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Review Article

DETAILED STUDY ON *COSTUS IGNEUS* PLANT FOR ITS MEDICINAL IMPORTANCE - A REVIEW

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ABSTRACT

A medicinal shrub called *Costus Igneus* may have a miraculous treatment for diabetes. The leaf of this medicinal plant, which is a member of the Costaceae family, strengthens the beta cells in the pancreas, which helps the body produce more insulin. This is why it is known as the "Insulin Plant" in India. There is a strong belief that eating the leaves of this plant can control blood glucose levels and diabetics, according to earlier research. For antidiabetic activities, the experts have used various extracts from plant parts or specific phytochemicals. This review provides the scholar with information on numerous activities on various diseases in addition to just antidiabetic activities.

Keywords: *Costus Igneus*, Taxonomy, Anticancerous Activity, Antioxidant activity, Hepatoprotective activity.

INTRODUCTION

Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources; many of these isolations were based on the uses of the agents in traditional medicine. (Sardessai., 2014). Since the beginning of time, plants have been a prime supply of both conventional medicine and pharmaceutical drugs for humans. Around 80% of people worldwide still rely on natural medicines for their medical needs. Roots account for 60% of the medicinal plants used in the traditional systems of medicine (Agarwal and Ghosh1985). Natural products are becoming more and more valued for their applications as "alternatives" against chronic diseases in both established and emerging nations. Medicinal plants used in traditional medicine are considerably useful and are readily available in rural areas at relatively cheaper than modern medicine it is estimated that 70 to 80% of the people worldwide rely chiefly on traditional health care system and largely on herbal medicines. In developing countries, the World Health Organization (WHO) estimates that about 80% of the population relies on plant based preparations used in their traditional medicinal system and as the basic needs for human primary health care (Gurib-Fakim 2006).

In many developing nations, a sizable percentage of the populace turns to traditional herbal practitioners for their basic medical needs. Despite the wide variety of modern, synthetic medications that are readily available, herbal medications more accurately, herbal drugs or herbals often maintain their appeal due to their strong historical and cultural values. Due to the rising demand for these herbal medications, concerns over their efficacy, safety, and quality upkeep are emerging in both developed and developing nations. These herbs have shown a range of biological functions in both their isolated compounds and the bioactive principles they contain. The medico folk lore literatures of many regions, as occasionally documented, contain extensive therapeutic data on such herbs.

Costus igneus

The Costaceae family, which includes the *Costus igneus* and is located in tropical Africa, Asia, and Australia, is known by the common names Fiery Costus and Spiral Flag in Sanskrit. It is in India. Cultivated in coastal regions, such as the Karnataka state's Uttar Kannada division. For the treatment of diabetes, locals in this region typically consume 2-3 leaves of this plant twice daily. Preliminary phytochemical screening of this plant extract revealed the

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presence of carbohydrate, protein, steroids, alkaloids, tannins, glycosides, saponins, fixed oils and flavonoids (Nandhakumar *et al.,* 2007). Studies have shown the antioxidant activity of plant flavonoids (Malomo *et al.*, 2011).

Costus igneus (Figure 1) whole plant is used for it anti-diabetic property and prevents the body from disease, protects mind and which prolongs the longevity of life in Southern India (Nagarajan *et al*., 2011). Preliminary phytochemical screening of this plant extract revealed the presence of carbohydrate, protein, steroids, alkaloids, tannins, glycosides, saponins, fixed oils and flavonoids (Nandhakumar *et al*., 2007).On seeing previous studies there is a strong belief that by consuming these plant leaves can control the blood glucose levels and diabetics. Those who consume the leaves of this plant reported a drop in the blood glucose levels (Shetty *et al*., 2010). Detoxification, in general, is the process of cleansing the body of substances that have a negative impact on cell structures or functions. As the amount and variety of toxic substances in the air, water, and food have expanded, so has the need to detoxify and cleanse our bodies. Modern research has shown that a wide range of plants can neutralize or detoxify toxins and protect respiratory, urinary, hepatic and neural systems from the toxic effects of drugs and chemicals (Al-Snafi 1999). Earlier studies suggest that *Costus igneus* leaf extract exerts antidiabetic and hypolipidemic effects in diabetic rats (Akhila *et al*., 2010). Administration of the aqueous and ethanolic stem extract of *Costus igneus* to rats with experimentally induced urolithiasis by ethylene glycol has been found to reduce the growth of urinary stones. Contents of *Costus igneus* plant preparation indicate its potential to reduce the oxidative stress.

