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## A REVIEW STUDY ON THE MEDICINAL PROPERTIES OF *CURCUMA*

### *CAESIA*, A POTENTIAL PLANT FROM NORTH EAST INDIA

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#### ABSTRACT

*Curcuma caesia* belongs to the family Zingiberaceae and is considered as the largest family which is popularly known as 'Kali haldhi'. *Curcuma caesia* is a perennial, erect, rhizomatous herb with large leaves. This herb is distributed throughout the North East India. It is less known medicinal plants used for mitigation of various ailments. Fresh rhizomes are aromatic with camphorous odour. The leaves and the rhizomes are widely used by the folklore practitioners. The plant is reported to contain antifungal, anticancerous, antiulcer, anti inflammatory etc activity. Few local people uses this rhizomes to cure stomach pain. Because of its usefulness character it is now considered as a valuable product in the development of various diseases. Now in these modern days, the chemicals present in this plants are used to treat various diseases. Still few are underreported. Several facts and data of *Curcuma caesia* are still being unknown. Because of its medicinal properties, the plant is more popularly being used by the researchers. The aim of this study was to evaluate the medicinal usefulness of *Curcuma caesia*.

**Keywords: Medicinal properties, antioxidant, *Curcuma caesia*, folklore practitioners**

## INTRODUCTION

Nature is considered as the source of fields of traditional medicine all over the world. Apart from all the plant based medicines used in today's life yet few are still underreported. Plant products as medicinal treatment [1]. *Curcuma* is important genus belonging to the Family Zingiberaceae, popularly known as 'Kali haldi'. It grows well in moist deciduous forest areas [2]. It is mostly used in sprains and apart from it, it is also used in the preparation of cosmetics [3]. The genus *Curcuma* is commonly known as 'Haldi' more than 200 species and subspecies are distributed around the world. *Curcuma caesia* is an erect perennial herb with large leaves. The bluish black tuberous rhizome have strong aromatic smell and medicinal properties [4]. The inner part of *C.caesia* is bluish- black in colour and have a sweet smell due to the presence of essential oil [5]. *C. caesia* has bluish black rhizome which is widely distributed in North East and Central India. Besides having medicinal properties it is well known for its high economic value. The rhizomes of *C.caesia* is used in the treatment of vomiting, bloating, menstrual disorder, cancer, fever etc. [6, 7]. Since for a long time *C. caesia* has been used as one of the best traditional herb in Ayurvedic, Unani and Siddha herbal system

Plants are used as medicines from the very early. According to 'World Health Organisation', it is reported that almost around 80% of the total world population uses [8]. Each part of this plant is medicinally very important, especially the rhizome and leaves are much more important. Apart from all, various parts of this plant are used for various purposes. In Kota Belud, Sabah (Malaysia), people consumed the young leaves of *C.caesia* as raw salad by Sama- Bajau people [9].

The usage of rhizome is more focused of this plant. As it has the same properties as the turmeric, it is sometimes used in the replacement of turmeric in Bengal India [10]. The rhizome is crushed and the paste is eaten or given as drink mixed with honey or milk for stomach ache, bloating, irregular menstrual flow [11]. Few tribal women uses the paste of rhizome of *C.caesia* as facial mask to enhance the beauty during their engagement or marriage ceremony [12]. Other uses of this plant are reported for the treatment of bronchitis, cold, cancer, epilepsy, fever, wounds, leucoderma, pneumonia, piles, tumor, toothache, vomiting, and gout [12-15]. The rhizome is not only used in humans but also used in animal healthcare, where the juice of rhizome is mixed with mustard oil and

given to cattle to treat dysentery once daily on an empty stomach for 2-3 days [15].

Various studies have been conducted on this plant to investigate the scientific basis for its traditional usage, especially in disease

therapies. The below **Table 1** will show the previous findings of the biological activities of *C.caesia*.

