Volume 1 Issue 2 2012

ISSN: 2320- 4818

Available online at: www. jsirjournal.com

JOURNAL OF SCIENTIFIC & INNOVATIVE RESEARCH

Selected Indian medicinal plant and their therapeutically effect against Diabetes management

Abhinav Sharma[*1], Alok Kumar[1], Pawan Kumar[1]

1. Gayatri College of Pharmacy, Sambalpur, Orissa-768101

[Email: abhinav.sharma2703@gmail.com]

Abstract: Diabetes mellitus is a chronic metabolic disorder of impaired carbohydrates, fat and protein metabolism, characterized by hyperglycemia, polyuria, polydipsia and weight loss, polyphagia, glycosuria, ketosis and acidosis which is due to insulin deficiency or insulin resistance which results in decrease utilization of carbohydrate and excessive glycogenolysis and gluconeogenesis from amino acid by fatty acids. The prevalence of diabetes is 6.4%, affecting 285 million adults, in 2010 and will increase to 7.7% and affecting the 439 million adults by 2030.

Keywords: Medicinal plant, Diabetes, Antidiabetic, Management

Introduction:

Diabetes is a chronic disorder of carbohydrate, fat and protein metabolism characterized by increased fasting and post prandial blood sugar levels. The global prevalence of diabetes is estimated to increase, from 4% in 1995 to 5.4% by the year 2025. The World Health Organization (WHO) has predicted that the major burden will occur in developing countries. The WHO has listed 21,000 plants, which are used for medicinal purposes around the world. Among these 2500 species are in India, out of which 150 species are used commercially on a fairly large scale. India is the largest producer of medicinal herbs and is called as botanical garden of the world. The current review

focuses on medicinal plants used in the treatment of diabetes mellitus, a major crippling disease in the world leading to huge economic losses.[1, 2]

In the last few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter.[3] A number of medicinal plants, traditionally used for over 1000 years named rasayana are present in herbal preparations of Indian traditional health care systems.[4] In Indian systems of medicine most practitioners formulate and dispense their own recipes.[5]

Herbal medicines are the medicinal products that contain plant materials as their pharmacologically active components.[6] Medicinal plants are important for pharmacological research and drug development, not only when plant constituents are used directly as therapeutic agents, but also as starting materials for the synthesis of drugs or as models for pharmacologically active compounds. Herbal drugs are of three types based on the nature of the active metabolites. Drugs used in crude form are the first category. The active constituents isolated after the processing of plant extracts represent the second category of herbal drugs. These are pure molecules and generally pharmacologically more active. Herbal drugs for which data on acute and chronic toxicity studies in animals is available represent the third type.[7] It is estimated that about 25% of the drugs prescribed worldwide are derived from plants and 121 such active compounds are in use. Nearly 80% of African and Asian population depends on traditional medicines for their primary healthcare.[8] In India, about 80% of the rural population uses medicinal herbs or indigenous systems of medicine.[9]

Generally, in traditional medicine in Asian countries, many herbal drugs are combined in the form of a multi-herbal formula to enhance their functions. The herbal constituents are selected to emphasize the therapeutic actions or to reduce the toxicity or side effects of compounds from other herbal species in the mixture.[10] Oral hypoglycaemic agents like sulphonylureas and biguanides are still the major players in management of the disease but there is

growing interest in herbal remedies due to side effects associated with the oral hypoglycaemic agents.[11] Nowadays, the use of complementary alternative medicine and especially the consumption of botanicals have been increasing rapidly worldwide, mostly because of the less frequent side effects when compared to modern western medicine. Therefore there is a need to search more effective and safe herbal drugs for diabetes and its complications.[12, 13]

There are many herbal remedies suggested for diabetes and diabetic complications. Medicinal plants form the main ingredients of these formulations. A details of medicinal plants with antidiabetic and related beneficial effects is given bellow.

