

Costus Igneus and Herbal Drugs Increases the Antidiabetic Activity

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Abstract: *Costus igneus* (or insulin plant) is a traditionally used medicinal herb which is native to Southeast Asia. The plant has been recently introduced into India and it is grown as an ornamental plant in south India. Insulin plant contains various phytochemical constituents like steroid, alkaloid, flavonoid, triterpene, glycoside, and saponins. Its leaves are being used as a dietary supplement in the treatment of diabetes mellitus. The catchphrase of the plant is "a leaf a day keeps diabetes away". Various pharmacological activities include antidiabetic effect, antiproliferative potential, antimicrobial activity, antiurolithiatic property anti-inflammatory potential, its effect on learning and memory, antioxidant activity, neuroprotective role, hypolipidemic activity etc. The present review article attempts to explore various medicinal properties of *Costus igneus* (insulin plant) for research purposes and its suitable formulation development in the future for the welfare of mankind.

Keywords: *Costus igneus*, Insulin plant, Fiery Costus, Spiral flag, Insulin plant, Step ladder

1. Introduction

Costus belongs to the family Costaceae, commonly known as insulin plant in India because its leaves help to build up insulin in the human body. Since oral hypoglycemic agents possess various side effects, there is a growing demand for herbal remedies for the treatment of diabetes mellitus. Many plant preparations are used in folklore and traditional system of medicine to manage diabetes mellitus. Investigation on new oral hypoglycemic compounds from medicinal plants will set a milestone for the development of pharmaceutical entities or as a dietary adjunct to existing therapies in the future. Insulin plant is one such traditional plant which is getting global acceptance nowadays and is now widely used as an ayurvedic medicinal herb. Consumption of the leaves are believed to lower blood glucose levels, and diabetics who consumed the leaves of this plant said to have a fall in their blood glucose levels. Insulin plant is native to Southeast Asia, especially on the Greater Sunda Islands in Indonesia. It is relatively a new entrant to India and is being grown as an ornamental plant in Kerala. In the Ayurvedic system of medicine, diabetes is traditionally treated by chewing the plant leaves for a period of one month to get a controlled blood glucose level [1].

Costus igneus N.E. Br. is a perennial, upright, tropical

evergreen plant belongs to the family Costaceae. Possesses evergreen leaves which are simple, alternate, entire and oblong, having 4-8 inches length with parallel venation. The large, smooth, dark greens leaves Possess light purple undersides and are spirally arranged around stems, forming attractive, arching clumps arising from underground rootstocks. It reaches a height of about 60cm with the tallest stems falling over and lying on the ground. Beautiful range flowers are produced in the warm months having a 2.5-12.5cm diameter, appears on cone-like heads at the tips of branches Propagation of insulin plant is by stem cutting.

2. Phytoconstituents

Phytochemical screening showed the presence of steroids, triterpenoids, alkaloids, tannins, flavonoids, glycosides, saponins, carbohydrates, and proteins. The methanol extract was found to contain the highest number of phytochemicals. Wild plant and callus (MS and LS medium) extracted with different solvents in preliminary screening indicated the presence of high content of phytochemicals like phenols, alkaloids, flavonoids, and terpenoids in methanolic extracts. And the sequential screening for phytochemicals of *Costus* leaves revealed that it is rich in protein, iron, and antioxidant components such as ascorbic acid, α -tocopherol, β -carotene, terpenoids, steroids, and flavonoids [2].

3. Herbal Drugs with antidiabetic properties

A. Ivy gourd

Ivy gourd extracts and other forms of the plant can be purchased online and in health food stores. These products are claimed to help regulate blood sugar levels. Some research supports that compounds in the plant inhibit glucose phosphate Glucose-6-phosphatase is one of the key liver enzymes involved in regulating sugar metabolism [3]. Therefore, ivy gourd is sometimes recommended for diabetic patients. Although these claims have not been supported, a fair amount of research on the medicinal properties of this plant are focusing on its use as an antioxidant antihypoglycemic immune system modulator, etc. Some countries in Asia, such as Thailand, prepare traditional tonic-like drinks for medicinal purpose [4].

B. *Abrus precatorius* L. (Fabaceae)

Antidiabetic *Abrus precatorius* L. (Fabaceae) Local Name: Kundumani The plant is a climber commonly known as Wild Liquorice and found through the plains of India. Leaf of this plant is mixed with the leaves of *Andrographis paniculata*, *Gymnema sylvestre* and seeds of *Syzygium cumini*. The mixture is shade dried and ground into powder and taken orally along with cow's milk. Dosage: About 50 ml of mixture is taken twice a day before food for 120 days 5.

C. *Trigonella foenum graecum*

Fenugreek It is found all over India and the fenugreek seeds are usually used as one of the major constituents of Indian spices. 4-hydroxyleucine, a novel amino acid from fenugreek seeds increased glucose stimulated insulin release by isolated islet cells in both rats and humans. Oral administration of 2 and 8 g/kg of plant extract produced dose dependent decrease in the blood glucose levels in both normal as well as diabetic rats. Administration of fenugreek seeds also improved glucose metabolism and normalized creatinine kinase activity in heart, skeletal muscle and liver of diabetic rats. It also reduced hepatic and renal glucose-6-phosphatase and fructose -1, 6-biphosphatase activity [6].

