population.

**I. Type I: diabetes mellitus**

This happens when the pancreas fails to generate enough insulin to fulfil the body's requirements. A sickness or stress might act as a trigger, causing the immune system to target and kill the pancreatic beta cells. As well as anything you would like to alter in this section. After that, click the button below. It's that simple! The pancreas thus stops generating insulin.

The main course of therapy for Type 1 diabetes is daily administration of insulin injections. This type of diabetes also goes by the names insulin-dependent type 2 diabetes (IDDM). Type I appears unexpectedly in adolescence or childhood.

**II. Type II: diabetes mellitus**

This result when the pancreas produces insulin, but the cells are unable to use it efficiently; this effect is called 'insulin resistance'. Type II diabetes is far more common than Type I and approximately 90% of all diabetes cases are Type II. There is a strong genetic predisposition for Type II diabetes. Age obesity and sedentary lifestyle are also risk factors. This form of diabetes is called non-insulin dependent diabetes mellitus (NIDDM). Type II mainly affects people over age 40 and is more common in overweight people.

**III. Gestational diabetes mellitus (GDM)**

This is glucose intolerance being recognized during pregnancy. It can complicate pregnancy leading to prenatal morbidity and mortality, so clinical detection is important. Gestational diabetes is fully treatable but requires careful medical supervision throughout the pregnancy. About 20%-50% of affected women develop type 2 diabetes later in life.

**IV. Other specific types of diabetes**

Maturity onset diabetes of youth (MODS) is due to impaired insulin secretion minimal or no insulin resistance, so hyperglycemia is noticed at an early stage. Genetic inability to convert proinsulin to insulin causes mild hyperglycemia. Pathological features of diabetes mellitus are due to the Following factors: 1) Decrease in utilization of glucose by the body cells. This results in increase in blood glucose concentration to 300 to 1 200 mg/dl. 2) Increase in mobilization of fats from the fat storage areas. This results abnormal fat metabolism and deposition of cholesterol in arterial walls causing atherosclerosis. 3) Tissues get depleted form protein i.e. protein depletion in tissues. [3]

**❖ HERB**

Include crude plant material, such as leaves, flowers, fruit, seeds, stems, wood, bark, roots, rhizomes or other plant parts, which may be entire, fragmented or powdered. [2]

**❖ HERBAL MATERIALS:**

Include, in addition to herbs, fresh juices, gums, fixed oils, essential oils, resins and dry powders of herbs. In some countries, these materials may

be processed by various local procedures, such as steaming, roasting or stir-baking with honey, alcoholic beverages or other materials. Diabetes mellitus is a disorder that affects the body's ability to make or use insulin. Insulin is a hormone produced in the pancreas that helps transport glucose (blood sugar) from the bloodstream into the cells so they can break it down and use it for fuel. People cannot live without insulin. Diabetes results in abnormal levels of glucose in the bloodstream. This can cause severe short-term and long term consequences ranging from brain damage to amputations and heart disease. [2]

- ❖ **Ayurvedic Treatments For Diabetes Mellitus.** Alternative and complementary therapies are frequently used by people with diabetes and other chronic conditions. In this review, the effectiveness and security of using several Ayurvedic remedies for diabetes mellitus are examined. 354 people participated in seven trials that we located (172 on treatment, 158 on control, and 24 could not be classified). Type 2 diabetes mellitus-afflicted adults were included in each of these trials. Only one study examined the 'whole system' Ayurvedic treatment whereas six examined five distinct herbal combinations (proprietary medications). From three to six months were spent on treatment. Glycohemoglobin A1C (HbA1C) levels were found to be considerably reduced after therapy with Diapason, Inolter, and Cogent DB (proprietary herbal mixes) compared to controls in one trial each. At the end of the trial period, the treatment group's fasting blood sugar levels were significantly reduced in two studies involving Diabecon and one study involving Cogent DB (proprietary herbal mixes). Objective To assess and compile information on the effectiveness of Ayurvedic treatments for diabetes mellitus. Design systematic evaluation of studies measurements and key findings We couldn't find any studies that evaluated Ayurveda as a medical system. The Ayurvedic treatment that was by far the most often examined was botanical therapy.
- **Ayurvedic Medicine For Diabetes Mellitus** Those who suffer from diabetes and other chronic illnesses frequently seek complementary and alternative therapies. This evaluation looks at the effectiveness and security of using several Ayurvedic remedies for diabetes mellitus. There were 354 participants in seven studies that we located (172 on treatment, 158 on control, and 24 could not be classified). Adults with type 2 diabetes were a part of all of this research. Only one 'whole system' Ayurvedic treatment was

