WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 10, 110-119. Review Article ISSN 2277– 7105

ANTI-DIABETIC TRADITIONAL MEDICINAL PLANTS: A COMPREHENSIVE REVIEW

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Article Received on
26 May 2022,

Revised on 16 June 2022,
Accepted on 06 July 2022

DOI: 10.20959/wjpr202210-24508

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ABSTRACT

Diabetes mellitus is one of the world's most significant health issues, with rising prevalence and related mortality. The epidemic was still controlled by the fourth leading cause of death in the most advanced countries and there in other emerging and recently industrialized nations. Inadequate blood sugar control has important health implications. The use of plants in treating various diseases was referenced by Ayurveda and other Indian writings. A recent area of research has been medicinal plants with anti-diabetic potential. Diabetic metabolic abnormalities can be regulated by the efficiency of these medicinal plants. This research will help researchers to select potential herbal medicines for diabetic treatment.

KEYWORDS: Medicinal plants, Diabetes mellitus, Ayurveda, Hypoglycaemic activity.

INTRODUCTION

Diabetes is generally a severe and life-threatening metabolic disorder. It is characterized by relative or absolute insufficiencies, which occur either when the body cannot use the insulin that it produces or when the pancreas does not produce adequate insulin. The hormone does not regulate blood glucose. Three kinds of diabetes mellitus Type-I (insulin-dependent), Type-II (noninsulin addictive) and gestational diabetes, have been identified by World Health Organization (WHO).[1]

The disease is related to reduced quality of life and higher mortality and morbidity risk factors. Long-term hyperglycaemia is a critical factor for micro and macrovascular complications development and progression. The global prevalence of DM was estimated at 2.8 percent in 2000 and 15 percent in 2035 for all age groups. Insulin and various oral

antihyperglycemic agents like sulfonylurea, biguanides and glinides are currently available for the treatment of DM. Products are costly and not easily accessible in developing countries. The interest in herbal formulations is currently growing because of their fewer side effects. Therefore, conventional herbal medicines, obtained mainly from plants, play an important role in managing DM. As a source of hypoglycemic agents, modern herbal medicinal products became important.

As folk medicine for diabetes, more than 1000 plant species were used. Plant products used as alternative medicines for the treatment of diabetes relate to their biological composition. Natural formulations are rich in phenolics, flavonoids, terpenoids and other components that gradually decrease in levels of blood glucose.[2]

Diabetes and its secondary effects prove to be an important therapeutic concern over a combination of natural and synthetic sources of hypoglycaemic agents. Many indigenous plants have demonstrated their effectiveness in controlling diabetes. One of several key advantages of traditional medicines is their convenience and comparatively low adverse effects. Plants have always been an example of drug sources, many of them are now directly or indirectly available.

Ethnobotanical knowledge of about 1000 plants shows that they possess a possible antidiabetic potential. In their assessment, several plants demonstrated their antidiabetic behaviour using currently available experimental techniques.[3]

This review lists several antidiabetic plants and elucidates their mechanisms of action, including *Acorus calamus, Aegle marmelos Adhatoda zeylanica, Andrographis paniculata, Alangium amarckii, Albizia odoratissima, Acanthopanax senticosus, Berberis aristate, Berberis vulgaris, Butea monosperma, Bryophyllum pinnatum, Barleria prionitis, Bruguiera gymnorrhiza, Biophytum sensitivum, Caesalpinia bonducella, Camellia sinensis, Cocos nucifera, Canarium schweinfurthi, Costus speciosus, Centaurium erythrea, Diospyros peregrine, Dillenia indica, Dolichandrone falcata, Eugenia Jambolana, Fructus Coini, Grewia Asiatica, Gymnema sylvestre, Heinsia crinata, Helicteres isora, Hypericum perforatum L., Irvingia gabonensis, Juglans regia L, Lawsonia inermis, Lithocarpus polystachyus, Momordica Charantia, Murraya koenigii, Myristica fragrans, Nelumbo nucifera, Nyctanthes arbor-tristis, Olea europaea L., Ocimum sanctum, Opuntia streptacantha, Pandanus odorus, Persea americana Mill., Piper betle L, Psidium guajava,*

Rhinacanthus nasutus, Ruellia tuberosa, Raphanus sativus, Ricinus communis, Salacia reticulata W., Senna auriculata, Strychnus potatorum L, Terminalia chebula, Tinospora Cordifolia, Triticum aestivum, Urtica ardens, Vitis vinifera, Withania somnifera, Xanthium strumarium, Zizyphus sativa Gaertn, Zygophyllum geslini Coss.