D. *Aloe barbadensis*

Aloe, a popular houseplant, has a long history as a multipurpose folk remedy. The plant can be separated into two basic products: gel and latex. Aloe vera gel is the leafpulp or mucilage, ale latex, commonly referred to as "aloe juice," is a bitter yellow exudate from the pericyclic tubules just beneath the outer skin of the leaves. Extracts of aloe gum effectively in glucose tolerance in both normal and diabetic rats. Treatment of chronic but not single dose of exudates of *Aloe barbadensis* leaves showed hypoglycemic effect in alloxanized diabetic rats. Single as well as chronic doses of bitter principle of the same plant also showed hypoglycemic effect in diabetic rats. This action of Aloe vera and its bitter principle is through stimulation of synthesis and/or release of insulin from pancreatic beta cells. This plant also has an anti-inflammatory activity in a dose dependent manner [7]. formulation used I diabetes mellitus, Indo American Journal of Pharmaceutical Research. 2012; :2 (10). extracts and other forms of the plant can be purchased online and in health food stores. These products are claimed to help regulate blood sugar levels. Some research supports that compounds in the plant inhibit glucose phosphate Glucose-6-phosphatase is one of the key liver enzymes involved in regulating sugar metabolism [3]. Therefore, ivy gourd is sometimes recommended for diabetic patients. Although these claims have not been supported, a fair amount of research on the medicinal properties of this plant are focusing on its use as an antioxidant anti-hypoglycemic immune system modulator, etc. Some countries in Asia, such as Thailand, prepare traditional tonic-like drinks for medicinal purposes [8].

E. *Allium cepa* (Onion) and *Allium sativum* (Garlic)

They are important dietary supplements belonging to family Liliaceae that involved in the eastern kitchen. Studies showed that oral administration of the ethanol extract of garlic regulated the blood-sugar level, normalizing the activity of both liver hexokinase and glucose-6- phosphatase. In addition, it elevated li, serum triglycerides, total cholesterol, urea, creatinine, AST and ALT levels [8] The antidiabetic activity of the extract was more potent than glibenclamide, the commonly known antidiabetic drug [9].

Many onion bulbs ether fractions showed significant hypoglycemic effects by decreasing the glucose peak in subcutaneous glucose tolerance tests Among them, A cepa increases the fasting serum high-density lipoprotein values, exhibiting alleviation of hyperglycemia in streptozotocin (STZ) diabetic rats. The hypoglycemic and hypolipidemic effects of onion were usually associated with a relevant antioxidant activity, as indicated by the increase in superoxide dismutase activity. No effects were observed on both lipid hydroperoxide and lipoperoxide levels [10].

The main active components present are sulfur-containing compounds being diallyl disulfide (allicin) in garlic and allyl propyl disulfide (APDS) in onions These active secondary metabolites present in the form of cysteine derivatives, as. S-alkyl cysteine sulfoxides that decompose upon extraction into polysulfides and thio-sulfinates in the presence of allinase. The potent antidiabetic activity of both plants may be attributed to the presence of these volatile decomposed products that predominate in their oils in addition to other nonvolatile sulfur-containing peptides and proteins [11].

F. *Aralia elata*

It is a woody plant belonging to the family Araliaceae, known also by Japanese angelica tree. The antidiabetic activity of its root cortex may be attributed to the presence of elatosides E together with oleanolic acid and its derivatives. These secondary metabolites lower the serum glucose level as shown by oral sugar tolerance test in rats [12]. The hypoglycemic activity of A. elata is mainly mediated through inhibition of aldose reductase activity [13].

G. *Azadirachta indica*

It belongs to the family Meliaceae and has been used for a long time in traditional medicine in treating several ailments, including diabetes Its leaves stem bark and seeds possess hypoglycemic activity via increasing insulin secretion from the beta cells of the pancreas. Its leaves are characterized by the presence of high fiber content that is potent in diabetes management and controlling of post-prandial hyperglycemia through delaying gastric emptying, increasing viscosity of GIT content thus, suppressing digestion and absorption of carbohydrate with no risk of hypoglycemia, hyperinsulinemia and undesirable weight [14].

H. *Bauhinia candicans* and *B. forficata*

They are medicinal plants native to Peru, Brazil and Argentina sub-tropical regions, belonging to family Caesalpinaceae the methanol extract of *B. candicans* leaves, together with its butanol exerted a potent antidiabetic activity reducing the plasma glucose level as well as urinary glucose excretion through enhancing peripheral glucose metabolism [16]. Administration of *B. forficata* leaves various extracts to alloxan-diabetic rats resulted in an obvious suppression in serum glucose, triglycerides and total cholesterol. Moreover, chromatographic purification of *B. forficata* leaves n-butanol fraction, resulted in the isolation of kaempferilrin, a flavonoid, which showed a potent hypoglycemic activity upon oral administration in alloxan-induced diabetic rats [17].

