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FILE: ▪Ginger (*Zingiber officinale*)
▪Efficacy

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RE: Effectiveness and Efficacy of Ginger Examined

Chrubasik S, Pittler MH, Roufogalis BD. Zingiberis rhizoma: a comprehensive review on the ginger effect and efficacy profiles. *Phytomed*. 2005;12:684-701.

Ginger rhizome (*Zingiber officinale*) has been used as a spice and medicine for thousands of years. Today, ginger is used in herbal medicine to treat conditions including nausea, coughs, motion sickness, and diarrhea. Compounds from ginger have demonstrated anti-inflammatory, antioxidant, antimicrobial, antiemetic, antitumor, and neuronal protective activity.

Chemical constituents of ginger include the pungent principles (zingerone, gingerols and shogaols), essential oil, and sulfonatated compounds. Some constituents of ginger may be effective in the treatment of conditions including high cholesterol, gastrointestinal disorders, pain, cancer, fungal and bacterial infections, and cardiovascular disease.

This systematic review covers safety and efficacy data on ginger from controlled and uncontrolled clinical trials, in vitro, and in vivo studies. The authors searched Medline for articles on ginger from the beginning of the database until December 2003.

In vitro experiments
Gingerols are agonists of the capsaicin-activated vanilloid receptor. Ginger extracts and constituents demonstrate antiplatelet and anti-inflammatory activities, including inhibition of cyclooygenase (COX-I and COX-II), inhibition of prostaglandin I_2 release, 5-lipoxygenase inhibitory activity, and reduction of platelet thromboxane formation. Crude ginger and ginger constituents protect against lipid peroxidation in several in vitro models. Ginger extracts and constituents also demonstrate antitumor promoter activity, as well as antiproliferative and cytotoxic effects via apoptotic cell death. Pungent compounds from ginger protect human neuroblastoma and umbilical vein endothelial cells from β-amyloid insult associated with Alzheimer's Disease. Ginger extracts and pungent compounds demonstrated antibacterial activity against a variety of bacterial strains including *Helicobacter pylori*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella*

typhimurium, *Escherichia coli*, and *Micrococcus luteus*. Ginger constituents also demonstrate antifungal activity against *Candida albicans* and other fungi, antirhinoviral activity, and antithelmintic activity.

In vivo experiments

Ginger extracts and pungent constituents of ginger (shogaols and gingerols) demonstrate antiemetic activity in four animal studies. Ginger extracts and compounds demonstrate anti-ulcer activity in animal gastric ulcer models, and ginger constituents also demonstrate digestive stimulant activity by increasing bile secretion and the activity of digestive enzymes. Pungent ginger constituents cause a rapid decrease in blood pressure and slow heartbeat in rats. Ginger extracts demonstrate antithrombotic activity in animal models including prostaglandin E_2, thromboxane B_2, and slowing blood coagulation time in rodent models. Anti-inflammatory activity of ginger extracts and constituents has been demonstrated in paw edema, rat skin edema, and paw and joint swelling experiments. Ginger extracts and pungent constituents demonstrate antipyretic and analgesic activity in animal experiments.

In some animal experiments, ginger lowers cholesterol, and in other experiments, ginger does not lower cholesterol, depending on the dose and preparation (extract vs. crude drug). Ginger (1 %) demonstrates antioxidant activity equivalent to ascorbic acid. In rodent experiments, ginger demonstrates antitumor activity and increases immunologic function in mice with tumors. Central effects of ginger and ginger extracts that have been demonstrated in vivo include antixylotic, antiemetic, inhibition of gastric contraction, inhibition of serotonin-induced hypothermia, inhibition of spontaneous motor time and prolonged sleeping time, and an antitussive effect. These central effects are largely attributed to gingerols and shogaols, the products of dehydration of gingerols.

Preclinical safety data

The acute oral LD_{50} of ginger oil in rats and the acute dermal LD_{50} in rabbits exceed 5 g/kg, and an 80% ethanol extract of ginger at 2.5 g/kg body weight is not lethal in mice. Ginger contains a mix of mutagenic and antimutagenic constituents. Alcoholic extracts are more cytotoxic that nonalcoholic ginger extracts. Ginger demonstrates marginal genotoxicity that may result from mixed pro- and anti-clastogenic constituents. Ginger tea and extract are not toxic to pregnant rats, but results are mixed on two studies of the effects of ginger tea and ginger extract on rat embryos.

Studies in humans

Human pharmacological studies on the impact of ginger on gastric motility show mixed results: ginger has been shown to have no effect on gastric emptying, to increase gastroduodenal motility, and to prevent gastric slow-wave dysrithmias. Oral administration of zingerone, a ginger constituent, causes sensitization, desensitization, and burning sensations in a similar manner to capsaicin. Three out of seven exploratory clinical trials on ginger and motion sickness demonstrate efficacy of ginger. These mixed results may be due to the different ginger preparations and varying strength of motion sickness stimuli. Initial clinical trials on ginger and platelet aggregation and ginger have not yielded positive results.

Studies on ginger and postoperative nausea have also demonstrated mixed results. Ginger shows post-operative antiemetic activity equivalent to metoclopramide in one study, no beneficial effect in another study, and antinausea activity but no anti-vomiting activity in another study. Three studies (two placebo-controlled, one vs. vitamin B12) show that ginger powder and extract are effective against nausea and emesis during pregnancy. Four exploratory clinical trials demonstrate that ginger may be as effective as other antiemetics and better than a placebo in treating motion sickness. Three studies on ginger's effect on nausea and emesis due to other causes demonstrate that ginger may have a trend towards efficacy.

Three exploratory clinical trials show that proprietary ginger preparations may be effective in reducing osteoarthritic pain. Three uncontrolled clinical trials show that ginger may relieve musculoskeletal pain.

The authors conclude that there is not enough evidence to determine if ginger is an effective post-operative antiemetic. The evidence does show ginger is effective in the treatment of nausea and vomiting related to pregnancy. There is no evidence that ginger has any drug-herb interactions. Adverse effects associated with ginger include heartburn, gastric irritation, and IGE-mediated allergy (when ginger dust is inhaled.) More clinical trials are warranted on the efficacy of ginger in treating osteoarthritic pain, post-operative emesis, motion sickness, and nausea and vomiting due to pregnancy. Future trials should monitor adverse events.

—Marissa Oppel, MS

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