Name of Herb

Ginger

Scientific and Common Names

Zingiber officinale[1,2]

African Ginger[1], Black Ginger[1], Cochin Ginger[1], Gingembre[1], Ginger root[1], Jamaica Ginger[1], Race Ginger[1], Zingiberis rhizoma[1], Gingerall[3], Cayenne Ginger[3], Ginger Peppermint Combo[3], Ginger Power[3], and Ginger Trips[3].

Description of Active Ingredients

The therapeutically useful portions of ginger are the rhizome (root)[1,2]. Active constituents are called gingerols found in ginger's oleo-resin[1,2]. These compounds have the following properties antipyretic, analgesic, antitussive, cardiac inotropic and sedative[1]. Dehydration products of gingerols are called shogaol homologues[2]. One of these products, 6-shogaol and galanolactone are thought to act on 5-HT receptors[1].

Active constituents for topical applications are in ginger's volatile oils. Major constituents are beta-bisabolene and zingiberene[2]. Other compounds in the oils include zingiberol, zingiberenol, ar-curcumene, beta-sesquiphellandrene, beta-sesquiphellandrol (cis and trans), and numerous monoterpene hydrocarbons, alcohols and aldehydes[2].

Mechanism of Action

Anti-emetic actions:
Ginger is suspected to reduce nausea and vomiting by increasing gastrointestinal motility and transport via the 6-gingerol constituent[1]. Like ondansetron, galanolactone seems to act on 5-HT3 receptors in the ileum to illicit an anti-emetic effect[1]. Some evidence suggests that constituents of ginger have central anti-emetic activity[1]. Another opinion is that the anti-emetic actions of ginger are more likely due to local effects on the GI tract rather than from effects in the CNS[3].

Inhibition of platelet aggregation:
Additionally, aqueous ginger extract also has the ability to inhibit platelet aggregation via ADP, adrenaline, collagen, and arachidonic acid pathways[2]. Human studies have also shown ginger to inhibit platelet aggregation induced by ADP and epinepherine[3].

Anti-inflammatory actions:
Researchers speculate that Ginger's anti-inflammatory activity could be due to the inhibition of cyclooxygenase and lipooxygenase pathways by certain ginger constituents[1]. Specifically, they are 6-gingerol, 10-dihydrogingerdione, and 10- gingerdione[2]. Based on in vitro studies, these compounds were stated to be more potent inhibitors of prostaglandin biosynthesis than indomethacin[2].

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GI protective effects:
Animal studies have suggested that ginger has GI protective effects. The suspected mechanisms include increasing mucosal resistance and enhancing the defense mechanisms against chemicals or alterations in prostaglandins[3]. In addition, a study with mice using acetone ginger extracts showed similar stimulation in GI motility as metoclopramide and domperidone[3].

Cholesterol lowering effects:
In animal studies, ginger oleo-resin, and dried ginger rhizome were found to reduce hypercholesterolemia[2]. The speculated mechanism for these compounds is by disrupting cholesterol absorption from the GI tract[2]. Also, fresh ginger juice may also have beneficial effects on hypercholesterolemia if taken daily[2].

Cardiovascular effects:
Also, in animal studies it was found that IV administered 6-shogaol could cause rapid hypotension followed by a pressor response (centrally acting)[2]. Gingerols also exhibit positive inotropic effects in guinea-pigs[2].

Current Indications and Efficacy

Indications: (not all indications have supporting evidence for efficacy)
Orally, ginger is used for motion sickness, morning sickness, colic, dyspepsia, flatulence, chemotherapy-induced nausea, rheumatoid arthritis, osteoarthritis, loss of appetite, post-surgical nausea and vomiting, discontinuing SSRI drug therapy, anorexia, upper respiratory tract infections, cough, and bronchitis[1].

Topically, the fresh juice of ginger is used to treat thermal burns[1]. Also the essential oil of ginger can be used as a topical analgesic[1].

