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A Systematic Review of Anti Diabetic Property of Medicinal Plant - Insulin Plant

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Abstract: *Hyperglycemia is the primary symptom of diabetes mellitus, a chronic, progressive, and poorly understood metabolic disease. The most common causes of T2DM, a spectrum of diseases that began with tissue insulin resistance and gradually progressed to a state marked by total loss of secretory activity of the insulin, are believed to be impaired insulin secretion, resistance to the actions of insulin in the tissue, or a combination of the two. pancreatic beta cells. The significant increase in the prevalence of non-communicable diseases that affect both industrialized and developing countries is largely due to type 2 diabetes. In this brief overview, we want to summarize the current guidelines for managing hyperglycemia in type 2 diabetes, along with the range of drugs currently used for pharmacologic treatment.*

Keywords: diabetes, clinical management, chronic, insulin, primary care

I. INTRODUCTION

The International Diabetes Federation's worldwide cartographic picture of diabetes (http://www.diabetesatlas.org/) clearly illustrates the pandemic nature of type 2 diabetes mellitus (T2DM). Hyperglycemia, or elevated blood sugar, is a complication of diabetes mellitus (DM), a chronic illness that is complicated and results from insufficiencies in insulin secretion, action, or both. Patients with this disease are at high risk for long-term macro- and microvascular complications due to the chronic metabolic imbalance that goes along with it. If patients do not receive high-quality care, they may experience frequent hospitalization and complications, including an increased risk of cardiovascular diseases (CVDs) (1). The four plasma glucose (PG) criteria—high fasting plasma glucose (FPG) (>126 mg/dL), increased 2-hour PG during a 75-g oral glucose tolerance test (OGTT) (>200 mg/dL), and elevated random PG (>200 mg/dL) with traditional hyperglycemia symptoms and indicators, or (iv) a
hemoglobin A1C level more than 6.5%. According to recent American Diabetes Association (ADA) guidelines, there is no test that is better than another for diagnosing diabetes. Regardless of body weight, testing all adults starting at age 45 is advised. Asymptomatic persons of any age who are overweight or obese, exhibit a diagnostic symptom, and have at least one additional risk factor for the development of diabetes should also be tested.

Being a frequent and risingly common condition, type 2 diabetes mellitus is a serious global public health concern. Globally, the International Diabetes Federation calculates that 387 million people have been diagnosed with diabetes (2). The Centers for Disease Control and Prevention estimate that 29.1 million adults in the US had diabetes in 2012, accounting for 9.3% of the country's total population. Additionally, 86 million people had prediabetes in that same year, and 15–30% of those individuals progressed to full-blown diabetes (3). Annually, over 1.4 million newly diagnosed cases are recorded in the United States. It is predicted that one in three Americans will have diabetes in 2050 if current trends continue. Diabetes raises a patient's risk of major health issues such as myocardial infarction, stroke, renal failure, eyesight loss, and early death. In the United States, diabetes continues to rank seventh in terms of cause of death due to its accompanying side effects. If conscious attention is not provided to diabetes-associated mortality, the World Health Organization predicts that the number of deaths attributable to diabetes would double by 2030 (4). Furthermore, epidemiological research indicates that diabetes kills more Americans annually than both breast cancer and acquired immunodeficiency syndrome (AIDS) put together (5). It is concerning that the incidence and prevalence of diabetes are on the rise and that this puts a significant strain on medical expenses and the current healthcare system.

Patients experiencing symptoms of ketoacidosis (frank nausea or vomiting, or even non-specific features like weariness or abdominal discomfort) should stop taking their SGLT2 inhibitor and seek medical assistance very away.

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Native to South and Central America, Costusigneus Nak (syn. Costus pictus D. Don, Costus mexicanus Liebm ex Petersen, or Costuscongenitus Rowle) is also known by the names flaming costus, step ladder, spiral flag, and insulin plant. This is a new American import to India as a herbal treatment for diabetes, hence the widespread name "insulin plant."[6]

Taxonomy:

- Botanical name: [7] Costusigneus N.E.Br
- Domain: Plantae
- Subkingdom: Plantae Viridae
- Classification: Plantae
- Euphyllophytina subphylum
- Phylogeny in Infratopses
- Category: Liliopsidae
- The Commelinidae subclass
- Classification: Zingiberanae
- Zingiberales in order
- The Costaceae family
- Classification: Asteroideae
- Coreopsideae Tribe
- Costus, genus
- Particular name: Igneus

Morphology

The highest stems of this perennial, spreading plant eventually topple over and lie on the ground. It grows to a height of about two feet. Simple, alternating, whole, oblong, evergreen leaves with parallel venation measure 4 to 8 inches in length. This tropical evergreen forms aesthetically pleasing, arching clusters from subterranean rootstocks with its huge, smooth, dark green leaves that have light purple undersides. In the warm months, gorgeous 1.5-inch-diameter orange flowers appear on cone-shaped heads at the tops of branches.(8) The fruits are green in hue, smaller than 0.5 inch, unassuming, and unshowy [Figure 1].