studied in one of six investigations that examined five distinct herbal combinations (proprietary medications). From three to six months were spent on treatment. A study on each of the proprietary herbal combinations Diabecon, Inolter, and Cogent DB revealed considerably lower levels of glycosylated hemoglobin A1C (HbA1C) than controls at the conclusion of the treatment period. There were significantly decreased fasting blood sugar levels in the treatment group at the end of the study period in two studies using Diabecon and one study using Cogent DB (proprietary herbal combinations). These trials didn't record any fatalities, and the intervention and control groups' side effects weren't noticeably different. No discernible improvement in health-related quality of life was found in one investigation using a pancreas tonic.

- **Drug** Triphala, fenugreek, and Shilajit decoctions are frequently used as medicines. AmalakiChurna, Naag Bhasma, and Haldi Powder are a few of the powders (Churana) that are employed. It is thought that the Ayurvedic remedies "Chandraprabhavati" and "Vasanta Kusumakar Ras" reduce blood sugar levels. Ayurveda is more than just herbs; it has now spread outside the borders of India to include the Indian subcontinent, Sri Lanka, Malaysia, Mauritius, Southern Africa, Japan, Russia, Europe, and North America. Ayurveda is Sanskrit for "knowledge of life" or "knowledge of longevity." Ayurveda's fundamental goal is to restore a person's natural equilibrium. Diet, exercise, meditation, herbs, massage, sun exposure, controlled breathing, and cleansing procedures are the mainstays of Ayurvedic medicine. [21, 22, 23]
- **Role Of Insulin And Glucagon** Glycogen synthesized, stored and secreted by the alpha cells of islets of Langerhans. Glucose is the major regulator of glucagon's secretion; hyperglycemia inhibits while hypoglycemia stimulate the release of glucagon's. The release of insulin from the beta cells of pancreas is stimulated by increase blood glucose level. Thus, glucagon's and insulin is mutually antagonist to each other in functions. Herbal drug with antidiabetic activity from ancient period, peoples are using herbal plants as home remedies for treatment of diabetes. The treatment is design to control Glucose level in blood. This is the immediate goal, which is to stabilize the blood sugar and eliminate the symptoms of high blood sugar. The long-term goals of herbal treatments

are to prolong life, improve the quality of life, relieve symptoms, and prevent complications.

➤ **Indian Medicinal Plants With Antidiabetic And Related Beneficial Effects**

There are many herbal remedies suggested for diabetes and diabetic complications. Medicinal plants form the main ingredients of these formulations. The main advantage of herbal drug is that, it is safer and cured disease with less side effect and have safer than synthetic drug. Some of the herbal used for treatment of diabetes are as follows: A list of medicinal plants with antidiabetic. [4]

❖ **Antidiabetic Activity Reported Plant**

1. **Acacia Arabica: (Babul)**



Fig. No. 1 Plant of Babul

The chloroform extracts of *Acacia arabica* (Leguminosae) bark in diabetic rats at 250 and 500 mg/kg, p.o. for two weeks, significantly decreased the serum glucose level and restored total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL) and low density lipoprotein (LDL) level. Moreover chloroform extract of *Benicia hispida* fruit, *Timisoara cordifolia* stem, *Osmium sanctum* (*O. sanctum*) areal parts and *Jatropha cercus* leaves were shown the similar effect in the diabetic rats. [5]

2. **Achyranthes Rubrofusca (Devil's Horsewhip, Prickly Chaff-Flower)**



Fig. No. 2 *Achyranthes rubrofusca*

The aqueous and ethanolic extracts of *Achyranthes rubrofusca* (Amaranthaceae) leaves in diabetic rats were investigated for antidiabetic activity. It decreased the blood glucose level significantly, pancreatic enzyme such as superoxide dismutase (SOD), catalase (CAT) and glutathione level were significantly increased in the treated group in the control group. Further aqueous extract showed better result compared to the ethanolic extract. [6]

3. **Aegle Mamelons: (Bengal Quince, Bel Or Bilva)**

Administration of aqueous extract of leaves improves digestion and reduces blood sugar and urea, serum cholesterol in alloxanized rats as compared to control. Along with exhibiting hypoglycemic activity, this extract also prevented peak rise in blood sugar at 1h in oral glucose tolerance test. [7]

4. **Allium Sativum: (Garlic)**

This is a perennial herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odor and it has been shown to have significant hypoglycemic activity. This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect. [8]