In Chinese medicine, ginger is used as a diaphoretic, diuretic, and stimulant. It is used to treat stomachache, diarrhea, nausea, cholera, and bleeding[1]. Orally, fresh ginger is used to treat acute bacterial dysentery, baldness, malaria, orchitis, poisonous snakebites, rheumatism, and toothaches[1].

Efficacy:

Anti-emetic Treatment:
A review analyzed 6 randomized clinical trials (RCTs) studying the anti-emetic effects of ginger. The authors used a methodological quality scale of 1-5. The trial about seasickness (Grontved et al.) had a score of 4, about morning sickness (Fischer-Rasmussen et al) had a score of 3, about chemotherapy-induced nausea (Pace) had a score of 2, about postoperative nausea (Bone et al) had a score of 3, about postoperative nausea (Phillips et al) had a score of 3, and about postoperative nausea (Arfeen et al) had a score of 4. The numbers of participants in the studies were 80, 30, 41, 60, 120, and 108 respectively. The pooled absolute risk reduction (ARR) for the postoperative nausea trials revealed that there was no significant difference between the

ginger and placebo groups when 1g of ginger was taken pre-operatively (ARR = 0.052, 95% CI -0.082 to 0.186)[4]. The other trials favored ginger over placebo.

Trial: Ginger Root against Seasickness (double blind randomized placebo trial)[5]
Population: 79 healthy naval cadets, age 16-19 y/o unaccustomed to the high seas
Dose: 1g of powdered ginger root po x1 dose
Results: Cadets taking ginger had a significant reduction in the frequency of vomiting and cold sweating $p<0.05$. No significant difference with the reduction of nausea and vertigo when the ginger was compared to placebo. No side effects were observed with ginger.

Trial: Ginger treatment of hyperemesis gravidarum – severe morning sickness (double blind randomized crossover trial)[6]
Population: 27 pregnant women who were admitted to the hospital with hyperemesis before the 20th week of gestation and had symptoms persisting for > 2 days.
Dose: Powdered ginger root 250mg po qid x 4 days (Dose does not exceed amounts found in food)
Results: Ginger provided significantly greater relief of hyperemesis symptoms compared to placebo ($p = 0.035$). The symptoms that were reduced to the largest extent were the frequency of vomiting and nausea. Also, the ginger treatment was significantly preferred over placebo ($p = 0.003$). No side effects were observed with ginger. 25 of the women were followed to full term and the infants did not exhibit any signs of abnormal development and were discharged in good condition. Regarding the 2 women that were not followed to full term: one had a spontaneous abortion (1 spontaneous abortion out of 27 women is not considered a high rate) and the other had a legal abortion due to severe marital and social problems.

Trial: Ginger for Nausea and Vomiting in Pregnancy: a randomized, double-masked, placebo-controlled trial[7]
Population: 70 pregnant women who attended clinic before 17 weeks gestation with symptoms of nausea from pregnancy with or without vomiting.
Dose: Powdered ginger root 250mg po pc and HS (qid) x 4 days.
Results: Primary outcome was improvement in nausea symptoms. Intent-to-treat analysis was performed. The study showed that there was a significantly greater reduction in nausea symptoms in the ginger group vs. placebo group on day 4 of treatment ($p = 0.03$). Additionally, the number of women who had episodes of vomiting was significantly less in the ginger group than in the placebo group ($p = 0.021$). The following side effects were observed in the ginger group: 5 women had HA, 1 had abdominal discomfort, 1 had heartburn, and another had diarrhea for 1 day. No significant difference was found when comparing the ginger and placebo groups in regards to spontaneous abortions ($p = 0.615$) and cesarean deliveries ($p = 0.509$). Most importantly, no infants had congenital anomalies and all were discharged in good condition.

Osteoarthritis treatment:
Trial: A randomized, placebo-controlled, cross-over study of ginger extracts and ibuprofen in osteoarthritis[8]
Population: 56 patients > 18 y/o with radiologically verified OA in the hip or knee. The patients had pain on movement of more than 30mm. Their mean duration of OA was 7.7 years.

