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**A review: Medicinal Plants and its impact on diabetes**

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## Abstract

Worldwide, diabetes mellitus (DM), including insulin-dependent DM (IDDM) and non-insulin- dependent DM (NIDDM), is a prevalent and dangerous metabolic disease. Worldwide, traditional plant therapies have been employed to treat diabetes mellitus. A number of herbs have been shown to treat and manage diabetes, in addition to numerous prescription drugs and complementary therapies.

Approximately 60% of people on the planet utilize traditional medicines made from medicinal plants. Diabetes is a significant illness that affects people in many different countries and from varied backgrounds. Medicinal herbs are frequently employed in many traditional medical systems to prevent diabetes and offer a possible source of hypoglycemic medications.

A significant number of plants were found to be effective in clinical trials, and in recent years, many phytoconstituents responsible for antidiabetic effects have been isolated from hypoglycaemic plants. This paper focuses primarily on diabetes, plants used as antidiabetics in various traditional medicines, and the potential benefits of several medicinal plants for various types of diabetes.These plants may delay the development of diabetic complications and correct the metabolic abnormalities through a variety of mechanisms.

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Key words: Medicinal plants, Herbal medicine, Diabetes mellitus, Antidiabetic

## Introduction

Diabetes is a long-term metabolic disease characterized by a lack of insulin secretion, either totally or partially, along with different degrees of insulin resistance. It can also be described as a disease in which the body either stops producing insulin or produces very little of it, or it gradually loses its ability to function. It has now spread like wildfire, with a 5% global incidence in the general population. By 2025, there will be 300 million adults worldwide who have diabetes, up from 135 million in 1995. The United States, China, and India will have the highest rates of diabetes in the world in 2025.

In India, the number of people with diabetes mellitus is over 30 million, and the prevalence is rising. Moreover, a large number of patients in the undiagnosed diabetic community. This rising prevalence over the past 20 years has been linked to changes in food consumption, stress, increased obesity, and decreased physical exercise. In the next 25 years, diabetes is expected to be the leading cause of disability and death worldwide.

Significant morbidity and death are caused by both macrovascular (heart attack, stroke, and peripheral vascular disease) and microvascular (retinopathy, neuropathy, and nephropathy) problems in patients with diabetes. The price of diabetes treatment and related

Problems cost more than $100 billion annually. Those with well-controlled blood sugar le3vels experience significantly fewer and milder problems. Diabetic ketoacidosis, nonketotic hyperosmolar

coma, and diabetic coma are examples of acute complications. Damage to blood vessels occurs when there is a prolonged increase in blood glucose levels, which is a chronic consequence.

In ancient medical systems, herbal pharmaceuticals with antidiabetic action have been praised for their therapeutic qualities, but they have not yet been commercially manufactured as contemporary medications. Since numerous plants and substances derived from plants have been used to treat diabetes, the plants offer a potential source of hypoglycemic medications.

Numerous Indian plants have been studied for their potential benefits in treating various forms of diabetes, with findings published in a number of scholarly journals. Many plants are utilized as herbal remedies for diabetes in Ayurveda and other traditional medical systems. medicines. Because they are inexpensive and have fewer adverse effects, they are therefore valuable as alternative medicine.□

## Diabetes ands its significance

Diabetes is a long-term metabolic disease of the lipid, protein, and carbohydrate metabolism that is characterized by elevated postprandial blood sugar and increased fasting. By 2025, the anticipated prevalence of diabetes worldwide would rise from 4% in 1995 to 5.4%. WHO has anticipated that The majority of the load will fall on developing nations. Over the past ten years, research carried out in India has demonstrated that not only is diabetes prevalence high, but it is also rising

quickly among the urban population. In India, the number of adults with diabetes is thought to reach 33 million. By 2025, this figure is probably going to rise to 57.2 million. A complicated metabolic condition called diabetes mellitus is brought on by either insulin malfunction or deficiency. Due to a deficiency of beta cells, insulin is insufficient, which results in type I diabetes (insulin dependent). Individuals with this condition are consequently entirely reliant on external sources of insulin, whereas those with Type II diabetes (insulin independent) are not responsive to insulin and can be

managed with dietary modifications, physical activity, and medication. Type II diabetes is the more common form of diabetes constituting 90% of the diabetic population. Symptoms for both diabetic conditions may include: (i) high levels of sugar in the blood; (ii) unusual thirst; (iii) frequent urination; (iv) extreme hunger and loss of weight; (v) blurred vision; (vi) nausea and vomiting; (vii) extreme weakness and tiredness; (viii) irritability, mood changes etc. Though pathophysiology of diabetes remains to be fully understood, experimental evidences suggest the involvement of free radicals in the pathogenesis of diabetes. and more importantly in the development of diabetic complications. Free radicals are capable of damaging cellular molecules, DNA, proteins and lipids leading to altered cellular functions. Many recent studies reveal that antioxidants capable of neutralizing free radicals are effective in preventing experimentally induced diabetes in animal

models. as well as reducing the diabetic complication.

