Ginger

Zingiber officinale Roscoe

[Fam. *Zingiberaceae*]

Overview

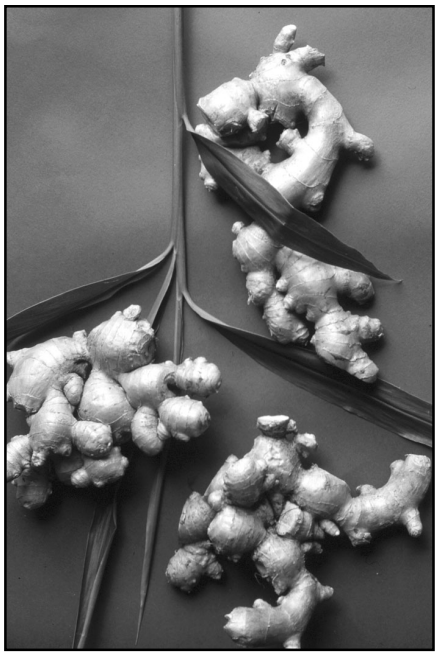
Ginger has been used for millennia as a common spice, food, and medicine, and has been mentioned in ancient Indian, Chinese, and Greco-Roman medical texts. Ginger dietary supplements have become increasingly popular in the past decade to help allay nausea associated with motion sickness. Ginger is used frequently as an alternative to antihistamines and anticholinergics, and as a prophylactic for motion sickness when side effects from pharmaceuticals warrant them unsuitable or intolerable for use. Ginger has also been investigated as an antiemetic for postoperative nausea and nausea induced by chemotherapy.

Primary Uses

- Motion sickness

Other Potential Uses

- Hyperemesis gravidarum
- Chemotherapy-induced nausea
- Morning sickness
- Nausea, postoperative
- Osteoarthritis



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Pharmacological Actions

Antiemetic; antiplatelet aggregation; anti-inflammatory.

Dosage and Administration

For motion sickness, take every 4 hours as needed.

FRESH OR DRIED RHIZOME: 2–4 g daily.

POWDERED DRY EXTRACT: 500 mg, 30 minutes before travel, and then 500 mg every 4 hours until end of travel.

INFUSION OR DECOCTION: 0.25–1.0 g in 150 ml boiled water, up to 3 times daily.

FLUID EXTRACT: 0.25–1.0 ml, 3 times daily [1:1 (*g/ml*)].

TINCTURE: 1.25–5.0 ml, 3 times daily [1:5 (*g/ml*)].

Contraindications

Patients with gallstones should consult a healthcare provider before using ginger.

PREGNANCY AND LACTATION: Fresh ginger is safe when used appropriately. It has traditionally been used to prevent morning sickness during the first trimester. Caution is advised against using excessive dosages of dried ginger during pregnancy.

Adverse Effects

None known.

Drug Interactions

None known. Reports of interaction with warfarin are anecdotal and not substantiated by documented case reports. Nevertheless, the narrow therapeutic index of warfarin warrants the cautious use of ginger in conjunction with it. Ginger does not appear to affect absorption of concurrent medications.

Clinical Review

Of 21 studies that included a total of 2,669 participants, all but four of the trials showed positive effects for indications including motion sickness, postoperative nausea, cardiovascular conditions, and osteoarthritis. Nine of the studies are randomized, double-blind, and placebo-controlled (R, DB, PC); two of these studies concluded that ginger significantly reduces the incidence of motion sickness. One study found that two grams of ginger does not significantly change bleeding time, platelet count, or platelet aggregation. Two studies demonstrated that ginger is as effective as metoclopramide in reducing post-operative nausea. Two trials resulted in no significant reduction in post-operative nausea. Two demonstrated some effect from ginger in the treatment of osteoarthritis. Three R, DB, comparison trials were conducted on a total of 1,577 participants: all found that a standardized ginger preparation is equally or more effective than dimenhydrinate (Dramamine®), with better tolerability and fewer side effects, as a prophylaxis for motion sickness. One R, DB, cross-over trial found that ginger diminishes or eliminates symptoms of hyperemesis gravidarum, a severe form of

morning sickness during pregnancy, while another R, DB, PC study suggested the safety and efficacy of ginger in reducing nausea during the first trimester of pregnancy. An early R, PC, single-blind, comparison study showed ginger to be superior to both placebo and dimenhydrinate (Dramamine®) in preventing motion sickness in patients with nausea induced in a tilted, rotating chair. A recent meta-analysis of six R, DB, PC studies concluded that ginger is a "promising antiemetic herbal remedy, but the clinical data to date are insufficient to draw firm conclusions."

