



Potential medical properties of Rhizome *Zingiber officinale*

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Abstract

Zingiber officinale (*Z. officinale*) is a perennial herb with several medicinal properties. Development of modern drugs from *Z. officinale* can be emphasized for the control of various diseases. The feasibility of using *Z. officinale* to treat parasite infections has received considerable interest nowadays. Therefore, this review focused on the anti-parasitic activity of *Z. officinale*. Method of this literature search was conducted on PubMed, Elsevier Scopus database and Google Scholar with no limitation on language or year of publication databases. *Z. officinale* was found to have a significant antihelmintic activity against *Schistosoma mansoni*, *Toxocara canis*, *Dirofilaria immitis*, *Angiostrongylus cantonensis*, *Aniskis simplex*, *Hymenolepis nana* and hydatid cysts either *in vitro* or *in vivo*. Also, it has an anti-protozoal effect against *Toxoplasma gondii*, *Giardia lamblia*, *Trypanosoma brucei brucei* and *Blastocystis* species. Additionally, it was found to have insecticidal, molluscicidal and anti-leech effects.

Keywords

Giardia lamblia, *Trypanosoma brucei*, *Blastocystis*

Introduction

Medicinal plants used in India for centuries have an important therapeutic source for treating a variety of ailments and has been found to immense global importance. India is perhaps the largest producer of medicinal herbs and is rightly called the 'Botanical Garden of the world'. Medicinal herbs have been used for thousands of years in the indigenous system of medicines like Ayurveda, Siddha and Unani. Helmenthiasis is one of the most common infections in mankind affecting a large proportion of the world population. Parasitic diseases may cause severe morbidities including lymphatic filariasis and onchocerciasis. Development of resistance to most of the commercially available anthelmintics becomes a problem world-wide.

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Zingiber officinale commonly known as ginger lends its name to its genus and family Zingiberaceae. Ginger produces clusters of white and pink flower buds that bloom into yellow flowers. Because of its aesthetic appeal and the adaptation of the plant to warm climates, ginger is often used as landscaping around subtropical homes. It is a perennial reed-like plant with annual leafy stems, about a meter (3 to 4 feet) tall. Traditionally, the root is gathered when the stalk withers; it is immediately scalded, or washed and scraped, to kill it and prevent sprouting. Preliminary research indicates that nine compounds found in ginger may bind to human serotonin receptors, which may explain ginger's extensive effects on the GI tract and suggesting a mechanism for its effects on anxiety.

Zingiber zerumbet also known as shampoo ginger belongs to the family Zingiberaceae. It is a vigorous ginger with leafy stems growing to about 1.2 m tall. It is found in many tropical countries. The rhizomes of *Zingiber zerumbet*, have been regularly used as food flavoring and appetizer in various cuisines while the rhizomes extracts have been used in Malay traditional medicine to treat various types of ailments like inflammatory and pain-mediated diseases, worm infestation and diarrhoea.

The anthelmintic activity of trikatu churna and its each ingredient is done and the results are noted. This result shows that, aqueous extracts of trikatu churna and its ingredients possess potent anthelmintic activity in dose dependent manner. The activity shown by aqueous extractis of considerable importance.

The extract of trikatu churna shows highest activity which is almost equal to the effects shown by standard albendazole solution. The time taken for the induction of paralysis and death in both albendazole and trikatu churna was almost same but the significant difference was observed in the case of comparison between albendazole and ingredients of trikatu churna alone. The extent of activity shown by crude extracts was found to be dose dependent.

Description

Ginger is herbaceous rhizomatous perennial, reaching up to 90 cm in height under cultivation. Rhizomes are aromatic, thick lobed, pale yellowish, bearing simple alternate distichous narrow oblong lanceolate leaves. The herb develops several lateral shoots in clumps, which begin to dry when the plant matures.

Leaves are long and 2 - 3 cm broad with sheathing bases, the blade gradually tapering to a point. Inflorescence solitary, lateral radical pedunculate oblong cylindrical spikes. Flowers are rare, rather small, calyx superior, gamosepalous, three toothed, open splitting on one side, corolla of three subequal oblong to lanceolate connate greenish segments [10].

