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Ginger

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Ginger, the rhizome of *Zingiber* officinale Roscoe, is best known for its role as a flavoring agent for food in Asian and Indian recipes. Since the 16th century, ginger has been used to treat various medical ailments and conditions, including migraines, arthritis, gingivitis, stroke, ulcers, constipation, diabetes, and nausea.[1,2] It is even believed to help with symptoms of the common cold or influenza.[2] In 1807, William Roscoe, an English botanist, named the ginger plant "Zingiber" after the Sanskrit word for "horn-shaped." The ginger family of plants comprises more than 1,200 species in 53 different genera.

It is important to note that not all ginger is the same. Genus *Zingiber* includes 85 species of aromatic herbs from East Asia and tropical Australia. Ginger (*Zingiber officinale* Roscoe) is often called "ginger root." The major world producers of ginger (*Zingiber officinale* Roscoe) include China, India, and Indonesia.[2,3] While Thai ginger and wild ginger are in the ginger family, they are not the same genus or species of ginger as ginger root. For the purpose of this article, "ginger" refers to *Zingiber officinale* Roscoe.

Ginger comprises volatile oils (1%–3%) and nonvolatile pungent compounds. The oils are responsible for its distinct aroma, and the pungent compounds account for the "hot" or "spicy" sensation it produces in the mouth.[1] The most abundant components of the volatile

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oils include zingeberene (35%), cucumene (18%), and farnesene (35%). The most abundant pungent compounds, as well as the biologically active constituents of ginger root, include gingerols, shogaols, paradols, and zingerone. Gingerols are the major active component in fresh ginger and shogaols are the more abundant active component in dried ginger. Gingerol becomes shogaol upon dehydration of fresh ginger.[1] Overall, the major biological constituents of ginger (ranging from highest to lowest amounts by weight) are: 6-gingerol, 6-paradol, 6-shogaol, and zingerone.[1,2,4]

Owing to its medicinal properties, ginger has gained considerable attention as a dietary supplement in the United States and Europe. To date, research studies have shown biological activities of ginger to include anti-inflammatory, antioxidant, antiemetic, antiapoptotic, antihyperglycemic, and anticancer properties. Most recently, ginger was shown to improve wound healing in combination with curcumin, a member of the ginger family and another spice with powerful antioxidant and anti-inflammatory capabilities.[5]

How is it Currently Used?

Ginger is typically consumed in the form of fresh, dried powder; an encapsulated powder or liquid extract; slices preserved in syrup; dried and preserved with a sugar coating (crystallized ginger), or as a tea flavoring.[1] Medicinally, ginger is used primarily to quell nausea associated with motion sickness, pregnancy, the postoperative period, and cancer chemotherapy.

In an early randomized trial in college students with self-reported high susceptibility to motion sickness, ginger was more effective than diphenhydramine (Dramamine) and each was more effective than dried chickweed herb placebo in preventing gastrointestinal symptoms of vection-induced motion sickness.[6] Ginger also was more effective than placebo in reducing vomiting related to seasickness in a group of naval cadets. The 40 cadets who ingested the ginger also reported fewer episodes of nausea, although the difference between the treatment and control groups was not statistically significant.[7] When ginger is used to prevent motion sickness, it is frequently suggested that it be taken 1 to 2 days before the trip and continued throughout the period of travel.[3]

Additionally, studies of ginger use in pregnant women found that it reduced nausea and vomiting during pregnancy at a dosage of 250 mg daily for 4 days.[8,9]

Furthermore, many published studies have addressed use of ginger for prevention of postoperative nausea and vomiting, though results have been mixed. Two studies comparing ginger (at a 0.5-g or 1-g dose) vs metochlopramide (at 10 mg) vs placebo for control of postoperative nausea in women undergoing gynecologic surgery demonstrated equal effectiveness of ginger and metoclopramide for postoperative nausea; in both studies ginger and metoclopramide were significantly more effective than placebo.[10,11] Phillips and coinvestigators[11] reported no significant differences in frequency of emesis between the three arms, while Bone and colleagues[10] reported less vomiting for both active drugs than for placebo.

In the study headed by Phillips, participants assigned to the ginger arm required significantly less postoperative “rescue” antiemetic treatment.[11] Potential confounding factors in studies of postoperative nausea and vomiting include the nausea-inducing effect of agents used to induce and maintain anesthesia and provide pain relief, as well as relatively short assessment periods, allowing little time for ginger to exert its maximum antinausea effects.

