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A REVIEW ON ANTI-DIABETIC HERBAL MEDICINAL PLANTS

Tushar P. Dukre*, Aniket N. Unde and Om S. Yelmame

Department of Pharmacognosy, Shri Swami Samarth Institute of Pharmacy.
At- Malwadi, Post- Bota, Tal- Sangamner, Dist- Ahmednagar, 422602.

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***Corresponding Author**
Tushar P. Dukre
Department of Pharmacognosy, Shri Swami Samarth Institute of Pharmacy.
At- Malwadi, Post- Bota, Tal- Sangamner, Dist- Ahmednagar, 422602.

ABSTRACT

Mycobacterium tuberculosis (TB) is a highly infectious pathogen and causative agent for TB. There are many herbal extracts, which have been identified with potential claims of anti TB spectrum. Although established anti TB regimen with drugs are effective, these medications do cause certain adverse effects. The use of herbal extracts in treating TB is becoming more interesting and prevalent due to minimum adverse reactions observed with herbal medications. In this review, the various types, constituents and the Antitubercular activity of traditional herbal extracts have been discussed. Tuberculosis (TB) is a disease that has affected mankind from very ancient times. Anti-TB allopathic medications have been prescribed to control symptoms of this disease but results into side effects like hepatitis, hypersensitivity reactions, nausea, vomiting *etc*. The use of herbal medicine becoming popular due to toxicity and side effects of allopathic medicines. Medicinal plants from Ayurveda (Indian traditional medicine system) and from foreign origin have been successfully employed to treat TB. The aim of this review is to highlight the work on anti-tubercular plants. Medical plants play an important role in the management of diabetes mellitus especially in developing countries where resources are meager. This review presents the profiles of plants with hypoglycaemic properties, reported in the literature. The profiles presented include information about the scientific name, family, methodology used, the degree of hypoglycaemic activity and the active agents.

KEYWORDS: Anti-mycobacterial, Drug resistance, Tuberculosis, Anti-Tubercular, Natural, Ayurveda, etc.

INTRODUCTION

Herbal medicine, also called botanical medicine or phyto-medicine, refers to the use of any plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more main stream as up-to-date analysis and research show their value in the treatment and prevention of disease. 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. A number of medicinal plants, traditionally used for over 1000 years named rasayana are present in herbal preparations of Indian traditional health care systems. In Indian systems of medicine most practitioners formulate and dispense their own recipes. The World Health Organization (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 herbal drug preparations and plants used in the treatment of diabetes mellitus, a major crippling disease in the world leading to huge economic losses.[1]

For most herbs, the specific ingredient that causes a therapeutic effect is not known. Whole herbs contain many ingredients, and it is likely that they work together to produce the desired medicinal effect. The type of environment (climate, bugs, soil quality) in which a plant grew will affect its components, as will how and when it was harvested and processed.

For the reasons described in the previous section, herbalists prefer using whole plants rather than extracting single components from them. Whole plant extracts have many components. These components work together to produce therapeutic effects and also to lessen the chances of side effects from any one component. Several herbs are often used together to enhance effectiveness and synergistic actions and to reduce toxicity. Herbalists must take many things into account when prescribing herbs. For example, the species and variety of the plant, the plant's habitat, how it was stored and processed, and whether or not there are contaminants.[2]

Herbalists treat many conditions such as asthma, eczema, premenstrual syndrome, rheumatoid arthritis, migraine, menopausal symptoms, chronic fatigue, and irritable bowel syndrome, among others. Herbal preparations are best taken under the guidance of a trained professional. Be sure to consult with your doctor or an herbalist before self-treating. Some

common herbs and their uses are discussed below. Please see our monographs on individual herbs for detailed descriptions of uses as well as risks, side effects, and potential interactions.

