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Evaluation of Antioxidant Activity in Different Parts of *Costus igneus*

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Abstract: ***Recently there is upsurge of interest in therapeutic potential of plants as antioxidants, reducing free radical induced tissue injury. Cancer, cardiovascuclar diseases, diabetes, age related muscular degeneration implicate oxidative stress are some of the common health issues, among them diabetes has serious consequences and limited treatment. Antioxidants prevent oxidative damage caused by free radicals interfering with oxidative process, chelating catalytic metals and act as oxygen scavengers. Present study focuses on antioxidant evaluation of Costus igneus commonly known as insulin plant which is efficient and effective herbal drug possessing various pharmacological activities such as hypolipidemic, diuretic, antidiabetic, antioxidant, antimicrobial, anticancerous. Pharmacological work was carried out on Costus igneus leaves but pharmacological potential of other plant parts requires exploration. The present study aims at evaluation of antioxidant activity in methanolic extract of leaves, rhizome and stem of Costus igneus. Present study revealed that among the tested samples, rhizome showed max antioxidant activity an average of 89% when compared to leaf 72% and stem 55%. Total phenolic content found to be maximum in rhizome with 0.453±0.011 and flavonoid content was 0.123 ± 0.017. High percentage of antioxidant activity in rhizome might be due to the phenolic contents present in it.***

Keywords: *Costus igneus*, Antioxidant activity, DPPH.

1. Introduction

Antioxidants are naturally occurring plant substances that protect the body from damage caused by harmful molecules called free radicals as they help to prevent oxidation, which can cause damage to cells and may contribute to aging. They improve immune function and perhaps lower the risk for infection, cardiovascular diseases, and cancer. Antioxidants exist as vitamins, minerals and other compounds in foods. A diet containing plenty of fruits and vegetables, whole grains and nuts can supply all the antioxidants which body needs. Diets rich in antioxidants can be very beneficial such as Apricots, broccoli, pumpkin, cantaloupes, spinach and sweet potatoes are good choices. Foods containing vitamins C and E are also good sources of antioxidants and minerals such as selenium and zinc (Kalpana kaloori et al 2021). The main characteristic of an antioxidant is its ability to trap free radicals. The most dangerous free radicals are the atomic and molecular varieties of oxygen which is known as Reactive Oxygen Species (ROS). These free radicals may oxidize nucleic acids, proteins, lipids and can initiate degenerative diseases. Antioxidants scavenge the free radicals such as peroxide, hydroperoxide or lipid peroxyl and thus inhibit the oxidative mechanisms. Antioxidants are the molecules that prevent cellular damage caused by oxidation of other molecules. Though oxidation reactions are crucial for life, they can also be damaging (Mamta Pal et al 2014). Plants and animals have a complex system of multiple types of antioxidants, such as vitamin C and vitamin E, as well as enzymes, such as catalase (CAT), superoxide dismutase (SOD), and various peroxidases (Hamid et al 2010). Oxidative stress plays a key role in causing various human diseases, such as necrosis, cardiovascular diseases, cancer, neurological disorder, Parkinson's dementia, Alzheimer's disease, inflammatory disease, muscular dystrophy, liver disorder (Amit and Priyadarsini 2011). Besides there are some antioxidants in the form of micronutrients which cannot be manufactured by the body itself such as vitamin E, β-carotene, and vitamin C, and hence these must be supplemented in the normal diet (Teresa et al 2011). Plant-based antioxidants derived from fruits, nuts, oils and vegetables are currently generating a lot of interest and a great deal of attention from researchers.