Fig. No. 3 Garlic

5. **Andrographis Paniculate (Create, Kariyat, Indian Echinacea)**

The oral administration of ethanol extract of *Andrographis paniculate* (Acantharean) in diabetic rats at a dose of 100 and 200 mg/kg, p.o. for 30 d treatment, significantly decreased the blood glucose level. Further it restored TG, TC, phospholipids, glycosylated hemoglobin, alanine transaminase (ALT), aspartate transaminase (AST), acid phosphate (ACP) and alkaline



phosphate (ALP) level which indicates its anti-diabetic activity. [9]

**6. Argyria Cuneata (Purple Morning Glory, Purple Convolvulus)**

The anti-diabetic activities of ethanol extract of leaves of *Argyria cuneata* (Convolvulaceae) in diabetic rats were investigated and found to have significant anti-diabetic as well as lipid lowering potential. [10]



Fig. No. 4 *Argyria cuneata*

**7. Azedarach indica: (Neem)**



Fig. No. 5 Neem

Hydroalcoholic extracts of this plant showed antihyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has antibacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects. [11]

**8. Barleria Prionitis (Kantsaria, Vajradanti)**

Alcoholic extracts of leaf and root of *Barleria prionitis* (Acanthaceae) in diabetic rats at 200 mg/kg, p.o. for 14 d treatment, significantly decrease blood glucose and glycosylated hemoglobin level. Moreover serum

insulin and liver glycogen level were significantly increased. [12]



Fig. No. 6 Vajradanti

**9. Capparis Deciduas: (Ker, Teet, Dela)**

The aqueous and ethanolic extract of *Capparis deciduas* (Capparaceae) stem in diabetic rats at 250 and 500 mg/kg, p.o. for 21 d treatment significantly decreased the blood glucose level which signified its anti-diabetic potential. [13]

**10. Eugenia Jambolana: (Indian Gooseberry, Jamun)**



Fig.No.7 Eugenia jambolana

In India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. This varies with different level of diabetes. In mild diabetes (plasma sugar >180 mg/dL) it shows 73.51% reduction, whereas in moderate (plasma sugar >280 mg/dL) and severe diabetes (plasma sugar >400 mg/dL) it is reduced to 55.62% and 17.72% respectively. The extract of jamun pulp showed the hypoglycemic activity in streptozotocin induced diabetic mice within

30 min of administration while the seed of the same fruit required 24 h. The oral administration of the extract resulted in increase in serum insulin levels in diabetic rats. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibited insulins activity from liver and kidney. [14, 15]

#### 11. *Ficus Bengalensis* (Banyan Tree)

The aqueous extract of *Ficus bengalensis* (*F. bengalensis*) (Moraceae) bark in both insulin dependent diabetes mellitus (IDDM) and Non-insulin dependent diabetes mellitus (NIDDM) rats at 1.25 g/kg, p.o. for 4 weeks, significantly decreased the plasma glucose and serum lipids level. Its show anti-diabetic potential of *F.bengalensis*. [16]



Fig.No.8 *Ficus bengalensis*

#### 12. *Limonia Acidissima* (Wood Apple)



Fig.No.9 *Limonia acidissima*

Methanolic extract of *Limonia acidissima* (Rutaceae) in diabetic rats at 200 and 400 mg/kg, p.o. for 21 d treatment, significantly decreased the blood glucose and malondialdehyde (MDA) level. Further the activity of antioxidant enzymes such as SOD, CAT were found in higher the treated group compared to the

control group which show the anti-diabetic and antioxidant potential for the plant. [17]

#### 13. *Mangifera Indica*: (Mango)

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of *Mangifera indica* possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose. [18]



Fig.No.10 *Mangifera indica*

#### 14. *Momordica Charania*: (Bitter Gourd)



Fig No:11 *Momordica Charania*.

Anti-Hyperglycemic and anti-oxidative potential of aqueous extracts of *Momordica charantia* (*M. charantia*) (Cucurbitaceae) pulp in diabetic rats for 30 d treatment were investigated. *M. charantia* extract significantly decreased the blood glucose levels. Moreover all the other parameter was significantly restored in the treated group compared to control group. Further similar activity was found with the *T.foenum graecum* extract treatment.[19]

**15. Ocimum Gratissimum (Vana Tulsi)**

Fig.No:12 Ocimum Gratissimum

The methanolic extract of *Ocimum gratissimum* (Lamiaceae) in diabetic wistar rat at 500 mg/kg, p.o. showed significant reduction of blood glucose level. Moreover methanolic extracts of *Ocimum americanum*, *O. sanctum* and *Ocimum basilicum* also show similar effect in the diabetic rats, with maximum potential in case of *O. sanctum* compared to the other tested extracts. [20] [24]