Figure: Insulin plant

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Growth and Propagation

Spiral flags can grow in either direct sunlight or some shade. It is typically grown close to water and requires rich soil and lots of moisture. Division of the clumps, cuttings, or separation of the offsets or plantlets that grow beneath the flower heads are the methods used for propagation. Nematodes and mites can cause issues, particularly in light, sandy soil. There are no serious illnesses that affect the plant.(8)

Phytochemical study

Ascorbic acid, α-tocopherol, β-carotene, terpinoids, steroids, and flavonoids are among the antioxidant components found in C. igneus leaves, which were shown to be rich in protein and iron through sequential screening for phytochemicals.[10,9] Another study demonstrated that the greatest concentration of phytochemicals, including proteins, carbohydrates, triterpenoids, alkaloids, tannins, saponins, and flavonoids, was present in methanolic extract.11] According to a preliminary phytochemical analysis, 21.2% of the leaves of the insulin plant (C. pictus) are made of fiber. 5.2% extractives in petroleum ether, 1.06% in cyclohexane, 1.33% in acetone, and 2.95% in ethanol were obtained from successive extractions. Steroids were found in every extract after a series of extracts were analyzed. There were alkaloids in the ethanol extract as well. Apart from α-tocopherol and ergastanol, a steroid, the main constituent of the ether fraction was bis (2'-ethylhexyl)-1,2-benzenedicarboxylate (59.04%).In [12]Stem revealed the presence of the steroid molecule stigmasterol and the terpenoid compound lupeol.[13] The rhizome of C. igneus yielded the bioactive components quercetin and diosgenin, a steroidal sapogenin.[14] Trace elemental analysis revealed that C. pictus leaves and rhizomes contain notable concentrations of K, Ca, Cr, Mn, Cu, and Zn.In [15] Clear, yellowish essential oils were obtained during steam distillation of the stems, leaves, and rhizomes of C. pictus D. Don. Table 1 lists the main ingredients found in the essential oil [16].

Table 1: Major constituents of essential oil

Essential Oil	Major Components (s)	Standard Percentage of Component
Eucalyptus	1,8-cineole (Eucalyptol)	78%[14]
Lavender	linalyl acetate	4.6-47%[15]
	linalool	28-37%[15]
	β-farnesene	0.9-7.1%[15]
	β-caryophyllene	0.6-6.3%[15]
	lavandulol acetate	0.8-4.8%[15]
Lemongrass	citral	≥75%[16]
Rose	geraniol	14-27%[17]
	Citronellol	29-55%[17]
	nonadecane	2.6-19%[17]
Sandalwood	α-santalol	≥43%[18]
	β-santalol	≥18%[18]
Tea tree	terpinen-4-ol	30-48%[19]
	γ-terpinen	10-28%[19]
	α-terpinen	5.0-13%[19]
	α-pinene	1.0-6.0%[19]
	p-cymene	0.5-8.0%[19]

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Toxicity study

Acute toxicity studies were studied with different doses of aqueous extract of C. pictus from 5, 10, 20, and 40 g/kg body weight. None of the doses of this extract produced mortality or any behavioral disorders.[17] Acute toxicity studies revealed that the administration of aqueous extract 1 g/kg b.w/day for 30 days produced no effect on the general behavior and all the animals survived the test period.[18] Administration of ethanolic extract of C. igneus leaves from 50 mg/kg b.w up to the dose of 5000 mg/kg b.w did not show significant toxicity signs during the first four hours and followed by daily observations for 14 days, and no mortality was also observed; the drug was found to be safe at the tested dose level of 5000 mg/kg b.wt.[19] However, in a study carried out on the methanolic extract of C. igneus, findings indicated toxicity at 250 mg/kg body weight.[20] Further, in another investigation, palmitic acid was found to be the major component in the stem, leaf, and rhizome oils of C. pictus. Palmitic acid is found to induce degeneration of myofibrils in healthy adult rat cardiomyocytes, enhance LDL to HDL cholesterol ratio, and it was found to be the important precursor for the development of coronary heart diseases. So, the constant use of C. pictus leaves for diabetic treatment may cause serious cardiac diseases, and it is not recommended for the treatment.[20]

