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# Phytochemistry and Pharmacological Properties of Ginger (*Zingiber officinale*)

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## ABSTRACT

*Zingiber officinale* is a plant native to India, which has been largely employed as flavoring agent in flavorful dishes such as curries and sweets such as cakes and biscuits, alcoholic beverages. Ginger is a well known herbal medicine, which is usually used in traditional medicine in all over the world. Many pharmacological activities of ginger are antiemetic, antidiabetic, analgesic, antiarthritic, anticancer, antioxidant, antiulcer, antimicrobial, anti-inflammatory immunomodulatory and cardiovascular activities. The pungency of the ginger is due to gingerols and shogaols. The main components of ginger are the aromatic essential oils, antioxidants and the pungent oleo-resin. These aromatic or pungent compounds have been identified as the phenylalkylketones, known as gingerols, shogaols, and zingerone.

Keywords: Ginger, Phytochemistsry and Pharmacological properties.

## INTRODUCTION

Ginger (*Zingiber officinale*) belongs to *Zingiberaceae* family (Kadnur and Goyal, 2005). It is a perennial herbaceous plant (Gupta and Sharma, 2014). It is commonly used as a spice and a medicinal plant (Ali *et al.*, 2008). The part of the plant used is rhizome. The plant produces an orchid like flower with petals that are greenish yellow streaked with purple colour. Ginger (*Zingiber*

*officinale* (L.) Roscoe) has been used as a spice for over 2000 years (Bartley and Jacobs, 2000). Ginger contains up to 3% of an essential oil that causes the fragrance of the spice (Nweze *et al.*, 2004). In India, and in other countries with hot and humid climates, ginger is eaten daily and is a well-known remedy for digestion problems (Ernst and Pittler, 2006).

### PHYTOCHEMICAL PROPERTIES

All major active ingredients of Ginger, such as zingerone, gingerdiol, zingibrene, gingerols and shogaols, are known to possess anti-oxidant activities (Chrubasik *et al.*, 2005). This antioxidant activity in ginger is due to the presence of polyphenol compounds (6-gingerol and its derivatives) (Herrmann, 1994). The chief active constituents of ginger are Volatile oil (zingiberene, curcumene, farnesene, zingiberol, D-camphor), Shogaols, Diarylheptanoids, Gingerols, Paradol, Zerumbone, 1-Dehydro-(10) gingerdione, Terpenoids and Ginger flavonoids (Baliga *et al.*, 2012). Aroma or pungency which is derived from key chemical components such as volatile essential oils and non-volatile pungent compounds oleoresin (Famurewa *et al.*, 2011). These compounds give ginger its characteristic hot sensation (Wohlmuth *et al.*, 2005). Gin-ger including terpenes and oleoresin which called ginger oil. Ginger also constitutes volatile oils approximately 1% to 3% and non-volatile pungent components oleoresin (Zick *et al.*, 2008). Phenylalkylketones or vanillyl ketones of ginger include 6-gingerol 8- gingerol and 10-gingerol, 6-shogaol, 8- shogaol, 10-shogaol and zingerone. 6-paradol, 6- and 10- dehydrogingerdione and 6- and 10-gingerdione have also been identified (Chrubasik *et al.*, 2007). The essential oil and oleoresin of *Zingiber officinale* exhibited significant antioxidant and anti-microbial activities (Bellik, 2014). In the fresh ginger rhizome, the gingerols were identified as the major active components and gingerol [5-hydroxy-1-(4-hydroxy-3-methoxy phenyl) decane-3-one] is the most abundant constituent in the gingerol series. The many beneficial effects of ginger are supposed to be due to the presence of bioactive phytochemicals like gingerols, shogaols, paradols, gingerdiols, and zingerone (Baliga *et al.*, 2013). Ginger may stimulate the conversion of cholesterol into bile acids, an important pathway of eliminating cholesterol from the body (Srinivasan and Sambaiah., 1991). Ginger significantly lowered lipid peroxidation by maintaining the activities of antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxidase in rats (Ahmed *et al.*, 2000). When ginger was included in animal diets, it was found that there was a considerable increase in the pancreatic and intestine lipase (Platel and Srinivasan, 2000).

