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Ginger

Updated: February 10, 2024.

OVERVIEW

Introduction

Ginger (Zingiber officinale) is a commonly used spice and herbal medication that is made from the roots (tuberous rhizomes) of a creeping perennial plant native to Southeast Asia. As an herbal supplement, ginger is used predominantly for gastrointestinal upset, nausea, and vomiting. Ginger is generally recognized as safe (GRAS) and has not been linked to serum aminotransferase elevations nor to instances of clinically apparent liver injury.

Background

Ginger (Zingiber officinale) is a food, spice, and traditional botanical medication that is made from the roots (rhizomes) of a creeping perennial plant native to Southeast Asia and that is used to treat gastrointestinal upset, nausea and vomiting, dyspepsia, as well as osteoarthritis, anxiety and agitation. Ginger is rich in volatile oils (2% to 3%) such as the aryl alkanes, gingerol, shogaols, gingerdiols and diarylheptanoids, which account for its scent and flavor as well as for its biologic activity. Ginger is 50% starch by weight and is a carbohydrate food source. In animal models, ginger extracts increase the flow of saliva, bile, and gastric secretions and increases peristalsis. It also inhibits serotonin and cyclooxygenase, suggesting that it might have activity in treating anxiety and depression as well as inflammatory conditions and pain. Ginger is not formally approved as therapy for any medical condition, but is used in over-the-counter dietary supplements for many conditions including gastrointestinal complaints such as nausea and vomiting, indigestion, psychological problems such anxiety and depression, inflammatory conditions such as arthritis, and metabolic disorders such as hyperlipidemia, diabetes and glucose control. Clinical trials have suggested that ginger may have some effect on the nausea and vomiting of pregnancy, and possibly for motion sickness and nausea and vomiting caused by cancer chemotherapy. There have been many clinical trials of ginger in various conditions, but the studies were often small and poorly controlled, and usually evaluated short courses of therapy and comparing ginger to placebo rather than other agents of proven benefit. The usual dose regimen of ginger varies greatly as does the concentration and purity of the product, some preparations being raw powdered extracts and others being semi purified components (usually gingerol and shogaols). The typical dose is up to the equivalent of 1000 mg of dried powdered extract daily. Ginger has been given in various forms and concentrations from one to three times daily. Ginger is generally recognized as safe (GRAS, by the FDA definition) and has few if any adverse side effects. Most frequently mentioned adverse events are mild and transient heartburn, bloating, dyspepsia, and diarrhea or constipation. In many clinical studies the rates of adverse events in ginger treated patients were similar to the rates in placebo recipients and less than in recipients of comparator agents. Ginger has been evaluated in pregnancy associated nausea and vomiting and has not been linked to fetal toxicity or teratogenesis.

Hypersensitivity reactions have been reported but are rare and usually characterized as mild-to-moderate urticaria or rash. Anaphylaxis and Stevens Johnson syndrome have not been described with its use.

Hepatotoxicity

Ginger has been extensively evaluated in many clinical trials for various conditions, but few studies included prospective monitoring of serum aminotransferase levels or other laboratory results. While ginger has not been linked to serum enzyme elevations during therapy, few studies in humans have included routine liver tests before and during treatment. Ginger is regularly described as well tolerated and often as without side effects. In more than 100 clinical trials of ginger, there were no reports of hepatotoxicity or clinically apparent liver injury. While ginger is a commonly used botanical, it does not appear in lists of herbs known to cause liver injury or reported to pharmacovigilance registries. A single case report from Japan described an elderly lady who developed acute hepatocellular injury with jaundice after having taken a commercial botanical product said to contain ginger for two months. She recovered rapidly after the product was stopped, but its purity, other constituents, and lack of contaminants were not characterized. Thus, ginger is an unlikely cause of acute liver injury but it has not been assessed carefully or thoroughly for the possibility.

Likelihood score: E (unlikely cause of clinically apparent liver injury).

Other Names: Indian ginger, Shoga, Zingiber officinale, Zingiberis, Zinziber officinale

Drug Class: Herbal and Dietary Supplements

PRODUCT INFORMATION

REPRESENTATIVE TRADE NAMES

Ginger – Generic

DRUG CLASS

Herbal and Dietary Supplements

CHEMICAL FORMULA AND STRUCTURE

DRUG	CAS REGISTRY NUMBER	MOLECULAR FORMULA	STRUCTURE
Gingerol	23513-14-6	C17-H26-O	SID: 135049126
Shogaol	555-66-8	C17-H24-O3	SID: 134976704

ANNOTATED BIBLIOGRAPHY

References updated: 10 February 2024

Abbreviations: DSHEA, Dietary Supplement Health and Education Act; HDS, herbal and dietary supplements.