Costus igneus Nak. commonly known as fiery costus, Step ladder or Spiral flag or Insulin plant, is native to South and Central America. *Costus igneus* is a tropical evergreen plant having large, smooth, dark green leaves which are spirally arranged around the stems growing to a height of 60 cm. It is widely grown in gardens as ornamental plant in South India and also grown wild in many places (Benny 2004). The plant belongs to the family Costaceae. Costaceae was first raised to the rank of family by Nakai on the basis of spirally arranged leaves and rhizomes being free from aromatic essential oils. Before the elevation to family status, Engler and Prantl recognized Costoideal as a subfamily under Zingiberaceae. Several anatomical and morphological features support this isolated position including well developed aerial shoot with distinct, rigid, and commonly branched stems. The family Costaceae consists of four genera and approximately 200 species. The genus *Costus* is the largest in the family with about 150 species that are mainly tropical in distribution (Benny 2004 and Eevera et al 2010). Leaves of *C. igneus* were one among the plants known to be effectively used for treating diabetes by the tribal people of Kolli hills of Namakkal district of Tamilnadu (Elavarasi et al 2012). Bioactive compounds quercetin and diosgenin, a steroidal sapogenin, were isolated from *C. igneus* rhizome (Kalailingam et al 2011). In Ayurvedic system the rhizome of this plant is considered as bitter, astringent, acrid, cooling, aphrodisiac, purgative, anthelminntic, depurative, febrifuge, expectorant and useful in burning sensation, constipation, leprosy, worm infection, skin diseases, fever, asthma, bronchitis, inflammations and anemia (Vishalakshi Devi and Asna Urooj 2010). Due to various health benefits of *Costus igneus*, the present study attempts to assess the antioxidant activity in rhizome, leaves

and stem of *Costus igneus*. Apart from antioxidant activity, determination of antioxidant compounds such as phenols, flavonoids were also analyzed.

2. Material and Methods

Costus igneus leaf, stem and rhizome were collected from the Garden of St. Ann's college for women, Mehdipatnam, Telangana state for the present study. Collected leaf, stem and rhizome were shade dried for further evaluation of antioxidant activity. All chemicals and solvents used were of Analytical grade.

Preparation of the Extract

The plant parts collected were cleaned off for extraneous matter and soil with tap water and later with distilled water thrice before drying. They were then surface sterilized with 60% alcohol followed by washing with distilled water, blotted with sterile blotting paper and dried at room temperature. The ground material was soaked in distilled water for 48 hour with stirring every ½ h using a sterilized glass rod. The final extract were passed through Whatman filter paper No.1

Determination of total Polyphenols

The total phenolic content of the plant extract was determined with the Folin-Ciocalteau assay (Vernon L Singleton et al 1999) The data for the total phenolic contents were expressed as milligrams of Gallic acid equivalents (GAE) per 100 grams dry mass (mg GAE/100g DW). The total flavonoid content were measured with alumimum chloride colorimetric assay (Chia-Chi chang et al 2002). The data for the total flavonoid contents were expressed as milligrams of Quercetin equivalents (QE) per 100 grams dry mass (mg QE/100g DW).

DPPH (2, 2-diphenyl-1-picryl hydrazyl) Radical Scavenging Assay

The aqueous extract of *Costus igneus* plant parts, leaf, stem and rhizome were studied for antioxidant potential using DPPH radical scavenging assay (Tomoko Yamaguchi et al 1997). The aqueous extracts of different parts collected were analyzed with DPPH assay after preparing the extract. Reaction mixture was prepared and incubated in the dark for 15 min, there after the optical density recorded at 517 nm against the blank after 30mins. of incubation in dark. The degree of discoloration indicates the scavenging potentials of the extracts. The antioxidants react with DPPH which is a stable free radical and convert 1, 1 dihydroxy 2-picrylhydrazine. The decrease in OD on addition of test samples in relation to the control were used to calculate the antioxidants activity as percentage inhibition (%) of DPPH radical. The capability of scavenging DPPH radical was calculated the following equation

$$\text{DPPH Scavenging (\%)} = \frac{A\ Control - A\ Test\ X\ 100}{A\ Control}$$

Where "A control" is the absorbance of the control reaction and "A test" is the absorbance of the sample of the extracts. Further IC50 value is calculated. Lower the IC50 value indicates higher antioxidant activity. IC50 value denotes the concentration of sample, which is required to scavenge 50% of DPPH free radicals.

