



## An Overview on the Advances of *Zingiber zerumbet*

Arijit Chaudhuri, SC Sharma, Foziya Khan

Department of Pharmacology, Bhupal Noble's University, Udaipur-313001, Rajasthan, India

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### Corresponding Author:

E-mail : [armanchaudhuri92@gmail.com](mailto:armanchaudhuri92@gmail.com)  
Mob.: +917908865270

### Abstract

*Zingiber zerumbet* traditionally Karpoori Haridra known to the India as "Bitter Ginger," is a perennial herb found in many tropical and sub-tropical countries, including India. The *Z. zerumbet*, rhizomes particularly, have been daily life used as a various food flavouring agent and appetizer in various Indian' cuisines while the rhizomes extracts have been used in Indian villagers folk medicine to treat various types of diseases (e.g., inflammatory- and pain-mediated diseases, worm infestation and diarrhoea, diabetes). This plant carried out using different in vivo and in vitro bioassays of biological evaluation. The various active pharmacological component of *Z. zerumbet* rhizomes most widely studied is zerumbone. This paper presents mainly the morphology, folk uses, chemistry, and pharmacology of this medicinal plant.

### 1 Introduction

In India lots of medicinal herbs and variety of plants are available. It contains a diverse variation in temperature and which possesses an environment which is suitable for various medicinal herbs. In India maximum medicinal plants are found in Himachal Pradesh, Kerala, Assam, Sikkim, etc. According to World Health organization reported 81% of the developing countries depends on folk medicines and of these, 85% use plants or their crude extracts as the active constituent.

*Z. zerumbet* is one of the most important medicinal plant in India its reported various activity. Mainly found in hill area and sub-tropical area.

#### 1.1 Study area & methodology

Udaipur is formerly the capital of Mewar Kingdom, in the western Indian state of Rajasthan. Located at 24.525049° N, 73.677116°.this city covers an area of 64 km<sup>2</sup> and altitude of 598.00m (1,962) above mean sea level. Udaipur normal average temperature is 28.3 and January is the coldest month. The traditional medicinal plant and different uses for this herb were recorded from literature in books and journals.

#### 1.2 Scientific classification<sup>1</sup>

Kingdom : Plantae

Division : Angiospermes

Class : Monocots

Order : Zingiberales

Family : Zingiberaceae

Genus : *Zingiber*

Species : *Z. zerumbet*

Synonym: *Zingiber zerumbet*

#### 1.3 Vernacular names<sup>2</sup>

English : Zerumbet Ginger

Sanskrit : Karpoori Haidraa

Hindi : Kapoor Haldi

Local : Mahabhari vachaa, Narkachura.

### 2 Morphology<sup>3-5</sup>

It is an erect annual herb, 0.9-2 m high. It has thick, yellowish, hard biennial rhizome with strong aromatic taste. Stem is about 33mm in diameter, leafy, cylindrical, glabrous. Leaves are unbranched, 20-30 by 5-7.5 cm, sessile, oblanceolate, acuminate, base narrowed, ligule 1.3-2 cm long, truncate, membranous. Flowering stem is usually 30-45 cm long, stout,

usually flexuous, clothed with long appressed obtuse sheaths. Flowers are white to pale sulphur yellow in colour. Fruits are 2.5 cm long, small, capsule shaped, ellipsoid and seeds are 4mm long, oblong, black in colour.

### 3 Habitat<sup>3,6</sup>

It is present throughout India, from Himalayas to Southwards, widely cultivated in the tropics, common in moist forests to over 500m. Flowering and Fruiting period of *Zingiber zerumbet* is December to April and June to August and collection period is April to June. Dosage: 1-3 g.

### 4 Chemical Constituents<sup>3</sup>

Mainly the rhizome contains flavonoid such as afzelin, flavonoid glycosides, essential oils, chlorogenic acid, ferrulic acid and curcumin. Also contains alkaloids; camphene camphor and monoterpenoids, gigerol, zingerol, zingerone, sesquiterpenoids including zerumbone and zerumbone epoxide, oxalic acid, kaempferol derivatives.

The oil contains about 13% monoterpenes of which major constituent is Camphene and several sesquiterpenes (humulene and zerumbone are major constituents).

### 5 Pharmacological perspectives

Particularly Rhizome has been used in numerous pharmacological applications including Antipyretic, Analgesic, Anti-inflammatory, Antibacterial, Anti-oxidant, Antiulcer, Anticancer, Antiplatelet, Anthelmintic, Antihyperglycemic, Carminative and Diuretic. Mostly the constituent "zerumbone" have been known to show biological and pharmacological activities<sup>7,8</sup>. Zerumbone inhibits the growth of *Micrococcus pyogens* var. *aurantus* and *Mycobacterium tuberculosis*.

#### 5.1 Antipyretic and Analgesic activity

The mechanism for the activity of *Z. zerumbet* for antipyretic and analgesic is still not known. However the ethanol and aqueous extracts known to show moderate to marked antipyretic activity (dose dependent). But only the ethanol extract revealed a dose dependent analgesic property<sup>9,10</sup>.

#### 5.2 Anti-inflammatory activity

*Z. zerumbet* inhibit inflammation produced by prostaglandin (prostaglandin: the causing factor for fever and inflammation). The extracts of *Z. zerumbet* inhibit prostaglandin and therefore reduce body temperature and inflammation<sup>9</sup>. The extract also owns the capability to prevent or inhibit the cyclooxygenase, lipoxygenase, myeloperoxidase and nitric acid synthase generated by lipopolysaccharides. This shows extract show multiple mode of action in assassinating anti-inflammatory effect<sup>11,12</sup>.

