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REVIEW ARTICLE

PHARMOCOLOGICAL POTENTIAL OF *CALOCASIA* AN EDIBLE PLANT

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ABSTRACT

Colocasia esculenta Schott belongs to the family Aracea and is grown for its edible corms as a staple food throughout subtropical and tropical regions of the world Colocasia esculent (family: Araceae), In India, it is known as "arbi" or "arvi". In Indonesia, it is called ***talas*** or ***keladi***.is widely grown throughout India. Stem of this plant are used as vegetable in Indian traditional food system from many decades. Besides stems, other parts of the plant, such as leaves and roots, have also been used in the traditional system of medicine. The leaves of the plant are reported to possess huge vitamin C content and the root is rich in starch and essential nutrient such as thiamine, riboflavin, niacin, oxalic acid. This plant was also used to reduce fever and pain. Furthermore, Manisha et al.(2010) claimed that the leaf of *C.esculenta* exhibits neuropharmacological activity. Tarro or dasheen corms provide healthy amounts of some important minerals like zinc, magnesium, copper, iron, and manganese. In addition, the root has very good amounts of potassium. Potassium is an important component of cell and body fluids that help regulate heart rate and blood pressure. The leaves are used as vegetable and as a ingredients of soup, Curry, stew or eaten fried as a side dish for rice. The present review describes morphological and pharmacological aspects of *Colocasia esculenta.*

KEY WORDS: *Colocasia esculenta, Pharmacology, Aracea, Flavanoids*

INTRODUCTION:

[1]Colocasia is a genus of 25 or more species[2,3] of flowering plants in the family Araceae, native to tropical Polynesia and southeastern asia[4]. They are herbaceous perennial plants with large corms on or just below the ground surface. The leaves are large to very large, 20–150 cm (7.9–59 in) long, with a sagittate shape. The elephant's-ear plant gets its name from the leaves, which are shaped like a large ear or shield. The plant reproduces mostly by means of rhziomes (tubers, corms) but it also produces "clusters of two to five fragrant inflorescenes in the leaf axils" [5]. In India, it is known as "arbi" or "arvi". In Indonesia, it is called *talas* or *keladi*.is widely grown throughout India. Stem of this plant are used as vegetable in Indian traditional food system from many decades. *Colocasia esculenta* is a tropical plant grown primarily for its edible corms, the root vegetables whose many names include Taro and Eddoe. It is believed to be one of the earliest cultivated plants.[6]

The popularity of herbal medicine in recent times is based on the premise that plants contain natural substances that can promote health. There are many herbs that are used to treat many disorders. Herbal drugs or medicinal plants, and their extracts and isolated compounds have demonstrated a wide spectrum of biological activities. Ethno pharmacological studies on such herbs or medicinally imported plants continue to interest investigators throughout the world.[7] Moreover, our traditional knowledge about these important indigenous plant species has also decreases in the younger generation influenced by urbanization. Indigenous plant species provide a variety of products like food, and medicines. The Indian subcontinent had been one of the rich emporia of 2500 plant species used in indigenous treatment and food sources [8]

BOTANY:

Colocasia esculenta is an herbaceous perennial plants with a large corm (Fig 1) on or just below the ground surface. The leaves are large to very large, 20–150 cm (7.9–59 in) long, with a sagittate shape. The elephant's-ear plant gets its name from the leaves, which are shaped like a large ear or shield. The plant reproduces mostly by means of rhziomes (tubers, corms) but it also produces "clusters of two to five fragrant inflorescences in the leaf axils"[9]. Like other members of the family, the plant contains an irritant which causes intense discomfort to the lips, mouth and throat. This acridity is caused in part by microscopic needle like raphides of calcium oxalate monohydrate and in part by another chemical, probably a protease [10]. The acridity helps to naturally deter herbivores from eating it. It must be processed by cooking, soaking or fermenting sometimes along with an acid (lime or tamarind) before being eaten [11]. The species is dangerously invasive into wetlands along the American Gulf coast, where it threatens to displace native wetland plants [12].

TAXONOMY:

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Table 1: Taxonomy of Calocasia[1]

Kingdom	Plantae
Order	Alismatales
Family	Araceae
Subfamily	Aroideae
Tribe	Calocasiodeae
Genus	Calocasia
Species	C.esculenta

Figure 1and 3: Calocasia esculenta,
Figure 2: Leaf of Calocasia
Figure 3: Corm of Calocasia,

GENERAL DESCRIPTION [13]

- Type: Bulb
- Family: Araceae
- Zone: 8 to 10
- Height: 3 to 6 feet
- Spread: 3 to 6 feet
- Bloom Time: July to August
- Bloom Color: White
- Bloom Description: Yellowish-white
- Sun: Full sun to part shade
- Water: Medium to wet
- Maintenance: Medium
- Flowers: Showy Flowers
- Leaves: Colorful
- Tolerates: Wet Soil
- Uses: Rain Garden, Suitable as Annual, Water Plant

ACTIVE COMPONENTS PRESENT IN CALOCASIA:

Mainly two pharmacologically active groups of compounds present in the Calocasia leaf extracts are flavonoids and triterpinoids.