Ginger

Zingiber officinale Roscoe
[Fam. *Zingiberaceae*]

Overview

Ginger has been used for millennia as a common spice, food, and medicine and is mentioned in the medical texts of Indian, Chinese, and Greco-Roman traditions. Ginger dietary supplements have become increasingly popular in the past decade and are used to help calm the nausea associated with motion sickness. China and India have cultivated ginger since ancient times and remain the world's leading producers.

Uses

Motion sickness; morning sickness associated with pregnancy; hyperemesis gravidarum (excessive vomiting associated with pregnancy); chemotherapy-induced nausea; nausea after surgery; osteoarthritis.

Dosage

For motion sickness, take every 4 hours as needed.

FRESH OR DRIED GINGER: 2–4 g daily.

POWDERED DRY EXTRACT: 500 mg, 30 minutes before travel, and then 500 mg every 4 hours until end of travel.

INFUSION OR DECOCTION: 0.25–1.0 g in 150 ml boiled water, up to 3 times daily.

FLUID EXTRACT: 0.25–1.0 ml, 3 times daily [1:1 (*g/ml*)].

TINCTURE: 1.25–5.0 ml, 3 times daily [1:5 (*g/ml*)].

Contraindications

Consult a healthcare provider before using ginger in cases of gallstones or gall bladder diseases.

PREGNANCY AND LACTATION: Fresh ginger is safe when used in moderation. Women have used ginger to prevent or treat morning sickness during the first trimester. However, pregnant women should use caution in taking excessive daily dosages of more than two grams of dried ginger and should consult their healthcare provider regarding the use of ginger or any dietary supplements during pregnancy or while nursing.

Adverse Effects

Fresh and raw ginger in its natural form are not known to cause adverse side effects.

Drug Interactions

There are no known drug interactions. According to anecdotal reports, ginger may interact with the blood-thinning drug warfarin (Coumadin®, Sofarin), but this has not been scientifically proven. Nevertheless, caution should be used when taking warfarin and ginger simultaneously. Ginger does not seem to affect the absorption of other drugs when taken at the same time.

Comments

When using a dietary supplement, purchase it from a reliable source. For best results, use the same brand of product throughout the period of use. As with all medications and dietary supplements, please inform your healthcare provider of all herbs and medications you are taking. Interactions may occur between medications and herbs or even among different herbs when taken at the same time. Treat your herbal supplement with care by taking it as directed, storing it as advised on the label, and keeping it out of the reach of children and pets. Consult your healthcare provider with any questions.

AMERICAN BOTANICAL COUNCIL

Ginger

Zingiber officinale Roscoe

[Fam. *Zingiberaceae*]

Overview

Ginger has been used for millennia as a common spice, food, and medicine; and was described in ancient Indian, Chinese, and Greco-Roman medical texts (Langner *et al.*, 1998). Ginger dietary supplements have become increasingly popular in the past decade to help allay nausea associated with motion sickness. In 2000, ginger sales ranked 17th of all herbal supplements sold in U.S. mainstream retail stores (Blumenthal, 2001). Ginger is frequently used as an alternative to antihistamines and anticholinergics, and as a prophylactic for motion sickness when side effects from pharmaceuticals warrant them unsuitable or intolerable for use (Robbers and Tyler, 2000). Ginger has also been investigated as an antiemetic for postoperative nausea and nausea induced by chemotherapy (Arfeen *et al.*, 1995; Meyer *et al.*, 1995). China and India have cultivated ginger since antiquity and remain the world's leading producers of ginger (Blumenthal *et al.*, 2000; USP, 1998).

Description

Ginger preparations consist of the peeled, finger-long, fresh or dried rhizome of *Zingiber officinale* Roscoe [Fam. *Zingiberaceae*] (Blumenthal *et al.*, 2000). Preparations include decoctions and infusions (teas), powdered ginger capsules, liquid extracts, tinctures, and candies made from ginger syrup or crystallized ginger (Blumenthal *et al.*, 2000). Some ginger products are standardized to 0.8% essential oils (McCaleb *et al.*, 2000).

Primary Uses

Gastrointestinal

- Motion sickness (Careddu *et al.,* 1999; Riebenfeld and Borzone, 1999; Schmid *et al.,* 1994; Grøntved *et al.,* 1988; Grøntved and Hentzer, 1986; Mowrey and Clayson, 1982)

Other Potential Uses

- Hyperemesis gravidarum (Fischer-Rasmussen *et al.*, 1990)
- Chemotherapy-induced nausea (Meyer *et al.,* 1995)
- Morning sickness (Vutyavanich *et al.,* 2001)
- Nausea, postoperative (Bone *et al.,* 1990; Phillips *et al.,* 1993)
- Osteoarthritis (Altman and Marcussen, 2001; Bliddal *et al.*, 2000)

Dosage

Internal

Crude Preparations

FRESH OR DRIED RHIZOME: 2–4 g daily (Blumenthal *et al.*, 1998).

