



Investigating the Potential Benefits of Using Herbal Remedies for Diabetic Mellitus

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ABSTRACT

As the most prevalent endocrine illness, A major contributor to morbidity and death is diabetes mellitus. For the management and avoidance of long-term ailments, such as diabetes mellitus, traditional medical practices advocate for a range of natural treatments. The purpose of this mechanistic review is to draw attention to the importance of medicinal plants that have historically been used in Persian medicine as dietary supplements in addition to prohibited standard medications for the management and avoidance of diabetes mellitus.

KEYWORDS: Diabetes mellitus, Herbal drugs, Treatment, Drawbacks

INTRODUCTION:

Diabetes mellitus (DM) is a metabolic disease that causes persistent hyperglycemia. Its etiology may involve abnormalities in the secretion or action of insulin (1). One hormone that aids in blood sugar regulation is insulin. Uncontrolled diabetes causes hyperglycemia, or high blood sugar, which causes catastrophic damage to many of the body's systems, including the neurons and blood vessels, over time. Treating diabetes involves the use of several medications, However, due to their natural origins and few side effects, herbal medicines have seen an exponential surge in popularity in the last several years, both in developing and wealthy nations. Medicinal plants, minerals, and organic materials are the sources of many commonly used traditional medicines (2). In Indian medical systems, the majority of practitioners create and administer their own formulas. The World Health Organization (WHO) has compiled a list of 21,000 plants that are used medicinally worldwide. Of these, 2500 species are found in India, of which 150 are employed on a very substantial commercial scale. The world's largest producer of medicinal herbs is India, which is also known as the botanical garden of the world (3). This research focuses on herbal medicine formulations and plants used to treat diabetes mellitus, a major global health issue that causes enormous financial losses (4).

PATHOPHYSIOLOGY OF DIABETES MILLITUS:

Type 1 DM Pathophysiology of this autoimmune disorder is although not entirely understood ,it appear to be impacted by genetic and environment variables. The pace of development of pancreatic β -cells. In most cases, autoimmunity and the illness manifest quickly ,particularly in newborns and children(5).

Type 2 DM - Two main causes combine to induce Type 2 Diabetes Mellitus (T2DM), one of the most common metabolic disorders: insufficient insulin secretion by pancreatic β -cells and insufficient insulin sensitivity by insulin-sensitive tissues. The molecular mechanisms involved in insulin synthesis, release, and detection are strictly regulated since these processes are necessary for maintaining glucose homeostasis. Patients diagnosed with type 2 diabetes usually exhibit obesity or a greater percentage of body fat, mainly in the abdomen (6).

One illness that might develop during pregnancy and go away after delivery is gestational diabetes. Long term effects of intrauterine factors may contribute to the risk of obesity and type 2 diabetes in offspring born to female GDM patients(7).

CLASSIFICATION OF DIABETES MELLITUS:

Diabetes comes in three main forms:



- Type 1 or insulin dependent increased
- Type 2 or non-insulin dependent,
- Gestational diabetes.

DIABETES OCCURRENCE AND FACTORS:

In people with diabetes mellitus, the pancreas either cannot create enough insulin, either makes no insulin at all or produces ineffective insulin. Diabetes causes an abnormally high blood glucose level as a result. People with Type 1 Diabetes have a severe insulin deficit due to damage to the pancreatic cells that create insulin.

This is believed to be the outcome of an autoimmune reaction, in which the body targets and kills its own cells in the pancreas. Numerous theories and possible catalysts have been proposed, despite the fact that the precise cause of this event remains unknown. These include: The body's autoimmune response can be brought on by a number of things, such as an infection with a specific virus or bacteria, exposure to food-borne chemicals and early exposure to cow's milk, which is thought to include an ingredient that causes the reaction in young children. These, however, are merely theories and by no means establish reasons. It is thought that type II diabetes arises when:

- Insulin resistance occurs when the body's receptors, which ordinarily react to the action of insulin, stop being stimulated by it. This may cause the pancreas to create more insulin, which eventually wears down the cells that make insulin;
- There is just not enough insulin on the market; and
- It's possible that the available insulin is aberrant, which prevents it from functioning properly (8).

RISK FACTOR:

The incidence of diabetes mellitus has surged worldwide, leading to an intensified public health concern. The disease itself actually begins when many risk variables coincide. Genetics, environment, loss of the initial phase linked to the initiation of insulin release, sedentary lifestyle, lack of exercise, smoking, alcohol consumption, dyslipidemia, decreased. The main risk factors for prediabetes and DM are elevated glucagon activity, hyperinsulinemia, β -cell sensitivity, and hyperinsulinemia. A person's risk of developing Type II diabetes is increased by the following factors:

- Increasing age
- Obesity;
- Physical inactivity (8).