Although a renaissance is occurring in herbal medicine in the United States, the FDA still classifies herbs as dietary supplements and forbids manufacturers to claim that their products are able to treat or prevent specific diseases. In some countries in Europe, however, herbs are classified as drugs and are regulated. The German Commission E, an expert medical panel, actively researches their safety and effectiveness.[3]

Diabetes mellitus

Diabetes mellitus is a clinical syndrome characterized by inappropriate hyperglycemia caused by a relative or absolute deficiency of insulin or by a resistance to the action of insulin at the cellular level. It is the most common endocrine disorder, affecting 16 million individuals in the United States and as many as 200 million worldwide. Diabetes has been a clinical model for general medicine. The primary defect in fuel metabolism results in widespread, multi-organ complications that ultimately encompass virtually every system of the body and every specialty of medicine. It has been said that to know diabetes is to know medicine and health care. Although from a clinical standpoint this may be true, our increasing knowledge of the pathophysiology of the syndrome, together with the mechanisms of long- term complications, has placed diabetes research at the frontier of immunology and molecular biology.[4]

Diabetes mellitus has been known since ages and the sweetness of diabetic urine has been mentioned in Ayurveda by Sushruta. Its pharmacotherapy however is over 80 years old. The word diabetes was coined by the Greek physician Aeretaeus in the first century A.D. In the 17th century, Willis observed that the urine of diabetics as wonderfully sweet as if imbued with honey or sugar. The presence of sugar in the urine of diabetics was demonstrated by Dobson in 1755.[5]

Diabetes mellitus is now recognized as a serious global health problem. Westernized cultures and populations experiencing rapid acculturation are showing a sharp rise in non-insulin-dependent diabetes mellitus. The prevalence of NIDDM is increasing exponentially.[6]

Plant with Anti-Diabetic Activity

The ethnobotanical information reports about 1000 plants that may possess antidiabetic potential among them, this review article enumerates some medicinal plants possessing

hypoglycemic properties and elucidating their mechanisms of action such as *Bauhinia forficata, Combretum micranthum, Elephantopus scaber, Gymnema sylvestre, Liriope spicata, Parinari excelsa, Ricinus communis, Sarcopoterium spinosum, Smallanthus sonchifolius, Swertia punicea, Vernonia anthelmintica* etc. and method of experiment on animals and therapeutic efficiency of plant extracts were exploited. Some of the important anti-diabetic potential herbal plants are mentioned below.

Some Important medicinal plants having anti- diabetic potential:

Bauhinia forficate

Bauhinia forficata is the most widely used herbal medicine for control of diabetes in Brazil, where it is known as Pata de Vaca (cows hoof).[7] The fresh leaves are the essential part of this plant which shows the hypoglycemic activity and the genus *Bauhinia* belongs to the family Caesalpiniaceae.[8] The initial reports of Bauhinia forficata antidiabetic activity in diabetic patients were made by Juliani (1941)[9] and Juliani (1931).[10] According to M.T. Pepato *et al* (2002) *Bauhinia forficate* decoction was prepared by boiling 150 g of fresh leaves in 1 litre of water for 5 min, allowed the decoction to stand for 30 min and filtered. The rats which are used for the experiment were fed a normal laboratory chow diet containing (wt./wt.) 16% protein, 66% carbohydrate and 8% fat and were housed under a 12:12 h light: dark cycle at 22-25°C. In this experiment they divided the rats into two groups i.e., diabetic and non diabetic groups, followed by administered the streptozotocin (STZ) 40 mg/kg body weight, after 3 days the serum and urinary glucose levels were increased. Then one group was injected with *Bauhinia for□cata* decoction and another with the drinking-water as control group. After 31 days of treatment the diabetic group treated with decoction showed a significant reduction in plasma glucose and urinary glucose. So the pharmacological, biochemical, histological and chemical studies are needed to elucidate the exact mechanism of action of *Bauhinia forficata* leaf decoction and to isolate any active compounds. Such investigations should also be carried out regarding type 2 diabetes**.**[11]

