



# COMPARATIVE STUDY ON MEDICINAL HERBAL PLANTS AND ALLOPATHIC DRUGS USED TO TREAT DIABETES MELLITUS

**Mohammad Rashid Ansari, Dr. Rajendra Singh Bapna and Dr. Karunakar Shukla**

Department of Pharmacy,

Dr. A. P. J. Abdul Kalam University, Indore (M.P.) - 452010, India

Corresponding Author Email : rashid22407@gmail.com

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## **ABSTRACT**

Diabetes mellitus is a chronic metabolic disorder characterized by high blood glucose levels resulting from impaired insulin production or insulin resistance. The management of diabetes requires a multimodal approach, including lifestyle modifications, medication, and monitoring. In recent years, there has been a growing interest in the use of medicinal herbal plants as complementary or alternative therapies for diabetes management. This research paper aims to provide a comprehensive review of the medicinal herbal plants and allopathic drugs used in the treatment of diabetes mellitus, their mechanisms of action, and the supporting scientific evidence.

**Keywords:** Insulin, Diabetes Mellitus, Allopathic drugs, Medicinal, Herbal plants

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## **I. INTRODUCTION**

Diabetes mellitus has become a global health concern, with an increasing prevalence and significant impact on morbidity and mortality. Allopathic drugs, such as oral hypoglycemic agents and insulin, have been the mainstay of diabetes treatment. However, due to the limitations and potential side effects associated with these drugs, there is a rising interest in exploring alternative treatment options, including medicinal herbal plants. Herbal plants have been used for centuries in traditional medicine systems to manage various ailments, including diabetes. Understanding the scientific evidence behind the use of these herbal plants is crucial for their integration into modern diabetes management strategies.

Medicinal herbal plants offer a holistic approach to diabetes management, as they contain bioactive compounds that can target multiple aspects of glucose regulation. They have the potential to improve insulin sensitivity, enhance glucose uptake, stimulate insulin secretion, and provide antioxidant and anti-inflammatory effects. However, the scientific evidence supporting the efficacy of herbal plants is often limited, with variations in study quality and

inconsistencies in outcomes. Standardization and quality control of herbal products also present challenges, as variations in plant species, cultivation conditions, and extraction methods can affect the therapeutic effects and safety of these plants.

On the other hand, allopathic drugs have undergone rigorous clinical trials and regulatory scrutiny, establishing their efficacy, safety, and standardized dosages. These drugs directly target specific aspects of glucose regulation, such as increasing insulin secretion, improving insulin sensitivity, or reducing hepatic glucose production. They have well-documented benefits in glycemic control and reducing the risk of diabetic complications. However, allopathic drugs may have side effects, such as hypoglycemia, gastrointestinal issues, weight gain, or cardiovascular risks, which need to be carefully monitored.

Integration of herbal plants with allopathic drugs can be complex and requires close monitoring due to potential herb-drug interactions. While some studies suggest potential synergistic effects and improved glycemic control with the combination of herbal plants and allopathic drugs, more research is needed to establish the safety and efficacy of such integrative approaches. Healthcare professionals play a crucial role in guiding patients in the integration of these treatment options, taking into consideration the individual patient's needs, preferences, and potential risks.

## II. ALLOPATHIC DRUGS TO TREAT DIABETES MELLITUS

Allopathic drugs, including oral hypoglycemic agents and insulin, play a crucial role in the management of diabetes mellitus. These drugs have been extensively studied and are widely prescribed to control blood glucose levels and prevent complications associated with diabetes.

Metformin, a first-line medication for type 2 diabetes, works by reducing hepatic glucose production, enhancing insulin sensitivity, and improving glucose uptake in peripheral tissues. It is known to effectively lower blood glucose levels and has shown benefits in reducing cardiovascular risks in diabetic patients.

Sulfonylureas, such as glipizide and glyburide, stimulate insulin secretion from pancreatic beta cells, thereby increasing insulin levels in the body. They are commonly used in patients with type 2 diabetes who have adequate pancreatic function. However, these drugs carry a risk of hypoglycemia and may cause weight gain.

Insulin therapy is essential for individuals with type 1 diabetes and is often required for some patients with type 2 diabetes who cannot achieve glycemic control with oral medications alone. Insulin therapy aims to mimic the physiological secretion of insulin and helps regulate blood glucose levels. It can be administered through multiple daily injections or insulin pumps, offering flexible and personalized treatment options.

Other classes of allopathic drugs used in diabetes management include thiazolidinediones (TZDs), dipeptidyl peptidase-4 (DPP-4) inhibitors, sodium-glucose cotransporter-2 (SGLT2)

inhibitors, and glucagon-like peptide-1 receptor agonists (GLP-1 RAs). These medications work through different mechanisms, such as enhancing insulin sensitivity, increasing insulin secretion, or inhibiting glucose reabsorption in the kidneys.

Allopathic drugs for diabetes treatment have undergone rigorous clinical trials and are backed by substantial scientific evidence. They are prescribed based on individual patient characteristics, including diabetes type, disease severity, comorbidities, and patient preferences. However, it is important to note that these drugs may have side effects, including hypoglycemia, weight gain, gastrointestinal issues, or cardiovascular risks, and their use should be closely monitored by healthcare professionals.