Therapist activity :-

Hypolipidemic activity

Rats with diabetes-induced hyperlipidemia were used in the study to compare the effects of C. igneus methanolic and aqueous extracts. According to the study, hyperlipidemia brought on by diabetes was corrected by methanolic and aqueous extracts at a level of 200 mg/kg body weight.[21] In rats treated with triton-induced hyperlipidemia, an alcoholic extract of C. igneus at a dose of 400 mg/kg (p.o.) dramatically reduced the levels of blood cholesterol, triglycerides, and LDL.21]

Diuretic effect

A study was conducted to evaluate the diuretic effect of furosemide at 4 mg/kg with that of an aqueous extract of C. pictus D. Don at doses of 100 and 200 mg/kg body weight. The findings showed that C. pictus had a natriuretic effect that was comparable to that of furosemide. Similar to the increase in potassium and sodium clearance brought about by furosemide, the aqueous extract appears to represent a sizable diuresis.(22)

Antioxidant activity

A moderate level of antioxidant activity was observed in an in vitro investigation using an alcoholic extract of C. mexicanus leaves.[23] DPPH, β-carotene, Deoxyribose, superoxide anion, reducing power, and metal chelating test were among the models used to evaluate the antioxidant properties of leaves and rhizomes in methanol, water, ethanol, and ethyl acetate extracts at varying concentrations. When C. pictus leaves and rhizomes were compared to standard BHT (Butylated Hydroxy Toulene) (85%) at a concentration of 400 µg/ml, they demonstrated good antioxidant activity of around 89.5% and 90.0%. The findings showed that, in comparison to other extracts, the methanolic extracts of C. pictus's leaves and rhizomes had more antioxidant activity. excerpts.[24] In a different investigation, the methanolic leaf extract of C. pictus D. Don significantly increased the levels of reduced glutathione, catalase, glutathione reductase, glutathione peroxidase, vitamin A, vitamin C, and vitamin E. As a result, it may be useful in lowering oxidative stress and diseases caused by free radicals. This plant's antioxidant properties might be attributed to the phenolic compounds it contains.Reference [25] C. pictus flower and stem methanolic extracts have antioxidant action against oxidative protein damage in vitro.(26] The chloroform extract of the bark of C. pictus D. Don showed the highest level of antioxidant activity among the extracts evaluated.In [27] For thirty days, diabetic rats were given an ethanolic extract of C. igneus rhizome at a dose of 200 mg/kg body weight. This treatment significantly increased antioxidant levels in the animalsThe plant's bioactive compounds, quercetin and diosgenin, demonstrated antioxidant activity that was adequate to stimulate glycolytic enzymes, regulate gluconeogenesis, and reverse oxidative stress in the liver, pancreas, and kidney of diabetic rats.(28)

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Ameliorative effect

The effects of ethanolic extract of rhizome (50 mg/kg b.wt, orally) on mitochondrial enzymes in alcohol-induced free radical toxicity in male albino rats were investigated. Mitochondrial enzyme levels returned to normal following a 21-day course of treatment, indicating that C. pictus enhanced mitochondrial functions during alcohol-induced free radical stress.29]

Anti-microbial activity

Maximum antibacterial activity was demonstrated by the methanolic extract of C. igneus against gram-negative strains of Salmonella typhimurium, Escherichia coli, Pseudomonas aeruginosa, Enterobacter aerogenes, and Pseudomonas cerus, as well as gram-positive strains of Bacillus megaterium, Micrococcus leuteus, Staphylococcus aureus, and Streptococcus lactis.[/30] A moderate level of antibacterial and antifungal activity was demonstrated by the isolated chemical derived from the ethanolic extract of Costusigneus against Staphylococcus aureus, Eschericia coli, and Candida albicans.(31) Out of all the extracts from different parts of C. pictus, the methanolic extracts from the stem and flower showed the most inhibitory activity at 150 µg/ml on the development of the microorganisms that were examined, which included Shigella flexneri, Klebsiella pneumonia, Bacillus subtilis, and Escherichia coli.[31]

Anti-cancer effect

In vitro mammalian fibrosarcoma (HT-1080) cells were used to test the anti-proliferative and anti-cancer properties of the ethanolic extract derived from C. pictus leaves.33] HT 29 and A549 cells were subjected to the powerful anti-cancer effects of all bark extracts.In

Putative activity

The putative activity of the aqueous extract of Costus stem and the isolated compounds stigmasterol and lupeol was confirmed by the promotion of calcium oxalate dehydrate (COD) crystal formation. This putative activity may be used to treat urinary stones by preventing the formation of calcium oxalate monohydrate (COM) crystals.[32]

II. CONCLUSION

This review supports the therapeutic potential of the leaves in diabetes. However, these results have to be further evaluated and revalidated by clinical trials. The anti-diabetic effect of its leaves is currently been tested in diabetic patients. Studies reveal its role in various diseases, which opens up new clinical research areas. Furthermore, it paves new avenues to explore the compounds responsible for these therapeutic effects, and study the mechanism of its action.