Combretum micranthum

Combretum Micranthum is a medicinal plant used for treating diabetes in Northwestern Nigeria. It is commonly known as ‘geza’ in Hausa, belong to the family of Combretaceae. It is a widely known ethno medicinal plant used in West Africa for treating several diseases.[12, 13] In Nigeria, more than 80% of the people depend on herbal medicines for treating their illnesses.[14] The plant have also been documented to show antioxidant, antimicrobial[15] as

well as anti-inflammatory[16] properties. The Aqueous extract of *Combretum Micranthum* was prepared by using Soxhlet extractor and it was dried in an evaporator at 45ºC and stored at 4ºC until ready for use. The hypoglycemic activity of this plant extract was tested by using glucose tolerance test and fasting blood sugar assessment in normal rats. The anti-hyperglycemic potential of this plant was performed by taking two group of animals i.e., diabetic group and non-diabetic groups. The aqueous leaf extract of *Combretum Micranthum* dissolved in normal saline (N/S) and administered to the both groups at 100 mg/kg, 200 mg/kg, and 400 mg/kg body weight, but 100 mg/kg of the extract was found to be the optimum dose of the 3 doses. The aqueous leaf extract of 100 mg/kg body weight dose produced a significant reduction in blood glucose level and 24.6% maximum reduction when compared to the maximum decrease of 21.9% and 18.9% produced by 200 mg and 400 mg/kg body weight doses, respectively.[17] In this study of this plant was showed that the aqueous leaf extract of Combretum Micranthum has potential antidiabetic property for both type 1 and type 2 Diabetes mellitus. Hence further studies are needed to study the various active constituents responsible for these properties.[18]

Cinnamomi cassia

Cinnamon is one of the traditional folk herbs used in Korea, China and Russia for diabetes mellitus.[19] Cinnamon is the bark of the *Cinnamomi cassia* (Lauraceae). Cinnamic aldehyde, cinnamic acid, tannin and methylhydroxychalcone polymer (MHCP) are its main components. Jarvull-Taylor's research also showed that cinnamon increases the insulin sensitivity and glucose uptake in adipocytes.[20]

The effects of administration of cinnamon extract with 50, 100, 150 and 200 mg/kg to db/db mice were determined first by measuring food consumption, changes in body weight, food efficiency ratio (FER) and blood glucose levels. The differences in the body weight and food intake of the mice treated with cinnamon extract and control were not significant. Changes in body weight and FER did not differ between the groups. The decline in blood glucose levels reached its maximum after 2 weeks and remained almost constant after 4 and 6 weeks of cinnamon extract administration. The "high dose" of cinnamon extract, 200 mg/kg was the most effective dose in decreasing the blood glucose level. Serum insulin levels were found to be significantly higher in the cinnamon extract 200 mg/kg than the control group. Serum concentration of triglyceride in the cinnamon extract treated db/db mice decreased by 45.0% than in the control group. But the level of HDL–cholesterol significantly increased by 1.5

fold ($P < 0.01$) in the cinnamon extract treated group. HDL–total cholesterol ratio (HTR) (%) was also found to be higher in the cinnamon-treated group than the control group. The small intestinal glycosidase activity was found to decrease in the cinnamon-treated db/db mice.[21] So, the possible mechanism by which cinnamon extract brings about its hypoglycemic action in diabetic mice may be by potentiating the effect of insulin in serum or by increasing either the pancreatic secretion of insulin from the existing beta cells or its release from the bound form.