Phytochemistry

Phytochemical screening showed the presence of alkaloids phytosterols, saponins, glycosides, carbohydrates, tannins & phenolic compounds flavanoid, terpenoids and lignin (Palanivel *et al*., 2013). Preliminary phytochemical screening of this plant extract revealed the presence of carbohydrate, protein, steroids, alkaloids, tannins, glycosides, saponins, fixed oils and flavonoids in *Costus igneus* (Nandhakumar *et al*., 2007). Sequential screening for phytochemicals of *Costus igneus* leaves revealed that it is rich in protein, iron, and antioxidant components such as ascorbic acid, α-tocopherol, β-carotene, terpinoids, steroids, and flavonoids.

Anticancerous Activity

One of the most serious health issues facing both developed and developing nations globally is cancer. Lung cancer has remained the most prevalent cancer diagnosed in males, and breast cancer is the most prevalent cancer diagnosed in women, among the most prevalent types of cancer (lung, stomach, colorectal, liver, and breast). According to estimates from the International Agency for Research on Cancer, there were 14.1 million new cases, 8.2 million cancer deaths, and 32.6 million new cases of the main types of cancer worldwide in 184 countries, in 2012, there were. Million cancer survivors globally (within 5 years of diagnosis). According to estimates, there will be 26 million new instances of cancer and 17 million annual cancer deaths by the year 2030 (Kumar and others, 2007) In vitro MCF 7 breast cancer cell line Dhanasekaran *et al*. (2014) investigated the anti-proliferative and apoptotic effects of methanolic extract of *Costus igneus*, as well as the safety of the extract for normal human lymphocytes. Because *Costus igneus* contains essential phytochemicals like alkaloids, glycosides, terpenoids and steroids, flavonoids, reducing sugars, triterpenes, phenolic compounds, tannins, and saponins, the results showed that (MECiL) reduces tumour size without affecting normal cells. Identifying the diosgenin in Costus igneus rhizome with anticancer ability to successfully inhibit STAT3 action was the focus of Premila *et al* (2016).'s research. Molecular docking study for STAT3 with diosgenin is more interactive and binding strongly at the active site, according to results from docking diosgenin against target proteins STAT3, JAK, and IL-6 using Auto Dock 4.2. These findings support the use of the *Costus igneus* vegetation.

Figure 1. Botanical name: *Costus igneus*

Antioxidant activity

Antioxidants are compounds that inhibit oxidation. Oxidation is a chemical reaction that can produce free radicals, thereby leading to chain reactions that may damage the cells of organisms. Antioxidants such as thiols or ascorbic acid (vitamin C) terminate these chain reactions. Shivaprakash *et al*., (2014) studied evaluation of antioxidant potential of *Costus igneus* in ethanol induced peroxidative damage in albino rats. Antioxidants estimated at the end of 30 days. The levels of reduced glutathione, superoxide dismutase, and catalase significantly reduced and (malondialdehyde) MDA levels raised in ethanol treated group compared to control group. The levels of reduced glutathione, SOD and catalase enzyme recovered completely in a dose dependent manner. These results demonstrate *Costus igneus* significantly reversed the reduction of GSH, SOD and CAT and reduced significantly the levels of MDA, a biomarker of lipid peroxidation in a dose dependent manner, suggesting its ability to enhance the antioxidant defense to prevent alcohol induced oxidative stress injury.

Antibacterial activity

Sulakshana *et al*., (2013) studied evaluation of antibacterial activity in three species of Costus (*Costus speciosus*, *Costus pictus* and *Costus igneus*) against gram positive bacteria *Bacillus subtilis* (ATCC 633), *Staphylococcus aureus* (ATCC 9144) and gram negative bacteria *Escherichia coli* (ATCC25922), *Pseudomonas aeruginosa* (ATCC25619).The results showed antimicrobial activity at different concentrations (500-2000µg) of the extract of Costus species the zone of inhibition increased with concentration from 500-2000µg of test solution. 2000µg concentration showed maximum activity on all the test organisms. On seeing the results the sensitivity varied among them. High inhibition zones were observed in S.aureus (1.26 cm) followed by *P.aeruginosa* (1.21 cm) followed by *E.coli* (1.18cm). *B. subtilis* showed low inhibition zone (1.12 cm) in *C.pictus*. The results conclude that the rhizome extract of three Costus species has a potent antibacterial property. Hence there is possibility of developing these plants as a source of herbal antibiotic and further studies are needed for isolation and purification of bioactive constituent. The isolated compound from the ethanolic extract of *Costus igneus* showed moderate anti-bacterial and anti-fungal activity against *Staphylococcus aureus*, *Eschericia coli* and *Candida albican*. The isolated compound from the ethanolic extract of *Costus igneus* showed moderate anti-bacterial and anti-fungal activity against *Staphylococcus aureus*, *Eschericia coli* and *Candida albican* (Saraswathi et al. 2010).