REFERENCES

[1]. Internal Clinical Guidelines Team. Type 2 Diabetes in Adults: Management. London: National Institute for Health and Care Excellence; (2015). 28 p. [Google Scholar] [Ref list]

[2]. Santos-Longhurst A, Krucik G. Type 2 Diabetes Statistics and Facts. Healthline; (2014). Available from: www.healthline.com/health/type-2-diabetes/statistics [Google Scholar] [Ref list]

[3]. Centers for Disease Control and Prevention. Diabetes Latest. (2014). Available from: www.cdc.gov/features/diabetesfactsheet [Ref list]

[4]. American Diabetes Association. National Diabetes Statistics Report: Statistics about Diabetes. (2014). Available from: www.diabetes.org/diabetes-basics/statistics/ [Ref list]

[5]. American Diabetes Association. Fast Facts-Data and Statistics about Diabetes. DiabetesPro; (2014). Available from: http://professional.diabetes.org/content/fast-facts-data-and-statistics-about-diabetes [Google Scholar] [Ref list]

[6]. Jose B, Reddy LJ. Analysis of the essential oils of the stems, leaves and rhizomes of the medicinal plant *Costus pictus* from southern India. *Int J Pharmacy Pharm Sci.* 2010;2(Suppl 2):100–1. [Google Scholar] [Ref list]

[7]. [Last accessed on 2013 Jun 23]. Available from: http://www.zipcodezoo.com/Plants/C/Costus_igneus . [Ref list]

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[8]. Gilman EF. Florida: University of Florida, Inc; c2012. *Costusigneus*. Fact sheet. FPS-151. EDIS-Electronic Data Information Source-UF/IFAS Extension. [Google Scholar] [Ref list]

[9]. Devi VD, Urooj A. Nutrient profile and antioxidant components of *Costus specious* Sm. and *Costusigneus* Nak. *Indian J Nat Prod Resour.* 2010;1:116–8. [Google Scholar] [Ref list]

[10]. Shankarappa L, Gopalakrishna B, Jagadish NR, Siddalingappa GS. Pharmacognostic and phytochemical analysis of *Costusignitius*. *Internationale Pharmaceutica Sciencia.* 2011;1:36–41. [Google Scholar] [Ref list]

[11]. Jothivel N, Ponnusamy SP, Appachi M, Singaravel S, Rasilingam D, Deivasigamani K, et al. Anti-diabetic activity of methanol leaf extract of *Costus pictus* D. Don in alloxan-induced diabetic rats. *Journal of Health Science.* 2007;53:655–63. [Google Scholar] [Ref list]

[12]. George A, Thankamma A, Rema Devi VK, Fernandez A. Phytochemical investigation of Insulin plant (*Costus pictus*) *Asian J Chem.* 2007;19:3427–30. [Google Scholar] [Ref list]

[13]. Manjula K, Pazhanichamy K, Kumaran S, Eevera T, Dale Keefe C, Rajendran K. Growth characterization of calcium oxalate monohydrate crystals influenced by *Costusigneus* aqueous stem extract. *Int J Pharm Pharm Sci.* 2012;4(Suppl 1):261–70. [Google Scholar] [Ref list]

[14]. Kalailingam P, Sekar AD, Samuel JS, Gandhirajan P, Govindaraju Y, Kesavan M, et al. The efficacy of *Costusigneus* rhizome on carbohydrate metabolic, hepatoproductive and antioxidative enzymes in steptozotocin-induced diabetic rats. *Journal of Health Science.* 2011;57:37–46. [Google Scholar] [Ref list]

[15]. Jayasri MA, Gunasekaran S, Radha A, Mathew TL. Anti-diabetic effect of *Costus pictus* leaves in normal and streptozotocin-induced diabetic rats. *Int J Diabetes and Metabolism.* 2008;16:117–22. [Google Scholar] [Ref list]

[16]. Meléndez-Camargo ME, Castillo-Nájera R, Silva-Torres R, Campos-Aldrete ME. Evaluation of the diuretic effect of the aqueous extract of *Costus pictus* D. Don in rat. *Proc West Pharmacol Soc.* 2006;49:72–4. [Google Scholar] [Ref list]