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## CLASSIFICATION OF DIABETES

In 1997, the American Diabetes Association published updated diabetes diagnostic guidelines and classification standards. The diagnosis of impaired glucose tolerance and impaired fasting glucose was added to these criteria in 2003.

### Type 1 diabetes

This type of diabetes is caused by immunological β-cell death that is mediated by cells, wh3ich typically results in complete loss of insulin production. While type 1 diabetes is typically diagnosed

in childhood and teenagers, research has shown that 15–30% of cases are diagnosed after the age of thirty. The death of β-cells in this older group of type 1 patients happens more gradually than in children, and symptoms appear less suddenly. This illustrates how patients may experience varying rates of cellular breakdown in terms of both pace and degree.Patients with type 1 diabetes who have insulinopenia require exogenous insulin to maintain their vitality. These people get potentially fatal ketoacidosis when they are not receiving insulin.

There are markers of autoimmune damage that can be used to evaluate risk or make a diagnosis. These include glutamic acid decarboxylase, antibodies to insulin, and islet cells. as well as IA-2b and IA-2 tyrosine phosphatase 2. When type 1 diabetes is diagnosed, one or more of these antibodies may be found in 85–90% of patients. Strong connections between the DQA, DQB, and DRB genes and human leukocyte antigens predispose people to type 1 diabetes. Type 1 diabetes concordance in monozygous twins ranges from 30% to 50%. As part of the polyglandular autoimmune syndrome, these patients are also susceptible to other autoimmune diseases, including vitiligo, celiac sprue, Hashimoto's thyroiditis, Graves disease, autoimmune hepatitis, myasthenia gravis, and pernicious anemia. There are markers of autoimmune damage that can be used to evaluate risk or make a diagnosis. These include glutamic acid decarboxylase, antibodies to insulin, and islet cells. as well as IA-2b and IA-2 tyrosine phosphatase 2. When type 1 diabetes is diagnosed, one or more of these antibodies may be found in 85–90% of patients. Strong connections between the DQA, DQB, and DRB genes and human leukocyte antigens predispose people to type 1 diabetes. Type 1 diabetes concordance in monozygous twins ranges from 30% to 50%. As part of the polyglandular autoimmune syndrome, these patients are also susceptible to other autoimmune diseases, including vitiligo, celiac sprue, Hashimoto's thyroiditis, Graves disease, autoimmune hepatitis, myasthenia gravis, and pernicious anemia.

### Type 2 diabetes

Noninsulin-dependent diabetes was the prior term used to describe this type of the disease. Insulin resistance, which modifies the target cells' usage of endogenously produced insulin, is now recognized as a feature of type 2 diabetes patients. Patients with type 2 have changed insulin in addition to output. Hyperinsulinemia is a result of elevated insulin production in many people, particularly in the early stages of the disease.

However, autoimmune destruction of β cells does not occur, and patients retain the capacity for some insulin production. This decreases the incidence of ketoacidosis in people with type 2 diabetes compared to those with type 1, but ketoacidosis can occur in association with the stress of another illness such as an infection. Type 2 is the form of diabetes present in 90–95% of patients with the disease. At the beginning of the disease and often throughout their lifetime, these individuals do not need insulin treatment to survive. The primary abnormality is insulin resistance and the b-cell dysfunction arises from the prolonged, increased secretory demand placed on them by the insulin resistance. Insulin secretion is defective in these patients and insufficient to compensate for insulin resistance. They can remain undiagnosed for many years because the hyperglycemia appears gradually and many times without symptoms. Most patients with this form of diabetes are obese or may have an increased percentage of body fat distributed predominantly in the abdominal region. Adipose tissue plays an important role in the development of insulin resistance. Elevated circulating levels of free fatty acids derived from adipocytes have been demonstrated in numerous insulin resistance states. Free fatty acids contribute to insulin resistance by inhibiting glucose uptake, glycogen synthesis, and glycolysis, and by increasing hepatic glucose production.

