

Herbal Drug Used in the Treatment of Diabetes: A Review

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Abstract

Background: Diabetes mellitus is a chronic disease that occurs at the point when the pancreas is not able to produce insulin, or when the body cannot utilize the insulin it produces. Diabetes mellitus is a complex metabolic disorder that affects various systems of body such as visual, circulatory, renal and nervous system. Human beings depend upon plants for their various needs such as food, fodder, fuel, timber, fibres, dyes, gums, resins, medicines etc. Conclusion: The human healthcare system is highly benefited from traditional knowledge. Ayurveda is a widely practiced system of medicine in India. A number of plants have been described in Ayurveda and other traditional medicines for the treatment of diabetes. Herbal medicines are currently in demand and their necessity is increasing eventually. India is one of the largest producers of medicinal herbs and is called as botanical garden of the world. This review intends to understand the importance of various types of herbal and poly-herbal formulations available traditionally, which can be used for diabetes treatment.

Keywords: Diabetes mellitus, herbal drug, anti-diabetic, herbal treatments, Mithila

INTRODUCTION

Diabetes mellitus is a group of complex metabolic disorder affects with one common manifestation hyperglycemia [1, 2]. Chronic hyperglycemia causes neuropathy, nephropathy, retinopathy etc. It is caused when the pancreas is no longer able to make insulin, or when the body cannot make good use of the insulin it produces [3]. In Ayurveda, diabetes mellitus (DM) is known as "Madhumeha", which literally means excessive urine with sweet taste like honey [4]. Diabetes is treated with various oral hypoglycemic drugs. Currently available synthetic antidiabetic drugs are found to be associated with various major side effects. Though there are different approaches of the treatment of diabetes and its secondary complications, herbal formulations are usually preferred over synthetic ones due to their lesser side effects. Certain advantages of herbal medicines, as opposed to pharmaceutical drugs, such as easy availability, less toxicity, raw consumption, easy affordability, least side effects and low cost make the herbal preparations more popular (Figure 1). The Indian healthcare system or Ayurvedic medicine has formed an integral and unavoidable part of the Indian tradition [5]. The aim of this review is to collect the available data on herbal drugs used in the treatment of diabetes mellitus in the Mithila region of Bihar reported in the pharmaceutical journals.

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TYPES OF DIABETES [4]

There are three types of Diabetes mellitus:

1. Type 1 (Insulin Dependent Diabetes Mellitus);
2. Type 2 (Non-Insulin Dependent Diabetes Mellitus); and
3. Gestational Diabetes.

Type 1 (IDDM)

Type 1 diabetes is a disease in which autoimmune destruction of pancreatic β -cells leads to insulin deficiency.

Type 2 (NIDDM)

Type 2 diabetes mellitus (DM) is a chronic metabolic disorder due to imbalance in insulin secretion and insulin resistance. Type 2 DM makes up about 90% of the diabetic population in the world.

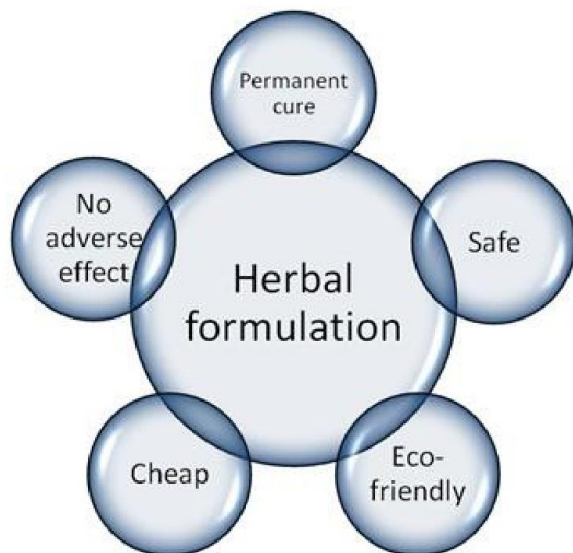


Figure 1. Advantage of herbal drug.

Gestational Diabetes

It refers to the onset or initial recognition of glucose intolerance during pregnancy, usually in the second or third trimester. It occurs in about 4% of all pregnancies.

DIAGNOSIS OF DIABETES MELLITUS

The diabetes can be measured by analyzing the blood sugar levels. The blood sugar level in healthy man on fasting are 80 mg/dl and in postprandial state is up to 160 mg/dl. Different tests for diagnosis of diabetes in laboratory are finger prick blood sugar test, fasting blood sugar, glucose tolerance diagnostic test etc. [6].