Medicinal plants with Anti diabetic activity

Natural products represent the main source of insight for promising leading candidates, who play a key role in future drug development. Wide availability, least side effects and reduced herbal medicines are the main players in all treatments available in rural areas in specific. The purpose of this article is not to acknowledge the anti-diabetic plants earlier thoroughly discussed in the textbook "Traditional medicines for modern plants," but to clarify more relevant data relating to these popular plants.[4]

Acorus calamus

Oral administration of *A. calamus* rhizome methanolic extract restored blood glucose levels in streptozotocin-induced diabetic rats after 21 days. Moreover, the level of lipid glucose 6-phosphatase and fructose 1 and 6-bis phosphatase and liver marker enzymes decreased.[5]

Aegle marmelos

The aqueous extract of the leaves was controlled blood glucose, body weight and liver glycogen. The extract was compared to insulin in restoring blood glucose and body weight to normal levels. Thus, the active principle of marmelos extract had a hypoglycemic effect similar to that of insulin.[6]

Bruguiera gymnorrhiza

The ethanol extract of *B. gymnorrhiza* root reduces blood sugar, total cholesterol, triglycerides, VLDL and LDL considerably.[5]

Biophytum sensitivum

Blood glucose, serum cholesterol, and total protein levels of the inducing diabetic rats were significantly lowered when *B. sensitivum* was administered in the body.[5]

Caesalpinia bonducella

The action of the diabetes-induced extracts reduces the level of high cholesterol and LDL significantly. The medicine can act as anti-diabetic and anti-hyperlipidemic.[5]

Camellia sinensis

Tea is a medicine known to be a hypotension and anti-diabetic plant in folk medicine. It works to reduce intestinal glucose absorption due to anti-diabetic action. After oral administration, the aqueous leaf extract (450 mg/kg) has a strong glucose-reducing effect in rats.[7]

Ficus racemosa

Glucose-lowering effectiveness of a methanol extract from the stem bark of *Ficus racemosa* Linn. It was assessed in both rats with normal and alloxan-induced diabetes. The extract at lower and higher doses showed significant hypoglycemic action in both experimental animal models when compared to the control group.[8]

Gymnema sylvestre

Alloxan-induced diabetic rats are given *Gymnema sylvestre*. It is also popular for its anticancer, antidiabetics and anti-microbial effects. It is rich in alkaloids, flavonoids, saponins and carbohydrates, among other phytotherapy products.[9]

***Helicteres isora* L**

The hot aqueous extract from *H. isora* fruit showed moderate antioxidant activity. It has shown that glucose up takes action and has been found to have insulin-like activities. An ethanol extract is used to treat type 2 diabetes through insulin sensitization and hypolipidemic activity.[10]

Justicia beddomej

The plant leaves are stated beneficial for the diabetes treatment. After administration of ethanolic extract of the leaves reduced serum glucose levels in induced diabetic rats. Plants also have other properties such as astringent, anti-inflammatory, antibacterial, antispasmodic, diuretic, anthelmintics, etc.[7]

***Lantana camara* L**

Once in day juice of *L. camara* leaf was given for 14 days showed hypoglycaemic effect in rats.[10]

***Murraya koenigii* Linn**

The aqueous extract of *M. koenigii* leaves has produced a hypoglycaemic effect in normal and alloxan diabetes. Oral feeding to normal rats of this plant during 60 days was shown by a

rise in the hepatic glycogen concentration due to hypoglycaemic actions. It suppresses blood glucose levels and has a positive effect on the metabolism of carbohydrates.[11]

Ossimum gratissium

In streptozotocin-induced diabetic rats, the hypoglycaemic effects of aqueous leaf extract *Opium gratisimum* were studied. During the 24 hours of extract the aqueous dose showed significantly lower diabetic rat blood glucose level.[7]

Pterocarpus marsupium

Pterocarpus marsupium extract has been used extensively for over 100 decades in the treatment of diabetes mellitus.[12,13] Various studies have shown hypoglycaemic effects in rats induced by the PM extract for diabetes. Few studies on the mechanisms of extract action and toxicity were also discussed.[14,15]

Polyalthia longifolia

The effect of methanalic extract *P. longifolia* bark decreased fasting blood glucose; in addition, higher SGOT, SGPT, ALP, triglycerides and total cholesterol concentrations in STZ-induced diabetic rats were restored to almost normal levels.[5]

Raphanus sativus

Root juice *Raphanus sativus* has a considerable potential for both hypoglycaemia and anti-diabetics. This effect was even more anti-diabetic than the Glibenclamide medication. Enzymatic studies are being conducted to elucidate the cellular and molecular mechanisms of action. Investigations are also underway to isolate and characterize the juice compounds that are responsible for lowering blood glucose level.[16]

Salacia reticulate

The impact of the aqueous extract prepared of *Salacia reticulata* leaves on the absorption of sugars in normal and type 1 diabetic mice was examined. The oral dose of extract simultaneously inhibited the postprandial elevation of plasma glucose and insulin levels and the intestinal activities of alpha-glucosidase in mice at a dose of 1.0 mg / mouse with maltose or sucrose. This makes the water extract from *S. reticulata* leaves to show its many effects as an effective foodstuff for preventing diabetes and obesity.[17-22]

