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SOME MEDICINAL PLANTS OF INDIA WITH ANTI-DIABETIC PROPERTIES

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ABSTRACT

Plants have been an exemplary source of medicine from ancient times. Various human diseases can be treated by the use of medicinal plants. India has a vast variety of plant species (about 45000) and among them, several thousands have been claimed to possess medicinal properties. Research on the plants has shown that many of the plants which were used by the people traditionally to cure diabetes have shown anti-diabetic property. The plants mentioned in this paper and their products (active, natural principles and crude extracts) that have been mentioned/used in the Indian traditional system of medicine and have shown experimental or clinical anti-diabetic activity. Indian plants which are most effective and the most commonly studied in relation to diabetes and their complications are: Allium cepa , Allium sativum , Aloe vera , Cajanus cajan , Coccinia indica , Caesalpinia bonducella , Ficus bengalenesis , Gymnema sylvestre , Momordica charantia , Ocimum sanctum , Pterocarpus marsupium , Swertia chirayita , Syzigium cumini , Tinospora cordifolia and Trigonella foenum graecum. Among these we have evaluated M. charantia , Eugenia jambolana , Mucuna pruriens , T. cordifolia , T. foenum graecum , O. sanctum , P. marsupium , Murraya koeingii and Brassica juncea . All plants have shown varying degree of hypoglycemic and anti-hyperglycemic.

INTRODUCTION

Diabetes mellitus (DM) is a very common endocrine disorder that affects more than 100 million people worldwide (6% of the population). In India, the prevalence rate of diabetes is estimated to be 1 −/5%. Historical accounts reveal that as early as 700 −/200 BC, DM was a

well recognized disease in India and was even distinguished as two types; a genetically based disorder.

The oral hypoglycemic agents/insulin are effective in controlling hyperglycemia, they have prominent side effects also and fail to significantly alter the course of diabetic complications. As the knowledge of heterogeneity of this disorder increases, there is need to look for more efficacious agents with lesser side effects.

Allium cepa: Pyaj (Hindi) and Onion (English)

It is cultivated throughout India and is an important dietary constituent. Various ether soluble fractions of onion as a single oral dose (0.25 mg/kg) showed significant hypoglycemic effect in normal fasted rabbits. Ethyl ether extract showed most potent hypoglycemic action. Petroleum ether insoluble fraction of the ether extract of dried onion powder (100 mg/ kg) given orally for 7 days to alloxanized (180 mg/kg) diabetic rabbits caused a significant anti-hyperglycemic effect. Oral administration of 250 mg/kg of ethanol, petroleum, chloroform and acetone extract of powder dried onion showed maximal reduction of 18.57, 8.35, 3.0 and 3.20% in fasting blood glucose of alloxanized (150 mg/kg IP) diabetic rabbit. In a preliminary study of seven different fractions obtained from onion bulb, only petroleum ether and chloroform extracts significantly lowered blood sugar in OGTT (2 gm/kg) in rabbits. Feeding of diet containing 3% freeze-dried onion powder for 8 weeks produced a significant hypoglycemia along with partial reversion.

Acacia arabica or nilotica: Babul (Hindi), Indian Gum Arabic tree (English)

It occurs in wild throughout in India and is also cultivated. Feeding of 94% seed diet to normal rats showed significant hypoglycemic effect versus controls. However, the same diet failed to show any hypoglycemic effect in alloxanized rats (175 mg/kg SC) indicating that plant acts through release of insulin. Powdered seeds of Acacia arabica administered in doses of 2, 3 and 4 gm/kg body weight exerted a significant (P B0.05) hypoglycemic effect in normal rabbits by

Azadirachta indica: Nim or Neem (Hindi)

It is a medium to large size tree found throughout India in deciduous forests and is also widely cultivated. Hydroalcoholic extract of Azadirachta indica showed hypoglycemic and anti-hyperglycemic effect in normal, glucose fed and STZ diabetic rats. The plant exerts its

pharmacological activity independent of its time of administration i.e. either prior or after alloxan administration. The plant blocks the action of epinephrine on glucose metabolism, thus increasing peripheral glucose utilization. It also increased glucose uptake and glycogen deposition in isolated rat hemidiaphragm.