Zimmerman HJ. Unconventional drugs. Miscellaneous drugs and diagnostic chemicals. In, Zimmerman, HJ. Hepatotoxicity: the adverse effects of drugs and other chemicals on the liver. 2nd ed. Philadelphia: Lippincott,1999: pp. 731-4.

(Expert review of hepatotoxicity published in 1999; several herbal medications linked to liver injury are discussed, but ginger is not mentioned).

Seeff L, Stickel F, Navarro VJ. Hepatotoxicity of herbals and dietary supplements. In, Kaplowitz N, DeLeve LD, eds. Drug-induced liver disease. 3rd ed. Amsterdam: Elsevier, 2013, pp. 631-58.

(Review of hepatotoxicity of herbals does not mention ginger).

Ginger. PDR for Herbal Medicines. 4th ed. Montvale, New Jersey: Thomson Healthcare Inc. 2007; pp. 365-70.

(Compilation of short monographs on herbal medications and dietary supplements).

Phillips S, Ruggier R, Hutchinson SE. Zingiber officinale (ginger)—an antiemetic for day case surgery. Anaesthesia. 1993;48:715-7. PubMed PMID: 8214465.

(Among 120 patients undergoing outpatient laparoscopic gynecological surgery treated postoperatively with ginger [1 g], metoclopramide [10 mg], or placebo twice daily for 4 days, nausea and vomiting were similar between the two treatment arms and slightly lower than with placebo, while "side effects were very low and not different between groups").

Schmid R, Schick T, Steffen R, Tschopp A, Wilk T. Comparison of seven commonly used agents for prophylaxis of seasickness. J Travel Med. 1994;1:203-206. PubMed PMID: 9815340.

(Among 1489 participants in a whale watch boat trip treated with one of 7 drugs to prevent seasickness, 203 were given ginger [250 mg], slight sickness occurred in 19-27% [ginger 22%] with vomiting in 4-10% [ginger 8%]; no mention adverse events).

Ernst E, Pittler MH. Efficacy of ginger for nausea and vomiting: a systematic review of randomized clinical trials. Br J Anaesth. 2000;84:367-71. PubMed PMID: 10793599.

(A systematic review of studies of prophylaxis with ginger against nausea and vomiting, found that ginger had a beneficial effect in most studies, but did not prevent all symptoms and some trials demonstrated no effect; no mention or discussion of adverse events).

Altman RD, Marcussen KC. Effects of a ginger extract on knee pain in patients with osteoarthritis. Arthritis Rheum. 2001;44:2531-8. PubMed PMID: 11710709.

(Among 247 adults with painful knee osteoarthritis treated with an herbal preparation with ginger [Zingiber officinalis] and a related ginger [Alpinia galanga] or placebo twice daily for 6 weeks, reduction in knee pain upon standing and after walking was greater with the ginger product as were adverse event rates [59% vs 37%], discontinuations for adverse events [13% vs 6%], and gastrointestinal side effects [45% vs 16%]; ALT levels were not monitored and there were no hepatic serious adverse events).

Vutyavanich T, Kraisarin T, Ruangsri R. Ginger for nausea and vomiting in pregnancy: randomized, double-masked, placebo-controlled trial. Obstet Gynecol. 2001;97:577-82. PubMed PMID: 11275030.

(Among 70 women with nausea and vomiting of pregnancy treated with ginger [1 g] or placebo once daily for 4 days, both nausea and vomiting episodes improved more with ginger, and side effects included only mild heartburn, abdominal discomfort and headache in one patient each; no serious adverse events or mention of hepatotoxicity).

Willetts KE, Ekangaki A, Eden JA. Effect of a ginger extract on pregnancy-induced nausea: a randomised controlled trial. Aust N Z J Obstet Gynaecol. 2003;43:139-44. PubMed PMID: 14712970.

(Among 120 pregnant women with daily morning sickness treated with either ginger [1.5 g] or placebo 4 times daily for 4 days, nausea symptom scores decreased in both groups, but more with ginger while vomiting scores did not differ, and adverse events of ginger leading to discontinuation included heartburn in 4, spontaneous abortion in 3, and an allergic reaction in one; ALT levels were not done).

Manusirivithaya S, Sripramote M, Tangjitgamol S, Sheanakul C, Leelahakorn S, Thavaramara T, Tangcharoenpanich K. Antiemetic effect of ginger in gynecologic oncology patients receiving cisplatin. Int J Gynecol Cancer. 2004;14:1063-9. PubMed PMID: 15571611.