Although insulin resistance is rarely returned to normal, it may improve with weight loss and/or

medication therapy. Apart from the significant hereditary susceptibility, which remains unclear, the

likelihood of contracting this type of diabetes increased with advancing age, obesity, a history of gestational diabetes, and inactivity.

### Gestational diabetes mellitus

Gestational diabetes mellitus is defined as glucose intolerance, which is first recognized during

pregnancy. It complicates 4% of all pregnancies in the U.S., resulting in 135,000 cases annually. The prevalence may range from 1% to 14% of pregnancies, depending on the population studied. G3esta

tional diabetes mellitus represents nearly 90% of all pregnancies complicated by diabetes; it usually has its onset in the third trimester of pregnancy and adequate treatment will reduce perinatal morbidity. Risk assessment for gestational diabetes mellitus should be performed at the first prenatal visit. Women at high risk are those older than 25 years of age, with positive family history of diabetes, previous personal history of gestational diabetes mellitus, marked obesity, and members of high-risk ethnic groups like African- Americans, Indians. They should get another screening in 24– 28 weeks if the first one turns up negative results. The first screening should be done at 24–28 weeks for women who are at average risk. After the pregnancy ends, the lady should take an oral glucose supplement for at least six weeks. Reclassified after passing a tolerance test. After giving birth, the majority of women with gestational diabetes mellitus regain normal blood sugar levels; although, having a history of the condition significantly raises the chance of acquiring type 2 diabetes in the future. The diagnosis of gestational diabetes mellitus may indicate a previously undiagnosed diabetic disease, the pregnancy-induced emergence of a compensated metabolic imbalance, or the direct metabolic result of hormonal changes. Hypertensive disorders are more common in women with gestational diabetes mellitus; also, there is a higher chance of fetal congenital defects, stillbirth, macrosomia, Respiratory collapse syndrome, polycythemia, hypoglycemia, jaundice, and hypocalcemia.

## OTHER SPECIFIC TYPES OF DIABETES

1. Genetic defects of the β cell

These disorders are linked to b-cell function abnormalities that are monogenetic. Hyperglycemia typically manifests before the age of 25. Known as maturity-onset diabetes of the young, these conditions are defined by decreased insulin secretion with little to no abnormalities in the way insulin acts. There is an autosomal dominant pattern to the inheritance of these abnormalities.

1. Genetic defects in insulin action

These are abnormalities associated with mutations of the insulin

receptor and may range from hyperinsulinemia and modest hyperglycemia to severe diabetes. Some individuals with these mutations may have acanthosis nigricans. Women may be virilized (development of male sex characteristics in a female) and have enlarged, cystic ovaries.

1. Diseases of the exocrine pancreas

Any process that diffusely injures the pancreas can cause diabetes. Acqu3ired

processes include pancreatitis, trauma, infection, pancreatectomy, and pancreatic carcinoma. Also included in this type are cystic fibrosis and hemochromatosis.

1. Drug- or chemical-induced diabetes

This form of diabetes occurs with drugs or chemicals that affect insulin secretion, increase insulin resistance or permanently damage pancreatic b cells. A commonly encountered example is the patient taking long-term or high-dose steroid therapy for autoimmune diseases or post-organ transplantation, which can result in steroid-induced diabetes.

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## MEDICINAL PLANTS WITH ANTIDIABETIC AND RELATED BENEFICIAL PROPERTIES

It is often known that traditional medicine and medicinal plants are used as the standard base for maintaining good health in the majority of developing nations. Numerous herbal treatments for diabetes and its consequences are recommended. Herbal remedies constitute the primary components of these mixtures. There have been reports of antidiabetic properties in a variety of plant families.

1. Momordica charantia ( Family Curcurbiceae)

Momordica charantia, also known as bitter gourd, is a medicinal plant used in the Ayurvedic system of medicine for treating a variety of illnesses, including diabetes mellitus. Today, unripe fruits, seeds, and aerial parts of the plant are used widely as vegetable and phytomedicine in various parts of the world to treat diabetes. Sodium orthovanadate is a well-known insulin mimetic and an antidiabetic compound. The results of a study suggested that Momordica fruit extract and sodium orthovanadate exhibit hypolipidemic as well as hypoglycemic effect in diabetic rats. A hypoglycemic peptide, polypeptide-p, has been isolated from Momordica charantia fruit, seeds, and

tissue. Studies were conducted to assess Momordica charantia's impact on type II diabetic patients' glucose tolerance.M. charantia is frequently referred to as a vegetable insulin. Administration of aqueous extract (AE), methanol fraction (MF), or methanol insoluble fraction (MIF) each significantly decreases plasma glucose levels at 30 min as compared with control, according to an oral sucrose tolerance test. Furthermore, following MF administration, the plasma insulin level drops at 30 minutes compared to the control group in the oral sucrose tolerance test. These findings show that bitter melon inhibits α-glucosidase activity, which in turn reduces postprandial hyperglycemia. In both normal and STZ diabetic rats, ethanolic extracts of M. charantia (200 mg/kg) demonstrated antihyperglycemic and hypoglycemic effects.