Aegle marmelose: Bael or Sirphal (Hindi), Holy Fruit Tree (English)

It is a medium sized, armed deciduous tree found wild, especially in dry forests and is also cultivated throughout India. Oral administration of aqueous decoction of Aegle marmelose root bark (1 ml/100 gm) showed hypoglycemic effect which was maximum (44%) at 3 h in normal fasted rats. In addition, the same extract completely prevented peak rise of blood sugar at 1 h in OGTT. The hypoglycemic activity was reduced upon storage of extract). Aqueous extract of the leaves (1 gm/kg for 30 days) significantly controlled blood glucose, urea, body weight, liver glycogen and serum cholesterol of allox- anized (60 mg/kg IV) rats as compared to controls and this effect was similar to insulin treatment When fed as aqueous leaf extract (1 gm/kg/ day) to STZ (45 mg/kg IV) diabetic rats for 2 weeks, it decreased malate dehydrogenase levels (an enzyme known to increase in diabetes) in comparison to diabetic controls. The extract was equieffective in comparison to insulin in restoring blood glucose and body weight to normal levels. Aqueous leaf extract administered orally for 28 days also normalized STZ (45 mg/kg body weight) induced histopathological alterations in the pancreatic and kidney tissues of rats

Allium sativum: Lahasun (Hindi) and Garlic (English)

It is a perennial herb cultivated throughout India and is commonly used as a food ingredient. Oral adminis- tration of 0.25 gm/kg of ethanol, petroleum ether, ethyl ether extract of Allium sativum causes 18.9, 17.9, 26.2% reduction in blood sugar in alloxan-diabetic rabbits (150 mg/kg IV)). Oral administration of 0.25 gm/kg allicin (isolated from A. sativum) produced hypoglycemia comparable to lbutamide in mildly diabetic rabbits (glucose levels ranging from 180 to 300 mg%) while it showed no such effect in severelydiabetic animals (blood sugar >350 mg%) Aqueous homogenate of garlic (10 ml/kg/day) administered orally to sucrose fed rabbits (10 gm/kg/day in water for 2 months) significantly increased hepatic glycogen and free amino acid contents, de- creased fasting blood sugar, triglyceride levels in serum,

Brassica juncea: Rai (Hindi)

It is commonly used spice in various food items in India. Oral feeding of Brassica juncea diet (10% w/w) for 60 days to normal rats led to significant hypoglycemic effect. This effect was attributed to stimulation of glycogen synthetase (leading to increase in hepatic glycogen content) and suppression of glycogen phos- phorylase and other gluconeogenic enzymes. Anti-oxidant and hypolipidemic activity) is also described in literature.

Eugenia uniflora: Pitanga and Surinam cherry (Vernacular)

It is a large bushy shrub cultivated in garden. It is also distributed in southern Asia, Africa, and in South America. Oral feeding of ethanol extract of the leaves of Eugenia uniflora to mice has been shown to contain plasma glucose levels during OGTT and plasma trigly- ceride level in oral corn oil tolerance test (

Few fractions isolated on the basis of polarity and molecular size from the ethanolic extract of the leaves of E. uniflora have shown positive effects in OGTT conducted in mice). In addition all fractions except one showed dose-dependent inhibitory effect on lipase activity and these effects were apparently due to the inhibition of the decomposition of carbohydrates and fats in the intestine

Musa sapientum: Kela (Hindi) and Banana (English)

It is cultivated throughout India and its various parts are used for different medicinal purposes including diabetes. Intragastric administration of fresh flower decoction (4 ml/kg) to hyperglycemic rabbits signifi- cantly decreased the hyperglycemic peak and/or the area under the glucose tolerance curve). Oral administration of various doses (150, 200 and 250 mg/kg) of chloroform extract of Musa sapien- tum flowers for 30 days significantly reduced blood glucose and glycosylated hemoglobin and increased total hemoglobin in alloxanized rats (150 mg/kg IP).

Salacia oblonga: Ponkoranti (Vernacular)

Aqueous extract of the root bark has shown hypo- glycemic activity. Two biologically active fractions from the petroleum ether extract of the root bark has been shown to exert hypoglycemic effect of about 60 and 76% potency of an equal dose of tolbutamide (250 mg/kg) in albino rats. Petroleum ether extract of the bark of the root has been shown to prevent STZ (65 mg/ kg) induced hyperglycemia and hypoinsulinemia in rats. The aqueous-methanolic extract of the roots inhibited increase in serum glucose level in sucrose and

maltose loaded rats. The water-soluble and ethyl acetate soluble portions of the same extract showed inhibitory activities on alpha-glucosidase and aldose reductase Further, salacinol and kotalanol with nine other sugar related component were isolated from the water soluble portion while, a new triterpene, kotala- genin 16-acetate along with known diterpene and triterpenes isolated from the ethyl acetate portion were found to be responsible component for the inhibitory activity on aldolase reductase. In addition, the extract has shown significant anti-oxidant activity.