HERBAL DRUG USED IN THE TREATMENT OF DIABETES MELLITUS

Treatment of diabetes mellitus without any adverse effects is still the biggest question to health professions. According to world ethanobotanical about 800 medicinal plants are used for the prevention of diabetes mellitus. It has been clinically proven that only 450 medicinal plants possess anti-diabetic properties; from which 109 medicinal plants have known mechanism of action. There is a long history of traditional plants used for the control of diabetes in India. There are various books available such as Charaka Samhita and Susruta Samhita which explain phytopharmacology features of diabetes and its adverse effects [7].

***Azadirachta indica* (Figure 2)**

Common name: Neem

Family: *Meliaceae*

Geographical source: India, Sri Lanka, Myanmar, Malaysia and Pakistan

Part used: Whole plant

Chemical constituents: It contains nimbidin, nimbin, nimbinin, nimbidinin, nimbolide, nimbilic acid, unsaponifiable matter, i.e. nimbostreol, complex metabolite, i.e. azadirachtin. Nimbidin is the active bitter principle. It also contains tannins such as gallic acid. Furthermore, it contains glycerides of saturated and unsaturated fatty acids.

Mode of Action: Glycogenolytic effect due to epinephrine action was blocked.

Pharmacological activity and other uses: The neem tree offers opportunity to reduce insulin requirements as safe and proven herb. Clinical trials have been carried out by many scientists using leaf extract supporting its hypoglycemic activity, anti-inflammatory, anti-pyretic, anti-fungal, anti-bacterial, anti-malarial, anti-arthritis, spermicidal, anti-tumor etc. [8].



Figure 2. Picture of *Azadirachta indica*.

***Allium cepa* (Figure 3)**

Common name: Onion

Family: *Liliaceae*

Geographical source: Native to south Asia but cultivated widely throughout the world.

Part used: Bulb

Chemical Constituents: The main chemical constituent or the active constituent of the *Allium cepa* is the allylpropyldisulphide (APDS) and dipropyldisulphide oxide.

Mode of Action: Stimulating the effects on glucose utilization and antioxidant enzyme.

Pharmacological activity and other uses: The active constituent i.e. APDS (allyl propyl disulphide) is responsible for its anti-diabetic activity. It is also used as an antioxidant [9].



Figure 3. Picture of *Allium cepa*.

***Momordica charantia* (Figure 4)**

Common Name: Karela

Family: *Cucurbitaceae*

Active constituents: momordicin I and momordicin II, cucurbitacin B.

Pharmacological Activity and Uses: It is used in the treatment of diabetes. It consists of lectin which has insulin like activity. Lectin is non-protein which is linked to insulin receptors. This lectin decreases the blood sugar level by acting on peripheral tissues [10].

***Aegle marmelos* (Figure 5)**

Common name: Wood apple

Family: *Rutaceae*

Geographical source: The plant is native to India

Part used: Leaves and fruit

Active constituents: Aegle marmelosine

Mode of action: Improves functional state of pancreatic β cell.

Pharmacological activity and other uses: It is used as an antidabetic. It is also used in chronic constipation, piles and dysentery [11].

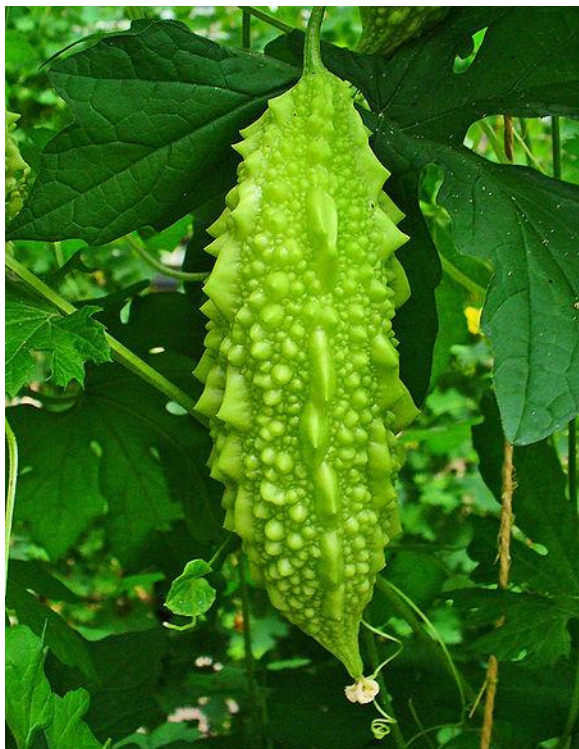


Figure 4. Picture of *Momordica charantia*.



Figure 5. Picture of *Aegle marmelos*.

***Allium sativum* (Figure 6)**

Common name: Garlic

Family: *Liliaceae*

Geographical source: Central Asia, Southern Europe, USA, India.