**Table 1: Review of Literature**

Part	Extraction/ Isolation methodology	Medicinal and Pharmacological properties	Findings	Reference
Rhizome	Soxhlet extraction with methanol	Antioxidant, antidiabetic activity	IC <sub>50</sub> values for $\alpha$ -amylase and $\alpha$ -glucosidase inhibition were found to be $442.92 \pm 10.05 \mu\text{g/mL}$ and $95.40 \pm 9.74 \mu\text{g/mL}$ , respectively. The extract also successfully scavenged superoxide and hydroxyl ions	Majumder <i>et al.</i> [16]
Rhizome	Soxhlet extraction with chloroform, dichloromethane, acetone, ethyl acetate, methanol, and ethanol	Antidiabetic activity	Chloroform and methanol fraction in the ratio of 80 : 20 showed highest $\alpha$ -amylase inhibition (IC <sub>50</sub> = $80.13 \mu\text{g/mL}$ )	Jain and Parihar, [17]
Rhizome	Soxhlet extraction with methanol	Analgesic, anti-inflammatory activity	Significant analgesic activity of <i>C. caesia</i> extract was observed in an acetic acid-induced writhing model and in a hot plate test. Extract also showed significant ( $p < 0.001$ ) anti-inflammatory activity by reducing the paw edema volume in carrageenan-induced paw edema in rats in the late phase (3 to 5 h) and decreased the dry weight of granuloma	Sawant <i>et al.</i> [18]
Rhizome	Maceration extraction with ethanol	Smooth muscle relaxant activity	The extract concentration dependently relaxed the carbachol ( $1 \mu\text{M}$ )-induced precontractions in isolated Guinea pig trachea with the IC <sub>50</sub> value of $239.36 \mu\text{g/mL}$	Arulmozhi <i>et al.</i> [19]
Rhizome	Hydrodistillation	Antioxidant and antibacterial activities	<i>C. caesia</i> essential oil possessed $22.5 \pm 0.12 \mu\text{g GAE}/\mu\text{L}$ oil content of phenolics, IC <sub>50</sub> $6.3 \pm 0.06 \mu\text{L}$ DPPH scavenging activity, and EC <sub>50</sub> $1.6 \pm 0.1 \mu\text{L}$ ferric reducing power. The essential oil also had antibacterial activity against <i>S. aureus</i> , <i>B. subtilis</i> , and <i>E. coli</i>	Angel <i>et al.</i> [20]
Rhizome	Maceration extraction with ethanol	Antiulcer activity	<i>C. caesia</i> showed significant ulceroprotective effect against gastric ulcer in albino rats by reducing the ulcer index ( $4.18 \pm 0.60$ ), volume of gastric juice ( $1.14 \pm 0.10 \text{ mL}/4 \text{ hr}$ ), free ( $46.40 \pm 2.13 \text{ mEq/L}$ ) and total acidity ( $66.80 \pm 1.35 \text{ mEq/L}$ ), pepsin along with increased production of mucus	Das <i>et al.</i> [21]
Rhizome	Maceration extraction with methanol	Anticancer activity	Treatment of mice with <i>C. caesia</i> extract attenuated the increased activities of the marker	Hadem <i>et al.</i> [22]