Conclusion

Due to economic constraints, providing modern medical healthcare in developing countries such as India is still a far-reaching goal. The most commonly used drugs of modern medicine such as aspirin, anti malarials, anti-cancers, digitalis, etc. have originated from plant sources. Out of an estimated 25000 higher plants, less than 1% have been screened pharmacologically and very few in regard to DM. Therefore, it is prudent to look for options in herbal medicine for diabetes as well. We have been working continuously towards establishing the scientific basis of use of certain plants in DM. We have previously shown that M. charantia and E. jambolana are very effective in controlling glucose levels in chemically induced mild to severe model of DM in rodents and seem to work by stimulating kinases involved in peripheral utilization of glucose. In addition, both these plants have shown excellent positive outcomes in respect to diabetic complications such as diabetic nephropathy, fructose induced insulin resistance and cataract.The 2 plants also partially prevented diabetic neuro- pathy Recently we have taken up work in assessing the efficacy of Trigonella foenum graecum , O. sanctum , P. marsupium , M. koeingii and B. juncea in DM and its related complications. Although all these plants have shown varying degree of hypoglycemic and anti-hyperglycemic activity, not all (notably M. pruriens , T. cordifolia , M.koeingii and B. juncea) were effective in severe experimental diabetes and its related complications. A novel anti-hyperglycemic amino acid has been extracted and purified from Fenugreek seeds (4-hydroxyleucine) which reportedly increases glucose-induced insulin release. A. vera has been shown to improve wound healing in STZ diabetic mice and A. sativum prevented diabetic cardiovascular complications. The apparent benefit of drinking water in the glass made out of the bark of Vijayasar by diabetic patients have been proven to be true by an Indian open multicentric study. Results of this study showed that the Vijayasar extract could control fasting and postprandial blood glucose levels in 69% of patients (n =97). Such an ethnomedical approach for diabetes is a practical, cost-effective and a logical for its

treatment. The goals of medicine no matter to which group it belongs, are the same i.e. the welfare of the patient.

References

- Abdel-Barry, J.A., Abdel-Hassan, I.A., Al-Hakiem, M.H. 1997. Hypoglycemic and antihyperglycemic effects of Trigonella foe- num-graecum leaf in normal and alloxan induced diabetic rats. Journal of Ethnopharmacology 58 (3), 149 −/155.
- Abdel-Hassan, I.A., Abdel-Barry, J.A., Tariq Mohammeda, S. 2000. The hypoglycemic and antihyperglycemic effect of Citrullus colo- cynthis fruit aqueous extract in normal and alloxan diabetic rabbits. Journal of Ethnopharmacology 71 (1 −/2), 325 −/330.
- Azad Khan, A.K., Akhtar, S., Mahtab, H. 1979. Coccinia indica in the treatment of patients with diabetes mellitus. Bangladesh Medical Research Council Bulletin 5 (2), 60 −/66.
- Babu, P.S., Srinivasan, K. 1997. Influence of dietary capsaicin and onion on the metabolic abnormalities associated with streptozoto- cin induced diabetes mellitus. Molecular and Cellular Biochemistry 175 (1 −/2), 49 −/57.
- Bailey, C.J., Day, C. 1989. Traditional plant medicines as treatment for diabetes. Diabetes Care 12, 553 −/564.
- Chakravarthy, B.K., Gupta, S., Gambhir, S.S., Gode, K.D. 1980. Pancreatic beta cell regeneration. A novel antidiabetic mechanism of Pterocarpus marsupium Roxb. Indian Journal of Pharmacology 12, 123 −/127.
- Daniel, R.S., Mathew, B.C., Devi, K.S., Augusti, K.T. 1998. Anti- oxidant effect of two flavonoids from the bark of Ficus bengalenesis Linn. in hyperlipidemic rats. Indian Journal of Experimental Biology 36 (9), 902 −/906.
- Grover, J.K., Rathi, S.S., Vats, V. 2002. Amelioration of experimental diabetic neuropathy and gastropathy in rats following oral admin- istration of plant extracts. Indian Journal of Experimental Biology, 40 (3) 273 −/276.
- Gupta, D., Raju, J., Baquer, N.Z. 1999. Modulation of some gluconeogenic enzyme activities in diabetic rat liver and kidney: effect of antidiabetic compounds. Indian Journal of Experimental Biology 37 (2), 196 −/199.