**Table.1. List of plants having Anti-diabetic activity [25]**

SR. NO.	PLANT	FAMILY	PART USED
1.	<i>Krameria triandra</i>	Krameriaceae	Root
2.	<i>Kyllinga triceps</i>	Cyperaceae	Root
3.	<i>Lagerstroemia parviflora</i>	Lythraceae	Aerial parts
4.	<i>Lagerstroemia speciosa</i>	Lythraceae	Bark, Root, Seed, Leave & ripe fruits
5.	<i>Lantana camara</i>	Verbenaceae	Leaves
6.	<i>Larrea tridentata</i>	Zygophyllaceae	Root, stem, bark, leaf
7.	<i>Lasia spinosa</i>	Araceae	Rhizome
8.	<i>Launaea nudicaulis</i>	Asteraceae	Roots
9.	<i>Laurus nobilis</i>	Lauraceae	Leaf
10.	<i>Lavandula multifida</i>	Lamiaceae	Flower
11.	<i>Lavandula stoechas</i>	Lamiaceae	Leaves, flower
12.	<i>Lawsonia inermis</i>	Lythraceae	Leaves
13.	<i>Leea crispa</i>	Vitaceae	Aerial parts
14.	<i>Leea indica</i>	Vitaceae	Leaves
15.	<i>Leonotis leonurus</i>	Lamiaceae	Leaves
16.	<i>Lepechinia caulescens</i>	Labiatae	Whole plant
17.	<i>Lepidium ruderae</i>	Cruciferae	Aerial part
18.	<i>Lepidium sativum</i>	Brassicaceae	Seeds
19.	<i>Lepidium sativum</i>	Brassicaceae	Leaves
20.	<i>Leucaena leucocephala</i>	Leguminoseae	Seeds
21.	<i>Ligustrum lucidum</i>	Lamiaceae	Fruit
22.	<i>Lillium auratum</i>	Liliaceae	Bulb
23.	<i>Lillium speciosum</i>	Liliaceae	Bulb
24.	<i>Limonia acidissima</i>	Rutaceae	Fruit



25.	Linum usitatissimum	Linaceae	Seeds
26.	Liriope spicata	Liliaceae	Root
27.	Lithospermum erythrorhizon	Boraginaceae	Seeds
28.	Litsea coreana	Lauraceae	Leaves
29.	Lodoicea sechellarum	Palmae	Fruit
30.	Lophophora williamsii	Cactaceae	Aerial parts
31.	Loranthus curviflorus	Loranthaceae	
32.	Loranthus micranthus	Loranthaceae	
33.	Luffa acutangula	Cucurbitaceae	Fruit
34.	Luffa aegyptiac	Cucurbitaceae	Aerial parts
35.	Luffa cylindrica	Cucurbitaceae	Seeds, leaves, flowers
36.	Luffa echinata	Cucurbitaceae	Aerial parts
37.	Luffa tuberosa	Cucurbitaceae	Fruit
38.	Lupin marmalades	Papilionaceae	Seeds
39.	Lupus albus	Papilionaceae	Seeds
40.	Lycium barbarum	Solanaceae	Fruit
41.	Lycium shawii	Solanaceae	Aerial parts
42.	<b>Lycopersicon esculantum</b>	<b>Solanaceae</b>	<b>Seeds</b>

### CONCLUSION:

The most prevalent endocrine illness, diabetes mellitus, affects more than 300 million individuals globally. Because of this, treatments evolved along the Western allopathic medical concepts frequently have little efficacy, run the danger of negative side effects, and are prohibitively expensive, especially for poor nations. Therefore, using chemicals derived from plants to treat diabetes mellitus that are readily available and do not require time-consuming pharmaceutical manufacturing is quite appealing. All of the herbal medications covered in this study have substantial clinical and pharmacological action. Herbal medications offer a higher potency and fewer negative effects than synthetic anti-diabetic medications. An effort has been made to focus on hypoglycemic plants in this review paper, which might be helpful to researchers, scientists, and academics working in the topic of therapeutics and pharmacology to create evidence-based alternative medicine to treat various forms of diabetes in humans and animals. The cost associated with purchasing foreign pharmaceuticals will be reduced by utilising local drug resources and working with local industries. Indigenous plants should be the focus of study and development because of their economic significance. Therefore, it is highly advised to do phytochemical and clinical study on the newly found plant species in

order to support and validate the traditional herbal treatments used by rural populations. These plants' active ingredients that are responsible for the hypoglycemic effects should also be investigated.

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