1. Emblica officinalis (Family: Euphorbiaceae)

Various solvent extracts of E. officinalis function as inhibitors of α-amylase and α-glucosidase. Significant anti-diabetic action further supports these extracts' potential as a treatment for diabetes. Low density oxidation is strongly inhibited by methanol extract .lipoprotein (LDL) in vitro measurements.

1. Pterocarpus marsupium (Family: Fabaceae)

The Indian Kino Tree, or Pterocarpus marsupium, is a moderate- to large-sized deciduous tree that is

primarily found in mountainous regions of India. Dogs that consumed the wood of this shrub 3

developed hypoglycemia due to a substance called pterostilbene.

shown that the extract's hypoglycemic action is caused by the presence of tannates. There is evidence that the flavonoid fraction derived from Pterocarpus marsupium induces β cell regranulation in the pancreas. This plant's marrupin, pterosupin, and liquoricegenin all exhibited

antihyperlipidemic properties. Its active ingredient, epicatechin, has been shown to be insulinogenic, increasing the release of insulin and the in vitro conversion of proinsulin to insulin. Epicatechin promotes fat cells' uptake of oxygen similarly to insulin and tissue slices from different organs, raises the rat diaphragm's glycogen level in a dose-dependent way.□

1. Trigonella foenum graecum (Family: Fabaceae)

It is widely distributed throughout India, and one of the main ingredients in most Indian spices is fenugreek seeds. In both rats and humans, isolated islet cells released more insulin in response to glucose stimulation when 4-hydroxyleucine, a novel amino acid derived from fenugreek seeds, was added. Oral administration of 2 and 8 g/kg of plant extract produced dose dependent decrease in the

blood glucose levels in both normal as well as diabetic rats.

Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also lowered hepatic and renal glucose-6- phosphatase and fructose –1,6-biphosphatase activity.

This plant exhibits antioxidant properties as well.

1. Mangifera indica ( Family :Anacraceae)

Nigerian traditional medicine uses the leaves of this plant as an antidiabetic agent, despite the fact that oral administration of an aqueous extract did not change blood glucose levels in normoglycemic or diabetic rats produced by streptozotocin. Nonetheless, when the extract and glucose were given to the rats at the same time, as well as when the extract was given to them 60 minutes before the glucose, antidiabetic effect was observed. The results reveal that aqueous extract of Mangifera indica possess hypoglycemic action. This could be the result of a decrease in intestinal glucose absorption.

1. Ocimum sanctum (Family :Lamiaceae)

Most people refer to it as Tulsi. This herb has long been recognized for its therapeutic qualities. Ocimum sanctum leaf aqueous extract demonstrated the notable decrease in blood sugar levels in rats with diabetes caused by alloxan as well as normal rats. Tulasi has been shown to have hypoglycemic and hypolipidemic effects in diabetic rats based on significant reductions in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride, and total lipid levels.

[49] When a plant extract (200 mg/kg) was taken orally for 30 days, the plasma glucose level dropped by about 9.06 and 26.4% on days 15 and 30, respectively. Skeletal muscle and hepatic glycogen levels fell by 68 and 75%, respectively, but the quantity of glycogen in the kidneys rose tenfold.

1. Achyranthes aspera (Family: Amaranthaceae)

It is found all throughout the tropical world. Both normal and diabetic rabbits experience a notable dose-related hypoglycemia response when given A. aspera powder orally. Additionally, the methanol and water extracts lower blood glucose levels in both normal and

rabbits with diabetes treated with alloxan. At oral quantities of up to 8 g/kg, there are no negative effects or side effects from this folk remedy, according to a rabbit investigation on acute toxicity. The plant could take action by giving the β-cells essential nutrients including calcium, zinc, magnesium, manganese, and copper.