Because of the abundance, relative safety, and low cost of ginger, extensive scientific studies of the herb have been undertaken, to uncover possible additional therapeutic properties. Potential medical uses for ginger include reversing diabetic proteinuria,[1] lowering blood pressure and reducing blood levels of lipids and cholesterol,[1,12] reducing arthritis symptoms,[13] protecting normal tissue from radiation,[14,15] and inhibiting gastric ulcers.[1,2,16] Further research is necessary to confirm the clinical effectiveness of ginger in humans for these medicinal purposes.

CHEMOPREVENTIVE EFFECTS OF GINGER have been observed in cancers of the skin, breast, and colon

What is the Evidence Related to Ginger and Cancer?

Over the last decade, ginger has been found to be anticarcinogenic through many different pathways. It has been shown to prevent initiation, promotion, and progression of various types of cancer.[2,17] Ginger has inhibited NF-kB activation and suppressed NF-kB-regulated gene expression induced by carcinogens.[2] Chemopreventive effects of ginger have been observed in cancers of the skin, breast, and colon.

In mouse studies, ginger extract administered in water significantly reduced the development of mammary tumors,[18] and ginger also inhibited the development and growth of colorectal tumors.[1,2,19] These studies suggest that ginger decreased lipid peroxidation and increased enzymatic and nonenzymatic antioxidant levels to reduce oxidative stress and inflammation. Additionally, ginger effectively suppresses ultraviolet B-induced skin carcinogenesis, as well as TPA (12-O-tetradecanoylphorbol-13-acetate)-induced skin edema.[20–22] For treatment of skin ailments, ginger has demonstrated effectiveness via oral and topical administration.[23,24]

Until recently, it was unclear whether or not ginger provided relief from chemotherapy-induced nausea. The majority of clinical trials investigating the efficacy of ginger for chemotherapy-induced nausea were plagued by design inadequacies, including small sample sizes and nonvalidated assessment methods.[25–27] In June 2009, there was immense publicity about ginger as an antinausea treatment for cancer patients receiving chemotherapy.[28]

A multisite, nationwide, randomized, double-blind, placebo-controlled study of 644 patients, by investigators from the University of Rochester Cancer Center Community Clinical Oncology Program (URCC CCOP), concluded that ginger supplementation significantly reduced acute chemotherapy-induced nausea. Preliminary results of the study were presented at the 2009 annual meeting of the American Society of Clinical Oncology (ASCO), and showed that all doses of ginger significantly reduced nausea ($P = .003$).[28]

The largest reduction in nausea occurred with 0.5-g and 1.0-g doses of ginger. Also, time of day had a significant effect on nausea ($P < .001$), with a linear decrease over 24 hours for patients using ginger.[28] Importantly, ginger has not been shown to inhibit the effectiveness of chemotherapeutic drugs.

> IN A RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED STUDY presented at ASCO, ginger significantly reduced nausea

What are the Potential Risks?

Ginger is on the US Food and Drug Administration (FDA) 'generally regarded as safe (GRAS)' list, and is considered safe at dosages of up to 4 grams daily.[1,2] Ginger has been shown to reduce platelet aggregation at a single dose of 10 grams in patients with coronary artery disease.[29] Ginger given at daily doses of 4 grams or less for more than 3 months, however, has not altered platelet aggregation, fibrinolytic activities, or fibrinogen levels.[29]

Previously, ginger had been thought to interact with the anticoagulant drug warfarin. Jiang et al., however, in an open label, three-way crossover, randomized study in 12 healthy individuals, confirmed that ginger and warfarin do not interact.[1] Ginger has been shown to cause mild diarrhea, heartburn, and gastric irritation at doses of 6 grams and higher.[1] Furthermore, ginger dust can produce an IgE-mediated allergy upon inhalation.[30] Nevertheless, ginger is a safe dietary supplement and herbal medicine overall, with very few adverse side effects.

What's the Bottom-Line Message?

Ginger has demonstrated effectiveness against nausea associated with motion sickness, cancer chemotherapy, pregnancy, and the postoperative period. Although ginger is generally regarded as safe and there is no evidence of danger with long-term use, a doctor should be consulted before starting supplementation.

Additional Resources

- National Center for Complementary and Alternative Medicine—Ginger. Available at: http://nccam.nih.gov/health/ginger/index.htm
- American Cancer Society—Ginger. Available at: http:/tinyurl.com/yhd6xzv
- Memorial Sloan-Kettering Cancer Center: About Herbs, Botanicals, and Other Products—Ginger. Available at: http://www.mskcc.org/mskcc/html/69234.cfm
- Drugs.com—Ginger. Available at: http://tinyurl.com/y9bdxe6

About Our Guest Editors

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