REVIEW ARTICLE

Indigenous Drugs for Diabetes Mellitus

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Diabetes mellitus is a major source of suffering and morbidity afflicting 20-30 million people of all social conditions throughout the World. It is a disorder of carbohydrate, protein and lipid metabolism associated with an absolute or relative insufficiency of insulin secretion, accompanied by various degrees of insulin resistance (1). Two major subdivisions of diabetes mellitus are now recognized: Type 1 Insulin dependent diabetes rnellitus (IDDM) and type II non insulin dependent diabetes mellitus (NIDDM). Absolute or near absolute insulin deficiency is the prime etiological factor of type I diabetes. It is commonly associated with islet cell antibodies. Impaired β cell function, insulin resistance, receptor deficiency or post receptor defect are features of type II diabetes. Ninety percent of diabetics have type II diabetes. While patients with type I diabetes are treated with insulin, type II can be treated with either insulin or drugs like sulphonylureas and biguanides. Presence of at least 30% functional β cell is essential for their action. Although these drugs are valuable for treatment of NIDDM patients, there are some drawbacks in their use. It is known that sulphonylureas may cause severe hypoglycernia and lactic acidosis is the most serious complication associated with the use of biguanides. Extracts of some plant products are being used by diabetic patients from a very long time. Advantage in using plants for treatment is that they have no or very few side effects. Information on such medicinal plants have been systematically reviewed (2-4). There is a long list of pl which have antidiabetic properties. It is not possib cover all of them in this review. Few commonly used p with proven antidiabetic effect are discussed below.

Plants with known hypoglycemic principles

Allium cepa (onion) and *Allium sativum* (garlic) l long been used as dietary supplement for treatmer diabetes. S-methylcysteine sulphoxide (SMCS), a su containing amino acid isolated from onion sho antidiabetic and hypolipidemic effect when give a dose of 200 mg/kg bw/day for a period of 45 day alloxan diabetic rats. Effects were comparable to tl of insulin and glibenclamide (5). An ether sol substance allicin was isolated from garlic. An increa the serum insulin, improvement in GTT and incre liver glycogen were reported in diabetic rats tre with allicin (6).

Four glycan anemarans A, B, C and D were isol from *Anemarrhena asphoetida*. Of these anemara reduced blood glucose in alloxan diabetic mice *Azadirachta indica* (neem) is a large tree with a nun of medicinal properties. It can be used for treatmer leprosy, piles and urinary diseases. Oil from its nuts leaves act as local stimulant, insecticide and antise (2). Nimbidin, a bitter principle isolated from neem se was effective at a dose of 200 mg/kg in alloxan diab rabbits (8). Leaves of *Coccinia indica* (kanduri) posse

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hypoglycemic property. The hypoglycemic property was stated to be due to the presence of a water soluble and dialyzable alkaloidal principle (9). *Cyamopsis tetragonolobus* Taub (Indian cluster bean, gowar) contain an antidiabetic principle (10).

Eugenia Jambolana (Hindi Jamun) grows throughout the plains from Himalayas to South India (2). Fruit pulp and seeds of this tree are reported to have hypoglycemic activity by Achrekar (11). Sharma *et. al.* (from our Laboratory) isolated hypoglycemic compounds from pulp and seeds (Patent applied). *Ficus bengalensis* (bargad) is a large tree with aerial roots. It grows wild in lower Himalayas and is found all over the country. Seeds and fruits of this plant are cooling and tonic, leaves are good for ulcer, the aerial roots are aphrodisiac, useful in gonorrhea, syphilis, dysentery and inflammation of liver (2). Bark of this plant has antidiabetic property. Hypoglycemic effect of ethanolic and water extract of this plant is demonstrated in alloxan diabetic rats, rabbits and in diabetic patients (12-14). Two hypoglycemic principles were purified from the bark by Shukia et al. & Babu et al. in our Laboratory (Patents applied).

Gymnemma sylvestre is a climbing plant growing in tropical forests of central and southern part of India. The leaves have a peculiar property of neutralizing temporarily the taste sensation for sugar. Hence the name gurmar is given to it. Alcoholic and water extracts of the leaves of this plant possess antidiabetic property. An active principle GS_4 was isolated from alcoholic extract of leaves. Administration of GS_4 for 4-6 weeks to streptozotocin diabetic rats led to glucose homeostasis (15). It is also reported that extract of leaves suppressed elevation of blood glucose level by inhibiting glucose uptake in the intestine (16).