**Table 1: Allopathic preparations, mechanism of actions and their adverse effects**

Class	Generic name and brand name	Mechanism of action	Adverse effects
Sulfonylureas	Gliclazide (Diamicon MR) Glimepiride (Amaryl) Glyburide (Diaβeta)	Stimulate the pancreas to produce more insulin	Hypoglycaemia (low blood sugar)
Meglitinides	Metformine (Glucophage) Metformine extended-release (Glumetza)	Reduce the production of glucose by the liver	Diarrhoea, metallic aftertaste, nausea
Thiazolidinediones (TZD)	Pioglitazone (Actos) Rosiglitazone (Avandia)	Increase insulin sensitivity of the body cells and reduce the production of glucose by the liver	Swelling due to water retention, weight gain Pioglitazone: increased risk of bladder cancer Rosiglitazone: increased risk of non-fatal heart attack
Alpha-glucosidases inhibitor	Acarbose (Glucobay)	low the absorption of carbohydrates (sugar) ingested	Bloating and flatulence (gaz)
Dipeptidyl-peptidase- 4 (DPP-4) inhibitors	Linagliptine (Trajenta) Saxagliptine (OnglyzaMC) Sitagliptine (Januvia) Alogliptine (Nesina)	Intensify the effect of intestinal hormones (incretines) involved in the control of blood	Pharyngitis, headache

		sugar	
Glucagon-like peptide-1 (GLP-1) agonist	Exenatide extended-release (Bydureon) Liraglutide (Victoza) Dulaglutide (Trulicity)	Mimic the effect of certain intestinal hormones (incretines) involved in the control of blood sugar	Nausea, diarrhoea, vomiting
Sodium glucose co-transporter -2 (SGLT-2) inhibitors	Canagliflozine (Invokana) Dapagliflozine (Forxiga) Empagliflozine (Jardiance)	Help eliminate glucose in the urine	Genital and urinary infections, more frequent urination

### III. MEDICINAL HERBAL PLANTS FOR THE TREATMENT OF DIABETES MELLITUS

Medicinal herbal plants have been utilized for centuries in traditional medicine systems for the treatment of various ailments, including diabetes mellitus. These plants offer a potential alternative or complementary approach to conventional allopathic drugs for managing diabetes. Several medicinal herbal plants have shown promising effects in improving glycemic control, insulin sensitivity, and reducing diabetic complications.

One notable plant is *Gymnemasylvestre*, commonly known as Gurmar or the "sugar destroyer." *Gymnema* extract has been reported to exhibit anti-diabetic properties by stimulating insulin secretion, enhancing glucose uptake, and inhibiting glucose absorption in the intestine. It may also help reduce cravings for sweet foods, thereby assisting in weight management.

*Momordicacharantia*, also known as bitter melon or bitter gourd, is another medicinal plant widely used in traditional medicine for its anti-diabetic properties. It contains bioactive compounds that have demonstrated hypoglycemic effects by increasing insulin secretion, improving glucose utilization, and reducing insulin resistance. Bitter melon extract may also have antioxidant and anti-inflammatory properties, which can potentially alleviate diabetic complications.

*Trigonellafoenum-graecum*, commonly known as fenugreek, has been recognized for its hypoglycemic effects. Fenugreek seeds and leaves contain soluble dietary fibers and bioactive compounds that help regulate blood glucose levels by slowing down carbohydrate digestion and absorption. Fenugreek may also enhance insulin sensitivity and stimulate glucose uptake in peripheral tissues.

Ocimum sanctum, or holy basil, is revered in Ayurvedic medicine for its medicinal properties. Holy basil extract has demonstrated anti-diabetic effects by lowering blood glucose levels, improving insulin secretion, and reducing oxidative stress. It may also possess anti-inflammatory properties, which can be beneficial for diabetic individuals as chronic inflammation is associated with diabetes complications.

Other medicinal herbal plants used for diabetes management include Cocciniaindica (ivy gourd), Allium cepa (onion), Aloe vera, and Cinnamomumverum (cinnamon). These plants contain various bioactive compounds that contribute to their anti-diabetic properties, such as enhancing insulin sensitivity, stimulating glucose uptake, and protecting pancreatic beta cells.

While medicinal herbal plants show promise in diabetes management, it is important to note that further research is needed to establish their efficacy, safety, and optimal dosages. Standardization of herbal preparations and rigorous clinical trials are necessary to validate their therapeutic potential and ensure their integration into evidence-based diabetes treatment protocols. Additionally, healthcare professionals should consider potential herb-drug interactions and individual patient characteristics when recommending herbal treatments for diabetes mellitus.