#### 5.3 Antioxidant and Cytotoxic activity

The ethanolic extract of *Z. zerumbet* rhizome is rich in polyphenols and flavonoids. The cytotoxicity was determined in vitro by trypan blue exclusion test and was found to be cytotoxic at concentrations higher for human consumption. Also HPLC analysis was done and result reveals that *Z. zerumbet* is a rich source of kaempferol. Based on this rhizome can be used safely as antioxidant<sup>13,14</sup>.

#### 5.4 Antibacterial and Antifungal activity

The crude ethanol extract and its petroleum ether and chloroform fractions were analysed for antibacterial and antifungal activity against 13 pathogenic bacteria and 3 fungi by disc diffusion method. At the concentration of 400µg/disc, all the sample demonstrated mild to moderate antibacterial and antifungal activity and produces the zone of inhibition. So, it can be concluded that, ethanol extract of *Z. zerumbet* can be used as both antibacterial and antifungal agent<sup>15,14</sup>.

#### 5.5 Anticancer activity

A natural compound Zerumbone (purified crystals) is found to be responsible for its anticancer activity on human cervical cancer cell line (HeLa). This activity was investigated using the MTT assay. This analysis demonstrates that there were changes noticed on HeLa cancer cells after treatment with zerumbone. Prominent growth retardation was found to the HeLa cancer cells. So it can be concluded that zerumbone can be used as a new chemo natural drug for the treatment of cervical cancer<sup>16</sup>.

#### 5.6 Diuretic activity

Diuretics is a class of drug that promotes diuresis, the increased production of urine to overcome various diseases<sup>17</sup>. 66 male Wistar strains were taken and grouped randomly into 22 groups (n=3). Group 1 given drug carrier suspension, Group 2 given furosemide suspension 3.6mg/kg and Group 3 given ethanol extract of *Z. zerumbet* rhizome with dose 50mg/kg. All the groups than received 5ml of warm water orally and 10 min later received the test drug. The animals were then transferred to metallic cages to collect urine for 5hrs. The data obtained was than analysed by ANNOVA method. The result was found that rhizome extract of *Z. zerumbet* (zerumbone) has diuretic activity<sup>18,19</sup>.

#### 5.7 Antiplatelet activity

Antiplatelet activity of the *Z. zerumbet* was measured in vitro by the Chrono Log Whole Blood Aggregometer using an Electrical Impedance Method.

Curcumin is the most adequate antiplatelet compound present in *Z. zerumbet* as it inhibits AA-collagen and ADP-induced platelet aggregation. So it can be concluded that rhizome extract containing flavonoids (main constituent- curcumin) are responsible for antiplatelet activity<sup>20</sup>.

### 5.8 Antiulcer activity

The main bioactive compound of *Z. zerumbet* i.e. zerumbone is used to evaluate the gastroprotective effect against ethanol induced gastric ulcer.

The intragastric administration of zerumbone was found to protect the gastric mucosa from the destructive effect of ethanol induced gastric ulcer, coexisted with reduced submucosal edema and leukocyte infiltration. The zerumbone founds to exhibit antisecretory activity against *H. pylori* strain<sup>21,8,22</sup>.

### 5.9 Anthelmintic activity

The alcoholic extract of *Z. zeumbet* rhizome exhibited good in vitro anthelmintic activity against *Ascaris lumbricoides*<sup>23</sup>.

Antihyperglycemic activity: Husen *et al.*, carried out the screening of aqueous extract at doses of 50, 100, and 150 mg/kg BW for potential blood glucose lowering effect in normoglycaemic and streptozotocin induced hyperglycaemic rats. Comparison with non treated and 10mg/kg BW- treated rats revealed that the aqueous extract caused no significant reduction in blood glucose level in both groups of rats indicating that the aqueous extract did not have antihyperglycemic activity<sup>24</sup>.

### 6 Medicinal uses<sup>25-30</sup>

- Used as a hot remedy for coughs, asthma, special disease worms, leprosy and other skin diseases.
- Used as stimulant, carminative and flavouring agent. Also used to treat fish poisoning.
- Rhizome is used to treat dyspepsia wounds, haemorrhoids and flatulent colic for the cure of stomach troubles and fever.
- Used in local traditional medicine as a cure for swelling, sores and loss of appetite. The juice of the boiled rhizome has also been used a medicine for worm infestation in children.
- Young shoots and the inflorescence are used as condiments and as a food supplement to reduce experimental ulcerative colitis.

### 7 Conclusion

*Z. zerumbet* has a rich source of many novel humulenoid sesquiterpenoids and is widely cultivated in INDIA. The rhizome of *Z. zerumbet* has been widely used as medicinal herb. As medicinal herb it is used to treat many infestations such as treatment of inflammation and pain associated ailments, digestive system related ailments, cough, stomachache, asthma and also as a vermifuge. Also used in leprosy and other skin diseases.

Zerumbone a natural cyclic sesquiterpene moiety is known as the powerful tool in the implementation of green chemistry with latent reactivity. Most of the claims have been confirmed via in vitro and in vivo techniques of biological evaluation. Since anti HIV and cytotoxic compounds were isolated from *Z. zerumbet*, the plant finds a prominent place in modern medicine now a days.

### 8 Conflict of interests

None

### 9 Authors contributions

AC, FK and SCS have carried out the literature review. AC drafted the manuscript. All authors approved the final manuscript.

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