



Review Article

Herbal way to diabetes mellitus

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ABSTRACT

Diabetes mellitus is one of the significant threats to human beings all over the world. It is a group of metabolic disorders sharing the common feature of hyperglycemia about 422 million people worldwide have diabetes, particularly in low-income countries (Afghanistan, Bangladesh, Myanmar, Nepal, Pakistan) and middle-income countries (Brazil, China, Mexico, Sri Lanka). Diabetes can be treated and its ramifications avoided or delayed with diet, physical activity, regular medication, herbal products consumption and regular screening and management of complications. The control and treatment of diabetes and its complications mainly depend on the chemical or biochemical agents with the distinctive traditional medical perspective and natural medicines several natural products in daily use can lower blood glucose in patients with diabetes. In Ayurveda many plants and its parts are used for diabetes with the extraordinary results, using herbal medicines for diabetes we take step toward "DIABETES FREE INDIA."

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1. Introduction

Diabetes mellitus is a group of metabolic disorders of carbohydrates, fat and protein metabolism which is characterized by a common feature of hyperglycemia.¹ That results from deficient insulin secretion, insulin sensitivity, or both. Mainly it is classified into two types i.e. TYPE 1 (insulin deficient) and TYPE 2 (insulin resistance). At present, the prevalence of type 2 diabetes is increasing in western and also in Asian countries. This prevalence mainly attributed to western diet modification, increasing obesity, sedentary lifestyle, and an increasing minority population. Statistical data shows that Diabetes is the leading cause of death and one of the top 10 causes of deaths worldwide.² Complications like retinopathy, neuropathy, nephropathy, foot damage, skin infections, and cardiovascular disease which rise to serious or fatal conditions.³

India is known as the capital of diabetes, as diabetes is a lifelong disease management of medicines is costly and it also develops various hazardous side effects. India is known

for herbal medicines and most ancient medicine system i.e. Ayurveda. In Ayurveda many plants and its parts are used for diabetes with the significant results, using herbal medicines for diabetes we take step toward "DIABETES FREE INDIA."⁴

2. Type 1 DM

5% to 10% cases are TYPE 1 DM compared to TYPE 2 DM, It generally develops in childhood or early adulthood. There is a latent period of 9 to 13 years marked by the presence of immune markers when β -cell destruction is thought to occur. Hyperglycemia occurs when 80% to 90% of β - cells are destroyed. There is a transient remission ("honeymoon" phase) followed by an established disease with associated risks for complications and death. Individuals with type 1 DM are often thin and are susceptible to develop diabetic ketoacidosis.¹

2.1. Symptoms

1. Increased thirst
2. Bed-wetting in children

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3. Weight loss
4. Blurred vision
5. Extreme hunger
6. Fatigue
7. Rapid breathing
8. Dry skin and mouth
9. Nausea
10. Vomiting

3. Type 2 DM

Type 2 DM accounts for 90% of DM cases, it generally results due to the presence of both insulin resistance and relative insulin deficiency. Insulin resistance is manifested by increased Lipolysis and free fatty acid production, increased hepatic glucose production and decreased skeletal muscle uptake of glucose. Type 2 diabetes is a lifelong disease caused by age 45 or older. Uncontrolled type 2 diabetes can cause serious complications.⁵

3.1. Symptoms

1. Lethargy
2. Polyuria
3. Nocturia
4. Polydipsia
5. Lack of energy
6. Fatigue

3.2. Pathophysiology

Depending upon etiology of DM, hyperglycaemia may result from the following:

1. Reduced insulin secretion
2. Decreased glucose use by the body
3. Increased glucose production

In type 1 DM is destruction of β -cell mass, usually leading to absolute insulin deficiency. While type 1B DM remains idiopathic. Currently, pathogenesis of type 1A DM is explained on the basis of 3 mutually-interlinked mechanisms: genetic susceptibility, autoimmune factors, certain environmental factors.

