

A review on medicinal values of ginger

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ABSTRACT

Ginger is a medicinal plant that is widely used in traditional systems of medicine. The two most active constituents of ginger-based preparations are gingerol and shogaol. It has antiemetic, antipyretic, analgesic, antiarthritic, and anti-inflammatory activities. Ginger (*Zingiber officinale* Roscoe) has strong antioxidant effects helping in the production of free radicals. Studies have proved the antitumor and hepatoprotective effects of ginger. This review discusses the pharmacological properties and clinical uses of ginger.

KEY WORDS: Antioxidant, Antitumor, Ginger, Hepatoprotective, *Zingiber officinale*

INTRODUCTION

Plants are being used by humans in many ways such as food and spices. Ginger or *Zingiber officinale* Roscoe belonging to the family Zingiberaceae which is an herbaceous rhizomatous plant. Ginger, the rhizomes of the plant *Z. officinale*, is arguably one of the most widely used culinary agents and spice in the world. In addition to its culinary use, ginger also possesses medicinal properties and has been used since ancient times worldwide to treat ailments such as cold, headaches, nausea, stomach upset, diarrhea, digestive, gastrointestinal disturbances, rheumatic complaints, asthma, parasitic infections, arthritis, and muscular discomfort.^[1-7]

PHARMACOGNOSY

Ginger [Figure 1] belongs to the family Zingiberaceae, genus *Zingiber*, species *Z. officinale*. The ginger plant was first cultivated in China and then cultivated in India. It is a perennial reed-like plant about 3–4 feet tall. The root is gathered when the stalk withers, it is immediately scalded washed and scraped to kill it and prevent sprouting. The roots of ginger are used as a spice in cooking. The main constituents are sesquiterpenoids with zingiberene as main constituent.

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Website: jprsolutions.info

ISSN: 0975-7619

GINGER AND ANTIOXIDANT ACTION

Antioxidants are the substances that have the ability to counteract the damaging effects of free radicals in tissues and thus are believed to protect against cancer and heart disease.^[8] About 40 antioxidants are present in ginger.^[9] [6]-dehydroshogaol, [6]-shogaol, and 1-dehydro-[6]-gingerdione were shown to be potent inhibitors of nitrous oxide (NO) synthesis in activated macrophages.^[10] The CO₂ extract from ginger roots has been shown to have a significant effect in inhibiting 2,2-diphenyl-1-picrylhydrazyl, up to 90.1%. Ginger also showed a higher chelating capacity. Increased generation of reactive oxygen species and reactive nitrogen species is implicated in various liver diseases and the toxic manifestations of various hepatotoxins.^[11,12] Ginger extracts, oleoresins, and the volatile oils possess free radical scavenging effects and are effective in scavenging the superoxide, hydroxyl, and NO *in vitro*.^[13] The phytochemical zingerone is also reported to be an effective scavenger of the free radicals such as superoxide,^[14-16] peroxy,^[17] and peroxynitrite,^[18] and to also inhibit the formation of 14 peroxynitrite-mediated tyrosine nitration. Gingerol is also shown to scavenge peroxy radicals, to inhibit the production of NO and reduce the generation of inducible NO synthase in lipopolysaccharide-stimulated cells.^[19]

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Received on: 07-04-2018; Revised on: 12-05-2018; Accepted on: 23-06-2018



Figure 1: Ginger

GINGER AND HEPATOPROTECTION

Phytochemical studies have shown that the unique culinary and medicinal properties of ginger are due to the presence of phytochemicals such as zingerone, shogaols, gingerols, paradols, β -phellandrene, curcumene, cineole, geranyl acetate, terpineol, terpenes, borneol, geraniol, limonene, β -elemene, zingiberol, linalool, α -zingiberene, β -sesquiphellandrene, β -bisabolene, zingiberenol, and α -farnesene. Scientific studies carried out in accordance to the principles of the modern system of medicine have convincingly shown that ginger possesses numerous health benefits such as antimicrobial, antiviral, gastroprotective, antidiabetic, antihypertensive, cardioprotective, anticancer, chemopreventive, and immunomodulatory effects. *In vitro* laboratory studies on animals have also shown that ginger to possess hepatoprotective effects and to protect the liver against the toxic effects of diverse class of the xenobiotic agents such as alcohol,^[20,21] country liquor,^[22] acetaminophen,^[23] heavy metals,^[24,25] CCl₄,^[26] paraben,^[27] and bromobenzene.^[28]

PHARMACOLOGICAL EFFECTS

Anticancer Effects

The anticancer effects of ginger are thought to be attributed to various constituents including vallinoids, namely (6)-gingerol and (6)-paradol, shogaols, zingerone, and galanals A and B.^[29,30]

Anticoagulant Effects

Ginger has been shown to inhibit platelet aggregation^[31-33] and to decrease platelet thromboxane production *in vitro*.^[33-35] Gingerol, shogaol, paradol, and gingerol analogs exhibited antiplatelet activities.