Agrotechnology Ginger grows in warm and humid climate. It is mainly cultivated in the tropics from sea level to an altitude of above 1500 MSL and it can be grown both under rainfed and irrigated conditions. For successful cultivation, ginger requires a moderate rainfall at the sowing time till the rhizomes sprout, fairly heavy and well distributed showers during the growing period and dry weather for about a month before harvesting.

Ginger thrives the best in well drained soils like sandy or clay loam, red loam or lateritic loam. A friable loam rich in humus is ideal. However, being an exhaustive crop it may not be desirable to grow ginger in the same site year after year. It thrives well under partial shade, though it is also grown on a large scale in open area.

Varieties of ginger

Several hybrid varieties of ginger are grown in South Asian region. However, the cultivars depends upon the climate, soil and local conditions. The important cultivars are: High Yielding Types: Maran, Karakkal, Rio de Janeiro and Mahim. Less Fiber Content: Jamaica, Bangkok and China Thingpuri. High Oleoresin: Emad Chemed, China, Karuppamadi and Rio de Janeiro. High Dry Ginger Recovery: Karakkal, Nadia, Maran and Tura. High volatile oil: Sleeva local, Narasapattam and Emad. Chemed.

Chemical composition Phytochemical studies show that ginger rhizome contains a wide variety of biologically active compounds which impart medicinal property. *Z. officinale* is reported to possess essential oils, phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, saponins, steroids, terpenoids and tannin as the major phytochemical groups. The chemistry of *Z. officinale* has been the subject of sporadic study since the early 19th century. In common with some other pungent spices, considerable advances were made in the early part of the 20th century, but it has only been in recent years that a fairly clear understanding of the relationship of its chemical composition to its organoleptic properties has emerged.

Ginger, owes its characteristic organoleptic properties to two classes of constituents: the odour and much of the flavour of ginger is determined by the constituents of its steam-volatile oil, while the pungency is produced by non steam- volatile components. The monoterpene constituents are believed to be the most important contributors to the aroma of ginger and they tend to be relatively

more abundant in the natural oil of the fresh ('green') rhizome than in the essential oil distilled from dried ginger. Oxygenated sesquiterpenes are relatively minor constituents of the volatile oil but appear to be significant contributors to its flavour properties. The volatile oil consists mainly of the mono- and sesquiterpenes; camphene, β -phellandrene, curcumene, cineole, geranyl acetate, terphineol, terpenes, borneol, geraniol, limonene, β elemene, zingiberol, linalool, α -zingiberene, β sesquiphellandrene, β -bisabolene, zingiberenol and afarmesene.

Zingiberol is the principal aroma contributing component of ginger rhizome [16]. The species contains biologically active constituents including the non-volatile pungent principles, such as the gingerols, shogaols, paradols and zingerone that produce a "hot" sensation in the mouth. The gingerols, a series of chemical homologs differentiated by the length of their unbranched alkyl chains, were identified as the major active components in the fresh rhizome. The pungency of dry ginger mainly results from shogaols, which are dehydrated forms of gingerols.

Gingerols are thermally labile because of the presence of a β -hydroxy keto group and readily undergo dehydration to form the corresponding shogaols. Paradol is similar to gingerol and is formed on hydrogenation of shogaol. Oleoresin, which is isolated by acetone and ethanol extraction, contains 4-7.5% of dried powder, pungent substances namely gingerol, shogaol, zingerone and paradol. Medicinal uses Ginger is found to possess aromatic, carminative, stimulant to GIT, antispasmodic, digestive, stomachic, vasodilator, appetizer, expectorant, bronchodilator, topical and local stimulant, analgesic, antifatulent, aphrodisiac, digestive, antitussive, antifatulent and laxative.

The pungent compounds in ginger have analgesic effects. It has been detected that *Zingiber officinale* has active influence on the digestive enzymes of intestinal mucosa and it enhanced intestinal lipase, disaccharidases, sucrase and maltase activity. The other potential uses include relief from the pain and inflammation of rheumatoid arthritis. In Ayurvedic system of medicine, adrak is used to treat stiffness, swelling, and pains that result from rheumatic conditions due to the entrance of cold and dampness in the body, an observation concurrent with those who suffer from rheumatic symptoms that are intensified by inclement weather.