3.3. Risk factors

3.4. Diagnosis

1. Glucose test
2. Hemoglobin A1C
3. Glucose tolerance test
4. Blood glucose monitoring
5. Postprandial glucose test
6. Fluid deprivation test

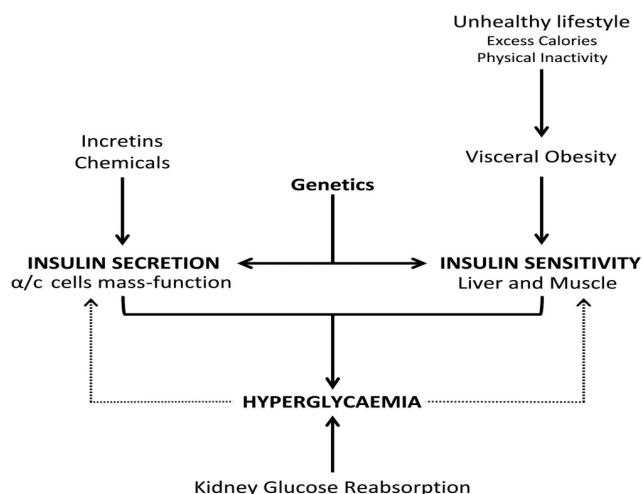


Fig. 1:



Fig. 2:

3.5. Goal of therapy

1. To boost symptoms of hyperglycemia.
2. To reduce the onset and progression of microvascular and macrovascular complications.
3. To reduce mortality, and improve quality of life.

3.6. Treatment

Treatment mainly depends on insulin therapy, improve functional state of pancreatic β -cells, increases the rate of glycogen synthesis, Regeneration of β -Cells of islets of Langerhans, this can be achieved by pharmacological therapy which includes sulfonylureas (tolbutamide), meglitinide (repaglinide), dipeptidyl-peptidase-4 inhibitor

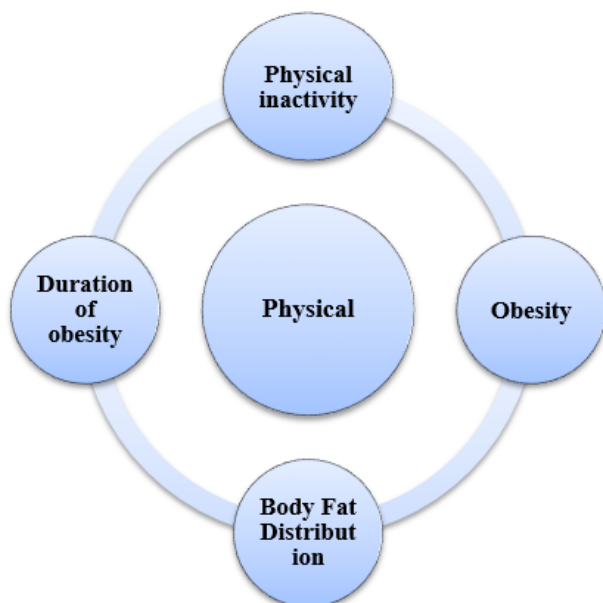


Fig. 3:

(teneligliptin), biguanide (metformin), thiazolidinedione (pioglitazone), alpha-glucosidase inhibitor (acarbose) and other miscellaneous drug's (bromocriptine)⁶ etc.

But the fact is that someone suffering from diabetes is not completely recovered only with these medications, the patient must follow diet modifications, exercise, regular monitoring of blood sugar level.⁷

Economically treatment is expensive and patient adherence to treatment is very poor due to various factors therefore if we treat a patient with the distinctive traditional medical perspective and herbal medicines several natural products in common use can lower blood glucose in patients with diabetes.⁸

The Indian Ayurveda medical system gives huge importance to herbal medicines from ancient times. Plants like *Aegle marmelos*, *Azadirachta indica*, *Allium sativum*, *Allium cepa*, *Momordica charantia*, *Abrus precatorius*, *Gymnea Sylvestre*, *Salacia Reticulate*, *Pterocarpus Marsupium* was proven to be lowering blood glucose level by different mechanism of action and with easy availability,⁹ our article gives a detailed account on these herbal ant diabetic agent list as Table 1.

