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Review Article

CURRENT UPDATES OF INDIAN ANTIDIABETIC MEDICINAL PLANTS

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ABSTRACT

Diabetes mellitus is an endocrine metabolic disorder i.e. characterized by high blood glucose in the circumstance of insulin resistance or deficiency or both. 170 million of the population suffers from this disease throughout the world and it has no known permanent cure. At the present time many article gives a general idea of diabetic mellitus and its treatment by using insulin and oral hypoglycaemic drugs. But due to their limitation and side effects we no longer used synthetic drugs. India still depends on medicinal plants and they have played an important role in treatment and prevention of variety of disease. This review focuses on current updates of Indian medicinal plants and various mechanisms by which herbs act against diabetes.

Keywords: Diabetes mellitus, oral hypoglycaemic drugs, medicinal plants.

INTRODUCTION

Diabetes is chronic metabolic disorder characterized by hyperglycaemia, glycosuria, hyperlipaemia and sometime ketonaemia; in the endocrine system[1, 2].Also it may be define as disease where body cannot respond normally to the insulin i.e. pancreas does not make enough insulin or decrease in the circulating level of insulin i.e. insulin resistance.[3] The disease is related with reduced quality of life and increased risk factors for mortality and morbidity. The long-term hyperglycaemia is an important factor in the growth and progression of micro- and macro vascular complications.[4]

Causes- when we taken food carbohydrates broken down in small intestine, from the taken food and glucose is than absorbed by intestinal cells into blood stream where it is utilized. But glucose cannot enter into cells without insulin because it helps to enter into cells. Insulin is a hormone synthesized from beta cells of pancreatic islets to control blood sugar. The role of insulin is to move glucose from the blood stream into muscle, fat, and liver cells, where it can be used as fuel. In patients with diabetes, the absence or inadequate production of insulin causes hyperglycaemia and glycosuria.[5]

Classification- The disease has two major forms: Type- 1 and Typt-2 diabetes mellitus. Recently two more diabetes disease states have also been added. These are: Type-3(other) and Type-4(gestational).

Type-1 diabetes (IDDM) – Insulin dependent diabetes mellitus most commonly afflicts juveniles but IDDM can also occur among adults. The disease is characterized by an absolute deficiency of insulin caused by massive beta cells lesions or necrosis. Loss of beta cell function may be due to invasion by viruses, the action of chemical toxins, or usually, through the action of autoimmune antibodies directed against the beta cells. As a result of destruction of beta cells, the pancreases fail to respond to ingestion of glucose. Type-1 diabetes shows classic symptoms of insulin deficiency (polydipsia, polyphagia and polyuria).[6]

Type-2 (NIDDM)- The metabolic alteration observed are milder than IDDM, but the long term clinical consequences can be just as devastating (e.g.: vascular complications and subsequent infection can lead to amputation or the lower limbs). In INDDM pancreas retain some beta cells function, resulting in variable insulin levels that are insufficient to maintain glucose homeostasis. Patient with Type-1 diabetes are often obese. Type-2 diabetes is

frequently accompanied by target organ insulin resistance that limits responsiveness to both endogenous and exogenous insulin. In some cases, insulin resistance is due to a decreased no. of mutation of insulin receptors.[7]

Symptoms[8]

1.Type-1 diabetes-

(a) Weight loss
(b) Fatigue
(c) Increased thrist and infrequent urination.
(d) Extreme hunger
(e) Blurred vision

2 .Type-2 diabetes-

(a) Drymouth
(b) Loss of consciousness
(c) Slowhealing sores
(d) Itching of skin(usually around the vaginal or groin area)
(e) Frequent yeast infection
(f) Acanthosisnigricans
(g) Numbness and tingling of the hands and feet
(h) Impotency

Type-3 diabetes-

In this type, there are other causes of hyperglycemia, e.g. chronic pancreatitis or chronic drug therapy with glucocorticoids, thiazids diuretics, diazoxide, growth hormone and with some protease inhibitors (e.g. saquinavir).