Saraca asoca

Oral administration of extract has resulted in significant blood glucose reduction in diabetic mice. All the extracts also improved other diabetes-associated biochemical alterations. In addition, extracted products have a positive effect on the pancreatic, liver and kidney histopathological changes in diabetic mice induced by STZ.[23]

Sclerocarya birrea

S. birrea stem bark methanol extract significantly lowered levels of blood glucose, plasma cholesterol, triglyceride and urea at normal level and increased plasma insulin levels for diabetic rats induced by STZ.[24]

Tectona grandis

Tectona grandis roots methanol extract has anti-diabetic activity on diabetic rats that are induced with alloxan. Its hypoglycemic effect was measured against glibenclamide and a 500mg/kg dose of hypoglycemic activity was reported.[24]

Terminalia chebula

The traditional medicines for treating diabetes are a herbal formulation containing *T. chebula* called triphala. The anti-diabetic effects of *T. chebula* chloroform extract in streptozotocin induced diabetic rats have been shown.[25]

Urtica dioica

U. dioica leaves extracts show anti-diabetic activity in the form of glycaemic status improvement on the type 2 model of diabetic that may be intermediated by the centric effect on pancreatic β-cell histology or functional status.[26]

Vernonia oligocephala

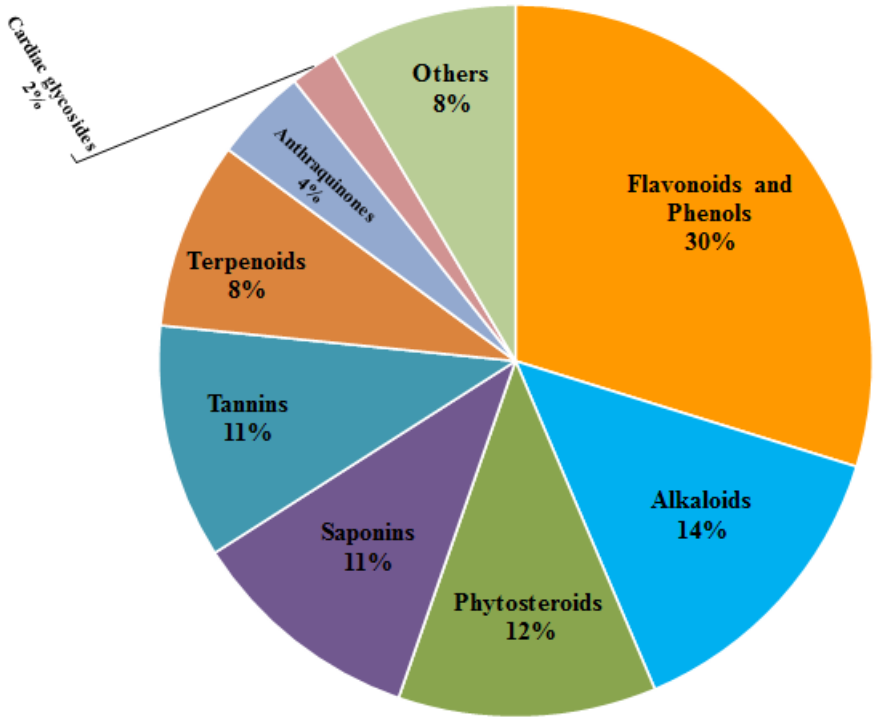
Plant is used for medicinal use for the alleviation of the stomach discomfort that is tonic. Flavonoid, glycoside, polyphenols, saponins and steroids are phytochemicals identified from *V. oligocephala*. This plant has been reported to treat diabetes by traditional healers in Eastern and West Cape Province.[27]

Withania somnifera

The *W. somnifera* root and leaf extracts in alloxan-induced diabetic rats have anti-diabetic and anti-hyperlipidaemic activities. *W. somnifera* root extract from contains more flavonoids than the extract of leaf.[28]

Zizyphus sativa

The hypoglycemic activity of normal and Alloxan diabetic rats was tested on an alcoholic extract from Zizyphus sativa leaves. A statistically significant dose-dependent reduction in blood glucose 2, 4 and 6 h later was shown in single oral extract doses for ordinary animals.[29-30]



The class of compounds with anti-diabetic bioactivity in plant.

CONCLUSION

This review discussed the treatment of diabetes mellitus in folkloric medicines. The majority of medicinal plants are used in rural areas, as there are a large number of medicinal plants available in those areas. Consequently, it seems highly attractive to treat diabetes mellitus with plant-based compounds that are accessible and do not require laborious pharmaceutical synthesis. This review has tried to investigate the use of anti-diabetic herbs and may be useful for pharmacologists, scientists and academics involved in the development of anti-diabetic medicines.

ACKNOWLEDGMENT

We would like to offer sincere thanks for your valuable support and encouragement to **Dr. S. J. Wadher,** Associate Professor, School of Pharmacy, Nanded, Maharashtra, India.

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