3.7. *Aegle marmelos*

3.7.1. Family: *Rutaceae*

It is locally known as bel in Bengal, bil in Gujrat, bael, bil in Himachal Pradesh, bilpatra, kumbala, in Karnataka, bilwa in Sanskrit, kuvalum in Tamil Nadu. *A. marmelos* leaf is used as an antidiabetic agent. Its active constituent is Aegeline. methanolic extract of *A. marmelose* notably reduces serum glucose level by reducing the oxidative stress

and by improving the functional state of pancreatic β -cells.¹⁰

In Ayurveda diverse medicinal uses are mentioned and it is available easily in India.

3.8. *Allium cepa*

3.8.1. Family: *Amaryllidaceae*

A. cepa commonly known as onion and belongs to genus *Allium*. It has various pharmacological activities including anticancer, antidiabetic, antimicrobial, and cardiovascular, antioxidant effects, etc. it contain Allyl propyl disulphide and diallyl disulphide and they are extracted from the bulb of *A. cepa*. works possibly by blocking the insulin destruction.¹¹

A. cepa is a popular spice product grown all over the world and used in various cooking items.

3.9. *Momordica charantia*

3.9.1. Family: *Cucurbitaceae*

Momordica charantia belongs to genus *Momordica*, commonly known in India as: Hindi karela, Urdu karela, Gujarati karelu, Punjabi karela, Kashmiri karel, Marathi karli, Bengali korola, etc. In Ayurveda, different parts of the *Momordica charantia* are used in the treatment of diabetes particularly it contains Polypeptide-p; an insulin analog eventually increases the rate of glycogen synthesis and lowers the blood glucose level.¹²

3.10. *Abrus precatorius*

3.10.1. Family: *Fabaceae*

Belongs to genus *Abrus*, commonly known in India as Kundu Mani in Tamil, Guruvinda ginja in Telugu and 'Kunni kuru' in Malayalam, has been used in Siddha medicine for centuries. A precatorius leaf used an antidiabetic agent,¹³ It is active constituents abrusogenine an ethanolic extract of *Abrus precatorius* was found to have antioxidant, it decreases blood sugar level

3.11. *Swertia chirata*

3.11.1. Family: *Gentianaceae*

It belongs to the genus *Swertia*. It is commonly known as Charaita in Hindi, Chirayita in Marathi, Nilavembu in Tamil, Chira Chiraita shireenita shireen in Urdu. Long-time ago, it has been proved that *Swertia chirata* has antihyperglycemic activity. It can be used as an herbal strategy for the management of diabetes in humans.¹⁴

4. Discussion

The use of herbal medicines is not a new concern as herbal medicines were known for a long time and used by many people to treat a variety of diseases. Physicians will need