(Among 48 women with gynecologic cancer receiving cisplatin based chemotherapy treated with either ginger root powder or metoclopramide for 5 days and crossed over during the next cycle, control of nausea and vomiting was no different with the two drug regimens, although side effects were less with ginger [19% vs 28%], restlessness in 5% vs 19%, constipation in 7% vs 14%, and diarrhea in 14% vs 5%; no mention of ALT elevations or hepatotoxicity).

Russo MW, Galanko JA, Shrestha R, Fried MW, Watkins P. Liver transplantation for acute liver failure from drug-induced liver injury in the United States. Liver Transpl 2004; 10: 1018-23. PubMed PMID: 15390328.

(Among ~50,000 liver transplants reported to UNOS between 1990 and 2002, 270 [0.5%] were done for drug induced acute liver failure, including 7 [5%] for herbal medications, none were specifically attributed to a product containing ginger).

García-Cortés M, Borraz Y, Lucena MI, Peláez G, Salmerón J, Diago M, Martínez-Sierra MC, et al. [Liver injury induced by "natural remedies": an analysis of cases submitted to the Spanish Liver Toxicity Registry]. Rev Esp Enferm Dig 2008; 100: 688-95. Spanish. PubMed PMID: 19159172.

(Among 521 cases of drug induced liver injury submitted to Spanish registry, 13 [2%] were due to herbals, but none were attributed to ginger).

Navarro VJ. Herbal and dietary supplement hepatotoxicity. Semin Liver Dis 2009; 29: 373-82. PubMed PMID: 19826971.

(Review of the problems of causality assessment in herbal and dietary supplement [HDS] associated liver disease, including the variable clinical presentations, the complexity and lack of information on their components, absence of controlled trials demonstrating safety and efficacy, the possibility of contamination or incorrect labeling, and the frequent underreporting of herbal use by patients. Regulation of HDS is under DSHEA, which requires manufacturers to determine safety and prohibits claims of efficacy in treating specific diseases. The US Pharmacopeia sets standards for food and drugs and includes HDS; HDS induced liver injury is a growing problem and currently accounts for at least 10% of cases of acute liver injury due to medications).

Jacobsson I, Jönsson AK, Gerdén B, Hägg S. Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. Pharmacoepidemiol Drug Saf 2009; 18: 1039-47. PubMed PMID: 19650152.

(Review of 778 spontaneous reports of adverse reactions to herbals to Swedish Registry; no mention of ginger).

Reuben A, Koch DG, Lee WM; Acute Liver Failure Study Group. Drug-induced acute liver failure: results of a U.S. multicenter, prospective study. Hepatology 2010; 52: 2065-76. PubMed PMID: 20949552.

(Among 1198 patients with acute liver failure enrolled in a US prospective study between 1998 and 2007, 133 [11%] were attributed to drug induced liver injury of which 12 [9%] were due to herbals, but none were attributed to ginger).

Teschke R, Wolff A, Frenzel C, Schulze J, Eickhoff A. Herbal hepatotoxicity: a tabular compilation of reported cases. Liver Int 2012; 32: 1543-56. PubMed PMID: 22928722.

(A systematic compilation of all publications on the hepatotoxicity of specific herbals identified 185 publications on 60 different herbs, herbal drugs and supplements, but ginger was not listed or mentioned).

Navarro VJ, Barnhart H, Bonkovsky HL, Davern T, Fontana RJ, Grant L, Reddy KR, et al. Liver injury from herbals and dietary supplements in the U.S. Drug-Induced Liver Injury Network. Hepatology 2014; 60: 1399-408. PubMed PMID: 25043597.

(Among 85 cases of HDS associated liver injury [not due to anabolic steroids] enrolled in a US prospective study between 2004 and 2013, none were attributed to a product containing ginger).

Chalasani N, Bonkovsky HL, Fontana R, Lee W, Stolz A, Talwalkar J, Reddy KR, et al.; United States Drug Induced Liver Injury Network. Features and outcomes of 899 patients with drug-induced liver injury: The DILIN Prospective Study. Gastroenterology 2015; 148: 1340-52.e7. PubMed PMID: 25754159.

(Among 899 cases of drug induced liver injury enrolled in a prospective database between 2004 and 2012, HDS were implicated in 145 [16%], the single major herbal cause being green tea and none were attributed to ginger [see also Navarro et al Hepatology 2014]).

