

- recommended. For Htn or antibacterial effect, 2.5 g/d or 1 clove or 300 mg of extract.
- Treatment should be evaluated over a 3- to 6-mo period to determine efficacy. To treat *M. canis*, sporotrichosis, and tinea pedis, recommended oral dosage is 2–5 mg of allicin extract; topical treatment calls for applying sliced cloves or garlic extract (ajoene) to lesion 2–3 times daily for 1–2 wk.
- Usual dosage is 300 mg of extract 2–3 times daily standardized to at least 1.3% allicin (equivalent to approx 3 g or 1 fresh clove daily).
- Moderate daily consumption has no effects on normal individuals. Effects are not seen with cooked garlic.

Assessment Points				
System	Effect	Assessment by Hx	PE	Test
CV	Reduced BP, reduced LDL cholesterol			BP, lipid profile
RESP		Halitosis, sulfuric odor		
ENDO	Hypoglycemia	Insulin, oral hypoglycemic use		Fasting blood glucose
HEME	Bleeding	Anticoagulant use, coagulopathy, dysfunctional platelets, bleeding disorders	Hematomas; poor surgical hemostasis	Prolonged PT, INR, plts, Hgb/Hct
GU		more than 5 cloves daily		
	Low dose	Enhanced peristalsis	Dyspepsia, eructation, pyrosis (heartburn), flatulence	
	Large doses	Inhibited peristalsis; possible reduction in stomach cancer	Constipation	
CNS	Spontaneous spinal epidural hematoma	Headache, paralysis	Neurologic examination	CT scan
ALLERGY/IMMUNE	Allergic reaction	Garlic oil contact dermatitis	Facial/tongue swelling	

Key References: Tsai CW, Chen HW, Sheen LY, et al.: Garlic: health benefits and actions, *BioMedicine* 2:17–29, 2012; Gardner CD, Lawson LD, Block E, et al: Effect of raw garlic vs. commercial garlic supplements on plasma lipid concentrations in adults with moderate hypercholesterolemia: a randomized clinical trial, *Arch Intern Med* 167(4):346–353, 2007.

Perioperative Implications

Perioperative Concerns/Possible Drug Interactions

- High consumption may cause significant antiplatelet activity; ASA, NSAIDs, other platelet inhibitors, thrombolytic agents, and certain herbs may cause risk of bleeding, but no clinical data are available.
- Hypoglycemia may be increased in individuals receiving antidiabetic agents.
- Garlic can interfere with oral contraceptives.
- Garlic is not recommended for individuals with thyroid disease.

Monitoring

- Preop PT (INR), blood glucose levels

Airway

- Malodorous breath and skin

Preinduction/Induction

- No special concerns

Maintenance

- Monitor blood glucose levels.

Extubation

- No special risks

Adjuvants

- No special risks

Postoperative Period

- Theoretically increased risk of bleeding and hypoglycemia

Anticipated Problems/Concerns

- Possible increased risk of bleeding and hypoglycemia
- Pts who are avid garlic consumers should not double up doses to make up for missed doses while undergoing surgery.
- If on warfarin postop, pts should be warned against heavy consumption.

Ginger (*Zingiber officinale*)

Mark R. Jones | Alan David Kaye

Uses

- Ginger ranks 18th in recent herbal supplement sales.
- Has long been used in Ayurvedic and Chinese medicine for a wide variety of conditions including arthritis, rheumatism, constipation, indigestion, nausea, vomiting, motion sickness, and diabetes mellitus.
- In vivo human studies show ginger to be effective in management of N/V postop and in association with pregnancy. Clinical research demonstrates potential effectiveness of ginger for dysmenorrhea, vertigo, morning sickness, and osteoarthritis.
- In vivo animal studies show ginger has significant anti-inflammatory, antithrombotic, hypotensive, glucose-lowering, and lipid-lowering effects.
- In vitro studies show ginger has significant antioxidant, antitumorogenic, anti-inflammatory, antiviral, and antimicrobial effects.
- Anecdotal or inconsistent evidence for ginger treatment in chemotherapy-induced nausea and vomiting, migraine headache, myalgia, and rheumatoid arthritis.