			enzymes (AST, ALT, ALP, and AChE), which was caused by DEN administration	
Leaves	Maceration extraction with methanol	Antioxidant, antimicrobial, and immunomodulatory activities	Extract showed antibacterial effect against <i>B. cereus</i> ( $14.95 \pm 0.71$ mm), <i>D. pneumoniae</i> ( $14.65 \pm 0.71$ mm), <i>M. glutamicum</i> ( $12.50 \pm 0.24$ mm), and <i>S. pyogenes</i> ( $13.71 \pm 0.41$ mm). The extract also had the highest antioxidant activity ( $73.3 \pm 0.45\%$ ) at the concentration of $250 \mu\text{g/mL}$ and showed 15% macrophage yeast digestion	Bhardwaj <i>et al.</i> [23]
Leaves	Hydrodistillation	Antioxidants and anti-inflammatory and antimicrobial activity	Leaf oil contained phenolics ( $2.13 \pm 0.027$ mg/mL) and flavonoids ( $11.36 \pm 0.096$ mg/mL) and exhibited antioxidant ( $\text{IC}_{50}$ value = $1.487 \mu\text{g/mL}$ ), anti-inflammatory ( $182.5 \mu\text{g/mL}$ ), and antimicrobial potential against <i>B. subtilis</i> , <i>B. cereus</i> , <i>S. aureus</i> , <i>S. typhimurium</i> , <i>A. fumigatus</i> , <i>A. niger</i> , <i>S. cerevisiae</i> , and <i>C. albicans</i>	Borah <i>et al.</i> [24]

### Plant Description:

**Table 2** shows the classification of *Curcuma caesia* according to the data from the Global Biodiversity Information Facility [25]

### **Taxonomical classification:**

Kingdom: Plantae

Phylum: Tracheophyta

Class: Liliopsida

Order: Zingiberales

Family: Zingiberaceae

Genus: *Curcuma*

Species: *caesia*

### **Botanical Description: [26]**

**Morphology:** The plant is erect with a height ranging from 0.5 to 1.0 m. The plant is divided into two parts underground tuberous rhizome called as root stock and an erect aerial shoot

along with leaves and reproductive part. The plant grows well in moist loamy soil.

**Roots:** As the plant propagates the primary roots are not seen. The roots present here is yellow brown and tapering adventitious roots which is spread all over the surface of the rhizome.

**Rhizome:** The tuberous rhizome is aromatic with sweet, pleasant smell. The diameter is about 2-6 cm with a variable shape and sizes. It has brown outer layer and bluish- black centre that has camphoraceous odour . It has scaly leaves and have circular wrinkles that looks like nodal and intermodal zone of the rhizome (**Figure 2**).

**Leaves:** There is a group of leaves almost about 10-20. The leaves are broad and oblong lanceolate. The leaves have deep purple

colour midrib down the lower surface of leaves. The leaves arise from underground rhizome (**Figure 1**).

**Inflorescence:** The inflorescence is about 15 cm with a spike. The inflorescence arise before the leaves open. The bracts are green in colour which turns red after maturation.

**Flower:** The flowers are pale yellow in colour and are almost shorter than the bract. Flowers appear mostly in June and July after the rainy season.

**Distribution:** The plant species mostly seen in North east and Central India. The species is mostly under cultivation.

**Ecology:** It is one of the most common among the Coastal areas and riverine alluvial soils.

**Flowering:** It appears mostly in June and July.

**Vernacular names:**

Hindi: Kali Haldi

Manipuri: Yaingang Amuba or Yaimu

Marathi: Kala – Haldi

Telegu: NallaPasupa

Bengali: Kala haldi

Mizo: Aihang, Ailaihan

Assamese: Kala haladhi

Malayalam: Kari manjal

Sanskrit: Rajani Nishaa



Figure 1: Whole plant (Source: [Internet](#))



Figure 2: Rhizome

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**Medicinal Properties of *Curcuma caesia*:****1. Antioxidant Properties:**

The therapeutic effects of some plant parts, such as fruits, vegetables, and grains which are traditionally used in folk medicines, are usually attributed to their antioxidant. *C. caesia* are best known for its antioxidant properties using sulphur free radical reactivity with curcumin as a reference indicator. It also gives good degree of radioprotection [27]. The protective role of plant phytochemicals may be associated with their antioxidant activity, they maintain a balance between oxidants and antioxidants in the body [28]. Hence, the antioxidant compounds from natural products constitute the major source of human health promotion and maintenance. Invitro and in vivo studies conducted on *C. caesia* extracts discovered their antioxidant activity. Various antioxidant assays were tested on *C. caesia*, such as 2,2-diphenyl-1-picrylhydrazyl (DPPH), ferric reducing activity (FRAP) [29, 30]. Plants contain secondary metabolite which is the reason for the effectiveness of the plants as herbal medicine. The amount of antioxidant ability of each *Curcuma* species varies; however, it has been reported that yellow turmeric (*C.longa*) has most antioxidant content and higher phenolic content, followed by black turmeric *C. caesia* [31, 32]. In earlier report it was reported that