***Tournefortia hartwegiana* steud**

Tournefortia hartwegiana Steud, (Boraginaceae) commonly known as "hierba rasposa", "clachichinol" or "tlachichinole", is a plant from the deciduous dry forest in Morelos, Mexico. In this region, decoction from dry leaves of this plant is used in traditional medicine as anti-diarrheic and anti-diabetic agent. *Tournefortia hartwegiana* aerial parts decoction (10 g/1000 ml per day, aproximately) is claimed to be useful in Morelos, Mexico, for the treatment of diabetes and this decoction is orally taken by people during 10–14 days to control the disease (personal communication with Dr. Castillo-Espa˜na). Treatment with 310 mg of methanol Extract of *Tournefortia hartwegiana* /kg body weight/day on alloxan-induced diabetic and normoglycemic rats up to 10 days, showed an important reduction in blood glucose levels ($p < 0.05$). The effect was significant in diabetic and normoglycemic rats. *Tournefortia sarmentosa* allowed the isolation of benzenoids with antilipid-peroxidative activity. It was directed to isolate the active constituents from the methanolic extract of *Tournefortia harwegiana* to allow understanding its mechanism(s) of action.

Averrhoa bilimbi Linn

Averrhoa bilimbi Linn (Oxalidaceae) is a small– sized tree growing up to 15 m tall and 30 cm diameter. The chemical constituents of A. bilimbi that have been identified include amino acids, citric acid, cyanidin–3–O– h–D–glucoside, phenolics, potassium ion, sugars and vitamin A. It is used as antibacterial, antiscorbutic, astringent; post–partum protective medicine; treatment of fever, mumps, pimples, inflammation of the rectum and diabetes (decoction of the leaves); treatment of itches, boils, rheumatism, cough and syphilis (paste of leaves); treatment of scurvy, bilious colic, whooping cough, hypertension and as a cooling drink (juice of preserved fruits); treatment of children's cough (syrup of flowers); treatment of stomach ache (fruits). Some researchers showed that ethanolic leaf extract of Averrhoa bilimbi and its semi–purified fractions possesses hypoglycemic and hypolipidemic properties

in Type I diabetic rats when administered intraperitoneally as well as orally. The semi–purified fractions of the ethanolic extract of Averrhoa bilimbi leaves such as AF (Aqueous Fraction) and BuF (Butanol Fraction) have potent hypoglycemic and hypotriglyceridemic properties in HFD–STZ–diabetic rats. AF (125 mg/kg BW) caused a significant hypoglycemic effect at 30 min, 60 min, 120–min and 180 min. when compared with vehicle control. The body weight, food and water intakes of the rats did not differ significantly in AF and BuF–treated diabetic rats. The semi–purified fractions of the ethanolic extract of *Averrhoa bilimbi* leaves such as AF and BuF ameliorated diabetes in HFD–STZ–diabetic rats. Moreover, AF is more potent than BuF in the amelioration of hyperglycemia and hypertriglyceridemia. However, the chemical nature of potential antihyperglycemic component (s) of AF and BuF remains to be elucidated.

Caralluma attenuate

Caralluma attenuata is a thick, succulent perennial herb growing wild in dry hill slope regions of Hyderabad and in several districts of Andhra Pradesh, India. Locally it is known as 'Kundaetikommu', and is eaten raw as a cure for diabetes (personal information from users) and the juice of the plant along with black pepper is recommended in the treatment of migraine. It reported the presence of luteolin-49-*O*-neohesperidoside with a significant anti-inflammatory and antinociceptive activity. *Caralluma tuberculata*, growing both wild and cultivated in Pakistan is either eaten raw or cooked as a vegetable and is also reported to be a cure for diabetes and rheumatism. The fresh juice of *C. tuberculata* was shown to possess hypoglycemic activity. The luteolin-4-*O*-neohesperidoside has been isolated from *C. tuberculata*. The effect of *C. attenuata* extracts has prevented the increase in blood glucose levels significantly (*P*-0.001) after glucose administration; the maximum glucose tolerance was observed at the 30th min for butanol extract. Also, in alloxan-induced diabetic rats only the butanol extract has shown significant (*P*-0.001) and considerable fall (25%) in blood glucose level. It is generally accepted that alloxan treatment causes permanent destruction of bcells. It is, therefore, conceivable that the hypoglycemic principles in the butanol extract of *C. attenuata* exert their effect by an extrapancreatic mechanism in diabetic rats.