3. Results and Discussions

The present study were conducted with an objective to identify the plant parts, rhizome, leaves and stem of *Costus igneus* containing maximum amount of antioxidant acidity and also aimed to identify the total phenolic and flavonoid content in them. Among the different plant parts used, rhizome showed high antioxidant activity measured as scavenging of DPPH for aqueous extracts when compared to standard ascorbic acid. Figure 1 shows the comparative account of the antioxidant activity among the leaf, stem and rhizome of *Costus ignues*. Leaf showed the least antioxidant activity when compared to stem and rhizome. Rhizome showed a maximum of 89% of antioxidant activity when compared to leaf which showed 72% antioxidant activity and stem around 55% antioxidant activity. Similar study was conducted by Nimmy chacko et al 2019., where plant extract produced 71.85% DPPH scavenging activity, compared to ascorbic acid which produced 84.47% at a concentration of 160 µg/ml. Muthukumar C et al 2019 worked with methanolic extract of the leaves showed maximum amount of phytochemicals in *Costus igneus.* The leaf and rhizome extracts of *C. pictus* show the good antioxidant activity of about 89.5% and 90% at a concentration of 400 µg/ml estimated by DPPH (Jayasri MA et al 2008). *Costus igneus* shows efficient antioxidant activity (Waseem khanday et al 2019). Antioxidant activities of methanolic extracts ranged between 4.89 µg/ml to 46.0 µg/ml ascorbic acid equivalents for the tested extracts (Ashwini Prabhu et al 2015). Similar study was conducted by Abdullah Mohammed Aladhreai, Dr. Shazia Jamal, 2019.

Table 1 shows the total phenolic and flavonoid content of *Costus igneus* of rhizome, leaf and stem. Total phenolic and flavonoid contents were found to be 0.453±0.011and 0.323±0.045 in rhizome respectively. Stem were containing the least phenolic and flavonoid content when compared to the standards 0.752±0.332 and 0.817±0.019 respectively. Preliminary phytochemical analysis was carried out by Sapna Patil and Malika Ahiya 2019 showed the presence of various phytochemicals along with the total phenols and flavonoid content in *Costus igneus*. Ramasubramnaiyan MR et al 2015 evaluated in wild plants of *Costus igneus* of different solvents in preliminary screening indicated the presence of high content of phytochemicals like phenols, flavonoids. Studies done by Mala Majumdar and Prachi S Parihar 2012 also showed that *Costus pictus* methanol extracts showed the highest antioxidant activity along with the total phenolic and flavonoid content. Results of the various studies indicated and correlated with the results carried out which showed that the total phenolics and flavonoids contents played a major role in inducing the antioxidant activity apart from other biomolecules. Similarly recent study carried out Zainab bahardeen 2020 also determined the total flavonoid and phenolic content, antioxidant activity in *Costus speciosus* along with *Gymnema sylvestre* leaf extracts which showed that mostly flavonoids were the determinants of antioxidants activity.

4. Conclusion

Costus igneus under Costaceae family is considered as a largest group of plants with various health benefits. Different works carried out so far revealed the presence so of many phytochemical constituents which in turn boost the immune system. Present study showed highest percentage of antioxidant were observed in the rhizome, followed by the leaf and least was the stem. As antioxidants enhances the immune system to fight against the free radicals and various other disease. Total phenolic content were also found to be high when compared with flavonoid contents. Further research work is needed to be carried out regarding the major health issues in relation with the phytochemicals present in the *Costus igneus.*

Table 1: Total phenolic and flavonoid contents of leaf, stem and rhizome of *Costus igneus* extract

S. No.	Sample	Total phenol content (mg GAE/100 gm DW)	Total Flavonoid content (mg QE/ 100 gm DW)
1	Standard	0.752 ± 0.332	0.817 ± 0.019
2	Stem	0.206 ± 0.005	0.053 ± 0.015
3	Leaf	0.343 ± 0.025	0.123 ± 0.017
4	Rhizome	0.453 ± 0.011	0.323 ± 0.045

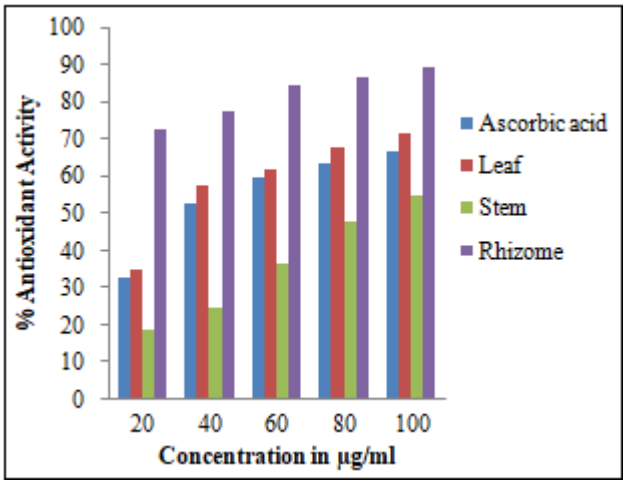

Figure: [1] DPPH scavenging activity of leaf, stem and rhizome of *Costus igneus* in comparison to Ascorbic acid.

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