1. Salacia reticulate (Family: Celastraceae)

The results suggest that the water extract of S. reticulata leaves could be a useful food material for the prevention of diabetes and obesity because of its multiple effects. Supplementing 0.01 % solution of the extract as drinking water prevents the elevation of the plasma glucose level and intestinal α-glucosidase activities in type 1 diabetic mice. This treatment also prevents the elevation of the plasma, pancreatic, and kidney lipid peroxide levels, lowering of the plasma insulin level, and elevation of the kidney aldose reductase activities in diabetic mice.

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1. Acacia arabica (Family: Fabaceae)

It is mostly found in its natural habitat, which is all over India. The plant extract functions as a secretagouge to release insulin, which is how it reduces blood sugar levels. It causes hypoglycemia in rats that are not alloxanized, but it does in control rats. powdered Acacia arabica seeds when given in (2), (3), and (4) g/kg body weight) given healthy rabbits caused the pancreatic beta cells to produce insulin, which resulted in a hypoglycemic effect.

1. Phyllanthus amarus (Family: Euphorbiaceae)

It's a 60 cm tall herb belonging to the Euphorbiaceae family. It goes by the name Bhuiamala. It is dispersed over the hotter regions of India, primarily the Deccan, Konkan, and southern states. It has historically been applied to diabetes treatments. Methanolic extract from

It was shown that Phyllanthus amarus exhibited strong antioxidant properties. In rats with alloxanized diabetes, this extract also lowered blood sugar levels. In addition, the plant exhibits anti- inflammatory, anti-mutagenic, anticarcinogenic, and antidiarrheal properties.

1. Tinospora cordifolia (Family: Menispermaceae)

It is a big, deciduous climbing shrub that belongs to the Menispermaceae family. It is glabrous. It is sometimes referred to as Guduchi and is extensively available throughout India. After taking the Tinospora cordifolia (T. cordifolia) root extract orally for six weeks, there was a notable decrease in lipids in serum and tissues, as well as in blood and urine glucose levels in rats with alloxan diabetes.

Additionally, the extract stopped the body weight from dropping.

In Indian ayurvedic medicine, T. cordifolia is frequently used to treat diabetes type.Blood glucose and brain lipids were significantly reduced in alloxan diabetic rats when an aqueous T. cordifolia

root extract was given orally.

1. Aloe vera (Family: Xanthorrhoeaceae )

Aloe vera gel is the leaf pulp or mucilage of the plant; aloe latex, also known as "aloe juice," is a bitter-yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Aloe gum extracts have been shown to effectively increase glucose tolerance in both normal and diabetic rats. Aloe is a popular houseplant with a long history of use as a multipurpose folk remedy.

In diabetic rats, both acute and long-term administrations of the bitter principle exhibited a hypoglycemic impact. Aloe vera works by stimulating the creation and/or release of insulin from pancreatic beta cells, which is the bitter principle of the plant. This herb also promotes wound healing in diabetic mice and exhibits dose-dependent anti-inflammatory properties.

1. Azadirachta indica (Family: Meliaceae )

This plant's hydroalcoholic extracts demonstrated antihyperglycemic activity in rats treated with streptozotocin; this effect is attributed to increased glucose absorption and glycogen deposition in the hemidiaphragm of isolated animals. This plant contains anti-bacterial, antimalarial, antifertility, hepatoprotective, and antioxidant properties in addition to its anti-diabetic action.

1. Spergularia purpurea (Family: Caryophyllaceae)

When administered at a dose of 10 mg/kg, the aqueous extract significantly lowers blood glucose levels in both normal and diabetic rats. Because basal plasma insulin may have an extra-pancreatic effect, this hypoglycemic effect could be caused by the aqueous extract of SP. concentrations do not alter following SP therapy. This indicates that endogenous glucose synthesis in mice is inhibited by aqueous extract perfusion of SP.

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1. Lagerstroemia speciosa ( Family: Lythraceae)

Blood glucose levels are significantly reduced when L. speciosa is standardized to 1% corosolic acid (Glucosol) and given daily dosages of 32 and 48 mg for two weeks. When taken as a soft gel capsule, glucosesol reduces blood glucose levels by 30% as opposed to 20%.

compared to a hard gelatin capsule formulation loaded with dry powder, indicating that the soft gel formulation has a higher bioavailability.