Antimicrobial activity

Sardessai *et al*., (2014) investigated the antimicrobial activity of the methanolic extract of the rhizomes of *Costus igneus*. The results indicate significant activity against both gram-positive (*Staphylococcus aureus* and *Bacillus subtilis)* and gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella typhimrium).* The antifungal study revealed no antifungal activity against both *Claviceps purpurea* and *Aspergillus niger*. It has been observed that as the concentration of the methanolic extract of the rhizomes of *Costus igneus* increases, there is significant inhibition seen in the growth of the cultures. This is indicated by drastic decline in the absorbance values and confirmed by plate counts, thus exhibiting strong activity. methanolic extract of the rhizomes of *Costus igneus* exhibits promising antibacterial and no antifungal activity.

Similar work on antibacterial studies using root extract of *Costus igneus* on *P.aeruginosa*, Klebsiella pneumonia, *Proteus vulgaris* and Salmonella sp. was reported (Arjun Nagaranjan *et al*., 2011). Studies on antimicrobial activities of different medicinal plants has been reported worldwide by many workers (Samy, 2005; Palombo and Semple, 2001; Ahmad *et al*., 2001). Antibacterial activity of *Curcuma longa* varieties against different strains of bacteria (Shagufta Naz *et al.,* 2010), rhizome extract of Acorus (Sabita rani *et al.,* 2003), leaf extract of *Mikania triangularis* (Cruz *et al.,* 1996), root and leaf extract of *Withania somnifera* (Mahesh and Satish, 2008) have been reported. Agar well diffusion method was used to test the antibacterial potential of *C. igneus* methanolic extract (100 mg/ml) which showed maximum zone of inhibition (7mm) against *E. coli* species. Methanolic extract of *C. igneus* showed maximum anti-bacterial activity against *gram-positive Bacillus cerus*, *Bacillus megaterium*, *Micrococcus leuteus*, *Staphylococcusn aureus*, *Streptococcus lactis*, and gram-negative strains *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, and *Salmonella typhimurium*. The isolated compound from the ethanolic extract of *Costus igneus* showed moderate anti-bacterial and anti-fungal activity against *Staphylococcus aureus*, *Eschericia coli*, and *Candida albicans* (Saraswathi *et al*., 2010).

Antidiabetic activity

Hyperglycemia is a hallmark of the metabolic disease diabetes mellitus. The World Health Organization (WHO) issues a warning that, over the following ten years, diabetes-related deaths will rise by 80% in some regions of the globe. With an estimated 35 million cases of diabetes worldwide, or 8% of the adult population, India has the highest prevalence. According to WHO estimates, there are presently close to 200 million diabetics worldwide. International Diabetes Federation estimates that this figure will increase to 333 million people by 2025. Only 5% of the diabetes in the world is type 1 (IDDM). The remaining 95% is type 2 (NIDDM).

Insulin is secreted in pancreatic β-cells in response to increase in postprandial blood glucose level. Glucose seems to be the nutrient responsible for insulin secretion and the process called glucose stimulated insulin secretion (Gonzalez *et al*., 2013). Kalailingam *et al.,* (2011) studied on oral administration of ethanolic extract of *Costus igneus* rhizome at 200 mg/kg body weight to diabetic rats for 30 days induced a significant antioxidant effect. The bioactive compound quercetin and diosgenin present in the plant

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exhibited antioxidant activity, which was sufficient to reverse oxidative stress in liver, pancreas, and kidney of diabetic rats as well as to stimulate glycolytic enzymes and control gluconeogenesis in diabetic animals. Similarly in Tamil Nadu, the leaves of *Costus igneus* used for treating diabetes by the tribal people of Kolli Hills of Namakkal district, Tamilnadu. Leaves of *Costus igneus* is known to be effectively used for treating diabetes by the tribal people of Kolli Hills of Namakkal district, Tamil Nadu (Elavarasi and Saravanan, 2012).

Hypoglycemic activity

On alloxan-induced diabetic albino Wister strain rats, Palanivel *et al*. (2013) assessed the hypoglycemic action of the Costus igneus (whole plant) ethanolic extract. On days 0 through 14 blood samples were taken and examined for fasting blood glucose levels (BGL) and cholesterol profiles. Glibenclamide (10 mg/kg) reduced blood glucose levels in diabetic rodents from 245.66 2.40 mg/dl to 95.00 1.34 mg/dl (55.33%). Blood glucose levels in diabetic mice treated with 250 mg/kg of ethanolic extract of Costus igneous (ECI) dropped from 243.83. At the end of the 14th day of treatment, 3.4 mg/kg had decreased to 90.17 5.04 mg/kg (50.46%), showing good hypoglycemic activity. Similar studies on the hypoglycemic action of *Costus igneus* extract were conducted by Shiny *et al*. (2013), Swarnalatha and Ramesh kumar (2015), and others.