- Haranath, P.S.R.K., Ranganatharao, K., Anjaneyulu, C.R., Rama- nathan, J.D. 1958. Studies on the hypoglycemic and pharmacolo- gical actions of some stilbenes. Indian Journal of Medical Science 12, 85 −/89.
- Hossain, M.Z., Shibib, B.A., Rahman, R. 1992. Hypoglycemic effects of Coccinia indica : inhibition of key gluconeogenic enzyme, glucose-6-phosphatase. Indian Journal of Experimental Biology 30 (5), 418 −/420.
- Indian Council of Medical Research (ICMR) Collaborating Centres, New Delhi, 1998. Flexible dose open trial of Vijayasar in cases of newly diagnosed non-insulin-dependent diabetes mellitus. Indian Journal of Medical Research (108), 24 −/29.
- Indira, G., Mohan Ram, M., 1992. Fruits, National Institute of Nutrition, Indian council of Medical Research, Hyderabad, India, pp. 34 −/37.
- Jafri, M.A., Aslam, M., Javed, K., Singh, S. 2000. Effect of Punica granatum Linn. (flowers) on blood glucose level in normal and alloxan-induced diabetic rats. Journal of Ethnopharmacology 70 (3), 309 −/314.
- Jain, R.C., Vyas, C.R. 1974. Letter: hypoglycemia action of onion on rabbits. British Medical Journal 2 (921), 730.
- Khandre, S.S., Rajwade, G.G., Jangle, S.N. 1983. A study of the effect of bija and jamun seed extract on hyperglycaemia induced by glucose load. Maharashtra Medical Journal 30, 117.
- Khanna, P., Jain, S.C., Panagariya, A., Dixit, V.P. 1981. Hypogly- cemic activity of polypeptide-p from a plant source. Journal of Natural Products 44 (6), 648 −/655.
- Lolitkar, M.M., Rao, M.R.R. 1966. Pharmacology of a hypoglycemic principle isolated from the fruits of Eugenia jambolana Linn. Indian Journal of Pharmacy 28 (5), 129 −/133.
- Mahapatra, P.K., Pal, M., Chaudhauri, A.K.N., Chakarborty, D., Basu, A. 1985. Preliminary studies on glycemic effect of Syzigium cumini seeds. IRCS.
- Nandkarni, A.K. 1992. Indian Materia Medica, vol. 1. Popular Prakashan, Bombay, p. 157.
- Ohsugi, M., Fan, W., Hase, K., Xiong, Q., Tezuka, Y., Komatsu, K., Namba, T., Saitoh, T., Tazawa, K., Kadota, S. 1999. Active- oxygen scavenging activity of traditional nourishing-tonic herbal medicines and active constituents of Rhodiola sacra. Journal of Ethnopharmacology 67 (1), 111 −/119.

- Pandey, M.C., Sharma, P.V. 1976. Hypoglycemic effect of bark of Pterocarpus marsupium ROXB. (Bijaka) on alloxan induced diabetes. Medicine and Surgery 16 (7), 9.
- Pant, M.C., Uddin, I., Bhardwaj, U.R., Tewari, R.D. 1968. Blood sugar and total cholesterol lowering effect of Glycine soja (Sieb and Zucc.), Mucuna pruriens (D.C.) and Dolichos biflorus (Linn.) seed diets in normal fasting albino rats. Indian Journal of Medical Research 56 (12), 1808 −/1812.
- Sachdeva, A., Khemani, L.D. 1999. A preliminary investigation of the possible hypoglycemic activity of Hibiscus rosa-sinensis . Biomedi- cine and Environmental Science 12 (3), 222 −/226.
- Saifi, A.Q., Shinde, S., Kavishwar, W.K., Gupta, S.R. 1971. Some aspects of phytochemistry and hypoglycemic actions of Pterocarpus marsupium .
- Trivedi, C.P. 1963. Observations on the effects of some Indigenous drug on blood sugar level of normal and diabetic rabbits. Indian Journal of Physiology and Pharmacology 7, S11 −/12.
- Vats, V., Grover, J.K., Tandon, N., Rathi, S.S. 2001. Treatment with extracts of Momordica charantia prevents hyperglycemia and Eugenia jambolana prevents hyperglycemia and hyperinsulinemia in fructose fed rats. Journal of Ethnopharmacology 76 (2), 139 −/ 143.