Table 1: Herbal medicines used for treatment of diabetes mellitus

S. No.	Plant species	Family	Active constituent	Part used	Mode of action
01	Aegle marmelos	Rutaceae	Aegeline	Leaf	Improve functional state of pancreatic β -cells
02	Azadirachta indica	Meliaceae	Nimbidin, rutin, quercetin	Leaf	Improve the functional status of pancreatic β -Cells
03	Allium sativum	liliaceae	Allylpropyl disulphide oxide, Allicin	Bulbs	Improve plasma lipid metabolism and plasma antioxidant activity
04	Allium cepa	Amaryllidaceae	Allyl propyl disulphide and diallyl disulphide	Bulb	Works possibly by blocking the insulin destruction
05	Momordica charantia	Cucurbitaceae	Charantin	Fruit	Increases the rate of glycogen synthesis
06	Abrus precatorius	Fabaceae	Abrusogenine	Leaf	Decreases blood sugar level
07	Gymnea sylvestre	Asclepiadaceae	Gymnemic acid, gymnemasaponins	Leaf	Increases secretion of insulin
08	Salacia reticulata	hippocrateaceae	Salacinol, kotalanol, magiferin	Stems & roots	Alpha glucosidase inhibitor
09	Pterocarpus marsupium	Leguminosae	Pterostibene, marsupin	Root	Regeneration of β -Cells of islets of Langerhans
10	Swertia chirata	gentianaceae	Mangiferin	Stem	Direct stimulation of β -Cells to release insulin
11	Coccinia indica	Cucurbitaceae	Triterpenoid, saponinococcinoside	Root	Decreases blood sugar level
12	Sarcopoterium spinosum	Rosaceae	linoleic acid and palmitic acid	Leaf	α -amylase and α -glucosidase was inhibited
13	Citrullus colocynthis	Cucurbitaceae	Isosaponarin, isovitexin and isoorientin 3'-O-methyl ether	Fruit	Increases insulin secretion
14	Nigella sativum	Ranunculaceae	Thymoquinone (TQ), dithymoquinone (DTQ), thymohydroquinone (THQ), and thymol (THY)	Seed	Inhibition of hepatic gluconeogenesis
15	Ocimum sanctum	Lamiaceae	Eugenol (1-hydroxy-2-methoxy-4-allylbenzene)	Leaf and stem	Inhibition of hepatic gluconeogenesis
16	Elephantopus scaber	Asteraceae	Sesquiterpene lactones, triterpenoids, steroids, flavonoids	Root and leaf	Regeneration of beta islet of Langerhans
17	Trigonella foenum graecum	Fabaceae	Diosgenin	Seed	Delay glucose absorption from GIT
18	Caesalpinia bonducella	Fabaceae	Caesalpinianone, and 6-O-methylcaesalpinianone	Root and stem	Delay glucose absorption from GIT
19	Tinospora cordifolia	Menispermaceae	Magnoflorine, Palmetine, Jatrorrhizin, flavonoids	Stem	Delay glucose absorption from GIT
20	Zingiber officinale	Zingiberaceae	Gingerols and shogaols	Ribosome	Modifying glucose utilization
21	Cyamopsis tetragonoloba	Fabaceae	Gallotannins, gallic acid, gallic acid derivatives	Seed	Modifying glucose utilization
22	Grewia asiatica	Malvaceae	Anthocyanins, tannins, phenolics and flavonoids	Fruit	Modifying glucose utilization
23	Curcuma longa	Zingiberaceae	Demethoxycurcumin and bisdemethoxycurcumin	Root	Antioxidant activity
24	Lycopene from tomato	Solanaceae	Lycopene	Fruit	Antioxidant activity
25	Wheat germ oil	Poaceae	Hexanal, 2-methyl-2-butene, 2,4- heptadienal, and limonene	Seed	Antioxidant activity