Perioperative Risks

- No toxic or unpleasant side effects reported in human studies with therapeutic doses.
- High doses may prolong bleeding time due to inhibition of thromboxane synthetase and stimulation of prostacyclin.
- High doses may lower BP.

Worry About

- Potential additive or synergistic effects with antiplatelet agents, heparin, or warfarin, which may increase bleeding risks.
- Potential hypotensive effect and additive effect with calcium channel blockers.
- Preliminary research demonstrates that ginger increases insulin levels. Therefore it could have an additive effect with any antidiabetes drugs and result in hypoglycemia (particularly important with NPO instructions).

Overview/Pharmacology

- Pungent constituents: Gingerol, shogaol, gingerdols, vanilloids, sesquiterpene, monoterpene volatile oils, and diarylheptanoids. These constituents have a variety of pharmacologic properties, including antipyretic, antitussive, anti-inflammatory, sedative, antibiotic, and weak antifungal effects.
- Plasma concentration curve is defined by a two-compartment model with a terminal half-life of 7.2 min and total body clearance of 16.8 mL/min per kg.
- 92.4% of ginger is serum-protein-bound with elimination by the liver and gut flora.

Mechanism of Action

- Anti-5-HT₃ mediates antiemetic effects.

- Direct cholinergic agonist of postsynaptic M₃ receptors and an inhibitor of presynaptic muscarinic auto-receptors. May mediate GI prokinetic effects.
- The aqueous extract of red and white ginger rhizomes displays anticholinesterase inhibitory action, thereby increasing levels of Ach in the synaptic junction, which may improve cholinergic neurotransmission.
- Cyclo-oxygenase and lipo-oxygenase inhibition: Mediates anti-inflammatory and antithrombotic effects by decreasing levels of thromboxane B₂, prostaglandin E₂, and leukotrienes.
- Inhibition of cytokine and chemokine induction in vitro: Mediates anti-inflammatory effects.
- Insulin sensitization mediates hypoglycemic and lipid-lowering effects.
- Calcium channel inhibition mediates decrease in BP and negative inotropic and chronotropic effects.
- Vanilloid mediates induction of apoptosis: antitumorogenic effects.
- Antioxidant effects may be hepatoprotective and nephroprotective.

Usual Dosage/Indications

- Dosage: The total daily dose is typically 1–4 g with an onset of antiemetic effect within 25 min and duration up to 4 h.
- Doses as high as 15 g/d well tolerated in human trials.

- Indications:
 - May be used to prevent pregnancy-associated and postop N/V.
 - Shows promise as therapy for postchemotherapy N/V.
 - May be used to alleviate dyspepsia and loss of appetite.
- May have anti-inflammatory and antithrombotic effects.
- Taken before exercise, 4 g of ginger significantly decreases muscle soreness.
- May be useful as an insulin sensitizer.
- May be useful in decreasing serum lipid and cholesterol levels.
- Recent in vivo animal studies of ginger have shown cognition-enhancing effects and a possible role in treatment of dementia.
- Contraindications: Must be used carefully in combination with antiplatelet drugs, warfarin, or heparin owing to potential for increased bleeding risks.

Assessment Points

System	Effects (Based on Animal/Human Studies)	Assessment by Hx	PE
CV	Hypotensive Augments inotropic effect by increase in Ca efflux across sarcoplasmic reticulum Large doses may lead to cardiac arrhythmias		BP/HR
GI	Increases gastric and intestinal motility as well as gastric, bile, and salivary secretions Antiemetic May be hepatoprotective		
RESP	Antitussive		
HEME	Inhibits thromboxane synthetase Acts as a prostacyclin agonist	Herb use Symptoms of bleeding Antiplatelet agents, heparin, or warfarin	
CNS	Prolongs duration of anesthesia induced by barbiturates Antipyretic through prostaglandin inhibition Large quantities may cause central nervous system depression		

Key References: Ali BH, Blunden G, Tanira MO, et al.: Some phytochemical, pharmacological and toxicological properties of ginger: a review of recent research, *Food Chem Toxicol* 46(2):409–420, 2008; Grzanna R, Lindmark L, Frondoza CG: Ginger—a herbal medicinal product with broad anti-inflammatory actions, *J Med Food* 8(2):125–132, 2005.