Suzuki Y, Yamazaki Y, Hashizume H, Oyama T, Horiguchi N, Sato K, Kakizaki S, et al. [Drug-induced liver injury caused by a dietary supplement (Kin-toki Shoga(®)) made from ginger]. Nihon Shokakibyo Gakkai Zasshi. 2015;112:108-14. Japanese. PubMed PMID: 25744927.

(70 year old woman developed abdominal pain and dark urine followed by jaundice two months after starting a supplement called Kin-toki Shoga ginger [bilirubin 10.8 mg/dL, ALT 2052 U/L, Alk P 784 U/L], liver biopsy showing an acute hepatitis and resolving over the 4 to 6 weeks after stopping).

McParlin C, O'Donnell A, Robson SC, Beyer F, Moloney E, Bryant A, Bradley J, et al. Treatments for hyperemesis gravidarum and nausea and vomiting in pregnancy: a systematic review. JAMA. 2016;316:1392-1401. PubMed PMID: 27701665.

(Systematic review including 17 randomized controlled trials of ginger for nausea and vomiting of pregnancy concluded that ginger had greater benefit than placebo and that side effects are generally mild, most frequently acid reflux).

García-Cortés M, Robles-Díaz M, Ortega-Alonso A, Medina-Caliz I, Andrade RJ. Hepatotoxicity by dietary supplements: A tabular listing and clinical characteristics. Int J Mol Sci 2016; 17: 537. PubMed PMID: 27070596.

(Listing of published cases of liver injury from HDS products, but does not mention or list ginger).

Brown AC. An overview of herb and dietary supplement efficacy, safety and government regulations in the United States with suggested improvements. Part 1 of 5 series. Food Chem Toxicol 2017; 107: 449-71. PubMed PMID: 27818322.

(Summary of the US regulations on safety and efficacy of herbal and dietary supplements).

Brown AC. Liver toxicity related to herbs and dietary supplements: Online table of case reports. Part 2 of 5 series. Food Chem Toxicol 2017; 107: 472-501. PubMed PMID: 27402097.

(Description of an online compendium of cases of liver toxicity attributed to HDS products, does not mention or list ginger).

Navarro VJ, Khan I, Björnsson E, Seeff LB, Serrano J, Hoofnagle JH. Liver injury from herbal and dietary supplements. Hepatology 2017; 65: 363-73. PubMed PMID: 27677775.

(Review of the problems of liver injury and HDS products, mentions that multiingredient dietary supplements account for the major of cases but does not mention a product with ginger as a component).

Bossi P, Cortinovis D, Fatigoni S, Cossu Rocca M, Fabi A, Seminara P, Ripamonti C, et al. A randomized, double-blind, placebo-controlled, multicenter study of a ginger extract in the management of chemotherapy-induced nausea and vomiting (CINV) in patients receiving high-dose cisplatin. Ann Oncol. 2017;28:2547-2551. PubMed PMID: 28666335.

(Among 251 adults undergoing chemotherapy for cancer with a cisplatin-based regimen treated with a purified extract of ginger [40 mg] or placebo twice daily for 4 days, nausea and vomiting symptom scores did not differ in the two groups and adverse event rates were similar and largely unrelated to therapy).

Anh NH, Kim SJ, Long NP, Min JE, Yoon YC, Lee EG, Kim M, Kim TJ, et al. Ginger on human health: a comprehensive systematic review of 109 randomized controlled trials. Nutrients. 2020;12:157. PubMed PMID: 31935866.

(An extensive systematic review of clinical trials of ginger for various conditions identified 109 qualifying trials including 43 considered to be of high quality, providing convincing data of the benefit of ginger for nausea and vomiting of pregnancy, inflammation [including osteoarthritis], metabolic function [hyperlipidemia, glucose control], digestive function, and colorectal cancer markers, whereas the beneficial effects of ginger in other conditions studied were "relatively controversial", but adverse events are mostly mild gastrointestinal complaints; no mention of serious adverse events or hepatoxicity).

Martins LB, Rodrigues AMDS, Monteze NM, Tibaes JRB, Amaral MHA, Gomez RS, Teixeira AL, et al. A double-blind placebo-controlled randomized clinical trial of ginger (*Zingiber officinale Rosc*.) in the prophylactic treatment of migraine. Cephalalgia. 2020;40:88-95. PubMed PMID: 31398997.

(Among 107 adults with episodic migraine treated with ginger [200 mg] or placebo 3 times daily for 3 months, there was no difference in rate of migraine episodes in the two groups, but adverse events were more frequent with ginger including heartburn in 12 [23%] that led to early discontinuation in 4 [7.5%], no mention of ALT elevations or hepatoxicity).