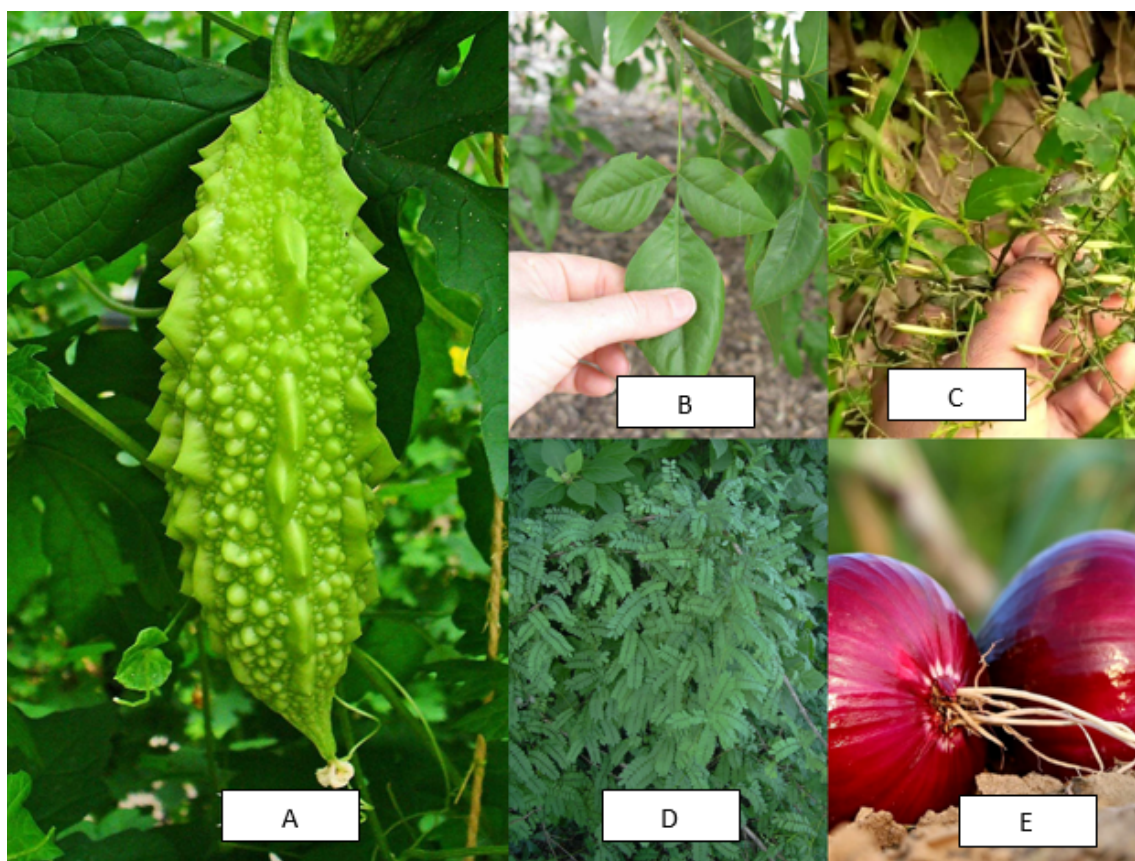


Fig. 4: **A:** *Momordica charantia*; **B:** *Aegle marmelos*; **C:** *Abrus precatorius*; **D:** *Swertia chirata*; **E:** *Allium cepa*

to keep track of this practice and they need to make the intervention of herbal medicines¹⁵ with regards to herbal medicines as they may improve or worsen the outcome of treatment of their patients. Herbal medicines are commonly given in diabetes as they are expected to have a crucial role in the treatment.

Aegle marmelos, *Allium cepa*, *Swertia chirata*, *Momordica charantia*, *Abrus precatorius* plants are regularly used in day to day life in Indians also in western countries. For example, *Aegle marmelos* dedicated to Lord Shiva. It is an imperative ritual of the worship of Lord Shiva. *Allium cepa* (onion) is a necessary ingredient in various cooking recipes also it is eaten as a salad.

Lowering blood sugar is our ultimate goal in the treatment of diabetes as mentioned above by various mechanisms. We can achieve our goal by using herbal medicines, but this can be beneficial when we use proper part of plant to get its active constituent, therefore, we need more knowledge regarding herbal medicine in the era of many artificial chemically prepared products or medicines and our review article substantially focuses on the detailed information of herbals and its active constituent, also they should easily available and economical to all class of patients. Study shows that in diabetic patients these herbal

medicines are more beneficial therefore there is no big deal to the patient for using these medicines however physicians should encourage the patient and also clinical pharmacist plays a major role for creating awareness.

5. Conclusion

The review clearly shows that these 25 plants (particularly its mentioned parts) are easily available and with minimal side effects show hypoglycemic effect. It's important to create awareness among diabetic patients about herbal medicines and to encourage research scholars for more herbal studies.

6. Source of Funding

None.

7. Conflict of Interest

None.

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