Type-4 diabetes-

It is also called "Gestational Diabetes Mellitus". It is observed in approximately 4-5% of all pregnancies. High blood sugar levels are observed in second or third trimester of pregnancy and usually resolved during the postpartum period. No genetic predisposition. The most plausible cause is the placental hormones that promote insulin resistance. [9]

Diagnostic Criteria[10]

Category of person	Fasting value		Post Prandial
	Minimum value	Maximum value	Value 2hr. after consuming glucose
Normal	70mg/dL	100mg/dL	< 140mg/dL
Early diabetes	101mg/dL	126mg/dL	140-200mg/dL
Established diabetes	>126mg/dL	_	>200mg/dL

Medicinal Plants Species with Proven Anti-diabetic Activity

Plants have always been good sources of drugs and current time many drugs are derived from plants. The aim of this review to given current updates of anti-diabetic herbal plants. In this review we categorized the drugs according to their treatment.

Plants Used in Type-1 Diabetes – There are long list of plants used in Type-1 diabetes treatment but we given description of few plants as an example-

1. Alangium salvifolium (Alangiaceae) – The plant *A. salvifolium* is native to Africa, Madagascar, Southern and Eastern Asia. In India found through the Hyderabad forest and Rajasthan. [11] *A. salvifolium* use for management of Type-1 diabetes, due to anti-oxidant and insulinotropic effects of methanolic extract, it shows antihyperglycemic effect in alloxan induced diabetic rats. [12]

2. Annona squamosa (Annonaceae) - The plant *A. squamosa* (Annonaceae), is commonly called sharifa in Hindi. [13] *A. squamosa* root extract decreased blood glucose in STZ-induced diabetic rats could also possibly be due to increased peripheral glucose utilization. Aqueous plant extract activate of ßcells and insulinogenic effects in diabetic rats.[14]

3. Biophytum sensitivum (Oxalidaceae) – *B. sensitivum* commonly found in tropical region of India and commonly called as lajalu in Hindi**.** Leaf extract of *Biophytum sensitivum* stimulated beta cells to increase insulin and shows hypoglycemic effect and improve oral glucose tolerance test in alloxan diabetic rabbits.[15]

4. Bougainvillea spectabilis (Nyctaginaceae) - Ethanolic leaf extract of *Bougainvillea spectabilis* increases glucose uptake by enhanced glycogenesis in liver of streptozotocin induced albino rats and act as hypoglycemic agent. *B. spectabilis* also used in the combination with *Azadiractica indica*, chloroform, methanolic and aqueous plants extracts were investigated for controlling diabetes. Chloroform extract of *A. indica* and aqueous and methanolic extract of B. *spectabilis* showed a good oral glucose tolerance, significantly reduced the intestinal glucosidase activity and increase in glucose-6-phosphate dehydrogenase activity and hepatic, skeletal muscle glycogen content after 21 days

of treatment.[16] Also observed that regeneration of insulin-producing cells and corresponding increase in the plasma insulin and c-peptide levels with the treatment of *A. indica* chloroform and *B. spectabilis* aqueous, methanolic extracts.[17]

5. Camellia sinensis (Theaceae) – *C. sinensis* commonly called as green tea. Hot water extract of *Camellia sinensis* shows insulinotropic effect in streptozotocin induced diabetic rats and the extract was found to possess both preventive and curative effects on experimentally produced diabetes in rats.[18]

6. Medicago sativa (Fabaceae) - *Medicago sativa*, also called lucerne, is a perennial flowering plant in the pea family Fabaceae. ethanolic leaf extract of Medicago sativa in combating hyperglycaemia, dyslipidemia, hepatic and renal dysfunctions and oxidative stress in alloxan induced diabetic animals.[19]

7. Semen coicis (Gramineae) - The seeds of *Semen coicis* possesses significant antidiabetic activity due to prevent pancreatic beta cells injury, induced by alloxan.[20]

8. Eriobotrya japonica (Rosaceae) - E. japonica (loquat) is evergreen shrub and cultivated as ornamental plant. Leaf extract of E. japonica shows hypoglycemic effect by induced significant decrease in plasma glucose concentration, glycosylated serum protein, total cholesterol, triglycerides and oxidative stress in streptozotocin diabetic rats.[21]