## SYNTHETIC DRUGS AND HERBAL MEDICINE

The sole condition for which oral hypoglycemic medications are prescribed is type 2 diabetes, a condition marked by an inability to use released insulin. Insulin is necessary for the treatment of type 1 diabetes since it is absent in the patient. Today, there are four categories of hypoglycemic medications These medications are

Only those with type 2 diabetes are permitted to use them, and those who have not improved with diet, exercise, or weight loss do so. For the treatment of diabetic pregnant women, they are not authorized. The most popular medications for treating type 2 diabetes are sulfonylureas, which work

by presumably increasing the secretion of insulin.

Although there is little clinical significance to these extra-pancreatic effects of sulfonylureas, one of them could be an increase in tissue sensitivity to insulin. Within the biguanide class of oral antidiabetic medications is metformin. It is the primary medication.

preferred for the management of type 2 diabetes, especially in individuals who are overweight or obese and have normal renal function. Only when insulin is present does it work. However, it doesn't directly increase insulin secretion like sulfonylureas do. The main outcome is a greater response to insulin. The inhibition of the liver's production of glucose seems to be one significant impact.

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## HERBAL DRUG FORMULATIONS

On the recommendation of their doctors, diabetic patients regularly utilize a variety of formulations that are available on the market. The "Himalaya" brand of diabetes is said to improve B cell repair, raise hepatic and muscle glucagon levels, and improve peripheral glucose consumption. and renewal as well as raising the level of C peptide. It shields B cells from oxidative stress and possesses antioxidant qualities. By lowering the amounts of glycocylated hemoglobin, restoring normalcy to microalbuminuria, and adjusting the lipid profile, it mimics the effects of

insulin. Long-term problems from diabetes are reduced. Epicatechin, a benzopyran, is the active ingredient in epinsulin, which is sold by Swastik Formulations. Epicatechin raises the islet's cAMP concentration, which is linked to a rise in insulin release. It contributes to the proinsulin to insulin conversion by an increase in cathepsin activity. It also inhibits the activity of Na/K ATPase from patient erythrocytes and has an insulin-mimetic effect on the osmotic fragility of human erythrocytes. It heals neuropathy, retinopathy, and problems with fat and glucose metabolism. It preserves the integrity of every organ system compromised by the illness. In order to lower the amount of insulin required, it is said to be a good adjuvant for Insulin Dependent Diabetes Mellitus

(IDDM) and a cure for Non Insulin Dependent Diabetes Mellitus (NIDDM).It is known to prevent diabetic complications and is recommended in conjunction with current oral hypoglycemic medications. It does not increase the risk of hypoglycemia because of its mild hypoglycemic action. Pancreas Tonic (Ayurvedic herbal supplement): Currently offered as a nutritional supplement, Pancreas Tonic is a botanical blend of traditional Indian Ayurvedic herbs. Powdered bitter gourd

sold under the Garry and Sun brands. It reduces sugar levels in the blood and urine. It cleanses blood and strengthens the body's defenses against illnesses. The bitter gourd has several beneficial med3ical properties. It has laxative, stomachic, antibilious, antipyretic, and appetizing properties. Native

African and Asian remedies also contain bitter gourd. In particular, bitter gourd is utilized as a folk remedy for diabetes. It contains substances such as alkaloids, saponins, and bitter glycosides. lowering sugars, oils, polypeptides, sterols, phenolics, free acids, and 17 amino acids, including methionine. It also produces a crystalline substance called p-insulin. Along with being antihaemorrhoidal, astringent, stomachic, emmenagogue, hepatic stimulant, anthelmintic, and blood purifier, it is also said to have hypoglycemic action.

## CONCLUSION

Diabetes is a serious metabolic disorder that is being made worse by differences in social structure, psychological stress, obesity, hormonal imbalance, and heredity. Currently, the main treatment for diabetes is a sustained reduction in hyperglycemia with the help of insulin and other medications such as biguanides, thiazolidinediones, sulphonylureas, D-phenylalanine derivatives, meglitinides, and α-glucosidase inhibitors. Nevertheless, the effectiveness of these medications is debatable due to unwanted side effects, and there is a need for new compounds to treat diabetes. Consequently, plants have been proposed as a rich, unexplored source of potentially helpful antidiabetic drugs.

However, because there aren't many available in vitro assays that are based on mechanisms, only a small number have been the focus of thorough scientific research. These initiatives might cure everyone and validate the use of novel, traditional medicinal herbs with potential anti-diabetic effects.

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**ACKNOWLEDGMENTS**

# Authors are thankful to Hon’ble Vice chancellor, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed to be University), Allahabad.□

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# Lat., 26:291–300.□

**ERRATA**