Allium sativum: (garlic)

This is a perennial herb cultivated throughout India. Allicin, a sulfur-containing compound is responsible for its pungent odour and it has been shown to have significant hypoglycemic hypoglycemic activity.[14] This effect is thought to be due to increased hepatic metabolism, increased insulin release from pancreatic beta cells and/or insulin sparing effect.[15] Aqueous homogenate of garlic (10 ml/kg/day) administered orally to sucrose fed rabbits (10 g/kg/day in water for two months) significantly increased hepatic glycogen and free amino acid content, decreased fasting blood glucose, and triglyceride levels in serum in comparison to sucrose controls.[16]

Aloe vera and Aloe barbadensis:

Aloe, a popular houseplant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leaf pulp or mucilage, aloe latex, commonly referred to as “aloe juice,” is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of aloe gum effectively increases glucose tolerance in both normal and diabetic rats.[17] Treatment of chronic but not single dose of exudates of Aloe barbadensis leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of Aloe vera and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells.[18] This plant also has an anti-inflammatory activity in a dose dependent

manner and improves wound healing in diabetic mice.[19]

Acacia arabica: (Babhul)

It is found all over India mainly in the wild habitat. The plant extract acts as an antidiabetic agent by acting as secretagouge to release insulin. It induces hypoglycemia in control rats but not in alloxanized animals. Powdered seeds of Acacia arabica when administered (2,3 and 4 g/kg body weight) to normal rabbits induced hypoglycemic effect by initiating release of insulin from pancreatic beta cells.[20]

Carum carvi (Black zeera):

Caraway commonly known as black zeera, member of aromatic umbelliferous plants. In ancient time, Caraway has been used for the treatment of digestive disorders. The major constituents of its seeds are carvone, flavonoids and limonone, whereas it's minor constituents are myrcene, beta-caryophyllene, thujone, anethole and pinene. Co-treatment of Carvi aqueous seed extract (30 and 60mg/kg bwt) for 60 days prevent the streptozotocin induced diabetic nephropathy by reducing the level of serum glucose, urea, creatinine, total urinary protein and total albumin excretion in diabetic rats. The overall renoprotective of Carum carvi is probably due to its antioxidant effect.[21]

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.[22] 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.[23]

Capparis deciduas:

This is found throughout India, especially in dry areas. Hypoglycemic effect was seen in alloxanized rats when the rats were fed with

30% extracts of Capparis decidua (C. decidua) fruit powder for 3 weeks. This extract also reduced alloxan induced lipid peroxidation significantly in erythrocytes, kidney and heart. C. decidua was also found to alter superoxide dismutase and catalase enzyme levels to reduce oxidative stress.[24] C. decidua additionally showed hypolipidaemic activity.[25]

Ginger:

Ginger (Zingiber officinale Roscoe, Zingiberacae) is widely used around the world in foods as a spice. For centuries, it has been an important ingredient in Chinese, Ayurvedic and Tibb- Unani herbal medicines for the treatment of catarrh, rheumatism, nervous diseases, gingivitis, toothache, asthma, stroke, constipation and diabetes.[26] Diabetic rats received the Ginger powder at 5% of their consumed food daily in streptozotocin induced diabetic nephropathy for 8 weeks significantly reduces the extent of lipid peroxidation, which is measured in terms of malondialdehyde (MDA) levels and improves plasma antioxidant capacity. Therefore Ginger causes a decrease in lipid peroxidation, an increase of plasma antioxidant capacity and a reduction in renal nephropathy.[27]

Gymnema montanum:

Gymnema species are traditionally used to treat disorders such as diabetes, high cholesterol, wounds, inflammation and gastrointestinal ailments.[28, 29] Gymnema montanum hook is one of such endemic plant species that belongs to Asclepiadaceae family and it is found mainly in the Shola forests of Western Ghats in India. Ethanolic extract of Gymnema montanum was tested to evaluate the reno-protective effect in alloxan-induced diabetic rats. An oral dose of 200 mg/kg body weight of the ethanol extract of leaves of Gymnema montanum was administered in rats for 3 weeks that significantly normalized the elevated blood glucose, renal markers including urea, creatinine and uric acid and lipid peroxidation markers including thiobarbituric reactive substances (TBARS) and hydroperoxides and increased the antioxidant enzymes levels such as superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and glutathione-S-transferase (GST) in diabetic kidney. Thus Gymnema montanum ethanolic leave extract was found to be more

effective in reducing oxidative stress and it confirming the ethnopharmacological use of Gymnema montanum in protecting diabetes and its complications.[30]

Mangifera indica: (Mango)

The leaves of this plant are used as an antidiabetic agent in Nigerian folk medicine, although when aqueous extract given orally did not alter blood glucose level in either normoglycemic or streptozotocin induced diabetic rats. However, antidiabetic activity was seen when the extract and glucose were administered simultaneously and also when the extract was given to the rats 60 min before the glucose. The results indicate that aqueous extract of Mangifera indica possess hypoglycemic activity. This may be due to an intestinal reduction of the absorption of glucose.[31]

Ocimum sanctum: (holy basil)

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.[32] 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 diabetic rats.[33, 34] 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.[35] This plant also showed antiasthemitic, antistress, antibacterial, antifungal, antiviral, antitumor, gastric antiulcer activity, antioxidant, antimutagenic and immunostimulant activities.

