



A Comprehensive Review on Folklore Antidiabetic Plants

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ABSTRACT

Diabetes mellitus is a lifestyle disorder that is rapidly becoming a major threat to populations all over the globe. Medical plants play an important role in the management of diabetes mellitus especially in developing countries where resources are meager. Herbal medicines have been the highly esteemed source of medicine throughout human history. Some of these herbal plants and their active chemical constituents which have a role in the management of diabetes mellitus are compiled here and discussed in this review.

Keywords: Diabetes mellitus; Medicinal plants; Hyperglycemia; Insulin.

INTRODUCTION

Diabetes mellitus is a heterogeneous metabolic disorder characterized by altered carbohydrate, lipid and protein metabolism which causes hyperglycemia resulting from insufficient insulin secretion, insulin action or both. It is a common and prevalent disease affecting the citizens of both developed and developing countries¹. It is estimated that 25% of the world population is affected by this disease. Diabetes mellitus, being a multifactorial disease, demands multiple therapeutic approaches. Although, synthetic oral hypoglycemics together with insulin are the main route for controlling diabetes. However, they exhibited prominent side effects and failed to reverse the course of its complications². This constitutes the major force for finding alternatives, mainly from plant kingdom that is of less severe or even no side effects. Natural products are the major mine for discovering promising lead candidates, which play an important role in future drug development programs. Herbal medicines involve the integration of several therapeutic experiences and practices of indigenous systems of medicine that may span many previous generations, which often provide valuable guidelines to the selection, preparation and application of herbal formulation with a view to providing therapeutic benefits.

Treatment of illness and maintenance of health/well-being using herbal medicines is the oldest and most popular form of healthcare practice known to humanity that has been practiced by all cultures in all ages throughout the history of civilization^{3,4}.

The herbal drugs with antidiabetic activity are yet to be commercially formulated as modern medicines, even though they have been acclaimed for their therapeutic properties in the traditional systems of medicine⁵. The

ethnobotanical information reports about 800 plants that may possess antidiabetic potential⁶. This review article enumerates some medicinal plants possessing antidiabetic activity.

Antidiabetic Effect of Medicinal Plants

Aegle marmelos

It belongs to family Rutaceae and is a mid-sized, slender, aromatic, armed, gum-bearing tree and has a leaf with three leaflets. It is seen in dry forests on hills and plains of northern, central, eastern and southern India, Pakistan, southern Nepal, Sri Lanka, Myanmar, Bangladesh, Vietnam. It has been reported that aqueous extract of the leaves (1 gm/kg for 30 days) significantly controlled blood glucose, urea, body weight, liver glycogen and serum cholesterol of alloxanized rats as compared to control and this effect was similar to insulin treatment. The extract was equi-effective in comparison to insulin in restoring blood glucose and body weight to normal levels⁷.

Alangium lamarckii

It is a small, bushy tree or deciduous herb offering a dense canopy with a short trunk belonging to family Alangiaceae. It bears fragrant white flowers which have green buds. It is native to Western Africa, Madagascar, Southern and Eastern Asia, tropical Australia, the western Pacific Ocean islands and New Caledonia. Alcoholic leaves extract of 250 and 500 mg/kg body weight was used for these studies. *A. lamarckii* have significant antidiabetic activity in STZ nicotinamide induced diabetic rat⁸.

Albizia odoratissima

Albizia odoratissima, a member of the Fabaceae family, is a fast-growing, deciduous tree. It is frequently found on hill slopes of sub-Himalayan tracts from the Indus eastward; Bangladesh; Myanmar; central, western and



southern India; and the low-lying country of Ceylon. Antidiabetic effect of methanolic bark extract of *Albizia odoratissima* in alloxan induced diabetic mice was proved. The methanolic extracts were fed to the animals at a dosage of 250 and 500 mg/kg body weight. The significant reduction in the levels of serum cholesterol, triglycerides, SGOT, SGPT, alkaline phosphatase and decrement of total proteins in alloxan induced albino mice were noticed⁹.

Artemis Sphaerocephala Krasch

Artemisia Sphaerocephala Krasch, compositae family, is widely distributed in the desert and semi-desert regions of Mongolia and China. Antioxidant effect of *Artemis sphaerocephala* gum on STZ induced diabetic rat was proved. Levels of serum and liver tissue thiobarbituric acid reactive substances (TBARS) and +OH were increased in STZ induced rat. The activity levels of liver and serum superoxide dismutase were decreased. After administration of an extract of *A. sphaerocephala*, levels of TBARS and +OH were decreased in serum and liver tissue. The significant increments in the levels of liver and serum SOD were also reported¹⁰.

Brassica juncea

Brassica juncea is a traditional medicinal plant which belongs to family Cruciferae. It is a widely distributed plant seen in Asia, America and Africa. *B. juncea* aqueous seed extract has a potent hypoglycemic activity which was investigated in STZ induced diabetic male albino rat. Doses which have hypoglycemic activity was reported as 250, 350, 450 mg/kg¹¹.