the extracts of *C. caesia* rhizomes exhibit higher antioxidant activity with lowest inhibition concentration. A study by Liu *et al.* [33] reported that the extract of *C. caesia* rhizome was considered as a good source of natural antioxidant.

**2. Antimicrobial properties:**

**Antibacterial properties:** Bacterial infection is considered as an epidemic in some of the countries. Almost about 50% methanol is extracted from the leaves of *C.caesia* showed a positive antibacterial effect after 4 to 8 hr of incubation with *Bacillus cereus*, *Diplococcus pneumoniae*, *Streptococcus pyrogens*, and *Micrococcus glutamicum* [34]. It has been reported by the research of Pandey and Gupta [47] that the extracts of *C. caesia* rhizome were found to be more effective than the stem and leaf extracts in inhibiting the bacterial growth. *C. caesia* was displayed to have antibacterial properties by acetone extract [35].

**Antifungal Properties:** Aflatoxin a kind of fungi is naturally found all over the world; they can contaminate to various food crops and may cause serious health threats to humans and livestock [36]. It is reported that the rhizome part of *C. caesia* have antifungal activity. *Curcuma* extract has been reported to be rich in bioactive compounds, which can act as antifungal agents [8, 37, 38]. The oil

extracted from *C. caesia* rhizome was tested against a number of human and plant pathogenic fungal strain. The rhizome of *C. caesia* containing ethanol was revealed to be effective in inhibiting the growth of *Aspergillus favus*. Nevertheless, a study by Borah *et al.* [24] essential oil is also found on the leaf of *C.caesia* that have an antifungal effect against *Aspergillus niger*, *Saccharomyces cerevisiae*, *Aspergillus fumigatus*, and *Candida albicans*.

### **3. Anticancer Properties:**

Cancer is one of the serious diseases in the worldwide which mainly causes death and may be developed due to several factors such as an unhealthy diet, physical in activity, genetic predisposition, or environmental factor. Most of the cases are caused by our unhealthy lifestyles and take about 20–30 years to develop [39]. Some of the plants were proven to have anticancer properties. The mechanism of action is through suppressing the inflammatory processes that lead to transformation, hyperproliferation, and the initiation of carcinogenesis [40]. Their inhibitory effects may eventually suppress the final steps of carcinogenesis, angiogenesis and metastasis [41]. The rhizomes of *C.caesia* contains methanolic extracts that showed positive effect of anticancer in mice against Ehrlich's ascites carcinoma (EAC) by

reducing the tumor volume, tumor weight [42]. Research on the anticancer effect of *C. caesia* rhizomes exposed the effectiveness of *C. caesia* extract against the hepatocarcinogen, diethylnitrosamine (DEN), by enhancing antioxidant status through free radical scavenging mechanisms resulting in attenuation of hepatic enzymes in the serum (aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), and cancer marker enzyme acetylcholine esterase (AChE) [22]. Apart of having anticancer property it is also used in the treatment of cancer with a chemotherapeutic drug as it has the capacity to prevent drug toxicity [43].

### **4. Anti-Inflammatory and Antiulcer Properties:**

Inflammation is a biological response of the immune system that can be triggered by various factors, which may induce acute and/or chronic inflammatory responses in the body systems and organs, potentially leading to tissue damage or diseases [44]. One important key role in the process of inflammatory is played by prostaglandins [45, 46]. The methanolic extract of *C.caesia* shows positive effects as anti-inflammatory agent. The pure isolated compounds of *C. caesia* extracts and hexane, methanolic showing anti-

inflammatory activity has been positively used [48].