Plants used in Type-2 diabetes-

1. Brassica nigra (Cruciferae) – *B. nigra* commonly known as black mustard**.** Aqueous, ethanol, acetone and chloroform extract of *Brassica nigra* decreases serum glucose level within two months in streptozotocin- niconamide induced Type-2 diabetic rats.[22]

2. Caesalpinia bonducella (Cesalpinaceae) - *Caesalpinia bonducella* is a medicinal plant, widely distributed throughout India and the tropical regions of the world. Its seed kernels are used in the management of diabetes mellitus. Four extracts (petroleum ether, ether, ethyl acetate and aqueous) of the seed kernels were prepared and tested for their hypoglycaemic potentials in alloxan induced diabetic rats. [23] Aqueous and Ethanolic extract of kernels increasing secretion of insulin in isolated islets and used in type-2 diabetes.[24]

3. Otholobium pubescens L. (Papilionaceae) - Bakuchiol was isolated from an extract of *Otholobium pubescens* (Fabaceae) by bioassay-guided fractionation for type-2 diabetes. *Otholobium pubescens* decreases blood glucose level in dose dependent manner, lower plasma glucose and triglyceride level in streptozotocin induced diabetic rats.[25]

4. Pandanus amaryllifolius (Pandanaceae) - The leaf of *Pandanus amaryllifolius* commonly known as pandan, is often used to give a refreshing, fragrant flavour. Besides it pandan leaves are used in the perfume industry and also medicinally as a diuretic, cardio-tonic and anti-diabetic.[26] *P. amaryllifolius* used in the treatment of type-2 diabetes by inducing the regeneration of beta cells and reduced blood glucose level.[27]

5. Tabernaemontana divaricata (Apocynaceae) - *Tabernaemontana divaricata* is an evergreen ornamental plant known as tagar. A number of chemical constituents such as alkaloids, terpenoids, steroids, flavonoids, phenyl propanoids, phenolic acids and enzymes from the leaves, stems, and roots have been reported previously. [28] Methanolic extract of *T. divaricata* used as hypoglycemic agent, it induces the generation of beta cells and increase insulin level and decreases glucose level in blood.[29]

6. Anoectochilus roxburghii (Orchidaceae) - *A. roxburghii* repair and regenerate pancreatic beta cells in streptozotocin induced diabetic rats. Kinsenoside, a high yielding constituent from *Anoectochilus roxburghii*, involve in the hypoglycemic effect on streptozotocin (STZ) diabetic rats and orally administered(15mg/Kg) and which is speculated to be partially attributed to modulating the activity of enzymatic antioxidants, scavenging free radicals, and reducing the content of factor NO.[30]

7. Ishige okamurae (**Ishigeaceae) -** Mode of action of *I. okamurae* is reduction of insulin resistance and regulates hepatic glucose metabolic enzymes. Diphlorethohydroxycarmalol (DPHC) isolated from *I. okamurae*, brown algae, may inhibit alpha-glucosidase and alpha-amylase activities, and alleviate postprandial hyperglycemia in streptozotocin-induced diabetic mice.[31]

8. Coffee (Rubiaceae) - Coffee intake improves glucose tolerance and insulin sensitivity and a lower risk of Type-2 diabetes. Caffeine in coffee activates sympathetic nervous system and adrenal gland, causing constriction of blood vessels, decreased circulation to the brain and a feeling of low blood sugar.[32, 33]

9. Nymphaea stellata (Nymphaeaceae) - Oral administration of *N. stellata* promoted the partial generation of pancreatic islets cells in diabetic rats. [34]

CONCLUSION

Diabetes mellitus is the most common metabolic disorder, affecting more than 300 million people worldwide. Usually anti-diabetic drugs may not be favourable for diabetic problems as they are associated with several side effects. Because of this, people may prefer natural drugs for diabetic remedies, as herbs has been highly valued and used regularly for thousand of year by the peoples of the world as the medicine and herbs has few or no side effects as compare to synthetic anti-diabetics. This review provided an overall view of herbal plants used in the treatment of diabetes and given current updates about herbal treatment of diabetes.

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