**Table 2: WHO has listed 15 medicinal herbal plants used in treatment of diabetes mellitus**

Scientific name	Common name	Family	Mechanism of action
Allium sativum	Garlic	Liliaceae	Improve plasma lipid metabolism and plasma antioxidant activity
Trigonella foenum graecum	Fenugreek	Fabaceae	Stimulate the secretion of insulin, reduce insulin resistance and decrease blood sugar levels
Aloe barbadensis	Aloe vera	Asphodelaceae	Improvement in impaired glucose tolerance
Tinospora cordifolia	Guduchi, gulvel	Menispermaceae	Decrease of glycaemia and brain lipids
Allium cepa	Onion	Liliaceae	Stimulating the effects on glucose utilization and antioxidant enzyme
Cinnamomum cassia	Cinnamon	Lauraceae	Increases the sensitivity of insulin receptor
Zingiber officinalis	Sunth	Zingiberaceae	Increases the insulin level

Carica papaya	Papaya	Caricaceae	Lowered fasting blood sugar, triglyceride, total cholesterol
Gymnemasylvestre	Gymnema, gudmar	Apocynaceae	Increase the serum G-peptide level which monitor the release of endogenous insulin
Azadirachtaindica	Neem	Meliaceae	Glycogenolytic effect due to epinephrine action was blocked
Eugenia jambolana	Jamun	Myrtaaceae	Inhibited insulinase activity from liver and kidney
Mangiferaindica	Mango	Anacardiaceae	Reduction in the intestinal absorption of glucose
Momordicacharantia	Bitter gourd, melon	Cucurbitaceae	Activate PPARs alpha, y and lower the plasma apobeta-100 in mice fed with high fat diet
Ocimum sanctum	Holy basil, tulsi	Lamiaceae	Increased insulin release
Brassica juncea	Mustard	Brassicaceae	Increased activity of glycogen synthetase

#### IV. COMPARING MEDICINAL HERBAL PLANTS AND ALLOPATHIC DRUGS TO TREAT DIABETES MELLITUS

Medicinal herbal plants and allopathic drugs are two different approaches to treating diabetes mellitus. Here is a comparison of these two treatment options:

##### Mechanism of Action

Herbal plants contain bioactive compounds that can influence glucose metabolism, insulin secretion, and insulin sensitivity. They may act through multiple mechanisms, such as enhancing glucose uptake, stimulating insulin production, reducing insulin resistance, and providing antioxidant and anti-inflammatory effects.

Allopathic drugs, such as oral hypoglycemic agents and insulin, are designed to directly target specific aspects of glucose regulation. They work by either increasing insulin secretion, improving insulin sensitivity, reducing hepatic glucose production, or enhancing glucose uptake in peripheral tissues.

### **Scientific Evidence**

While there is a long history of traditional use and anecdotal evidence supporting the efficacy of medicinal herbal plants, the scientific evidence is often limited and varies in quality. Some herbal plants, such as *Gymnemasylvestre* and *Momordicacharantia*, have been studied more extensively, with clinical trials and meta-analyses suggesting potential benefits in glycemic control. However, more high-quality research is needed to establish their effectiveness and determine optimal dosages.

Allopathic drugs have undergone rigorous clinical trials and have a substantial body of scientific evidence supporting their efficacy and safety in diabetes management. They have well-defined dosages, established guidelines for use, and are regulated by health authorities.

### **Standardization and Quality Control**

Standardization and quality control of herbal products can be challenging due to variations in plant species, cultivation conditions, extraction methods, and formulation processes. Lack of standardization may result in inconsistent therapeutic effects and potential variability in safety and efficacy.

Allopathic drugs are manufactured through controlled processes, ensuring consistent quality, purity, and potency. They undergo stringent regulatory requirements, including clinical trials, to establish their safety and efficacy before being approved for use.

### **Safety and Side Effects**

Herbal plants are generally considered safe when used appropriately, but they can still carry the risk of adverse effects, herb-drug interactions, and allergic reactions. Additionally, the long-term safety and potential interactions with other medications may not be well-understood for all herbal plants.

Allopathic drugs have well-documented safety profiles, but they can also have side effects, such as hypoglycemia, gastrointestinal issues, weight gain, and cardiovascular risks. Healthcare professionals closely monitor patients using these drugs to minimize risks and adjust treatment as necessary.

### **Integration with Conventional Treatment**

Herbal plants are often used as complementary or adjunct therapies alongside allopathic drugs. Integrating herbal treatments requires careful consideration of potential herb-drug interactions and close monitoring of blood glucose levels and medication adjustments.

Allopathic drugs are the cornerstone of diabetes treatment and are commonly prescribed by healthcare professionals. They may be used as monotherapy or in combination with other drugs to achieve optimal glycemic control.

## V. CONCLUSION

In conclusion, the treatment of diabetes mellitus involves a multifaceted approach, and both medicinal herbal plants and allopathic drugs have their roles to play. Medicinal herbal plants offer the potential for alternative or complementary therapies, with their diverse bioactive compounds and holistic effects on glucose regulation. Medicinal herbal plants offer a holistic approach and potential benefits, but their scientific evidence and quality control need further development. Allopathic drugs, on the other hand, have well-established efficacy and safety profiles, but may carry side effects. Integrating herbal plants with allopathic drugs requires careful monitoring and further research. Ultimately, individualized treatment decisions should be made based on the patient's unique circumstances and in consultation with healthcare professionals.

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