Meanwhile, ulcer is a condition in which the skin surface breakout or the mucus membrane cannot heal it. The factors that contributes for the ulceration are free radical production, internal injury etc. [49, 50]. Flavonoids and tannins are considered as antiulceronic substances. It is also revealed that alkaloid induce stress, tannins inhibit development of ulcer due to their high protein precipitation and effects of vasospasm, which the contracting action can help in healing microproteins on the site of ulcer, by the formation of an impenetrable layer over the hinder lining gut that secretes and protects the mucosa [51]. The extract of *C.caesia* is detected as helpful anti-ulcer agent and is being further compared with a drug named ranitidine [21].

### 5. Antidiabetic Properties

Due to unhealthy lifestyle, rapid urbanization, and lack of nutrition lead to the growing diabetic and obesity cases [52-54]. Lack of carelessness and without control it may cause damage to the heart, blood vessels, eyes, kidneys, and nerves, which may eventually bring death or disability [55]. According to Majumder *et al.* [16], the rhizome of *C. caesia* was displayed as an antidiabetic agent when studied in STZ-induced diabetic rats. Not only

that, recently Jain and Parihar [17] investigated further on the antidiabetic agent of *C.caesia* rhizome extract.

### Toxicity study of *Curcuma caesia*:

The toxicity study of substances in vitro studies may be observed by the study of accidental exposures of a substance, by the use of cells/cell lines, and in vivo exposure on animal models [56]. Previously toxicity were mainly observed in invitro and invivo studies. In-vitro toxicity studies of the *C. caesia* extract have been done against EAC [57], human laryngeal cancer (Hep 2), human liver adenocarcinoma (HepG2), human colon adenocarcinoma (HT 29), monkey kidney (VERO) [58], and human acute monocytic leukemia (THP-1) cell lines [59], which all demonstrated the toxicity effects of the plant. Apart from the toxicity of a *C. caesia* it can also be observed by biochemical parameters, such as the kidney and liver marker enzymes that are mainly used to quantitatively evaluate the damage to the organs [39].

### Effort on plant conservation:

Currently the plant *C.caesia* is considered as rare because of its extensive use of traditional human and it multiply low at soil and the root causes fungal diseases [60] as well as the growing population and industrialization destroys the natural habitat of this particular plant [61]. Thus, in order to conserve this

species from further extinction, measures are been taken by the researchers through tissue culture [62].

### CONCLUSIONS:

Apart from all the plant based medicines used in today's life yet few are still underreported. Now a days medicinal plants are in great demand due to safety issues and leads to a number of discoveries. Among all *Curcuma caesia* is one of the popular herbal plant which is gaining popularity among the researchers as it has lots of benefit. The present study emphasizes the knowledge on the plant *Curcuma caesia*. Although it is not being assigned as a prescribed drug and not known across a wide spectrum, the *Curcuma caesia* is widely administered in some parts of India for its antifungal activity, antibacterial activity, anthelmintic activity, antioxidant activity, analgesic activity, locomotor depressant and anti-ulcer applications. The rhizome of this plant has been widely used for bioactive compounds. There is still lacking of knowledge and information with regarding to clinical, toxicity and phytoanalytical properties of the plant demands for further studies. Further we can conclude that *Curcuma caesia* has the potentiality to be used as natural product and alternative health therapy to be used for the pharmaceutical

industries and nutraceutical industries. Researchers conveyed the medicinal and pharmaceutical potential may be due to the presence of variety of metabolites. The plant is very popular among the folklore practitioners of North East India but as the plant is not harvested in scientific way, there is a great threat of extinction of this plant in near future. Hence scientific interventions are highly required to conserve the natural habitat of this plant.

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