It is also an excellent ingredient in arthritic formulas to counter stomach problems resulting from the overuse of prescriptive drugs (Kiuchi et al., 1992).

Pharmacological activity Ginger inhibits the production of immune-system components called cytokines (Peng et al., 1995). These chemicals are believed to create a long-term tendency toward inflammation (Ojewole et al., 2006). Ginger also stimulates blood circulation (Shoji et al., 1982). Ginger contains very potent anti-inflammatory compounds called gingerols (Kwang et al., 1998). Study demonstrates that daily consumption of raw and heat-treated ginger resulted in moderate-to-large reductions in muscle pain following exercise-induced muscle injury. Ginger (*Zingiber officinale* Roscoe, Zingiberaceae) is a medicinal plant that has been widely used in Chinese, Ayurvedic and Tibb-Unani herbal medicines all over the world, since antiquity, for a wide array of unrelated ailments that include arthritis, rheumatism, sprains, muscular aches, pains (Srivastava, 1989). An ethanolic extract of the rhizomes of *Zingiber officinale* (Figures 3 and 4) was investigated for anti-inflammatory, analgesic, antipyretic, antimicrobial and hypoglycaemic activities.

The growth of both gram-positive and gram-negative bacteria was significantly inhibited. A dose-dependent inhibition of prostaglandin release effect was observed using rat peritoneal leucocytes (Mascolo et al., 1989). Currently, there is a revival of interest in ginger, and several scientific investigations are aimed at isolation and identification of active constituents of ginger, scientific verification of its pharmacological actions and of its constituents, and verification of the basis of the use of ginger in some of several diseases and conditions in which it has been used traditionally.

The main pharmacological actions of ginger and its isolated compounds include immuno-modulatory, anti-tumorigenic, anti-inflammatory, anti-apoptotic, antihyperglycemic, anti-hyperlipidemic and anti-emetic actions. Ginger is a strong anti-oxidant substance and may either mitigate or prevent generation of free radicals. It is considered a safe herbal medicine with only few and insignificant adverse/side effects. More studies are required in animals and humans on the kinetics of ginger consumption over a long period of time (Amin et al., 2006) Cardiovascular health Including in Ayurvedic science, ginger has been described as great heart tonic. It helps in preventing various heart diseases by reducing blood clotting that can lead to plaque formation or thrombosis. It can also open the blockage in the blood vessels thus decreasing peripheral vascular resistance and hence blood pressure. Ginger also may help to lower high cholesterol making the heart healthy (Akoachere et al., 2002).

Antiplatelet activity Srivastava (1984) found that aqueous extract of ginger inhibited platelet aggregation induced by ADP, epinephrine, collagen and arachidonic acid in vitro. Ginger acted by inhibiting thromboxane synthesis. It also inhibited prostacyclin synthesis in rat aorta. The antiplatelet action of 6-gingerol was also mainly due to the inhibition of thromboxane formation (Guh et al., 1995). Powerful antioxidant helps to prevent all kind of disease and it also slower downs the aging process. There was a study of more than 120 plant foods, published in the Journal of Nutrition. In the report ginger was ranked number one among the five richest food sources of antioxidants, including berries, walnuts, sunflower seeds, and pomegranates. Test-tube and animal researches have shown that ginger inhibits the production of free radicals. Ginger also enhances the body's internal production of antioxidants (Srivastava and Mustafa, 1992).

Conclusion

The pharmacological activities as anti-inflammatory and for the treatment of rheumatoid and osteoarthritis has been documented. Although it exerts effects on cardiovascular parameters, exhibits anti-oxidant activities and involved in cancer chemotherapy. All these are due to the synergistic effects of zingiberene and related types of components bring about the pharmacological impact. In conclusion ginger has wide range of medicinal uses and can be used either as single drug or compound drugs to treat different ailments. It can be used as preventive medicine due to its potential against oxidative stress.

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Conflict of Interest

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