[17]. Remya R, Daniel M. Phytochemical and pharmacognostic investigation of antidiabetic *Costus pictus*. D. Don. *Int J Pharm Biomed Res.* 2012;3:30–9. [Google Scholar] [Ref list]

[18]. Bhat V, Asuti N, Kamat A, Sikarwar MS, Patil MB. Antidiabetic activity of insulin plant (*Costusigneus*) leaf extract in diabetic rats. *J Pharm Res.* 2010;3:608–11. [Google Scholar] [Ref list]

[19]. Krishnan K, Vijayalakshmi NR, Helen A. Beneficial effects of *Costusigneus* and dose response studies in streptozotocin induced diabetic rats. *International Journal of Current Pharmaceutical Research.* 2011;3:42–6. [Google Scholar] [Ref list]

[20]. Mani P, Kumar AR, Bastin TM, Jenifer S, Arumugam M. Comparative evaluation of extracts of *C. igneus* (or *C. pictus*) for hypoglycemic and hypolipidemic activity in alloxan diabetic rats. *Int J Pharm Tech.* 2010;2:183–95. [Google Scholar] [Ref list]

[21]. Chacko N, Shastry CS, Shetty P, Shyamma P, D'souza U, Maulika P. Anti hyperlipidemic activity of *Costusigneus* in Triton X-100 induced hyperlipidemic rats. *International Journal of Pharmaceutical and Chemical Sciences.* 2012;1:813–8. [Google Scholar] [Ref list]

[22]. Dhanabal SP, Kumar A, Chandrasekar R, John S, Joseph S, James M, et al. Hypoglycemic and antioxidant activities of *Costusmexicans* (Costaceae) *Aryavaidyan.* 2007;21:53–8. [Google Scholar] [Ref list]

[23]. Jayasri MA, Mathew L, Radha A. A report on the antioxidant activity of leaves and rhizomes of *Costus pictus* D. Don. *Int J Integr Biol.* 2009;5:20–6. [Google Scholar] [Ref list]

[24]. Sethumathi PP, Nandhakumar J, Sengottuvelu S, Duraisam R, Karthikeyan D, Ravikumar VR, et al. Antidiabetic and antioxidant activity of methanolic leaf extracts of *Costus pictus* D. Don in alloxan induced diabetic rats. *Pharmacologyonline.* 2009;1:1200–13. Available from: http://www.pharmacologyonline.silae.it/files/archives/2009/vol1/120.SETHUMATH.pdf . [Google Scholar] [Ref list]

[25]. Majumdar M, Parihar PS. Antibacterial, antioxidant and antiglycation potential of *Costus pictus* from southern region, India. *Asian J Plant Sci Res.* 2012;2:95–101. [Google Scholar] [Ref list]

[26]. Sathuvan M, Vignesh A, Thangam R, Palani P, Rengasamy R, Murugesan K. *In vitro* antioxidant and anticancer potential of bark of *Costus pictus* D. Don. *Asian Pac J Trop Biomed.* 2012;2:S741–9. [Google Scholar] [Ref list]

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[27]. Kalailingam P, Sekar AD, Samuel JS, Gandhirajan P, Govindaraju Y, Kesavan M, et al. The efficacy of *Costusigneus* rhizome on carbohydrate metabolic, hepatoproductive and antioxidative enzymes in steptozotocin-induced diabetic rats. *Journal of Health Science.* 2011;57:37–46. [Google Scholar] [Ref list]

[28]. Maruthappan V, Sakthisree K. Ameliorative effect of *Costus pictus* D. Don rhizome on mitochondrial enzymes in male albino rats. *Int J Integ Biol.* 2010;9:62–6. [Google Scholar] [Ref list]

[29]. Gothandam KM, Aishwarya R, Karthikeyan S. Preliminary screening of antimicrobial properties of few medicinal plants. *J Phytol.* 2010;2:1–6. [Google Scholar] [Ref list]

[30]. Saraswathi R, Upadhyay L, Venkatakrishnan R, Meera R, Devi P. Isolation and biological evaluation of steroid from stem of *Costusigneus*. *J Chem Pharm Res.* 2010;2:444–8. [Google Scholar] [Ref list]

[31]. Nadumane VK, Rajashekar S, Narayana P, Adinarayana S, Vijayan S, Prakash S, et al. Evaluation of the anticancer potential of *Costus pictus* on fibrosarcoma (HT-1080) cell line. *J Nat Pharm.* 2011;2:72–6. [Google Scholar] [Ref list]