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.[36] The plant also shows

antiinflammatory, antimutagenic, anticarcinogenic, antidiarrhoeal activity.

Tinospora cordifolia: (Guduchi)

It is a large, glabrous, deciduous climbing shrub belonging to the family Menispermaceae. It is widely distributed throughout India and commonly known as Guduchi. Oral administration of the extract of Tinospora cordifolia (T. cordifolia) roots for 6 weeks resulted in a significant reduction in blood and urine glucose and in lipids in serum and tissues in alloxan diabetic rats. The extract also prevented a decrease in body weight.[37] T. cordifolia is widely used in Indian ayurvedic medicine for treating diabetes mellitus.[38-41] Oral administration of an aqueous T. cordifolia root extract to alloxan diabetic rats caused a significant reduction in blood glucose and brain lipids. Though the aqueous extract at a dose of 400 mg/kg could elicit significant antihyperglycemic effect in different animal models, its effect was equivalent to only one unit/kg of insulin.[42] It is reported that the daily administration of either alcoholic or aqueous extract of T. cordifolia decreases the blood glucose level and increases glucose tolerance in rodents.

Picrorhiza scrophulariiflora:

Picrorhiza is a perennial herb belonging to the family of Scrophulariaceae. The dried rhizomes of Picrorhiza have long been used to treat inflammatory diseases such as arthritis and asthma in Southeast Asia. Oral administration of ethanol extract of dried rhizomes of Picrorhiza scrophulariiflora at a dose of 400 mg/kg per day for 5 or 10 weeks in streptozotocin induced diabetic rats significantly attenuated oxidative stress in the diabetic kidney by a reduction in NADPH (nicotinamide adenine dinucleotide phosphate) oxidase-dependent superoxide generation and decreased expression of malondialdehyde and advanced oxidation protein products in renal tissue. This was accompanied by an improvement in renal inflammation, including decreased macrophage influx and downregulated expression of chemokines such as CCL2 (chemokine (C-C motif) ligand 2) and transforming growth factor-ß1 (TGF-ß1). These data suggest that Picrorhiza scrophulariiflora might improve diabetic nephropathy, probably through inhibition of redox-sensitive inflammation.[43]

Conclusion:

The present review has focused the selected medicinal plants used in the treatment of diabetic complications. It shows that the plants highlighted above have potent role in diabetic complications. Most of the plant extracts and its isolated constituents exhibited hypolipidemic and antioxidant effects, which may be helpful to treating diabetes and its associated complications. Thus many different plants have been used for treatment of diabetes and its complications. Efforts are now being made to investigate mechanism of action of some of these plants using model systems.

Reference:

1. Pontiroli, A.E., Ealdera, A., Pozza, G. Diabetes, metabolism Reveiws, 1994; 10: 31.
2. Gurden, G., Perin, P.C. and Camussi, G. Insight on the Pathogenesis of Diabetic Nephropathy from the Study of Podocyte and Mesangial Cell Biology, Curr Diab.Rev .2005;1: 27-40.
3. Grover, J.K., Yadav, S., and Vats, V.: Medicinal plants of India with antidiabetic potential. J. Ethnopharmacol., 81, 81–100, 2002.
4. Scartezzini, P. and Sproni, E.: Review on some plants of Indian traditional medicine with antioxidant activity. J. Ethnopharmacol., 71, 23–43, 2000.
5. Seth, S.D. and Sharma, B.: Medicinal plants of India. Indian J. Med. Res., 120, 9–11, 2004.
6. Schulz, V., Hansel, R., Tyler,V.E: Rational Phytotherapy: A Physicians' Guide to Herbal Medicine. Berlin, Germany, Springer Verlag, 1998.
7. Iwu, M.M., Duncan, A.R., Okunji, C.O. New antimicrobials of plant origin. In: Janick J, editor. Perspectives on new crops and new uses. Alexandria: ASHS Press; 1999: 457.
8. Seth, S.D. and Sharma, B. Medicinal plants of India. Indian J. Med. Res., 2004; 120: 9–11.
9. DeFronzo, R.A. Pharmacologic therapy for type 2 diabetes mellitus. Annals of Internal Medicine 1999; 131: 281–303.
10. Bansky, D., Barolet, R. Chinese Herbal Medicine Formulas and

Strategies. Eastland Press, Seattle, 1990: 7–8.