POWDERED DRY EXTRACT: 500 mg, 30 minutes before travel, and then 500 mg every 4 hours until end of travel (Riebenfeld and Borzone, 1999; Tenne, 1999).

INFUSION OR DECOCTION: 0.25–1.0 g in 150 ml boiled water, up to 3 times daily.

FLUID EXTRACT: 1:1 (*g/ml*), 0.25–1.0 ml 3 times daily (Blumenthal *et al.*, 1998).

TINCTURE: 1:5 (*g/ml*), 1.25–5.0 ml 3 times daily.

Duration of Administration

Internal

For motion sickness, at least 30 minutes before travel and every 4 hours as needed (Tenne, 1999).

Chemistry

Ginger rhizome contains 4.0–10.0% oleoresin composed of nonvolatile, pungent principles (phenols such as gingerols and their related dehydration products, shogaols); nonpungent fats and waxes; 1.0–3.3% volatile oils, of which 30–70% are sesquiterpenes, mainly β-bisaolene, (-)zingiberene, β-sesquiphellandrene, and (+)arcurcumene; monoterpenes, mainly geranial and neral; 40–60% carbohydrates, mainly starch; 9–10% proteins and free amino acids; 6–10% lipids composed of triglycerides, phosphatidic acid, lecithins, and free fatty acids; vitamin A; niacin; and minerals (BHP, 1996).

Pharmacological Actions

Crude Preparations

Human

Antiemetic (Grøntved and Hentzer, 1986; Grøntved *et al.,* 1988; Mowrey and Clayson, 1982; Fischer-Rasmussen *et al.*, 1990; Bone *et al.*, 1990; Phillips *et al.,* 1993; Meyer *et al.,* 1995); antiplatelet aggregation (Bordia *et al.*, 1997; Verma *et al.,* 1993; Srivastava, 1989).

Animal

Antiemetic (Chang and But, 1987); reduces chemotherapy-induced vomiting in dogs (Sharma *et al.*, 1997); enhances bile secretion; works as an antiulcer agent; enhances gastrointestinal motility; suppresses gastric contraction (Yamahara *et al.,* 1990); strengthens cardiac muscle (Shoji *et al.,* 1982); inhibits cholesterol synthesis (Tanabe *et al.*, 1993).

In vitro

Antiplatelet aggregation (Bordia *et al.*, 1997; Surh *et al.*, 1998); stimulates calcium uptake in skeletal and cardiac muscles (Kobayashi *et al.*, 1987); antibacterial (Mascolo *et al.*, 1989); antifungal (Endo *et al.*, 1990); antirhinoviral (Denyer *et al.*, 1994); anti-schistosomal (Adewunmi *et al.*, 1990); antioxidant (Cao *et al.*, 1993; Zhou and Xu, 1992); anti-atherosclerotic (Fuhrman *et al.*, 2000); anti-inflammatory (Surh *et al.*, 1998); chemopreventative (Surh *et al.*, 1998).

Standardized Preparations

Human

Antiemetic (Careddu *et al.*, 1999; Riebenfeld *et al.,* 1999; Schmid *et al.,* 1994); anti-inflammatory (Srivastava, 1989; Bliddel *et al.*, 2000).

Mechanism of Action

- Acts directly at the gastric level and not on the central nervous system for anti-nausea effect (Holtman *et al.*, 1989).
- Increases gastrointestinal motility, but does not seem to influence gastric emptying rate (Philips *et al.*, 1993; Meyer *et al.*, 1995).
- Reduces stimuli in gastrointestinal tract by absorbent property, blocking nausea feedback loop between brain stem and tract (Mowrey and Clayson, 1982).
- Inhibits cyclo-oxygenase and lipo-oxygenase pathways, inhibiting both prostaglandin and leukotriene synthesis (Verma *et al.,* 1993; Srivastava and Mustafa, 1992; Srivastava, 1989).
- Inhibits thromboxane synthetase; inhibits conversion of arachidonic acid (AA) to thromboxane (TXA2); decreases platelet aggregation (Bordia *et al.,* 1997; Verma *et al.,* 1993; Backon, 1991). Ginger's effect on thromboxane synthetase activity is dose dependent, or occurs with fresh ginger only. Up to 2 g of dried ginger is unlikely to cause platelet dysfunction when used therapeutically (Lumb, 1994).
- Inhibits prostaglandin PGE2 and leukotriene LTB4 synthesis, producing an anti-inflammatory effect (Kiuchi *et al.,* 1992; Srivastava and Mustafa, 1992; Srivastava, 1989).