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Dose: Eurovita Extract 33 170mg po tid (purified for HMP compounds found in ginger which are inhibitors of cyclooxygenase and 5-lipoxygenase)
Results: The investigators found a significant ranking of efficacy on pain level and function: ibuprofen 400mg po tid > ginger > placebo ($p = 0.0001$). Using a test for multiple comparisons there was no difference when ginger extract was compared to placebo. However, when an exploratory statistical test was performed on the data before the crossover a significant difference was found between ginger extract and placebo ($p < 0.05$). The authors caution the interpretation of a cross-over study of ginger extract. The only adverse events reported for ginger extract with a significant difference in incidence in comparison to other study groups were bad taste and 1 case of allergic conjunctivitis.

Rheumatic disorder treatment:
Trial: Ginger (Zingiber officinale) and Rheumatic Disorders (Case history reports)[9]
Population: **Patient #1:** One 50y/o Asian male in Canada with rheumatoid arthritis; **Patients #1-6:** Six 50-67 y/o people from Denmark (2 males, 4 females) with rheumatoid arthritis or arthritis deformalis.
Dose: **Pt #1:** 50g fresh ginger QD x 3 months; **Pts #1-6:** Average dose - 5g fresh ginger or 0.5-1g powdered ginger x 3 months.
Results: Patient #1 consumed the ginger on a daily basis cooked with vegetables and various meats. After 3 months of the ginger regimen the patient was completely free of pain, swelling and inflammation. The patient continued his job as an auto-mechanic with no relapses of arthritis over a span of 10 years. Patients #1-6 were taking NSAIDs for pain and inflammation, but stopped taking them because they were ineffective and the patients were convinced that ginger relieved their symptoms. The patients reported that ginger provided pain relief, better joint movement, and a decrease in swelling and morning stiffness. Additionally, ginger has been reported to be useful for rheumatic disorders in *Ayurvedic* and *Tibb* systems of medicine. The theoretical mechanism of ginger in the context of treating rheumatic disorders is that it acts as a dual inhibitor of cyclooxygenase (prostaglandins) and lipoxygenase (leukotrienes) pathways. Ginger is also speculated to inhibit the formation of free radicals (super oxide), which may alleviate the chronic inflammation in arthritis.

Contraindications/Allergies

Because of ginger's proposed MOAs, excessive doses could be contraindicated in patients with bleeding conditions, diabetes, heart conditions, and high BP or low BP[1,2]. Patients taking anticoagulants should be medically monitored if the concurrent use with ginger is necessary because the combination may prolong bleeding time[3].

Medicinal use of ginger may also be contraindicated in pregnancy because effects are unknown[3].
* more info under other safety issues

Adverse reactions:
Ginger taken orally is generally well tolerated. Some patients can have side effects including abdominal discomfort, heartburn, diarrhea, and a pepper-like irritant effect in the mouth and throat[1]. In sensitive individuals, ginger can cause dermatitis[1]. With an overdose of ginger there is a possible risk of CNS depression or arrhythmias[3].

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Dosage Forms, Recommended Doses, Duration

Dosage forms include: dried powder ginger root (100mg, 425 mg)[1,3], extract (250 mg)[1,3], whole root (530 mg)[1,3], capsules (100 mg, 425 mg)[3], chewable tablets(67.5 mg)[3], ginger tea[1,3] and tinctures[1].

The following are dosing regimens that have been used and do not claim to be recommendations. ***Recommended max dose is 4g / day***

Morning sickness: 250 mg ginger QID was used in studies [1]
General anti-emetic: powdered root 2g QD is typical[1]
Motion sickness: 1g of dried powdered ginger root 30min-4hrs before travel[1]
Osteoarthritis: Eurovita Extract 33 170 mg TID or 255 mg BID[1]
Nausea and disequilibrium from SSRI d/c or tapering: 550-1100 mg ginger TID[1]
Prevention of postoperative N/V: 1g powdered ginger root 1 hr before induction of anaesthesia[1]
Chemotherapy-induced nausea: Powdered ginger 2-4g QD, Ginger tea* on the day of Chemo and continue prn[1]

