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A. Rajendran

Lifecare Phytoremedies,
Ayyappanthangal- 600056, Chennai,
India

R. Sudeshraj

Life Care Phyto Labs, Perambalur-
621212, Tamil Nadu, India

S. Sureshkumar

Department of Chemistry, Rajalakshmi
Engineering College, Chennai- 602105,
Tamil Nadu, India

Correspondence:

Dr. A. Rajendran

Lifecare Phytoremedies,
Ayyappanthangal- 600056, Chennai,
India

Email: [rajendran_dr\[at\]hotmail.com](mailto:rajendran_dr[at]hotmail.com)

Potential antidiabetic activity of medicinal plants – A short review

A. Rajendran, R. Sudeshraj, S. Sureshkumar

ABSTRACT

Diabetes mellitus is a dreadful disease caused by the increase in hepatic glucose production and impaired insulin action. The usage of herbal based medicine has been increasing tremendously in both developing and developed countries over the last three decades. The present study aims to provide a comprehensive review of antidiabetic activity of following medicinal plants like *Gymnema sylvestris*, *Rubia cardifolia*, Bilberry, Green Tea, *Salacia reticulata*, *Berberis aristata*, *Pterocarpus marsupium*, Fenugreek, Ashwagandha, Bitter melon. The efficiency of these medicinal plants may regulate the diabetic metabolic abnormalities. This work would help researchers to choose potential herbal for diabetic treatment.

Keywords: Medicinal plants, Anti-diabetic activity.

INTRODUCTION

Now a day's medicinal plants are considered as an important therapeutic aid for reducing ailments of human being. Strong medicinal systems like ayurveda, unani and chinese, are still promising and has been practised over 1500 years. The people (>60-80%) from developed as well as developing countries depend on these medicinal system for their health care requests [1]. Existing medicinal plants contain several active chemical constituents which responsible to treat various ailments [2]. Several research articles have been published upon n-number of traditional medicinal plants that these plants possess specific action on various ailments such digestive, respiratory, reproductive systems, diabetes, vision, and urinary systems [3].

Diabetes mellitus (DM) is a faction of metabolic disorder and commonly affects many people around the globe. Due to decrease in insulin, DM has been characterized by hyperglycemia, hyperlipidemia, hyperaminoacidemia, and hypoinsulinaemia. DM generally known to be two types based on insulin dependent (i.e., type I and type II diabetes). Type I diabetes is also known as immature diabetes which depend on insulin and affects 5% of diabetic population. The Type II diabetes known to be non-insulin dependent and generally affects people who are above 40 age groups. It is well established that the hyperglycemia of diabetes which damages organs in the body [4]. It has severe effects on lipid metabolism arises from chronic hyperglycemia and abnormality of lipid profile. These end up with lot more problems including retinopathy, cardiovascular disorder, polyurea and polyphasia [5]. Even though scientist from academics and pharmaceutical industries are inventing medicines for diabetic still the DM and related ailments are major health issues among people which is upsetting over 10% of people worldwide [6,7]. Conventional therapies are available for diabetes mellitus such as administering various oral antidiabetic and insulin. But in developing countries the anti-diabetic medicines are not affordable by many people as they are expensive. Alternatively, active molecules have been discovered from traditional medicinal plants by several research groups to overcome the diabetes and associated oxidative damage.

This review article provides a compiled report of most common medicinal plants which has hypoglycaemic activity available in various scientific journals. This review article may be useful for scholars who are doing research in phyto pharmacology and helping to build up their knowledge on developing alternative medicine for various kind of DM and associated ailments.

Medicinal plants with Anti diabetic activity

Gymnema sylvestre

Gymnema sylvestre (GS) is one of the important medicinal herb and possess anti hyperglycemic activity, often used to supplement patients having DM [8]. The herb GS cultivated in southern region Asia and the East Indies. The GS plant root and leaves possess medicinal value but, the exact mechanism is still not clear. Besides the plant extracts has the ability to distinguish sweet taste, increase enzyme activity responsible for the glucose uptake and utilization. The GS extract kindle pancreatic cell functionalities, and increase insulin release [9]. Studies are reported that GS extract lowered blood sugar level, and to possess antisweet and hepatoprotective activities. Recent study reported that GS leaf extract exhibited anti hypoglycemic activity and lowered blood cholesterol level in streptozotocin-induced diabetic rats [10].

Rubia cardifolia

Rubia cardifolia (RC) is found in upper Ghats in evergreen forest up to 3500m above the sea level. RC has been known from traditional medicine with their therapeutic activity towards various ailments. It has several therapeutic values includes blood purifier and hence is extensively used against blood, skin and urinary diseases [11]. The root has some peculiar characteristics includes sweet, acrid, bitter and astringent with following medicinal values such as antidysenteric, antipyretic, analgesic, antiinflammatory, antiseptic, constipating, diuretic, anodyne, galactopurifier, and rejuvenating tonic. Based on the above said properties the GS extract has been used to treat variety of ailments in the modern pharmacopeia [12-14].

Bilberry

The botanical name of bilberry is *Vaccinium myrtillus* belongs to Ericaceae family. The bilberry has several medicinal values for the treatment of various ailments including fever, cough, diabetic and liver disorder. Mostly, this plant found Europe and the northern USA forest [15,16]. The scientific articles evidenced that the fruit has antidiabetic and hypoglycemic activity [17]. The bilberry plant has the following phytochemicals such as quercetin, catechins, tannins, vitamins and pectins [18].