Contraindications

According to the German Commission E, patients with gallstones should consult a healthcare provider before use (Blumenthal *et al.,* 1998).

Pregnancy and Lactation: A recent clinical trial reported no adverse effects of ginger use in pregnancy (Vutyavanich *et al.*, 2001). However, the Commission E previously contraindicated ginger during pregnancy based on *in vitro* research on single compounds from ginger (Blumenthal *et al.,* 1998); and the American Herbal Products Association advised against its therapeutic use during pregnancy (McGuffin *et al.,* 1997), based in part on the Commission E contraindication, but there is little clinical evidence to support these precautions when used in normal doses.

Adverse Effects

None known (Blumenthal *et al.,* 1998).

Drug Interactions

None known (Blumenthal *et al.,* 1998). Reports of interaction with warfarin are anecdotal and speculative and not substantiated by documented case reports (Heck *et al.,* 2000). Nevertheless, the narrow therapeutic index of warfarin warrants the cautious use of ginger in conjunction with warfarin. Ginger does not appear to affect absorption of concomittant medications (Philips *et al.*, 1993; Meyer *et al.*, 1995).

American Herbal Products Association (AHPA) Safety Rating

Fresh root

Class 1: Can be safely consumed when used appropriately.

Dried root

Class 2b: Not to be used during pregnancy based on *in vitro* research and cautions from Chinese texts related to excessive use of dried ginger. See Contraindications/Pregnancy and Lactation Section.

Class 2d: Persons with gallstones should consult a practitioner prior to use.

Note: The classifications and concerns for this herb are based upon therapeutic use and may not be relevant to its consumption as a spice (McGuffin *et al.*, 1997).

Regulatory Status

Austria: Dried rhizome official in the *Austrian Pharmacopoeia*, ÖAB (Meyer-Buchtela, 1999; Wichtl, 1997).

Australia: Ginger is permitted as an active ingredient in listable Therapeutic Goods. High single dose of crude ginger (2 g and above) and/or highly concentrated extracts (25:1 or higher) are subject to required label warnings (TGA, 2000).

Belgium: Traditional Herbal Medicine (THM) accepted for specific indication as digestive aid (Bradley, 1992).

Canada: Food, Drug, or New Drug depending on label claim statements (HPB, 1993). When labeled as a Traditional Herbal Medicine (THM) or as a homeopathic drug, ginger is regulated as a non-prescription drug requiring pre-market registration and assignment of a Drug Identification Number (DIN) (Health Canada, 1995, 2001).

China: Dried ginger, fresh ginger, ginger tincture, and ginger fluid extract are all official preparations of the *Pharmacopoeia of the People's Republic of China* (PPRC, 1997).

European Union: Dried rhizome official in the *European Pharmacopoeia,* Third edition, Supplement 2001 (Ph.Eur., 2001).

France: Food. No monograph in the *French Pharmacopoeia*.

Germany: Dried rhizome, for preparation as tea or other equivalent galenical dosage forms, is an approved nonprescription drug of the German Commission E monographs (Blumenthal *et al.*, 1998). Dried rhizome is official in the *German Drug Codex* (DAC, 1993) and in the *German Pharmacopoeia* (DAB, 1999). The dried rhizome, for preparation of alcoholic mother tincture and liquid dilutions, is official in the *German Homoeopathic Pharmacopoeia* (GHP, 1993).

India: Dried rhizome official in the Government of India *Ayurvedic Pharmacopoeia* of India, First edition, volume I (API I,

1989) and fresh rhizome official in API, First edition, volume II (API II, 1999). Dried rhizome also occurs in the *Indian Herbal Pharmacopoeia* (IHP II, 1999).

JAPAN: Dried rhizome and powdered dried rhizome official in *Pharmacopoeia of Japan* (JSHM, 1993).

SWEDEN: Classified as foodstuff. As of January 2001, no ginger products are listed in the Medical Products Agency (MPA) "Authorised Natural Remedies" (MPA, 2001).

SWITZERLAND: Dried rhizome official in the *Swiss Pharmacopoeia*, Ph.Helv. (Meyer-Buchtela, 1999; Wichtl, 1997). Dried powdered rhizome in capsule has positive classification (List D) by the *Interkantonale Konstrollstelle für Heilmittel* (IKS) and corresponding sales category D with sale limited to pharmacies and drugstores, without prescription (Morant and Ruppanner, 2001).

