Traditional Medicinal Plants for the Treatment of Diabetes-An Overview

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Abstract **- Traditional medicines produced from medicinal plants are utilised by approximately 67% of the people of the world. This study focuses on Indian ayurvedically antidiabetic medicines and plants which are used to treat diabetes or hyperglycemia. Now a day's diabetes is an important & common disease through which many humans suffer especially in elder age. So, chance of side effect will be more as for age. That is why herbal medicines at this age are the most popular. Although numerous techniques to reducing the negative effects and subsequent problems of diabetes are available. It is also appropriate for rural areas or financially challenged people because of its inexpensive costs. The list is collected of herbal medicinal plants used for the treatment of diabetes with the antidiabetic and associated positive properties. The damage caused by the free radicals, and therefore an antidiabetic substance with antioxidant capabilities, is one of the etiological factors in the development and consequences of diabetes.**

Index Terms **- Traditional medicional plants, Diabetes Mellitus, hypolipidemic.**

INTRODUCTION

In recent years the area of plant health has grown exponentially, and both emerging and developed nations are becoming increasingly popular due to their natural origin and fewer side-effects 1. Such medications, minerals and organic materials are obtained from several traditional medical products used. A number of herbal herbs of Indian traditional health care systems have traditionally utilised for more than 1000 years, termed rasayana. Most practitioners create and provide their own recipes in Indian medical systems 2. 21200 plants have been recognised by the World Health Organization (WHO) and are utilised worldwide for medicament purposes. Of these 2530 species, 151 are economically employed on a rather substantial basis in India. India is the world's biggest medicional herbal grower and is known as the botanical kingdom. The review focuses on herbal medicinal products and plants for the treatment of diabetes mellitus, the main paralytic illness in the world which causes significant financial losses 3.

DIABETES & THEIR SYMPTOMS

Diabetes is a condition defined by a change of lipid, carbohydrate and protein metabolism through hyperglycemia. The most prevalent chronic and metabolic disorder is Diabetes mellitus, which characterizes a rise in glucose levels because to absolute or relative insulin deficiency. The disease is linked to long-term problems of the eye, renal, cardiovascular and neurological. Symptoms such as polyuria, tiredness, weight loss, a slow wound cure, blurry eyesight, increases in urine glycosis are also connected with this illness. One impairment of control of the immune system is the destruction of the beta cells of Langerhans islets in the pancreas, which lead to the development of insulin-dependent diabetes. Various genetic and environmental variables impact the immune system and cause lymphocyte attacks, particularly lymphocytes and pancreatitis. This inflammatory reaction can lead to diabetes and insulits 4-6.

In the absence of appropriate therapy, cardiac, vascular, neurological, and renal damage and neuropathy may develop. Treatment includes diet, exercise, and medication. Currently, the main and effective treatment for diabetes is the use of insulin and hypoglycemic drugs, but these compounds also have many adverse side effects. Medicinal plants are

utilised for many years and are now widely used for different ailments. The usage of medicinal plants might be increased for many reasons. Many plants from various regions of the globe for antidiabetic properties were studied 7-10.

INDIAN MEDICINAL PLANT WITH ANTIDIABETIC ACTIVITY

Ficus religiosa

Ficus religiosa, commonly known as peepal in India, belongs to family Moraceae. *Ficus religiosa* has been reported to be used in the traditional system of Ayurveda for the treatment of diabetes. F. *religiosa* has been shown to possess a wide spectrum of *in vitro* and *in-vivo* pharmacological activities: antidiabetic, hypolipidemic, anticonvulsant, anti-inflammatory, analgesic, antimicrobial, antiviral etc.

A number of bioactive principles, including tanins, saponins, polyphenolic chemicals, flavoids, and sterols, are thought to be present in the plant. Hypoglycemic action is thought to stimulate sitosterol-d-glucoside found in the bark of Ficus religiosa. Leucocyandin 3-O-beta-d-galactosyl cellobioside and leucopelargonidin-3-O-alpha-L rhamnoside are the bioactive elements contained in Ficus. Ficus can have a strong antidiabetic impact on the phytoconstituents. Phytosterols, flavonoids, tannins and derivatives of furanocoumarin, namely bergaptene and bergaptol were observed to contain.

The leaves of Ficus religiosa for antihyperglycemic action were also investigated. The oral addition of Ficus religiosa aquatic extract for 21 days led to a substantial reduction in blood glucose levels and a higher level of insulin. A major location of insulin-stimulated glucose absorption is the skeletal muscle. Reduction in diabetic muscle and hepatic glycogen has been reported with peepal extract 11.

Allium Sativum:

This is a permanent herb grown in India. The strong odour of allicin, a sulfur-containing molecule, has shown substantial hypoglycemic action. This is supposed to be related to enhanced hepatic metabolism, increased pancreatic beta-cell release of insulin and insulin-saving impact. Aqueous garlic homogenate (10 ml/kg/day) orally to saccharose rabbit (10 g/kg/day in water for two months) substantially raised the level of hepatic glycogen and free amino acid, lowered rapid blood glucose and lowered serum triglyceride levels compared with sucrose controls.