Antiemetic Effects

Elements in ginger which are responsible for antiemetic effect are anticipated to be the gingerols, shogaols, and galanolactone, a diterpenoid of ginger.^[36-38]

Anti-inflammatory Effects

Ginger has been found to inhibit prostaglandin biosynthesis^[39] and interfere with the inflammatory cascade and the vanilloid nociceptor.^[3] Ginger has been shown to share pharmacological properties with nonsteroidal anti-inflammatory drugs because it suppresses prostaglandin synthesis through the inhibition of cyclooxygenase-1 and cyclooxygenase-2.

Gastrointestinal Effects

There is evidence that ginger rhizome (root) increases stomach acid production. If so, it may interfere with antacids, sucralfate (Carafate), H₂ antagonists, or proton-pump inhibitors. In contrast, other *in vitro* and animal studies have revealed gastroprotective properties.^[40,41] Shogaol, generally more potent than gingerol, has inhibited intestinal motility in intravenous preparations and facilitated gastrointestinal motility in oral preparations. Ginger extract has also been reported to inhibit the growth of *Helicobacter pylori in vitro*. However, Desai *et al.* observed a significant increase in the exfoliation of gastric surface epithelial cells following the consumption of 6 g or more of ginger.^[42]

Antimicrobial Activities

Ingenol and (6)-shogaol, isolated from ginger rhizome, demonstrated antiviral activity.^[8] (10)-gingerol has been reported as active inhibitor of *Mycobacterium avium* and *Mycobacterium tuberculosis in vitro*. Gingerol and related compounds have been investigated for antimicrobial activities.

(6)-gingerol and (12)-gingerol, isolated from ginger rhizome, demonstrated antibacterial activity against *Porphyromonas gingivalis*, *Porphyromonas endodontalis*, and *Prevotella intermedia*.^[43]

Antiarthritic Effect

Crude ginger extract, (6)-gingerol to reduce joint swelling in animals induced with rheumatoid arthritis and exhibited potent anti-inflammatory action.^[44]

Ginger Uses in Dentistry

A study based on laboratory investigations to investigate the antifungal activity of *Z. officinale* (Ginger) on *Candida albicans*. *C. albicans* (PTCC 5027, ATCC10231) was obtained from Iranian microbial collection and was confirmed by germ tube formation test. Ethanol ginger extract was prepared. The results showed that the ethanol extract was effective on *C. albicans*. This study indicates that

ginger extract might have promising results on oral candidiasis.

In another study, paradol, which was derived from ginger root and certain Zingiberaceae plants protected mouse skin from a tumor-inducing agent and showed dose-dependent cytotoxicity in an oral carcinoma cell line (KB), with specific features of caspase-3-mediated apoptosis. Viable KB cells were reduced in number to <50% of untreated control when incubated with 50 IM [6]-paradol for 48 h. In addition, an ethanol extract of ginger-mediated antitumor-promoting effects decreased the number of tumors in a Sencar mice skin tumor model.^[20]

In a study, acyclovir-resistant clinical isolates of herpes simplex virus type 1 (HSV-1) were analyzed *in vitro* for their susceptibilities to essential oils of ginger, thyme, hyssop, and sandalwood. The active components of essential oils might consist of lipophilic carbohydrates that interact with the lipid membrane. These antibacterial active substances might exhibit similar activities against viral envelopes. Acyclovir-resistant clinical isolates were significantly inhibited by the essential oils, and the titers of HSV were reduced by 95.9–99.9%. Essential oils act by inactivating HSV before it enters the cell. The effective dosage for a systemic application of essential oils is rather high and leads to cytotoxic effects. Furthermore, a short-term systemic bioavailability makes a systemic application unlikely.^[21] Aqueous ginger extracts which were used to check antimicrobial activity found to be efficient in treating toothache^[11] and as a sialogogue, to promote salivation.^[18]

CONCLUSION

Various pharmacological properties and possible clinical use of ginger are discussed. Further, human studies will have to be done to validate the use of ginger as a therapeutic drug. With its numerous medical uses, ginger promises to be an effective therapeutic agent for various diseases in the future.

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Source of support: Nil; Conflict of interest: None Declared