11. Patel, K., Srinivasan, K., Plant foods in the management of diabetes mellitus: vegetables as potential hypoglycemic agents. Nahrung 1997; 41:68–74.
12. Borchers, A.T., Sakai, S., Henderson, G.L et al. Shosaikoto and other Kampo (Japanese herbal) medicines: a review of their immunomodulatory activities, J. Ethnopharmacol 2000; 73:1 -13.
13. Pari, L., Uma, MJ. Hypoglycaemic effect of Musa sapientum L. in alloxan-induced diabetic rats. JEthnopharmacol 1999; 68:321-325.
14. Sheela, C.G. and Augusti, K.T.: Antidiabetic effects of S-allyl cysteine sulphoxide isolated from garlic Allium sativum Linn. Indian J. Exp. Biol., 30, 523–526, 1992.
15. Bever, B.O. and Zahnd, G.R.: Plants with oral hypoglycemic action. Quart. J. Crude Drug Res., 17, 139–146, 1979.
16. Zacharias, N.T., Sebastian, K.L., Philip, B., and Augusti, K.T.: Hypoglycemic and hypolipidaemic effects of garlic in sucrose fed rabbits. Ind. J. Physiol. Pharmacol., 24, 151– 154, 1980.
17. Augusti, K.T. and Shella, C.G.: Antiperoxide effect of S-allyl cysteine sulfoxide, an insulin secretagogue in diabetic rats. Experientia, 52, 115–120, 1996.
18. Al-Awadi, F.M. and Gumaa, K.A.: Studies on the activity of individual plants of an antidiabetic plant mixture. Acta Diabetologica, 24, 37–41, 1987.
19. Ajabnoor, M.A.: Effect of aloes on blood glucose levels in normal and alloxan diabetic mice. J. Ethnopharmacol., 28, 215–220, 1990.
20. Wadood, A., Wadood, N., and Shah, S.A.: Effects of Acacia arabica and Caralluma edulis on blood glucose levels on normal and alloxan diabetic rabbits. J. Pakistan Med. Assoc., 39, 208–212, 1989.
21. Wang,S.C., Lee,S.F., Wang,C.J., Lee,C.H., Lee,W.C., Lee,H.J. Aqueous Extract from Hibiscus sabdariffa linnaeus Ameliorate Diabetic Nephropathy via Regulating Oxidative Status and Akt/Bad/ 14-3-3g in an Experimental Animal

Model.eCAM. 2009:1-9. doi:10.1093/ecam/nep181.

22. Chakrabarti, S., Biswas, T.K., Rokeya, B., Ali, L., Mosihuzzaman, M., Nahar, N., Khan, A.K., and Mukherjee, B.: Advanced studies on the hypoglycemic effect of Caesalpinia bonducella F. in type 1 and 2 diabetes in Long Evans rats. J. Ethnopharmacol., 84, 41–46, 2003.
23. Sharma, S.R., Dwivedi, S.K., and Swarup, D.: Hypoglycemic, antihyperglycemic and hypolipidemic activities of Caesalpinia bonducella seeds in rats. J. Ethnopharmacol., 58, 39–44, 1997.
24. Kannur, D.M., Hukkeri, V.I., and Akki, K.S.: Antidiabetic Yadav, P., Sarkar, S., and Bhatnagar, D.: Lipid peroxidation and antioxidant enzymes in erythrocytes and tissues in aged diabetic rats. Indian J. Exp. Biol., 35, 389–392, 1997.activity of Caesalpinia bonducella seed extracts in rats.
25. Agarwal, V. and Chauhan, B.M.: A study on composition and hypolipidemic effect of dietary fiber from some plant foods. Plant Foods Human Nutr., 38, 189–197, 1988.
26. Wang, W.H., Wang, Z.M. Studies of commonly used traditional medicine-ginger. Zhongguo Zhong Yao Za Zhi. 2005; 30: 1569–1573.
27. Afshari,A.T., Shirpoor,A., Farshid,A., Saadatian,R., Rasmi,Y., Saboory,E., Ilkhanizadeh,B., Allameh,A. The effect of ginger on diabetic nephropathy, plasma antioxidant capacity and lipid peroxidation in rats. Food chemistry 2007; 101:148-153.
28. Shanmugasundaram, K.R., Panneerselvam, C., Sumudram, P., Shanmugasundaram, E.R.B. Insulinotropic activity of Gymnema sylvestre , R.Br. and Indian medicinal herb used in controlling diabetes mellitus. Pharmacol. Res. Commun. 1981; 13: 475–486.
29. Mhaskar, K.S., Caius, J.F. A study of Indian medicinal plants. II. Gymnema sylvestre , R.Br. Ind. J. Med. Res. Mem. 1930; 16: 2–75.
30. Ramkumar, K.M., Ponmanickam, P., Velayuthaprabhu, S., Archunan, G., Rajaguru, P. Protective effect of Gymnema montanum against renal damage in experimental diabetic rats.