Momordica charantia (Hindi Karela) is a climber cultivated throughout India as a vegetable. Fruits of this plant are considered to have prophylactic properties and inspite of bitter taste often included in diet. Alcoholic extract showed significant reduction in fasting blood glucose and improvement in glucose tolerance in alloxan induced diabetic rabbits. Charantin and a compound similar to but better than it, was isolated and shown to have hypoglycemic effect (17a,b). Three hypoglycemic compounds Kakara Ia, IIIa and IIIb were isolated from *M. charantia* fruits (17c). A polypeptide similar to bovine insulin has been isolated from fruits of *M. charantia*. It was clinically tried and shown to produce 45% fall in blood sugar of diabetic patients (18).

Pterocarpus marsupium Roxb. known as Vijayasar in Hindi and Indian malabar Kino in English is a large deciduous tree found in hilly regions. Its gum (Kino) is reported to be astringent and used in diarrhea, pyrosis and toothache. Leaves are used externally for boils, sores and for various skin diseases. The water kept overnight in wooden tumbler of the plant is said to be beneficial for chest pain and diabetes in several parts of North India (3). An active principle epicatechin was isolated from the ethanolic extract of the bark. The active principle when administered at a dose of 30 mg/kg b.w. twice daily for 4-5 days lowered blood glucose level of diabetic rats to near normal. Regeneration of β cells has been proposed in diabetic rats treated with epicatechin (19). However, the hypoglycemic activity of epicatechin was contradicted (20). Recently two phenolic compounds marsupin and pterostilbene were isolated from heart wood of this plant. They significantly lowered blood glucose in hyperglycemic rats and their effect was comparable to metamarfin (21).

Trigonella foenum graecum known as fenugreek in English and methi in Hindi is an annual herb, widely used for culminary and medicinal properties for centuries in many parts of the world. Seeds of this plant have

antidiabetic effect. An alkaloid trigonelline present in seeds has a transient and mild hypoglycemic effect and it countered the hyperglycemic effect of cortisone in non diabetic rabbits when administered concomitantly. Other hypoglycemic components were nicotinic acid, courmarin and scopoletin (22). On the basis of the study conducted on streptozotocin diabetic rats, it was suggested that the blood glucose modulating effects were mainly due to delayed gastric emptying coupled with direct interference with intestinal absorption of glucose and cholesterol (23). Moorthy *et. al.* isolated an active principle from seeds of methi (patent applied), which was found to have considerable hypoglycemic activity in mild as well as severe alloxan induced diabetes in rabbits (Moorthy *et. al.* unpublished data).

Plants with uncharacterized hypoglycemic principles

Some more plants which have been used in traditional systems of medicine for treatment of diabetes were demonstrated to have hypoglycemic effect, although the active principles are not isolated.

Whole plant of *Aloe vera* (Ghikanvar) and *Phyllanthus amarus* have antidiabetic effect. Whole dried plant of *P. amarus* at a dose of 5 gm/day was found to reduce blood glucose in humans (24,25). Water extract of whole plant of *Inula racemosa* reduced blood glucose in diabetic rabbits (26). Leaves and stem of Salacia prenoids and whole plant excluding root of *Indigophora tinctoria* were found to be effective in reducing blood glucose (27,28). Extracts of root of *Panax ginsang* and *Hamiltonia suaveolens* were found to be effective in diabetic mice and rabbits respectively (29,30). Ethanolic extract of root of Hedychium spicatum was found effective in rats (31). Seeds of *Zizyphus zujuba* (Baer) and *Trichosanthus dioica* were shown to reduce blood glucose in rabbits (32,33).

Conclusion

Many plants known to be useful in Indian system of medicine and other ancient systems of the World for treatment of diabetes mellitus, have been evaluated according to modern system of medicine. From many plants, only extracts have been prepared and their usefulness evaluated in experimental diabetes in animals and in some cases in diabetic patients also. From some plants like *Allium cepa*, *Allium sativum*, *Ficus bengalensis*, *Gymnema sylvestre* etc. active hypoglycemic principles have been isolated and their mechanism of action studied. Most of them seem to stimulate blood insulin level in NIDDM patients or in experimental diabetic animals. They can be of great use in treatment of diabetes mellitus patients, either by themselves or as supplement to conventional therapy.

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