*Ginger tea is prepared by steeping 0.5-1g dried root in 150 ml boiling water for 5-10 min and then straining[1]
Tinctures are typically taken in doses of 0.25-3ml[2]

Drug Interactions and Drug-Disease Interactions

Anticoagulant/Antiplatelet potential:
Ginger is speculated to inhibit thromboxane synthetase and decrease platelet aggregation[1]. Theoretically concomitant use of herbs with coumarin constituents or affect platelet aggregation could increase the risk of bleeding in some people[1]. Likewise, the concomitant use of excessive amounts of ginger and anticoagulant or antiplatelet drugs could also increase the risk of bleeding[1]. (Examples of herbs to avoid: angelica, anise, arnica, asafetida, bogbean, boldo, capsicum, celery, chamomile, clove, danshen, fenugreek, feverfew, garlic, ginkgo, ginseng-Panax, horse chestnut, horseradish, licorice, meadowsweet, prickly ash, onion, papain, passionflower, poplar, quassia, red clover, turmeric, wild carrot, wild lettuce, willow and others)[1]. Theoretically excessive doses of ginger could also have interactions with bleeding conditions[1]. ***Mixed evidence:*** Inhibition of platelet aggregation was reported in a single case where presumably large quantities of marmalade with 15% raw ginger were consumed[10]. Platelet function returned to normal once the ginger was discontinued[10]. In a randomized multiple crossover study, 9 healthy men and 9 healthy women ate vanilla pudding containing 15g of Brazilian ginger root, 40g of stem ginger or placebo QD x 14days[10]. Venous blood samples were taken on days 12 and 14[10]. The investigators found no significant change in platelet thromboxane B_2 production with gingerroot or stem ginger compared to placebo[10]. In a randomized, double blind crossover study of 8 men using a single dose dried ginger 2g; no significant effect on platelet function was discovered via analysis of blood samples[10]. In another study, 7 women ingested 5g of raw fresh ginger daily x7days; no difference in thromboxane activity from baseline was observed[10].

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GI effects:
There have been some examples of ginger rhizome increasing stomach acid[1]. As a result, it is thought that it could interfere with antacids, sucralfate, H-2 antagonists or PPIs[1]. Ginger also has the potential to worsen gallstone symptoms[1].

Sedative potential:
Because of ginger's use as a sedative, it could potentially enhance barbituate effects[1].

Cardiovascular altering potential:
Hypertensive or hypotensive effects of ginger might interfere with antihypertensive therapy[1]. Ginger's inotropic effects might interfere with cardiac drug therapy[1]. Theoretically excessive doses of ginger could also have interactions with heart conditions, high BP, or low BP[1].

Hypoglycemic potential:
Ginger might interfere with diabetes therapy due to hypoglycemic effects[1]. Theoretically excessive doses of ginger could also have interactions with diabetes[1].

Other Safety Issues

Pregnancy: It is likely safe for women to use ginger in amounts found in food. It is possibly *unsafe* for women when ginger is used orally for medicinal purposes[1]. The issue is controversial because there has not been conclusive evidence that ginger is harmful during pregnancy[1]. However, it is advised that the medicinal use of ginger should be avoided during pregnancy until more data is available[1]. Some women have used ginger for morning sickness with no apparent harm[1]. There has also been a case report of a spontaneous abortion in the 12th week of pregnancy in a patient taking ginger for morning sickness[1]. It was unclear if ginger was the causative agent[1]. Additionally, there is some evidence that high dose 6-gingerol could be mutagenic, but this outcome has not been confirmed in humans[1].

Lactation: Insufficient reliable information available. It is advised to avoid using amounts of ginger greater than those found in foods[1].

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Other Comments

The whole ginger root may not have the same actions as its isolated constituents. For example, the whole root does not seem to have antipyretic, anti-inflammatory or mutagenic properties[1].

Ginger naturally grows in Jamaica, India and China[3]. The rhizome (root) is usually the most valued part of the plant[3].

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