The precursor of allicin and garlic oils is S-lyl cysteine sulfoxide (SACS), a sulphur that contains amino acid, and controls lipid peroxidation better than glibenclamide and insulin. Diabetic circumstances have also improved. Invitro insulin secretion from beta cells isolated by normal rats has also been enhanced by SACS. In addition, Allium sativum also has antibacterial, cardiovascular and anticancer activity 12.

Caesalpinia bonducella

Caesalpinia bonducella is widely distributed throughout the coastal region of India and used ethnically by the tribal people of India for controlling blood sugar. Both the aqueous and ethanolic extracts showed potent hypoglycemic activity in chronic type II diabetic models. These extracts also increased glycogenesis thereby increasing liver glycogen content. Two fractions BM 169 and BM 170 B could increase secretion of insulin from isolated islets. The aqueous and 50% ethanolic extracts of *Caesalpinia bonducella* seeds showed antihyperglycemic and hypolipidemic activities in streptozotocin (STZ)-diabetic rats. The antihyperglycemic action of the seed extracts may be due to the blocking of glucose absorption. The drug has the potential to act as antidiabetic as well as antihyperlipidemic 13-15.

Ocimum sanctum

It is commonly known as Tulsi. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed the significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and hypolipidemic effects of tulsi in diabetes. Oral administration of plant extract (200 mg/kg) for 30 days led to decrease in the plasma glucose level by approximately 9.06 and 26.4% on 15 and 30 days of the experiment respectively. Renal glycogen content increased 10-fold while skeletal muscle and hepatic glycogen levels decreased by 68 and 75% respectively in diabetic rats as compared to control. This plant also showed antiasthemitic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity,

antioxidant, antimutagenic and immunostimulant activities 16.

Eugenia jambolana: (Indian gooseberry, jamun)
In India decoction of kernels of *Eugenia jambolana* is used as household remedy for diabetes. This also forms a major constituent of many herbal formulations for diabetes. Antihyperglycemic effect of aqueous and alcoholic extract as well as lyophilized powder shows reduction in blood glucose level. This varies with different level of diabetes. In mild diabetes (plasma sugar >180 mg/dl) it shows 73.51% reduction, whereas in moderate (plasma sugar >280 mg/dl) and severe diabetes (plasma sugar >400 mg/dl) it is reduced to 55.62% and 17.72% respectively. The extract of jamun pulp showed the hypoglycemic activity in streptozotocin induced diabetic mice within 30 min of administration while the seed of the same fruit required 24 h. The oral administration of the extract resulted in increase in serum insulin levels in diabetic rats. Insulin secretion was found to be stimulated on incubation of plant extract with isolated islets of Langerhans from normal as well as diabetic animals. These extracts also inhibited insulinase activity from liver and kidney 17-18.

Azadirachta indica: (Neem)
Hydroalcoholic extracts of this plant showed anti-hyperglycemic activity in streptozotocin treated rats and this effect is because of increase in glucose uptake and glycogen deposition in isolated rat hemidiaphragm. Apart from having anti-diabetic activity, this plant also has anti-bacterial, antimalarial, antifertility, hepatoprotective and antioxidant effects 19.

Trigonella foenum-graecum
Trigonella foenum-graecum (fenugreek, methi) belongs to the family Fabaceae. Seeds and leaves are the most frequently used parts of the plant. The antihyperglycemic effect has been correlated with decline in somatostatin and high plasma glucagon levels. Fenugreek seed powder has been shown to normalize the activity of creatinine kinase in liver, skeletal muscles, and heart of diabetic rats. The antihyperglycemic effect of fenugreek has been hypothesized to be due to the amino acid 4-hydroxyisoleucine which acts by the enhancement of insulin sensitivity and glucose uptake in peripheral tissues. The steroids present in methi have been reported to reduce blood glucose level when supplemented to diabetic rats. A considerable increment of the area of insulin-immunoreactive β cells has been observed 20.

Momordica charantia
Momordica charantia (bitter gourd or karela) belongs to the family Cucurbitaceae. Fruit as a whole and fruit's seeds are the parts most frequently used for therapeutic benefits. *Momordica charantia* is a popular fruit used for the treatment of diabetes, cardiovascular diseases. The hypoglycemic and lipid-lowering properties of bitter melon have been observed. Studies have shown that Momordica *charantia* can repair damaged β-cells thereby stimulating insulin levels and also improve sensitivity/signalling of insulin. Bitter gourd is also reported to inhibit absorption of glucose by inhibiting glucosidase and suppressing the activity of disaccharidases in the intestine. Ethanolic extract of *Momordica charantia* is reported to show antihyperglycemic effect in normal and streptozotocin diabetic rats which might be due to inhibition of glucose-6-phosphatase and also stimulation of the activity of hepatic glucose-6-phosphate dehydrogenase 21.