**CURRENT TREATMENT OF DIABETES:****HERBAL DRUGS**

Sr no	product	Drug	activity	Dosage	Industry
1	Diabecon	Vijaysar, Gurmar, Shilajit	promotes the production of insulin in the body.	1 tablet before meal	Himalaya
2	Pancreatic tonic 180 cp	Momardica charanthia, Pterocarpus marsupium, gymnema sylvestre	improved glucose control in type 2 diabetic patients with HbA(1c) levels between 10.0% to 12.0%	2 capsules 3 times per day for 3 months	ayurvedic herbal supplement
3	Bitter gourd Powder	Momardica charanthia	Acts as a vegetable insulin	1-12 grams for 16 weeks	Garry and Sun natural Remedies
4	Dia-care	Azadirachta indica(neem), emblica officinalis(amlam)	Helps maintain healthy blood sugar levels.	Before or after meal 3 gram	Admark Herbals Limited
5	Gurmar capsules	Gymnema sylvestre	It is useful in the management of diabetes due to its antioxidant and anti-inflammatory properties	1-2 capsules per day	Garry and Sun natural Remedies
6	Epinsulin	Vijaysar Momardica charanthia, methi, jamun, Gymnema sylvestre	Additionally it has an insulin-mimetic effect on osmotic fragility of human erythrocytes and it inhibits Na/K ATPase activity from patient's erythrocytes	-	Swastik Formulations
7	Syndrex	Fenugreek seeds	It is reported to have anti oxidant and anti diabetic property	-	Plethico Laboretaries

HOMEOPATHIC

Sr no	product	Drug	activity	Dosage	Industry
1	Abroma Augusta Mother Tincture	Abroma Augusta	attenuates diabetes induced nephropathy and cardiomyopathy via inhibition of oxidative stress and inflammatory response	3-5 drops of Abroma Augusta Dilution in half cup water three times a day	SBL.Pvt.Ltd
2	Syzygium Jambolanum Mother Tincture	Syzygium Jambolanum	decreases fasting blood glucose levels and improved carbohydrate metabolic key enzyme activities in hepatic tissue i.e., hexokinase, glucose-6-phosphate dehydrogenase and glucose-6-phosphatase	10 drops in half cup of water three times a day	SBL.Pvt.Ltd
3	Acid Phosphoric Dilution 200 CH		-	5 drops 3 times daily	Dr. Reckeweg & co
4	Gymnema Sylvestre Mother Tincture	Gymnema Sylvestre	It stimulates the insulin secretion from the pancreas and delay the glucose absorption from the blood.	15 drops three times a day till the symptoms disappears	SBL.Pvt.Ltd



ALLOPATHIC

Sr no	product	Drug	activity	Dosage	Industry
1	Precose	Acarbose	Prevents high blood sugar helps prevent kidney damage. Acarbose works in your intestine to slow the breakdown and absorption of carbohydrates from foods that we eat	Max dose shouldnot exceed 100 mg 3 times a day	Bayer healthcare pharmaceuticals
2	miglitol (glyset)	miglitol	It is an alpha-glucosidase inhibitor used to treat non-insulin dependent (Type II) diabetes mellitus. It works by decreasing the absorption of carbs so that blood sugar rises less after a meal.	should be taken orally three times a day at the start of each main meal	Pfizer
3	Glucovance tablets	Glucovance	Both metformin and gliburide are oral medications for diabetes that aid in blood sugar regulation. When used in conjunction with diet and exercise, glucovance helps persons with type 2 diabetes better control their blood sugar levels.	Twice daily with meals	Merck
4	Nesina	Alogliptin	Alogliptin is used with a proper diet and exercise program to control high blood sugar in people with type 2 diabetes	25 mg taken orally once daily	Takeda pharmaceuticals

Drawback of current treatment:

The limits of the diabetes medications available today, such as different drug responses among individuals, failure to achieve glycemic control, and adverse effects. Drugs like Metformin is eliminated via renal filtration, and a key worry when prescribing it relates to inadequate kidney function. When decreased renal function causes metformin excretion to decrease, Lactic acidosis is more likely to occur as blood concentrations of the medicine rise.

Two research studies examined adverse drug reactions (ADRs). The initial study concentrated on metformin, an antidiabetic medication, whereas the subsequent research investigated the antihyperglycemic drug category without specifying a particular drug. In one of the studies examining adverse drug reactions associated with a specific medication (metformin), it was discovered that 26.7% of the 101 participants suffered from diarrhea. Another study that looked at adverse drug reactions related to a particular drug category (antihyperglycemic) discovered that patients with type 2 diabetes mellitus (T2DM) accounted for 46.9% of 484 hypoglycemic episodes. Inhibitors of sodium glucose co transporters 2, such as Dapaglifozin and Canaglifozin, may dehydrate patients and increase the risk of genital tract and urinary tract infections. Alpha-glucosidase inhibitors like miglitol and acarbose may cause gastrointestinal issues and should be avoided in individuals with inflammatory bowel disease, multiple renal diseases, or hepatic disorders. Certain medications, such as exenatide and liraglutide, are linked to side effects like gastrointestinal discomfort, reduced appetite, weight loss, and potential severe pancreatitis.