### PHARMACOLOGICAL PROPERTIES

Ginger is the herbal treatment for colds and other viral infections, poor appetite, digestive problems, arthritis and headache (Ghayur *et al.*, 2005).

Ginger and its constituents have antiemetic, antithrombotic, anti-inflammatory and antioxidant effects (Khaki *et al.*, 2009). The major pharmacological activity of ginger appears to be due to gingerol and shogaol (Duke and Beckstrom, 1999).

#### **Antioxidant**

Ginger is a strong anti-oxidant substance and may either mitigate or prevent generation of free radicals. Ginger, which is the underground stem or rhizome of the plant *Zingiber officinale* Roscoe, contains polyphenol compounds (6-gingerol and its derivatives), which have a high antioxidant activity (Herrman, 1994).

#### **Antiemetic**

Powdered ginger root in the dose used was found to be effective in reducing nausea and vomiting induced by low dose cyclophosphamide in combination with drugs causing mild emesis (Sontakk *et al.*, 2003).

#### **Anti-inflammatory and Analgesic**

The active constituents of ginger comprise gingerols and shogaols have the anti-inflammatory and analgesic properties of ginger (Ali *et al.*, 2008). Ginger could be used as anti-inflammatory agent and thus as anti-pain (Thomson *et al.*, 2002).

#### **Anti-ulcer**

The phenolic content in aqueous extract of ginger is reported to have potential ulcer preventing ability, aqueous extract of ginger will also reduce free radicals damage during ulceration. Hence, ginger is used as ulcer preventive agent (Nanjundaiah *et al.*, 2011).

#### **Anti-cancer**

Ginger anticancer properties are attributed to the presence of certain pungent vallinoids, like [6]-gingerol and [6]-paradol, and some other constituents like shogaols, zingerone etc. [6]- gingerol may be useful for preventing or treating angiogenesis-dependent human diseases such as cancer (Kim *et al.*, 2005).

#### **Digestive**

The active component of ginger is reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive tract. Ginger has been used as a digestive aid and for ailments caused by cold, damp weather for at least 2500 years (Kemper, 1999).

### **Cardio protective**

It stimulates blood circulation throughout the body by powerful stimulatory effect on the heart muscle and by diluting blood (Mowrey and Clayson, 1982).

### **Anticlotting**

Ginger reduced the formation of proinflammatory prostaglandins and thromboxane thus lowering the clotting ability of the blood (Meena, 1992).

### **Antibacterial, Antiviral, Antifungal and Antiparasitic**

Ginger extract (10 mg/kg) intraperitoneally had a dose dependent antimicrobial activity against *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Escherichia coli* and *Candida albicans* (Jagetia *et al.*, 2003). Ginger is effective in the control of a range of bacterial, viral, fungal and parasitic diseases (Agrawal *et al.*, 2001).

### **Immunomodulatory**

Ginger is effective as an immunomodulatory agent in animals and fish and helps to reduce the losses caused by diseases in aquaculture (Nya and Austin, 2009).

### **Gastrointestinal activities**

*Zingiber officinale* is traditionally used to treat inflammatory gastrointestinal disorders. Ethanolic extract of dried rhizomes of ginger displayed protective effects against acetic acid-induced ulcerative colitis in rats (El-Abhar *et al.*, 2008).

### **Antiarthritic**

Alcoholic and Aqueous extracts of *Zingiber officinale* possess a significant antiarthritic activity against formaldehyde induced arthritis model (Prakash *et al.*, 2016).

### **Antidiabetic**

At a dose of 500 mg/kg, raw ginger was significantly effective in lowering serum glucose, cholesterol and triacylglycerol levels in the ginger-treated diabetic rats compared with the control diabetic rats (Al-Amin *et al.*, 2006). By improving insulin sensitivity it reduces fasting blood glucose and improves serum insulin level (Behera and Yadav, 2013).

### **Hypoglycaemic activity**

Ginger juice exhibits hypoglycaemic activity in both normal and streptozotocin (STZ)-induced diabetic rats (Akhani *et al.*, 2004).

## CONCLUSION

Ginger is consumed worldwide as a spice and flavoring agent and is featured to have many medicinal properties such as cardioprotective, antiinflammatory, antimicrobial, antioxidant, antiulcer, anticlotting and anticancer properties etc. The ginger is also used as growth promoter and as an immunostimulant.

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