Flavanoids present in the calocasia leaf extract are orientin, isoorientin, isovitexin, vicenin-2,orientin7-Oglucoside, isovitexin 3'-O-glucoside, vitexin X''-Oglucoside, leteolin 7-O-glucoside[14]

Phytochemical investigations on the *Colocasia* extracts have shown the presence of anthocyanins such as cyanidin-3-glucoside, pelargonidin-3-glucoside and cyanidin-3-rhamnoside, which have antioxidant activities as evident from previous studies [15, 16, 17].Therefore, anthocyanins may be responsible for the hepatoprotective as well as anti-lipid peroxidative activity that was observed associated with the leaf juice of *Colocasia esculenta*

PHARMACOLOGICAL PROPERTY:

ANTIDIBATIC ACTIVITY:

The ethanol extract of *C. esculenta*(EECE) leaves were subjected to phytochemical investigation and evaluated for antidiabetic activity on blood glucoselevel and on the body weight in alloxan induced diabetic rats. EECE (100, 200 and 400 mg/kg) and metformin (450mg/kg) were administered orally in alloxan (120 mg/kg, i.p.) induced diabetic rats. In acute oral toxicity (AOT 425)study, administration of EECE no mortality upto 5000 mg/kg was observed. The onset of reduction of blood glucose was observed at 4 h (96 mg/dl), peak at 6 h (120 mg/dl) but antihyperglycaemic effect waned at 24 h. In subacute study,maximum reduction in blood glucose was observed (174.34 mg/dl) at the dose of 400 mg/kg on 14th day. EECE prevented further loss of body weight. EECE (400 mg/kg) was found to have significant ($p<0.001$) blood glucose lowering effect. Preliminary Phytochemical investigation revealed the presence of alkaloids, flavonoids, saponins and tannins as the major constituents in the ethanol extract. These results suggest that EECE (400 mg/kg) showed antihyperglycaemic activity in alloxan induced diabetic rats.[18]

ANTIMICROBIAL ACTIVITY [19]:

The *in-vitro* antimicrobial activity in aqueous extract of *Colocasia esculenta* (AECE) leaves were studied against gram positive bacterial strains i.e. *Streptococcusmutans* (MTCC-890), *Bacillus subtillis* (MTCC-121), gram negative bacterial strains i.e *Klebsiella pneumoniae* (MTCC-109), *Pseudomonas fragi* (MTCC-2458), *Escherichia coli* (MTCC-483) and fungal strains *Aspergillus niger* (MTCC-281) *Candida albicans* (MTCC-227). The

antimicrobial activity of AECE was determined by agar well diffusion methods at the concentrations ranging from 100-500µg /ml. Standard antibiotic discs were used as positive controls. AECE gave maximum activity against *Streptococcus mutans* amongst the selected microbial strains. In conclusion, the *Colocasia esculenta* extract exhibited good antimicrobial activity against some of tested bacteria and fungus at low concentration. The results provide promising information for the potential use of *Colocasia esculenta* aqueous extract in the treatment of infection.

ANTI-LIPID PEROXIDATIVE ACTIVITY [20]:

The effect of free radicals was studied on liver cells *in vitro* by using rat liver slice model. The liver slices were incubated in presence of cytotoxic concentrations of CCl4 and acetaminophen. Co-incubation of liver slices with the hepatotoxins and *Colocasia esculenta* leaf juice was conducted to assess the potency of natural components of *Colocasiaesculenta* leaf juice in scavenging the free radicals formed due to the metabolism of CCl4 and acetaminophen. The evaluation was carried using the Thio-Barbituric Acid Reactive Substances and the total glutathione levels in the liver tissue. After the statistical treatment results revealed that the *Colocasia esculenta* whole leaf juice prevented the elicit of lipid peroxidative reactions caused due to the presence of free radicals generated by the hepatotoxins. Simultaneously marked elevations and prevention of depletion of total tissue glutathione were observed in presence of *Colocasia esculenta* whole leaf juice. From the results it is concluded that the *Colocasia esculenta* whole leaf juice contains free radical scavenging efficacy.

ANTIHEPATOTOXIC/HEPATOPROTECTIVESTUDY [21]:

The antihepatotoxic and hepatoprotective studies were carried against two well-known hepaotoxins paracetamol and CCl4 using *in vitro* liver slice method. The free radicals generated by CCl4 and paracetamol cause oxidative stress as well as damage various cell organellaes consequently resulting in injury to the hepatocytes. The extent of damage caused by these free radicals as well as evaluation of antihepatotoxic and hepatoprotective efficacy associated with the *Colocacia esculenta* leaf juice was measured using the leakage of marker enzymes of liver function *viz* AST, ALT and ALP in the incubation medium. In presence of CCL4 as well as paracetamol there was increase in the levels of marker enzymes indicating hepatotoxicity of these compounds. At one and two hours interval insignificant alterations were observed in the enzymes levels. Marked elevations of toxicity marker enzymes were noted at four hours in presence of CCl4 as well as paracetamol. However the leaf juice of *Colocacia esculenta* remarkably declined the leakage of AST, ALT and ALP in the medium indicating hepatocyte integrity. The investigation is supportive to conclude that the *Colocacia esculenta* leaf juice as a whole possesses antihepatotoxic and hepatoprotective efficacy when tested *in vitro* using rat liver slice model.