Hepatoprotective activity

Liver is the major site of intensive metabolic activity. Liver dysfunction as a result of toxic chemicals, certain drugs and environmental pollutants has been largely increased in the last few decades. Herbal treatments of many diseases including hepatopathy are increasing in many countries (Venukumar and Latha, 2002). Liver diseases are a serious health problem. In the absence of reliable liver protective drugs in allopathic medical practices, herbs play an important role in the management of various liver disorders. A number of plants have shown hepatoprotective property (Scott Luper, 1998). Nimmy and Shastry (2012) reported administration of *Costus igneus* extract prior to acetaminophen administration effectively prevented the induction of damage by acetaminophen, which was confirmed by normal enzyme levels and lack of necrotic changes in the histopathological studies. The effect produced by 400mg/kg of *Costus igneus* was comparable with that produced by the standard drug silymarin. The alcoholic extract of the leaves of *Costus igneus* was used for the experiment.

Paracetamol was used in a dose of 300mg/kg orally to induce hepatic damage. (Goldin and Ratnayaka 1996).The induction of liver damage was confirmed by elevated serum enzyme levels and histopathological picture showing zonal focal necrosis. Silymarin was used as reference standard in a dose of 100mg/kg. Hepatoproductive ethanolic extract from rhizome of *Costus igneus* at a single dose of 100 and 200 mg/kg per day orally administered to diabetes induced rats for 30 days. Carbohydrate metabolic enzymes such as glucokinase-6-phosphatase, hepatoproductive enzymes such as aspartate and antioxidative enzymes such as superoxide dismutase, catalase, glutathione peroxidase in liver, kidney and pancreas activity were investigated in this study *Costus igneus* was found to reverse the oxidative stress in liver, pancreas (Kalailingam P *et al*, 2010). The *Costus igneus* ethanolic leaves extract had sufficient potential to prevent the damage induced by paracetamol in liver when compared to standard silymarin and it was confirmed by histopathological studies as well (Chacko *et al*, 2012).

Anti-inflammatory

Srivastava, *et al*., 2013 had proved the anti-inflammatory and analgesic effects of methanol crude extracts of *C. speciosus* aerial parts. 800 mg/kg dose of this crude extract showed a significant anti-inflammatory action in experimental rats while 400 and 800 mg/kg doses had made potent analgesic effect. The β-amyrin a triterpenoid present in *Costus igneus* has been reported for potent anti-inflammatory activity by preventing the prostaglandin-E2(PGE2), cyclo oxygenase2(COX-2), and interleukin-6(IL-6) via the inhibition of translocation of NF-κB from the cytoplasm to the nucleus during Lipopolysaccharide-induced inflammation (Krishnan *et al*, 2014).

Antihyperlipidemic activity

Costus igneus extract's antihyperlipidemic action in Triton X-100-induced hyperlipidemic rats was the focus of a 2012 study by Nimmy et al. Rats receiving triton-X-100 (100 mg/kg) had higher levels of total cholesterol, total lipids, VLDL, and LDL, and lower levels of HDL. Rats induced with Triton were given *Costus igneus* at dosages of 100, 200, and 400 mg/kg per day. The benchmark used was atorvastatin. The levels of TC, TG, VLDL, and LDL could be substantially reduced by treatment with plant extract. Also the extract was found to cause a significant increase in the HDL levels. The artherogenic index also was decreased in a dose dependent manner. (Funakoshi- Tago *et al*., 2011). Alcoholic extract of *C. igneus* plant at the dose of 100, 200, 400 mg/kg (p.o.) was found to significantly decreased the level of serum cholesterol, triglycerides, low density lipid in Triton-induced hyperlipidemic rats. Atorvastatin was used as a standard. Authors concluded that extract has potential to increase high density lipid and decrease low density lipid level (Chacko N *et al*, 2012).

CONCLUSION

The paper reviewed the Anticancerous Activity, Antioxidant activity , Antibacterial activity , Antimicrobial activity, Antidiabetic activity, Hypoglycemic activity, Hepatoprotective activity, Anti-inflammatory, Antihyperlipidemic activity effects of the *Costus igneus* to open the door for their utilization in medical applications as a result of effectiveness and safety.

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