Perioperative Implications

Preoperative Period

- Possible interaction with antiplatelet agents or warfarin

Induction

- May potentiate barbiturates.
- May potentiate hypotension.

Postoperative Concerns

- May increase bleeding complications.

Anticipated Problems/Concerns

- May increase bleeding complications when used with antiplatelet drugs, warfarin, or heparin.

- Consider avoiding use in the presence of gallstone conditions.
- May potentiate periop hypotension.
- May cause hypoglycemia, requiring adjustment of DM medication regime.

Ginkgo biloba

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Uses

- Antioxidant and polyphenol properties.
- Improved cognitive performance in pts with Alzheimer disease, particularly short-term visual memory and speed of cognitive processing, for 6 mo to 1 y.
- Improved cognitive performance in vascular dementia and may be neuroprotective in pts with preexisting cerebral ischemia.
- Used to improve symptoms of intermittent claudication, Raynaud phenomenon, and acrocyanosis. Evidence for effectiveness is debated.
- *Ginkgo biloba* extract (GBE) used in pts with normal-tension glaucoma and those with early diabetic retinopathy, improving measures of colored vision; also possibly effective in treating age-related macular degeneration, symptoms of vertigo and other equilibrium disorders, depression, anxiety, and vitiligo.
- GBE is believed to work via the dopaminergic system, which modulates prolactin secretion. One study has shown that it enhances the copulatory behavior of male rats.

Perioperative Risks

- Increased risk of bleeding and drug interactions; therefore the ASA recommends stopping 2–3 wk prior to surgery since the half-life of a given ginkgo preparation is unknown.
- Lack of safety data in certain populations; therefore not recommended for use in pregnancy, breastfeeding, and in children <12 y of age.

- Commonly reported side effects include N/V and diarrhea, headache, and bleeding.

Worry About

- Spontaneous bleeding can occur related to the inhibition of platelet aggregation.
- Risk of bleeding is further increased if combined with antithrombotic drugs (aspirin, NSAIDs, clopidogrel, dipyridamole), anticoagulant drugs (heparin, enoxaparin), and other herbal medicines known to increase bleeding (ginger, garlic, ginseng). Recent studies show that coagulation parameters were unchanged when GBE was coadministered with warfarin.
- Can decrease the effectiveness of numerous anticonvulsants (valproate, carbamazepine, phenobarbital, primidone, gabapentin, phenytoin); also ginkgotoxin, which is contained in a far greater concentration in the seeds, can cause seizures; anecdotal reports of seizure occurring after pts with and without epilepsy Hx took ginkgo leaf; finally, ginkgo has been shown to decrease alprazolam levels by 17% when GBE 120 mg taken 2 times daily.
- May enhance the effects of MAO inhibitors (phenelzine, selegiline, tranylcypromine) and increase the risk of serotonin syndrome when taken with SSRIs.
- Interactions have also been reported with CCBs, trazodone, acetylcholinesterase inhibitors, blood glucose-lowering medications, insulin, drugs for erectile dysfunction, and thiazide diuretics.

- Animal studies have shown that GBE induces pathologic changes in liver, thyroid gland, and nose, most notably an increase in liver tumors and thyroid gland follicle cell tumors. No human studies to verify these findings.

Overview

- *Ginkgo biloba* (GBE) is one of the oldest tree species and GBE is one of the most common supplements used worldwide. Several extracts have been isolated.

Drug Class/Mechanism of Action/Usual Dose

- Active elements responsible for ginkgo's medicinal effects incl ginkgo flavone glycosides and terpene lactones, both obtained from the dry leaves.
- Extracts standardized to contain 24–27% of ginkgo flavone glycosides and 6% terpenes are commonly found in 40- to 80-mg oral capsules and recommended 3 times daily.
- Ginkgo has a wide range of properties: Antagonism of platelet activating factor, lowering of serum fibrinogen levels, stimulation of endothelium-derived relaxing factor, facilitation of prostacyclin release, and inhibition of nitric oxide.
- CNS effects are mainly attributed to ginkgo's antioxidant characteristics. By causing a decrease in superoxide release and acting as a scavenger of free radicals, ginkgo helps to prevent hypoxic damage to