Phyllanthus amarus: (bhuiawala)
It is a herb of height up to 60 cm, from family Euphorbiaceae. It is commonly known as Bhuiamala. It is scattered throughout the hotter parts of India, mainly Deccan, Konkan and south Indian states. Traditionally it is used in diabetes therapeutics. Methanolic extract of *Phyllanthus amarus* was found to have potent antioxidant activity. This extract also reduced the blood sugar in alloxanized diabetic rats. The plant also shows antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity 22.

Pterocarpus marsupium:
It is a deciduous moderate to large tree found in India mainly in hilly region. Pterostilbene, a constituent derived from wood of this plant caused hypoglycemia in dogs showed that the hypoglycemic activity of this extract is because of presence of tannates in the extract. Flavonoid fraction from *Pterocarpus marsupium* has been shown to cause pancreatic beta

cell regranulation. Marsupin, pterosupin and liquiritigenin obtained from this plant showed antihyperlipidemic activity. Epicatechin, its active principle, has been found to be insulinogenic, enhancing insulin release and conversion of proinsulin to insulin in vitro. Like insulin, epicatechin stimulates oxygen uptake in fat cells and tissue slices of various organs, increases glycogen content of rat diaphragm in a dose-dependent manner 23.

MODERN TECHNIQUE OF DELIVERING HERBAL DRUGS

In the past few decades, considerable attention has been concentrated on the evolution of a novel drug delivery system (NDDS) for herbal drugs. Conventional dosage forms, including prolonged-release dosage forms, are unable to satisfy for both holding the drug component at a distinct rate as per directed by the requirements of the body, all through the period of treatment, as well as directing the phytoconstituents to their desired target site to obtain an utmost therapeutic response. In phytoformulation research, developing nano-sized dosage forms (polymeric nanoparticles and nanocapsules, liposomes, solid lipid nanoparticles, phytosomes, and nanoemulsion) has a number of advantages for herbal drugs, including enhancement of solubility and bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improving tissue macrophage distribution, sustained delivery, and protection from physical and chemical degradation. Thus, the nano-sized NDDSs of herbal drugs have a potential future for enhancing the activity and overcoming problems associated with the plant medicines. Liposomes, which are biodegradable and essentially nontoxic vehicles, can encapsulate both hydrophilic and hydrophobic materials.

The Phytosomes The majority of phytomedicine's bioactive substances are flavonoids that are not accessible in orally. Water-soluble plant components (primarily polyphenols), which are known as phytosomes, may be transformed into lipid-compatible molecular complexes. Phytosomes are more organic than ordinary herbal extracts because to their increased mental ability to pass through the biomembranes, which are rich in lipids to eventually reach their origins. The lipid-phase substances employed to make phytoconstituents lipid compatible are phospholipids from soy, mainly phosphatidylcholine. Some of herbal formulations in Phytosomal drug delivery systems were listed in following table.

Plants & their constituents	Therapeutic effect	Purpose to use of pytosomes
Naringenin	Antioxidant Effect	For prolong duration of action.
Curcumin	Anticancer & Antioxidant	For improving Antioxidant & bioavailability.
Silybin	Hepatoprotective, for skin disease	For enhancing Absorption which is 7times greater.
Quercetin	Anticancer & Antioxidant Effect	For extertation better therapeutic efficacy
Ginkgo biloba	Cardioprotective	For stabilized the Ros due to GBP of flavonoids
Ginsenosides	Immunomodulator & Nutraceuticals	For enhance Absorption
epigallocatechin	Nutraceuticals & systemic antioxidant	For increase Absorption

Phytosomal complexes were first investigated for cosmetic applications, but mounting evidence of potential for drug delivery has been amassed over the past few years, with beneficial activity in the realms of cardiovascular, anti-inflammatory, hepatoprotective, and anticancer applications. Phytosome complexes show better pharmacokinetics and therapeutic profile than their noncomplexed herbal extract. The phytosome technology has markedly enhanced the bioavailability of selected phytochemicals.

CONCLUSION

As per Ayurveda, only few of the herbal plant have been scientifically proven with antidiabetic effect. *Ficus religiosa, Allium sativum, Trigonella foenum graecum, Pterocarpus marsupium, Ocimum sanctum, Momordica charantia, Eugenia jambolana,* and *Ficus religiosa* have shown varying degrees of antidiabetic efficacy. These herbs have also

been shown to help manage diabetic problems. Future research might focus on bioactive chemicals in such plants being isolated, purified and characterised. The results of these research can serve as the basis for the development of antidiabetic medicines. This examination can be useful in diabetes treatment.

Many plants have therefore been utilised separately or in formulations for the treatment and problems of diabetes. The study included Pytosomes as an enhancing new drug delivery method as well as increasing the distribution of phytoconstituents, taking active components, binding receptors properly, improving bioavailability and much more [24-25].

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