Part used: Ripe bulb

Chemical constituents: It contains a wealth of sulphur compounds; most important for the taste being Allicin, which is produced enzymatically from allin.

Pharmacological activity and other uses: Oral administration of the ethanol extract, juice and oil of *allium sativum* has shown marked blood sugar lowering effect in normal streptozocin induced diabetic rates through stimulation of insulin secretion from potential cells of pancreas [12].



Figure 6. Picture of *Allium sativum*.

***Curcuma longa* (Figure 7)**

Common name: Turmeric, Haldi

Family: *Zingiberaceae*

Geographical source: Native to south East Asia

Part used: Tubers and Rhizomes

Active constituents: α -phellantrene, tripinolene, turmerol, curcumin.

Mode of Action: Lowers blood sugar, increases glucose metabolism and potentiates insulin activity.

Pharmacological activity and uses: Due to the presence of curcumin and flavonoid it shows anti-diabetic activity, whooping cough, asthma, bronchitis, scabies, irritation, chronic skin disorders, wounds, strokes, bruises, eczema, prurigo and ringworm [13].



Figure 7. Picture of *Curcuma longa*.

***Eugenia jamboldana* (Figure 8)**

Common name: Jamun

Family: *Myrtaceae*

Geographical source: Native to Bangladesh, India, Nepal, Pakistan, Srilanka, Malaysia, Philippines, and Indonesia.

Part used: Fruits and seeds

Active constituents: Tri-terpenoids, Oleanolic acid, ellagic acid.

Mode of action: Inhibited insulinase activity from liver and kidney.

Pharmacological activity and uses: It shows the hypoglycemic activity by inhibiting the insulinase Enzyme [14].

***Zingiber officinalis* (Figure 9)**

Common name: Ginger

Family: *Zingiberaceae*

Geographical source: Indigenous to Southern China and India and also found in Europe and West Africa.

Part used: Rhizomes

Active constituents: 6-Gingerol, tannins, polyphenolic compounds, flavonoids.

Pharmacological activity and its uses: Ginger exhibits hypoglycemic activity in both normal and diabetic rats. They further reported that ginger contains magnesium, calcium and phosphorus which play important roles in bone formation, curbing muscle spasm, depression, hypertension, convulsion, nausea, gastrointestinal disorders, paralysis, kidney damage and several other bio-functions necessary for keeping body in homeostatic conditions [15].



Figure 8. Picture of *Eugenia jamboldana*.



Figure 9. Picture of *Zingiber officinalis*.

***Emblica officinalis* (Figure 10)**

Common Name: Amla

Family: *Phyllanthaceae*

Geographical source: Native to India

Part used: Fruit

Active constituents: Tannins 30%, Phyllanthin.

Mode of action: Reduction of glycemia.

Pharmacological activity and uses: Presence of chromium is of therapeutic value in diabetes. Chromium, a trace element possesses significant anti-diabetic activity in various experimental models of diabetic mellitus. The fruits are sour, astringent, bitter, acrid, sweet, cooling, anodyne, etc. Their uses such as ophthalmic, carminative, digestive, stomachic, laxative, alterant, aphrodisiac, rejuvenative, diuretic, antipyretic, cough, asthma, bronchitis, cephalalgia, ophthalmopathy, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, erysipelas, skin diseases, leprosy, inflammations, anemia, emaciation, hepatopathy, jaundice, strangury, diarrhoea, dysentery, hemorrhages, leucorrhoea, menorrhagia, and grayness of hair. Amla is a rich natural source of vitamin C [16].



Figure 10. Picture of *Emblica officinalis*.

***Gymnema slyvestre* (Figure 11)**

Common name: Madhunashini

Family: *Asclepiadaceae*

Geographical source: India

Part used: leaves

Active constituents: Gymnemic acids, flavones, anthraquinones.

Pharmacological activity and other uses: It has shown to exhibit hypoglycemic activity by releasing insulin by regenerating beta cells of pancreas [17].



Figure 11. Picture of *Gymnema slyvestre*.

CONCLUSIONS

Currently, many countries face large increases in the number of people suffering from diabetes. After several literature searches, all of the plants were found to be effective against diabetes in

pharmacological studies in animal models. The traditional medicine performed a good clinical practice and is showing a bright future in the therapy of diabetes mellitus. Hence, treatment with herbal drugs has an effect on protecting β -cells and smoothing out fluctuation in glucose levels. In general, there is very little biological knowledge on the specific modes of action in the treatment of diabetes, but most of the plants have been found to contain substances like glycosides, alkaloids, terpenoids, flavonoids etc. that are frequently implicated as having antidiabetic effects.

CONFLICTS OF INTEREST

The author has no conflicts of interest to declare.

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