U.K.: Herbal medicine on *General Sale List*, Schedule 1, Table A (Bradley, 1992). Dried rhizome official in the *British Pharmacopoeia*, BP 1993 (ESCOP, 1996; Newall *et al.*, 1996). Strong Ginger Tincture and Weak Ginger Tincture official preparations of the *British Pharmacopoeia* (BP, 1980).

U.S.: Generally recognized as safe (GRAS) (US FDA, 1998). Dietary supplement (USC, 1994). Dried rhizome and powdered dried rhizome official in the *United States National Formulary,* 19th edition (USP, 2002).

Clinical Review

Twenty-one studies (2,669 total participants) are outlined in the following table, "Clinical Studies on Ginger." All but four (Bliddal *et al.*, 2000; Janssen *et al.*, 1996; Arfeen *et al.*, 1995; Vislyaputra *et al.*, 1998) demonstrated positive effects for indications including motion sickness, postoperative nausea, cardiovascular conditions, and osteoarthritis. Nine of the studies were randomized, double-blind, and placebo-controlled (R, DB,PC); two of these (Grøntved *et al.*, 1986 and 1988) concluded that ginger significantly reduced the incidence of motion sickness. One study (Lumb, 1994) found that 2 g of ginger did not significantly change bleeding time, platelet count, or platelet aggregation. Two studies demonstrated that ginger was as effective as metoclopramide in reducing postoperative nausea (Bone *et al.*, 1990; Phillips *et al.*, 1993). Two trials resulted in no significant reduction in postoperative nausea (Vislyaputra *et al.*, 1998; Arfeen *et al.*, 1995). Two studies demonstrated some effect from ginger in the treatment of osteoarthritis (Altman and Mercussen, 2001; Bliddel *et al.*, 2000). Three R, DB, comparison (Cm) trials (1,577 participants), found that Zintona® (standardized ginger preparation) was equally or more effective than dimenhydrinate (Dramamine®), with better tolerability and fewer side effects as a prophylaxis for motion sickness (Careddu *et al.*, 1999; Riebenfeld and Borzone, 1999; Schmid *et al.*, 1994). One R, DB, crossover trial (Fischer-Rasmussen *et al.*, 1990) found ginger diminished or eliminated symptoms of hyperemesis gravidarum, a severe form of morning sickness during pregnancy; and a recent R, DB, PC trial showed that ginger reduced nausea in pregnant women during the first trimester with no adverse effects on birth rates or newborns (Vutyavanich *et al.,* 2001). An early R, PC, single-blind, Cm study (Mowrey and Clayson, 1982) showed ginger to be superior to both placebo and dimenhydrinate in preventing motion sickness in patients with nausea induced in a tilted, rotating chair. A recent meta-analysis of six R, DB, PC studies concluded that ginger is a "promising antiemetic herbal remedy, but the clinical data to date are insufficient to draw firm conclusions" (Ernst and Pittler, 2000).

Branded Products*

Blackmores custom powdered ginger capsules: Blackmores Ltd. / 23 Roseberry Street / Balgowlah / NSW 2093 / Australia / Tel: +61-29-95-1011-1 / Fax: +61-29-94-9195-4 / www.blackmores.com. Capsules contain 500 mg of ginger powder BP 1988 custom made according to standards of the *British Pharmacopoeia* of 1988.

EV. EXT 33: Ferrosan A/S / Sydmarken 5 / 2860 Soeborg / Denmark / Tel: +45-3969-2111 / Fax: +45-3969-6518 / www.ferrosan.com. Chinese ginger standardized to hydroxymethoxy phenyl compounds (HMP) formulated in soft gelatin capsules.

EV. EXT 77: Ferrosan A/S. Each capsule contains 255 mg extract from 2,500–4,000 mg dried ginger rhizomes and 500–1,500 mg dried galanga [*Alpinia galanga*] rhizomes.

Martindale powdered ginger capsules: Martindale Pharmaceuticals Pty. Ltd. / Hubert Road / Brentwood / Essex / CM14 4LZ / U.K. / Tel: +44-01-27-72-6660-0 / Fax: +44-01-27-78-4897-6 / Email: mail@martindalepharma.co.uk / www.martindalepharma.co.uk. Capsules contain 500 mg powdered ginger rhizome.