Nocerino R, Cecere G, Micillo M, De Marco G, Ferri P, Russo M, Bedogni G, et al. Efficacy of ginger as antiemetic in children with acute gastroenteritis: a randomised controlled trial. Aliment Pharmacol Ther. 2021;54:24-31. PubMed PMID: 34018223.

(Among 150 children with acute gastroenteritis treated with ginger extract [10 mg in 20 liquid drops, repeated every 8 hours until vomiting stops] vs placebo, episodes of vomiting occurred in 67% vs 87% in the subsequent two days and there were no adverse events reported from either group).

Ballotin VR, Bigarella LG, Brandão ABM, Balbinot RA, Balbinot SS, Soldera J. Herb-induced liver injury: Systematic review and meta-analysis. World J Clin Cases. 2021;9:5490-5513. PubMed PMID: 34307603.

(Systematic review of the literature on herb induced liver injury identified 446 references describing 936 cases due to 79 different herbal products, the most common being He Shou Wu [91], green tea [90] Herbalife products [64], kava kava [62] and greater celandine [48]; ginger was not among the 79 implicated products).

Bessone F, García-Cortés M, Medina-Caliz I, Hernandez N, Parana R, Mendizabal M, Schinoni MI, et al. Herbal and dietary supplements-induced liver injury in Latin America: experience from the LATINDILI Network. Clin Gastroenterol Hepatol. 2022;20:e548-e563. PubMed PMID: 33434654.

(Among 367 cases of hepatotoxicity enrolled in the Latin American DILI Network between 2011 and 2019, 29 [8%] were attributed to herbal products, the most frequent being green tea [n=7], Herbalife products [n=5] and garcinia [n=3], while ginger is not mentioned).

Samadi M, Moradinazar M, Khosravy T, Soleimani D, Jahangiri P, Kamari N. A systematic review and meta-analysis of preclinical and clinical studies on the efficacy of ginger for the treatment of fatty liver disease. Phytother Res. 2022;36:1182-1193. PubMed PMID: 35106852.

(Review of the literature on efficacy of ginger in nonalcoholic fatty liver disease in animal models and in 3 human studies suggested that therapy with ginger reduced serum ALT by 3 U/L, AST by 1 U/L, cholesterol by 3.5 mg/dL, triglycerides by 5 mg/dl and fasting blood sugar by 2.5 mg/dL; no mention of adverse events).

Choi J, Lee J, Kim K, Choi HK, Lee SA, Lee HJ. Effects of ginger intake on chemotherapy-induced nausea and vomiting: a systematic review of randomized clinical Trials. Nutrients. 2022;14:4982. PubMed PMID: 36501010.

(Systematic review of 23 randomized controlled trials found no evidence for a benefit effects of therapy with ginger in preventing early or delayed nausea or vomiting and while 9 studies reported no adverse events, 7 studies reported adverse event rates that were similar to those in placebo recipients, the most common being gastrointestinal symptoms; no mention of ALT elevation or hepatotoxicity).

Sarecka-Hujar B, Szulc-Musioł B. Herbal medicines-are they effective and safe during pregnancy? Pharmaceutics. 2022;14:171. PubMed PMID: 35057067.

(Literature review of the safety and efficacy of selected herbal therapies [cranberry, chamomile, Echinacea, garlic, ginkgo, peppermint, and ginger] concludes that data on safety are somewhat sparse for most agents, but data fairly strongly indicate that doses of ginger 1000 mg/kg or less in animals and 1000 mg or less in humans have no adverse effects on pregnancy or fetal health and development).

Afshar F, Abdolahi N, Amin G, Esmaily H, Ziayie S, Azimi S, Darvishi B, et al. A randomized, double-blind placebo-controlled phase I clinical study on safety and efficacy of the G-Rup® syrup (a mixture of ginger extract and honey) in symptomatic treatment of knee osteoarthritis. J Clin Pharm Ther. 2022;47:2295-2301. PubMed PMID: 36453014.

(Among 44 adults with osteoarthritis of the knee treated with a commercial syrup containing ginger and honey or placebo twice daily for 12 weeks, symptom scores for pain, stiffness, and function improved more with the ginger syrup than placebo and adverse event rates were similar in the two groups; no mention of hepatotoxicity).

Mahawer SK, Kumar R, Prakash O, Arya S, Singh S, de Oliveira MS, Rawat DS. A comprehensive review on phytochemistry, ethnopharmacology, and pharmacological properties of *Zingiber roseum* (Roxb.) Roscoe. Curr Top Med Chem. 2023;23:931-942. PubMed PMID: 36703584.

(Review of the phytochemistry, traditional uses, pharmacology, and biologic activities of ginger).