SIGNIFICANCE OF HERBAL DRUG AND HOW DO TREAT DIABETES:

Over the past few decades, as more research has been done in the field of traditional medicine, plant-based pharmaceuticals that are safe, affordable, biocompatible, and environmentally friendly have come to the fore. Many writers have reviewed the literature on anti-diabetic herbal remedies; however, Atta-ar-Rahman's review, which lists over 300 plant species recognized for their hypoglycemic qualities, is the most enlightening. The review's plants have been grouped based on their botanical name, country of origin, constituents, and kind of active ingredient. The plant *Momordica charantia* is a member of the Cucurbitaceae family. The World Health Organization has listed 21,000 plants with global medicinal goals. Out of these, India is home to 2500 species, 150 of which are heavily exploited for commercial gain. Considered the world's botanical garden, India is the world's largest producer of medicinal plants.



HERBAL RESEARCH IN DIABETES:

There are various herbal researches done in antidiabetic activity. Table-1 shows some antidiabetic researches and their routes of administration (9)

Table-1

SCIENTIFIC NAME	FAMILY	PLACE OF STUDY	USED PARTS	ACTIVE INGREDIENT	MECHANISM OF ACTION	ROUTE
Acalypha godseffiana	Euphorbiaceae	Nigeria	Leaves	Flavonoids; Proanthocyanidins	Inhibits the α -glucosidase enzyme.	Oral
Amaranthus hybridus L.	Amaranthaceae	India	Leaves	Flavonoids, glycosides, terpenoids, saponins, alkaloids, tannins, and steroids.	Reduces the level of high glucose in the blood.	Oral
Angiopteris helferiana	Marattiaceae	Nepal	Rhizome	Lactones	Inhibited the enzyme α -glucosidase	Oral
Azadirachta indica	Meliaceae	Kenya	Leaf	Flavonoids; Tannins; Sterols; Saponins, Anthraquinones; Alkaloids	Hypoglycemic	Intraperitoneall.
Barleria prionitis	Acanthaceae	India	Leaf and root	Further studies are required.	Hypoglycemic	Oral
Cuminum cyminum	Apiaceae	Egypt	Seeds	Phenols; Flavonoids.	Anti-hyperglycemic Increased insulin sensitivity.	Oral

Novel carrier based approaches for drug delivery in Diabetes:

Novel drug delivery carrier systems that precisely and carefully transport antidiabetic drugs to the right location for a predetermined period of time in a regulated manner are being developed in an effort to increase therapeutic efficacy and, ultimately, improved control over diabetes mellitus. This paper outlines the ways in which studies, new technologies, and research have made a substantial contribution to the development of safe, efficient, and alternative diabetes treatment delivery methods in the near future.

Solid lipid nanoparticles, polymeric nanoparticles, niosomes, and liposomes are among the novel techniques that are covered and investigated in this review. Researchers exploring novel carriers filled with plant extracts as potential anti-diabetic medicines may find the review to be helpful. This offers a thorough summary of the most recent developments in carrier-based medication delivery techniques for diabetes. The objective of this review is to stimulate additional research and innovation towards personalized and precision diabetic therapies by clarifying the concepts, applications, and future prospects of innovative carrier systems (10).



CARRIER	ACTIVE CONSTITUENT	FORMULATION	ANTI-DIABETIC ACTIVITY	TECHNIQUE	REFERENCE
1.Liposome	Curcumin	PEG2000, DSPE, Cholesterol (8.5:0.5:1)	Enhance hypoglycaemic activity	Thin film hydration	(11)
	Momordica charantia, Trigonella foenum graecum and Withania somnifera	Phosphatidylcholine, Cholesterol (8:2)	Enhance hypoglycaemic activity	Solvent evaporation method	(12)
	Pterocarpus marsupium	Cholesterol, Chloroform, DOPC, DPPC	Enhance hypoglycaemic activity	Bath sonification	(13)
2.Niosome	Lycopene	Span 60, Cholesterol (1:1)	Enhance hypoglycaemic activity	Probe sonication technique	(14)
	Tradescantia pallida	Span 60, Cholesterol (1:1)	Enhance hypoglycaemic activity	Probe sonication technique	(15)
3.Polymeric nanoparticle	Quercetin	Chitosan, Alginate (1:3)	Enhance hypoglycaemic activity	Ion cross linking	(16,17)
	Ferulic acid	Chitosan, Tripolyphosphate (4:1)	Enhance hypoglycaemic activity	Ionotropic gelation method	(18)
4.Solid lipid nanoparticle	Myricitrin	Compritol, Tween80, Span 20	Enhance hypoglycaemic activity	Cold Homogenization method	(19)

CONCLUSION:

Hyperglycemia, a dangerous chronic metabolic illness caused by abnormalities in insulin secretion, action, or both, is the hallmark of diabetes mellitus (DM). The health advantages of vitamins and medicinal plants in the affordable prevention and treatment of diabetes mellitus should be widely publicized, particularly to people in poor nations who cannot pay the exorbitant expenses of contemporary medication(1). Plants with medicinal properties are used to treat both infectious and non-infectious diseases. Nowadays, many potent medications are made from lead compounds that occur naturally or are obtained straight from plant sources. It appears that the plant's substance may one day be a major source of innovative medications due to the renewed scientific interest in its use in drug discovery and development. Medicinal chemists' interest in natural product drug discovery has led to the development of many novel methodologies(9).

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