Zintona®: Dalidar Pharma c/o BioDar Ltd. / Yavne Technology Park / P.O. Box 344 / Yavne 81103 / Israel / Tel: +972-08-942-0930 / Fax: +972-08-942-0928 / Email: dalidar@dalidar.com / www.dalidar.com. Ginger powder standardized to min. 1.4% volatile oils and min. 2.0 mg gingerols and shogaols in a capsule containing 250 ginger material. (As per 7th Supplement, USP-NF 18).

*American equivalents, if any, are found in the Product Table beginning on page 398.

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Clinical Studies on Ginger (*Zingiber officinale* Roscoe)

Kinetosis (Motion Sickness)

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Careddu *et al*., 1999	Children with history of motion sickness	R, DB, Cm n=28 (ages 4–8 years)	2 days	Ages 3–6 years: 250 mg 1/2 hour before trip, followed by 250 mg every 4 hours as necessary; 6 years and older: 500 mg using above formula; or 1/2–1 capsule (12.5–25mg) dimenhydrinate 1/2 hour before the trip and if necessary 1 capsule every 4 hours	Zintona® vs. dimenhydrinate	Significantly better therapeutic effectiveness in ginger-treated group than dimenhydrinate-treated group. Physician ratings reported good results in 100% of subjects taking ginger, and 31% of subjects taking dimenhydrinate. Ginger reduced symptoms within 30 minutes, and this difference was highly significant ($p< 0.0001$). None of the children taking ginger had any adverse side effects, while 69% of cases in the dimenhydrinate group had adverse effects from the drug, and this difference was also highly significant ($p< 0.0001$).
Riebenfeld and Borzone, 1999	Sea sickness in passengers on a cruise ship	R, DB, Cm n=60 (ages 10–77 years; mean age 31 years)	7 months	500 mg, 1/2 hour before embarkation, followed by 500 mg every 4 hours over a 48-hour period, or 100 mg of dimenhydrinate, 1/2 hour before embarkation followed by 100 mg every 4 hours over a 48-hour period	Zintona® vs dimenhydrinate	Significantly improved total motion sickness score ($p<0.005$). Ginger is as effective as dimenhydrinate for treatment of motion sickness, with greater tolerability and lower incidence (13.3% vs. 40%) of side effects ($p<0.001$).
Schmid *et al*., 1994	Sea sickness in tourists on a whale-watching safari	R, DB, Cm n=1,489 (ages 16–65 years)	3 months	Group 1: 500 mg, 2 hours prior to departure, 500 mg, during trip, if needed. Group 2: 500 mg, after dinner on evening before trip, 500 mg, 2 hours prior to departure	Zintona®	Ginger showed equal potency to 7 common pharmaceutical drugs for sea sickness, and better effectiveness than scopolamine transdermal patch ($p=0.14$). As neither clinically relevant nor significant differences were found between products used, personal preference should be followed as to the medication taken as prophylaxis for seasickness.

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Clinical Studies on Ginger (*Zingiber officinale* Roscoe) (cont.)

Kinetosis (Motion Sickness) (cont.)

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Stewart *et al.*, 1991	Motion sickness and gastric function	PC, Cm Phase 1 motion sickness, n=8; Phase 2 motion sickness, n=8; Phase 3 motion sickness, n=4; Phase 4 gastric function, n=8	14 hours	Phase 1: 500 mg or 1,000 mg ground ginger root or 0.6 mg scopolamine HBr or placebo on separate test days; Phase 2 One 1,000 mg fresh ginger root capsule or placebo Phase 3: 940 mg ground ginger or placbo Phase 4: Two, 250 mg capsules ginger or placebo	Phase 1: ground ginger root Phase 2: fresh ginger (capsules prepared by researchers) Phase 3: ground ginger Phase 4: 250 mg of ginger capsules	Powdered ginger partially inhibited tachygastria but did not enhance the EGG amplitude. Did not significantly alter gastric function during motion sickness or possess antimotion sickness activity.
Grøntved *et al.*, 1988	Seasickness in naval cadets unaccustomed to sailing	R, DB, PC n=80 (median age 17 years)	4 hours	1 g	Powdered ginger capsules (brand not stated) vs. placebo	Ginger significantly reduced tendency to vomit and experience cold sweats ($p<0.05$). No side effects reported in both groups.
Grøntved and Hentzer, 1986	Vertigo and nystagmus (healthy volunteers who received caloric stimulation of the vestibular system)	R, DB, CO, PC n=48	6 days	1 g/day	Powdered ginger capsules (brand not stated)	Ginger significantly reduced the induced vertigo better than placebo ($p<0.05$). No statistically significant action upon the duration or maximum slow phase velocity of nystagmus.
Mowrey and Clayson, 1982	Motion sickness produced by a motor driven, tilted, revolving chair	R, Cm, PC, SB n=36 volunteer subjects with self-rated extreme or very high susceptibility to motion sickness (ages 18–20 years)	31 minutes	Single dose of 2 capsules (940 mg total)	Powdered ginger capsules (brand not stated)	Ginger is superior to both placebo and dimenhydrinate ($p<0.05$) in preventing the gastrointestinal symptoms of experimentally-induced motion sickness in highly susceptible individuals.