Green Tea

The botanical name of green tea is *Camellia sinensis*, the plant has high amount of polyphenols which possess pharmacological activity. Green tea is considered as one of the important beverages consumed worldwide [19]. Fresh tea leaves contain polyphenol oxidase and there is a scientific report that this compound responsible for antidiabetic activity [20]. The polyphenol content in green tea might contribute to anti diabetic activities.

Salacia reticulata

The common name of the *Salacia reticulata* is meharimula. The structure of the plant is like climbing, and perennial woody. The roots and stem contains phytochemicals which are used to treat various ailments. Tezuka *et al.* and Yoshikawa *et al.* Reported that [21, 23] compounds such as Salcinol and kotalanol isolated from *Salacia reticulata* possess α -glucosidase inhibiting activity. Rajashree *et al.* [22] reported that the *S. reticulata* and *Catharanthus roseus* L mixtures showed hypoglycemic and hypolipidemic effects in diabetic induced rats. Further they report that herbs decreased blood glucose level when compared to control in diabetic induced rats. The decreased blood glucose level is mainly due to the inhibition of pancreas lipase enzyme, aldose and glucosidase. One more report by Yoshikawa, that the hot water-soluble fraction of *Salacia reticulata* roots showed anti-obesity effects in rats.

Berberis aristata

Berberis aristata belongs to Berberidaceae family, it has been found Ayurveda medicines as one of a prominent herb due to their various pharmacological activities including fever, stress, cooling laxative to children, heart and liver tonic. It has been found in literature that *Berberis aristata* showed potential action for following indications including febrifugal, hypotensive, immunostimulating. The herb *berberis aristata* also showed following pharmacological activities including, anti-hemolytic, anti-plasmodal, hypolipidemic activity, anti-granuloma activity and [24-28].

Pterocarpus marsupium

Pterocarpus marsupium Roxb. (PM) is well known medicinal plant for the treatment of diabetes mellitus. The common name of the plant is known as Malabar kino, and belongs to the family of Fabaceae (Leguminosae). The origin of PM is India, Sri Lanka and Nepal. PM possess multiple pharmacological activities. The extract of PM is comprehensively used to treat diabetes mellitus for over 100 decades [29, 30]. The height of PM plant is usually up to 30 meters and the outer bark is rough and vertically cracked [31]. Several studies were conducted that the PM extract showed Hypoglycaemic effects in diabetes induced rat. Few studies have addressed about the mechanism of action and toxicity of the extracts as well [32, 33]. The extracts also effective for the cell regeneration in pancreas [34], insulin release and insulin-like action [35, 36]. The PM extract also showed the following such as antioxidant effects and antidyslipidaemic effects can be found in some literatures [37, 38]. The PM extract contains number of compounds responsible for the antidiabetic effects but mainly focused on pterostilbene and (-)-epicatechin.

Fenugreek

The botanical name of fenugreek is *Trigonella foenum-graecum*. Fenugreek has been cultivated majorly in the following countries like North Africa, and southern Europe. India is exporting large amount of fenugreek worldwide. Galactomannan (40-45%) is the compound isolated from *trigonella foenum-graecum* is responsible for anti hypoglycemic activity [39]. Research articles revealed that fenugreek galactomannan lowered blood glucose level in the alloxan modelled specimen [39].

Ashwagandha

Withania somnifera (L.) is botanical name of ashwagandha plant. It is generally called as Indian ginseng. Ashwagandha belongs to Solanaceae family. Ashwagandha has withanolides, a group of steroidal lactones are responsible for various pharmacological activities [40]. The compound withanolide steroidal lactone is usually found in the leaves of ashwagandha. Several studies have indicated that the withanolide exhibited antitumor properties and hypoglycaemic activity. The plant also has nutritional properties of phenolic compounds, including flavonoids, have been extensively studied. Flavonoids are generally known for the purpose to treat hypoglycemic and antidiabetic activities [40].

Bitter melon

Momordica Charantia is better known hypoglycaemic plant belong to cucurbitacea, found in Asia, India, East Africa. This plant grows upto 5m long and having the fruits with knobby structure. The bitter melon contains chemical constituent like alkaloids, lipids, steroids and phenolic compounds. These compounds are responsible for anti diabetic activity. The major compounds of the bitter melon is that the triterpenoids which have AMP-activated protein kinase activity. This activity is a plausible hypoglycaemic mechanism of *Momordica Charantia* [41].

CONCLUSION

In conclusion the review article has presented compiled report on common medicinal plants with anti-diabetic activity used for the treatment of diabetes mellitus. Antidiabetic medicines derived from plant sources have lesser side effects and offered cost effective management of diabetes through nutrient supplementation. The active chemical constituents of plants are responsible for this ant diabetic action. *Gymnema sylvestris*, *Rubia cordifolia*, Bilberry, Green Tea, *Salacia reticulata*, *Berberis aristata*, *Pterocarpus marsupium*, Fenugreek, Aswagandha, Bitter melon were widely used for the treatment of diabetes. Moreover, since last decades some of the active molecules isolated from hypoglycaemic plants showed anti-diabetic activity with more effective than conventional drugs. However, further investigations required to study the mechanism of action of hypoglycaemic medicinal plants.

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