Picrorrhiza kurroa

Picrorrhiza kurroa (Family—Scrophulariaceae) is a small herb available in the Himalayan region from Kashmir to Sikkim. Dried rhizomes of the plant are being used for medical treatment. The extract made from the rhizomes has been shown to have antioxidant activity

equal to that of a-tocopherol and BHA. Recently it has observed that the *P. kurroa* extract could scavenge oxygen free radicals such as superoxides, hydroxyl radicals and inhibited lipid peroxidation induced by Fe2+ ascorbate system in rat liver homogenate. It has been known that alloxan induces its diabetogenic activity mainly by inducing oxygen free radicals and thereby damaging the pancreas. *kurroa* extract was found to reduce the glucose level in normal, glucose loaded animals and in animals made diabetic with alloxan. Alloxan has been shown to induce free radical production and cause tissue injury. The pancreas is especially susceptible to the action of alloxan-induced free radical damage. 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 on the protection of vital tissues including the pancreas, thereby reducing the causation of diabetes in these animals.

Eugenia jambolana

Eugenia jambolana (EJ) of family Myrtaceae (called black plum in English and Jamun in Hindi in India) is being widely used to treat diabetes by the traditional practitioners over many centuries. It is a large evergreen tree growing up to 30 m high found widely in India. It is also found in Thailand and Philippines. Its fruits are oval to elliptical 1.5–3.5 cm long, dark purple or nearly black, luscious, fleshy and edible. The anti-hyperglycemic activity of seeds of EJ is well established.

However, there is little information on the effect of this plant extract in different types of diabetes and its role in improving lipid profiles except for the one by. They compared the ethanolic extract's effect on severe diabetic (SD) rabbits (type-I or IDDM) where pancreas was near totally to destroy and when the mildly diabetic (MD) rabbits (type 2 or NIDDM) still had functional b cells.[22]

DISCUSSION AND CONCLUSION

Diabetes is a metabolic disorder which can be considered as a major cause of high economic loss which can in turn impede the development of nations. Moreover, uncontrolled diabetes leads to many chronic complications such as blindness, heart failure, and renal failure. In order to prevent this alarming health problem, the development of research into new hypoglycaemic and potentially antidiabetic agents is of great interest. The methods used in the experiments are diverse. Transient hyperglycaemia can be produced by an oral glucose

tolerance test (OGTT). However, the diabetic model that was most commonly used was the streptozotocin- and alloxan-induced diabetic mouse or rat to obtain type I diabetic models.

This review has presented a list of anti-diabetic plants used in the treatment of diabetes mellitus. It showed that these plants have hypoglycaemic effects. Many new bioactive drugs isolated from plants having hypoglycaemic effects showed antidiabetic activity equal and sometimes even more potent than known oral hypoglycaemic agents such as daonil, tolbutamide and chlorpropamide. However, many other active agents obtained from plants have not been well characterized. More investigations must be carried out to evaluate the mechanism of action of medicinal plants with antidiabetic effect. The toxic effect of these plants should also be elucidated.