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Clinical Studies on Ginger (*Zingiber officinale* Roscoe) (cont.)

Nausea During Pregnancy

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Vutyavanich *et al*., 2001	Hypermesis gravidarum (women with nausea and vomiting in early pregnancy)	R, DB, PC n=70	7 days	One, 250 mg capsule 4x/day	Fresh, baked ginger root ground into powder (prepared by researchers)	Significant median change in nausea scores with ginger post-therapy (p=0.014). Significant reduction in nausea scores with ginger on day 4 of only treatment (p=0.0348). Significant improvement in patients' subjective response with ginger (p<0.001). No adverse effect with ginger on pregnancy outcomes.
Fischer-Rasmussen *et al*., 1990	Hyperemesis gravidarum	R, DB, CO n=30 pregnant women admitted to hospital before 20 weeks of gestation with symptoms 2x/day (ages 18–39 years)	4 days	One, 250 mg capsule 4x/day	Powdered ginger capsules (brand not stated)	Ginger diminished or eliminated symptoms of hyperemesis gravidarum. Statistically significant preference for ginger. Reduced degree of nausea and number of attacks of vomiting. No side effects observed.

Postoperative Nausea

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Vislyaputra *et al*., 1998	Gynecological diagnostic laparoscopy	R, DB, PC, Cm n=120 (ages 20–40 years)	24 hours	Four, 500 mg capsules ginger, or 1.25 mg droperidol, or placebo	Powdered ginger capsules (prepared by researchers) vs. placebo vs. droperidol IV	No significant reduction in incidence of postoperative nausea and vomiting. Severity of nausea and frequency of vomiting within 24 hours were not statistically different with ginger root capsules or the combination of ginger root and droperidol.
Arfeen *et al*., 1995	Day case gynecological laparoscopy	R, DB, PC n=108 (ages 18–75 years)	3 hours	One-time dose before surgery of 10 mg diazepam (orally) plus either 1–2 capsules (500 mg ea.) powdered ginger or placebo	Blackmores Ltd. BP 1988 custom powdered ginger capsules vs. placebo	Ginger in doses of 0.5 or 1.0 g given with oral diazepam premedication one hour prior to surgery was found ineffective in reducing the incidence of postoperative nausea and vomiting. Incidence of nausea and vomiting increased slightly, but insignificantly (nausea, p=0.2; vomiting, p=0.15), with increasing dose of ginger.
Phillips *et al*., 1993	Day case gynecological laparoscopy	R, P, DB, PC, Cm n=120 (ages >16 years)	24 hours	Two, 500 mg capsules ginger, or 10 mg metoclopramide	Martindale Pharmaceuticals powdered ginger capsules vs. placebo vs. metoclopramide	Ginger similarily reduced incidence of nausea and vomiting as metoclopramide. Oral administration of 1 g of ginger reduced incidence of nausea and vomiting by 50% and appears to be as effective as metoclopramide, 10 mg when given by mouth one hour before anesthesia. Ginger is an effective and promising prophylactic antiemetic without toxic effects, which may be especially useful in day case surgery.
Bone *et al*., 1990	Major gynecological surgery	R, DB, PC, Cm n=60 (ages 16–65 years)	24 hours	0.5 g ginger or 10 mg metoclopramide injection or placebo	Powdered ginger capsules (brand not stated) vs. placebo vs. metoclopramide	Statistically fewer recorded incidences of nausea for ginger compared with placebo (p<0.05). Numbers of incidences of nausea in ginger vs. metoclopramide groups were similar.

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Clinical Studies on Ginger (*Zingiber officinale* Roscoe) (cont.)