ANTIMATASTATICACTIVITY [22]:

Breast cancer mortality is primarily due to the occurrence of metastatic disease. This study have identified a novel potential therapeutic agent derived from an edible root of the plant Colocasia esculenta, commonly known as taro, which has demonstrable activity in a preclinical model of metastatic breast cancer and that should have minimal toxicity. Results shown for the first time that a water-soluble extract of taro (TE) potently inhibits lung-colonizing ability and spontaneous metastasis from mammary gland-implanted tumors, in a murine model of highly metastatic estrogen receptor, progesterone receptor and Her-2/neu-negative breast cancer. TE modestly inhibits the proliferation of some, but not all, breast and prostate cancer cell lines. Morphological changes including cell rounding were observed. Tumor cell migration was completely blocked by TE. TE treatment also inhibited prostaglandin E2 (PGE2) synthesis and down regulated cyclooxygenase 1 and 2 mRNA expression. The active compound with a native size of approximately 25 kDa contains two fragments of nearly equal size. The N-terminal amino acid sequencing of both fragments reveals that the active compound is highly related to three taro proteins: 12-kDa storage protein, tarin and taro lectin. All are similar in terms of amino acid sequence; posttranslational processing and all contain a carbohydrate-binding domain. This is the first report describing compound(s) derived from taro that potently and specifically inhibits tumor metastasis.

ANTIGUNGAL ACTIVITY [23]

Yang et al evaluated the antifungal activity of taro along with molecular cloning and recombinant gene expression studies. The result confirmed that recombinant CeCPI protein exhibited strongly cysteine protease inhibitor activity. Thus, the investigation clearly revealed a toxic effect of the plant on the mycelium growth of phytopathogenic fungi.

ANTI-INFLAMMATORYACTIVITY [24]

The anti-inflammatory activity of the ethanolic extracts of the leaves of CE in Wistar rats using the carrageenan-induced left hind paw edema, carrageenan-

induced pleurisy, and cotton pellet induced granuloma model. The results indicated that the ethanolic extract produced significant ($p<0.05$) anti-inflammatory activity when compared with the standard and untreated control.

ANTIOXIDANT EFFECT [25]

The methanol extract of *C. esculenta*corm (CME) possess antioxidant potential in different studied models. However, the observed antioxidant potential of CME is moderate as compared to reference standard BHTand BHA. Result of salivary alpha-amylase inhibitory assay also reveals that CME possess salivary alpha-amylase inhibitory potential. From the results of the present antioxidant andsalivary alpha-amylase inhibitory activity study of methanol extract of *C. esculenta* cormstudy, it is confirmed that the earlier observed antidiabetic potential of *C.esculenta* corm could be due to its antioxidant and amylase inhibitory activity.

BENEFITS OF CALOCASIA [26]

- Calocasia (Taro) leaves as well as yellow-fleshed roots have significant levels of phenolic flavonoid pigment antioxidants such as *ß-carotenes, and cryptoxanthin* along with vitamin A. 100 g fresh taro leaves provides 4825 IU or 161% of RDA of vitamin A. Altogether, these compounds are required for maintaining healthy mucus membranes, skin and vision. Consumption of natural foods rich in flavonoids helps to protect from lung and oral cavity cancers.
- Calocasia leaf juice extract is is good stimulant, expectorant, astringent, appetizer and otalgia.
- Calocasia juice of the corm is used in cases of alopecia.
- Calocasia juice expressed from the leaf stalks with salt is used as an absorbent in cases of inflamed glands and buboes.
- Calocasia juice of the petiole is stypic, and is used to arrest arterial hemorrhage.
- Calocasia corm is one of the finest source dietary fibers; 100 g flesh provides 4.1 g or 11% of daily-requirement of dietary fiber. Together with slow digesting complex carbohydrates, moderate amounts of fiber in the food helps gradual rise in blood sugar levels
- Calocasia, the corms provide healthy amounts of some important minerals like zinc, magnesium, **copper**, iron, and manganese. In addition, the root has very good amounts of potassium. Potassium is an important component of cell and body fluids that help regulate heart rate and blood pressure.
- Leaf juice of this plant is applied over scorpion sting or in snake bite as well as it is used in food poisoning of plant origin.

CONCLUSION:

Calocasia esculanta is a hearty succulent herb, with clusters of long heart or arrowhead shaped leaves that point earthwards, which grows on erect stems that may be green, red black or variegated. Chemically the plant contains various biologically active components like flavanoids, triterpinoids, glycosides minerals and micronutrients. The plant has been studied for various pharmacological activities like antifungal, anticancer, antibacterial, antioxidant, hypolipidemic, hepatoprotective, hypoglycemic, antihyperlipidemic activity. Thus Calocasia leaf extract has been shown to be a promising medicinal plant. The popularity of herbal medicine in recent times is increasing based on the premise that plants contain natural substances that can promote health.

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