Coccinia indica

Coccinia indica, Cucurbitaceae family, are perennial climbing or creeping herbs widely used in traditional treatment of diabetes mellitus in sub-Saharan Africa and Southeast Asia. Alcoholic extract of the plant was found to be active in reducing blood glucose level, then this extract was subjected to further fractionation to evaluate its biochemical parameters affecting diabetes and results suggested toluene as an active fraction. The exact action of these principles may be due to their β -cell restorative properties against alloxan-induced damage¹².

Dioscorea dumetorum

Dioscorea dumetorum belonging to family Dioscoreaceae is a robust climber with annual stems growing from a tuber. It is widely seen in Asian and African countries. Used in the treatment of diabetes in traditional medicine, possesses hypoglycemic effect. An alkaloid present in an extract, dioscoretine, has been reported to possess hypoglycemic effect. It has been reported that aqueous extract of *D. Dumetorum* tuber control hyperlipidemia, hypercholesterolemia and hyperketonemia¹³.

Eugenia jambolana

It is an evergreen tropical tree in the flowering plant family Myrtaceae. This plant is native to the Indian

Subcontinent and adjoining regions of Southeast Asia. *Eugenia jambolana* has been indicated in Ayurveda, an ancient system of Indian medicine, for use in diabetes.

In accordance with its claimed anti-diabetic effect in traditional medicine, *E. jambolana* has been reported to have hypoglycemic effects both in experimental models and clinical studies¹⁴.

Gymnema sylvestre

Gymnema sylvestre is a woody, climbing plant, native to India and other south Asian countries belonging to family Asclepiadaceae.

Investigation of the hypoglycemic activity of saponin constituents from gymnemic acid, a crude saponin fraction of *G. sylvestre*, identified not only two new saponins, Gymnemosides A and B, but also Gymnemic acid V as the active principle.

The triterpene glycosides isolated from plant inhibited glucose utilization in muscles and Gymnemic fractions also inhibit glucose uptake in the intestine.

According to a study, *G. sylvestre* enhances the production of endogenous insulin. The studies have revealed that the drug acts indirectly through stimulation of insulin secretion of the pancreas, as it has no direct action on the carbohydrate metabolism and it significantly reduced glucose levels in the hyperglycemic rats, it had no effect on normal rats.

It was also found that the *G. sylvestre* aqueous extract of leaves stimulates insulin secretion from mouse cells and isolated human islets in vitro, without compromising cell viability and the crude extracts and its isolated compound dihydroxy gymnemic triacetate shows a hypoglycaemic effect against streptozotocin-induced diabetic rats in dose and time dependent manner¹⁵.

Picrorrhiza kurroa

Picrorrhiza kurroa, family Scrophulariaceae, is a small herb found in the Himalayan region from Kashmir to Sikkim. Dried rhizomes of the plant are being used for medical treatment. Recently, it has been known that alloxan induces its diabetogenic activity mainly by inducing oxygen free radicals and thereby damaging the pancreas.

P. kurroa extract was found to reduce the glucose level in normal, glucose loaded animals and in animals made diabetic with alloxan. It was reported earlier that *P. kurroa* extract can act as a free radical scavenger *in vitro* and it indicates that administration of *P. kurroa* can reduce the level of serum lipid peroxides as well as ameliorate the destruction of WBC and confirms the possibility that the major function of the extract is the protection of vital tissues including the pancreas, thereby reducing the causation of diabetes in these animals.

Alcoholic extract of *P. kurroa* (75 mg extract/kg) reduced serum glucose that was maximum 2 h after the dose.



It also showed an antihyperglycemic effect in alloxanized diabetic rats¹⁶.

Ougeinia oojeinensis

Ougeinia oojeinensis, family Fabaceae, mostly found sub-tropical regions of India is a medium-sized, semi-deciduous tree. The ethanolic extract of *O. oojeinensis* (200 mg/kg) bark significantly decreased the blood glucose level, triglycerides, LDL, VLDL and total cholesterol and increased high density lipoprotein level in alloxan-induced diabetic rats¹⁷.

Solanum xanthocarpum

It belongs to family Solanaceae and is a species of nightshade native to Asia and is adventive in Egypt. It is a bushy plant with sharp and prickly branches. The methanolic extract of both the leaves of *S. xanthocarpum* at a dose of 200 mg/kg given orally, significantly reduced the blood glucose level, urea, uric acid and creatinine level and increased the serum insulin level in alloxan-induced diabetic rats¹⁸.

CONCLUSION

The prevalence of diabetes mellitus continues to rise worldwide and treatment with oral hypoglycemic drugs ends with numerous side effects and huge monetary expenditure¹⁹.

Hence, herbal medicines are increasingly becoming popular and it is prudent to search for options from medicinal plant extracts for new antidiabetic hypoglycemic substances^{20,21}. In the present review an attempt has been made to investigate the antidiabetic medicinal plants and more investigations must be carried out to evaluate the mechanism of action of medicinal plants with antidiabetic effect.

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