Cardiovascular

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Bordia *et al.*, 1997	Platelet aggregation in patients with coronary artery disease with history of myocardial infarcation (76 months)	PC n=60	3 months	4 g ginger daily for 3 months or single dose of 10 g ginger vs. 5 g (2 x 2.5 g) fenugreek daily for 3 months vs. placebo	Powdered ginger capsules (prepared by researchers) vs. fenugreek vs. placebo	Powdered ginger in dose of 4 g/day did not affect ADP and epinephrine-induced platelet aggregation. However, single dose of 10 g powdered ginger after 4 hours produced a significant reduction in platelet aggregation ($p<0.05$).
Janssen *et al.*, 1996	Platelet thromboxane production	R, PC, multiple CO n=18 healthy volunteers (mean age 22 years)	3 x 2 weeks	15 g daily raw ginger root vs. 40 g daily stem ginger	Vanilla custard with either 15 g raw ginger root or 40 g stem ginger	Daily treatment with either 15 g ginger root or 40 g stem ginger mixed in custard for 14 days did not affect maximum *ex vivo* platelet thromboxane B2 production ($p=0.616$).
Lumb, 1994	Platelet function	R, DB, PC, CO n=8 healthy male volunteers	24 hours	Single dose of 4 capsules (2 g total) dried ginger powder	Dried ginger power (capsules prepared by researchers)	No significant differences in bleeding time, platelet count, or platelet aggregation. 2 g dried ginger unlikely to cause platelet dysfunction when used therapeutically.
Verma *et al.*, 1993	Platelet aggregation induced by fatty diet (fed 100 g butter x 7 days)	R, PC n=20 healthy males (ages 30–50 years)	1 week	Four, 625 mg capsules 2x/day with meals	Powdered ginger capsules, 625 mg (prepared by researchers)	Ginger significantly decreased platelet aggregation ($p<0.001$) when taken with fatty meals. Serum cholesterol and triglyceride levels remained unchanged from ginger.
Srivastava, 1989	Thromboxane synthesis	CC, Cm n=12	1 week	5 g/day	Raw fresh ginger	Ginger inhibited eicosanoid biosynthesis. Ginger consumption produced 37% inhibition ($p<0.1$) on TxB2 production in serum.

Other

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Altman and Marcussen, 2001	Osteoarthritis (OA) of the knee	R, DB, PC, MC, PG n=247 men and women with OA of the knee (ages ≥ 18 years)	6 weeks preceeded by 1 week washout period	One, 255 mg capsule 2x/day or placebo	EV. EXT 77, (each capsule contains 255 mg extract from 2,500– 4,000 mg dried ginger and 500–1,500 mg dried galanga [*Alpinia galanga*] rhizomes) or placebo	Ginger extract produced greater reduction in the primary efficacy variable, knee pain on standing, compared with placebo (63% vs. 50%; p= 0.048). Ginger extract also produced a greater response in the secondary efficacy variables compared with placebo, when analyzing mean values: reduction in knee pain after walking 50 ft (15.1 mm vs. 8.7 mm on a visual analog scale; p=0.016), reduction in the Western Ontario and McMaster Universities OA composite index (12.9 mm vs. 9.0 mm on a visual analog scale; p=0.087). The researchers concluded that this highly purified and standardized ginger extract statistically significantly reduced symptoms of OA of the knee. The ginger extract had a moderate effect and a good safety profile with usually mild g.i. adverse events in 59 patients (45%) in the ginger group compared to 21 (16%) in placebo group. An accompanying editorial noted possible lack of effective blinding (ginger patients were told of ginger's pungent taste), although the trial was otherwise well designed; nevertheless, the editorial notes ginger's beneficial effects were "small and inconsistent."
Bliddal *et al.*, 2000	Osteoarthritis	R, PC, DB, CO, Cm n=56 (mean age 66 years)	10 weeks	170 mg ginger extract 2x/day or 400 mg ibuprofen 2x/day	EV. EXT 33 (ginger extract) vs. ibuprofen vs. placebo	Statistically significant effect demonstrated by explorative statistical methods in the first period of treatment before cross-over, but not following crossover periods. Caution should be observed in the interpretation of a cross-over study of ginger extract. The study concluded that 400 mg/day ibuprofen found to be more efficacious on pain level and function than 170 mg ginger ($p<0.0001$). The 3-week period of therapy and the single dosage level of ginger used may have been insufficient to discover all of ginger's effects.

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Clinical Studies on Ginger (*Zingiber officinale* Roscoe) (cont.)

Other (cont.)

Author/Year	Subject	Design	Duration	Dosage	Preparation	Results/Conclusion
Meyer *et al*., 1995	Extra-corporeal chemotherapy (photo-pheresis) nausea associated with oral psoralen (8-MOP) therapy	O, Cm n=11	Not reported	Single dose of three, 530 mg capsules, 30 minutes prior to 8-MOP ingestion	Powdered ginger capsules (brand not stated)	Significantly reduced nausea induced by psoralen (8-MOP) therapy when taken 30 minutes prior to 8-MOP ingestion. Did not affect 8-MOP absorption or therapeutic effectiveness.

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