I. *Brassica nigra*

It belongs to family Brassicaceae and endogenously grows in the Mediterranean regions. The aqueous *B. nigra* seeds extract exhibited a potent antidiabetic activity in STZ induced diabetic rats manifested by significant reduction in fasting serum glucose, glycosylated hemoglobin and serum lipids exceeding that of ethanol, acetone and chloroform extracts [18]. Its mode of action is mainly attributed to stimulating insulin release from pancreas and normalizing the effects of glucose metabolizing enzyme, therefore, improving glucose homeostasis in both liver and kidney [19].

J. *Cinnamomum zeylanicum*

It is commonly known as Cinnamon (Lauraceae) and widely used in East Asia and Europe. It is extensively used in folk medicine to treat diabetes. It contains volatile oils, mainly cinnamaldehyde. Cinnamon ingestion decreased total plasma sugar level with insulin sensitivity improvement. It also significantly reduced gastric emptying and profoundly decreasing postprandial glycemic response [20]. In addition, cinnamon aqueous extract revealed a potent antidiabetic effect through its up regulation of uncoupling protein-1 (UCP-1) and enhancing the translocation of GLUT4 in the muscle and adipose tissues [21].

K. *Eugenia jambolana*

It is familiar by Jamun or black plum, belonging to family Myrtaceae. It is also known as *Syzygium cumini* and is widely being used over many centuries for the treatment of diabetes by the traditional practitioners. Oral administration of the pulp extract of the fruit resulted in the enhancement of insulinemia through insulin secretion stimulation and insulinase activity suppression from liver and kidney [22]. While, administration of the seeds dried alcohol extract resulted in hypoglycemia and decreased glycosuria, partially restoring the altered hepatic and skeletal muscle glycogen content as well as hexokinase, glucose-6-phosphatase, phosphofructokinase and glucokinase [23].

Moreover, the flavonoid rich extract of its seeds showed a potent antidiabetic activity manifested by a reduction in fasting

and peak bloodglucose levels, in addition to an improvement in glycogen biosynthesis, glucose homeostatic enzymes' activities as well as the in vitro insulin release from pancreatic islets. Its mechanism of action is probably due to up regulation of both PPAR α and PPAR γ in addition to its ability to differentiate 3T3-L1 preadipocytes [24]. Besides, seed kernel extracts were found effective in inhibiting α -glucosidase accounting for the mode by which this herb exerts its anti-diabetic [25].

L. *Gymnema sylvestre*

A member of family Asclepiadaceae, which is widely known as gumar. It is a woody, climbing plant; its main constituents are gymnemic acid, gumarin, a polypeptide of 35 amino acids and saponins [26]. *G. sylvestre* leaves extract exhibited a potent antidiabetic activity in type 2 diabetes, as evidenced by causing a prominent suppression in bloodglucose, glycosylated hemoglobin and glycosylated plasma proteins together with restoring blood glucose homeostasis in type 2 diabetic patients. These results postulated that the beta pancreatic cells may be regenerated by *G. sylvestre* leaves extract supplementation and further confirmed by insulin levels elevation in patients serum [27].

Moreover, studies revealed that *G. sylvestre* enhanced the production of endogenous insulin without direct effect on the metabolism of carbohydrate. It was found that gymnemic acid prevents taste buds activation by sugar molecules, curbing the sugar craving by filling the receptor locations on the taste buds. Similarly, it occupies the receptor location in the intestine absorptive external layers thus inhibiting the sugar molecules uptake by the intestine, resulting in obvious reduction in plasma sugar level [22].

M. *Momordica charantia*

A well-known plant (bitter melon) belonging to family Cucurbitaceae that widely used in folk therapy for the treatment of diabetes. Oral administration of the fruit juice or seed powder resulted in a significant decline in FBG and pronounced amelioration of glucose tolerance exerting both insulin secretagogue and insulinomimetic activities [28]. This potent antidiabetic activity mainly attributed to the presence of an insulin-like polypeptide known by polypeptide- P, similar in structure to the bovine insulin, which reduces plasma sugar levels when injected subcutaneously into type I diabetic patients and appears to inhibit gluconeogenesis. In addition, it improves glucose tolerance in type II diabetes [8] [20]. Other reported hypoglycemic agents isolated from M.

4. Conclusion

The research works that have been done yet showed that *Costus igneus* is an important medicinal herb presented with various pharmacological actions. The studies have done on this plant proved that it possesses many important phytoconstituents such as conjugated flavonoids, flavones, flavonols, catechin and catechin derivatives, chlorophylls a and b, resinoids, essential oil, and alkaloid named saussurine, inulin and resin

and steroids etc. [29], [30] And these compounds found to be responsible for various pharmacological properties such as antidiabetic effect, antiproliferative effect, antimicrobial activity, anti-urolithiatic property, anti-inflammatory potential, the effect on learning and memory, antioxidant activity, neuroprotective Role, hypolipidemic activity etc. Further exploration of medicinal properties of *Costus igneus* and other herbals drugs their various phytoconstituents responsible the pharmacological actions are required to be done to make by adding to market formulation having increase the antidiabetic activity.

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