Food and Chemical Toxicology 2009; 47: 2516–252.

31. Aderibigbe, A.O., Emudianughe, T.S., and Lawal, B.A.: Antihyperglycemic effect of Mangifera indica in rat. Phytother Res., 13, 504–507, 1999.
32. Vats, V., Grover, J.K., and Rathi, S.S.: Evaluation of antihyperglycemic and hypoglycemic effect of Trigonella foenumgraecum Linn, Ocimum sanctum Linn and Pterocarpus marsupium Linn in normal and alloxanized diabetic rats. J. Ethnopharmacol., 79, 95–100, 2002.
33. Rai, V., Iyer, U., and Mani, U.V.: Effect of Tulasi (Ocimumsanctum) leaf powder supplementation on blood sugar levels, serum lipids and tissue lipid in diabetic rats. Plant Food For Human Nutrition, 50, 9–16, 1997.
34. Vats, V. and Yadav, S.P.: Grover, Ethanolic extract of Ocimum sanctum leaves partially attenuates streptozotocin induced alteration in glycogen content and carbohydrate metabolism in rats. J. Ethnopharmacol., 90, 155–160, 2004.
35. Kim,H.J., Kong,M.K., Kim,Y.C. Beneficial effects of Phellodendri cortex extract on hyperglycemia and diabetic nephropathy in streptozotocin-induced diabetic rats. BMB reports. 2008; 41(10): 710-715.
36. Raphael, K.R., Sabu, M.C., and Kuttan, R.: Hypoglycemic effect of methanol extract of Phyllanthus amarus on alloxan induced diabetes mellitus in rats and its relation with antioxidant potential. Indian J. Exp. Biol., 40, 905–909, 2002.
37. Stanely, P., Prince, M., and Menon, V.P.: Hypoglycemic and hypolipidemic action of alcohol extract of Tinospora cordifolia roots in chemical induced diabetes in rats Phytother. Res., 17, 410–413, 2003.
38. Stanely, M., Prince, P., and Menon, V.P.: Antioxidant action of Tinospora cordifolia root extract in alloxan diabetic rats. Phytother. Res., 15, 213–218, 2001.
39. Price, P.S. and Menon, V.P.: Antioxidant activity of Tinospora cordifolia roots in experimental

diabetes. J. Ethnopharmacol., 65, 277–281, 1999.

40. Mathew, S. and Kuttan, G.: Antioxidant activity of Tinospora cordifolia and its usefulness in the amelioration of cyclophosphamide-induced toxicity. J. Exp. Clin. Cancer. Res., 16, 407–411, 1997.
41. Dhaliwal, K.S.: Method and composition for treatment of diabetes. US Patent 5886029, 1999.
42. Gupta, S.S., Varma, S.C.L., Garg, V.P., and Rai, M.: Antidiabetic effect of Tinospora cordifolia. I. Effect on fasting blood sugar level, glucose tolerence and adrenaline induced hyperglycemia. Indian J. Exp. Biol., 55, 733–745, 1967.
43. Li, J.H., Hou,F.F., Zhang,X., Liang,M., Guo,z.j., Xie,D. Ethanol extraction of Picrorhiza scrophulariiflora prevents renal injury in experimental diabetes via anti-inflammation action .Journal of Endocrinology. 2009; 200: 347–355.