REFERENCES

1. Ang-Lee, MK; Moss, J; Yuan, CS, "Herbal medicines and preoperative care", JAMA, 286.
2. D'Epiro, NW "An historical, regulatory, and medical use perspective on nine common herbs. In: Micozzi MS, Bacchus AN, eds. The Physician's Guide to Alternative Medicine. Atlanta, Ga", *American Health Consultants*, 1999; 21-30.
3. Fugh-Berman, A; Ernst, E "Herb-drug interactions: review and assessment of report reliability", *Br J Clin Pharmacol*, 2001; 52 (5): 587-595.
4. Debra, HJ. Management of Diabetes Mellitus, Perspective of care across the life span, 2nd Edition, New York: Haven Press, 1991.
5. Satoskar, RS, Bhandarkar, SD, Ainapure, SS. Pharmacology and Pharmacotheraputics, 16th Edition, Mumbai: Popular Prakashan, 1999.
6. Akhilesh K. Tripathi[1], Pravin K. Bhoyar[1*], Jagdish R. Baheti[2], Herbal Antidiabetics: A Review, Int. J. Res. Pharm. Sci, 2011; 2(1): 30-37.
7. Miyake, E.T., Akisue, G., Akisue, M.K. Pharmacognostic characterization of pata-devaca *Bauhinia for□cata*. Revista Brasileira de Farmacognosia, 1986; 1: 58-68.
8. Viana, E.P., Santa-Rosa, R.S., Almeida, S.S.M.S., Santos, L.S. Constituents of the stem bark of *Bauhinia guianensis*. Fitoterapia, 1999; 70: 111-112.
9. Juliani, C. Acao hipoglicemiante da '*Bauhinia for□cata*, link Novos estudos clinicos e experimentais. Jornal dos Cli´nicos, 1941; 3: 93-112.
10. Juliani, C. Acao hipoglicemiante de *Bauhinia for□cata* link. Novos estudos experimentais. Revista Sudamericana de Endocri- nologia Immunologia e Quimioterapia, 1931; 14:

326- 334.

11. M.T. Pepato, E.H. Keller, A.M. Baviera, I.C. Kettelhut, R.C. Vendramin, I.L. Brunetti, Anti- diabetic activity of *Bauhinia for□cata* decoction in streptozotocin-diabetic rats, Journal of Ethnopharmacology, 2002; 81: 191- 197.
12. Muhammad, S., Amusa, N.A. The important food crops and medicinal plants of north-western Nigeria. Research Journal of Agriculture and Biological Sciences, 2005; 1: 254–260.
13. Inngjerdingen, K., Nergård, C.S., Diallo, D., Mounkoro, P.P., Paulsen, B.S. An ethnopharmacological survey of plants used for wound healing in Dogonland, Mali, West Africa. Journal of Ethnopharmacology, 2004; 92: 233–244.
14. Hostettmann, K., Marston, A. Twenty years of research into medicinal plants: results and perspectives. Phytochemistry Reviews, 2002; 1: 275–285.
15. Karou, D., Dicko, M.H., Simpore, J., Traore, A.S. Antioxidant and antibacterial activities of polyphenols from ethnomedicinal plants of Burkina Faso. African Journal of Biotechnology, 2005; 4: 823–828.
16. Olajide, O.A., Makinde, J.M., Okpako, D.T. Evaluation of the anti-inflammatory property of the extract of *Combretum micranthum* G. Don (Combretaceae). Inflammo-pharmacology, 2003; 11: 293–298.
17. Aminu Chika.,Shaibu Oricha Bello. Antihyperglycaemic activity of aqueous leaf extract of *Combretum micranthum* (Combretaceae) in normal and alloxan-induced diabetic rats. Journal of Ethnopharmacology, 2010; 129: 34–37.
18. M Upendra Rao*, M.Sreenivasulu, B.Chengaiah, Herbal Medicines for Diabetes Mellitus: A Review, International Journal of PharmTech Research, 2(3): 1883-1892.
19. Bailey CJ, Day C. Traditional plant medicines as treatments for diabetes. *Diabetes Care*, 1989; 12: 553–564.
20. Jarvull-Taylor KJ, Anderson RA, Graves DJ. A hydroxychalcone derived from cinnamon functions as a mimetic for insuin in 3T3-L1 adipocytes. *Journal of the American College of Nutrition*, 2001; 20: 327–336.
21. Kham A, Safdar M, Alikhan MM, Khattak KN, Anderson RA. Cinnamon improves glucose and lipids of people with type 2 diabetes. *Diabetes Care*, 2003; 26: 3215–3218.
22. Saravana Kumar, 1s. Kavimani, 2k.N. Jayaveera, A Review On Medicinal Plants With Potential Antidiabetic Activity, *International Journal Of Phytopharmacology*, 2011; 2(2): 53-60.