

Zingiber officinale (Ginger root)



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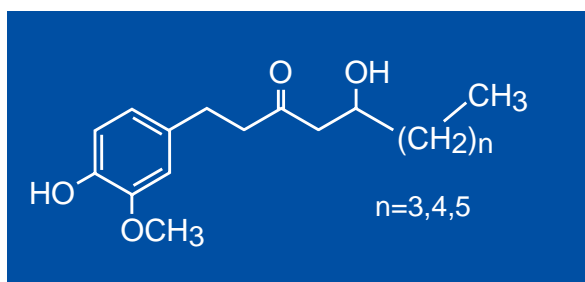
### Introduction

Ginger, the rhizome of *Zingiber officinale*, is one of the most widely used species of the ginger family (*Zingiberaceae*) and is a common condiment for various foods and beverages. Ginger has a long history of medicinal use dating back 2,500 years in China and India for conditions such as headaches, nausea, rheumatism, and colds.<sup>1</sup> Characterized in traditional Chinese medicine as spicy and hot, ginger is claimed to warm the body and treat cold extremities, improve a weak and tardy pulse, address a pale complexion, and strengthen the body after blood loss.<sup>2</sup>

### Active Constituents

Ginger contains a number of pungent constituents and active ingredients. Steam distillation of powdered ginger produces ginger oil, which contains a high proportion of sesquiterpene hydrocarbons, predominantly zingiberene.<sup>3</sup> The major pungent compounds in ginger, from studies of the lipophilic rhizome extracts, have yielded potentially active gingerols, which can be converted to shogaols, zingerone, and

paradol.<sup>4</sup> The compound 6-gingerol appears to be responsible for its characteristic taste. Zingerone and shogaols are found in small amounts in fresh ginger and in larger amounts in dried or extracted products.



### Mechanisms of Action

The mechanism underlying ginger's anti-emetic activity is not clearly understood, but the aromatic, spasmolytic, carminative, and absorbent properties of ginger suggest it has direct effects on the gastrointestinal tract.<sup>5</sup>

Studies do not indicate ginger has influence within the vestibular or oculomotor system.<sup>6</sup> A mechanism involving the central nervous system cannot be ruled out, considering several of ginger's components antagonize serotonin type-3 receptors; however, this has not been clearly demonstrated.<sup>7-9</sup>

The compounds 6-gingerol and 6-shogaol have been shown to have a number of pharmacological activities, including antipyretic, analgesic, antitussive, and hypotensive effects.<sup>10</sup> Ginger extracts exhibit inhibition of platelet aggregation and thromboxane synthesis *in vitro*,<sup>11-15</sup> which has led to concerns ginger extracts may prolong bleeding; however, several European studies using ginger orally did not find any significant anticoagulant effects *in vivo*.<sup>16</sup> Daily consumption of 15 g raw ginger rhizome or 40 g cooked rhizome by 18 healthy volunteers for two weeks failed to decrease platelet cyclooxygenase activity.<sup>17</sup> Similarly, differences were not found in bleeding time, platelet count, and platelet functioning when eight healthy volunteers were given a single 2-gram dose of the dried rhizome or placebo.<sup>18</sup> *In vitro* studies suggest ginger

may produce anti-inflammatory effects by inhibiting arachidonic acid metabolism in both the cyclooxygenase and lipoxygenase pathways.<sup>19-21</sup>

## Clinical Indications

### *Motion Sickness*

Ginger has long been used as a remedy to decrease nausea and vomiting associated with several conditions. A randomized, double-blind, placebo-controlled study was performed to assess the effects of ginger extracts on motion sickness and gastric slow-wave dysrhythmias induced by circular vection.<sup>22</sup> Volunteers with a history of motion sickness were pre-treated with ginger (1,000 mg and 2,000 mg). Individuals then underwent circular vection during which nausea, tachygastric, and vasopressin were assessed. Ginger improved each of the above parameters, significantly prolonging the latency period before nausea onset and shortening the recovery time after vection cessation.

Five other double-blind studies have been performed that demonstrate a positive effect of ginger on motion sickness.<sup>23-27</sup> These studies show ginger to be as effective as many traditional antiemetic pharmaceuticals such as dimenhydrinate, domperidone, scopolamine, cyclizine, and meclizine. One double-blind study found no benefit with ginger (0.5-1.0 g) when compared to scopolamine, d-amphetamine, or placebo.<sup>28</sup>

### *Nausea and Vomiting in Pregnancy*

Ginger is used to ameliorate symptoms of nausea in pregnancy. Most recently, a double-blind, placebo-controlled, randomized clinical trial was conducted on 26 women in the first trimester of pregnancy.<sup>29</sup> Subjects ingested one tablespoon of ginger syrup (containing 1 g ginger) or placebo in 4-8 ounces of water four times daily. Duration and severity of nausea was evaluated over a two-week period. Daily vomiting ceased in eight of 12 women in the ginger group by the sixth day, while only two of 12 in the placebo group reported a cessation of vomiting. At the end of the study, 20 women (77 percent) consuming the ginger syrup reported a significant decrease in nausea, while 20 percent in the placebo group reported improvement.

Other double-blind, placebo-controlled studies have been performed evaluating the effectiveness of ginger on morning sickness.<sup>30</sup> In one study of 70 pregnant women, participants received either 250 mg freshly prepared ginger powder or a placebo. Results indicated a significant reduction in nausea and number of vomiting episodes.<sup>31</sup>

### *Post-surgical Nausea*

Two double-blind studies were performed on women following major gynecological surgery.<sup>32,33</sup> In both studies there were three parallel groups comparing efficacy of ginger to placebo or 10 g metoclopramide. Women were dosed one hour before anesthesia was administered. In the study by Bone et al, nausea in the placebo group was observed throughout the duration of the study, while only 28 percent in the ginger group and 30 percent in the metoclopramide group experienced nausea. In the study by Phillips et al, ginger also significantly reduced nausea and vomiting when compared to placebo and metoclopramide.

In a recent double-blind study, ginger failed to demonstrate an anti-emetic effect following laparoscopic surgery.<sup>34</sup> Pre-operative doses of 100 or 200 mg were administered and followed by repetitive 100 or 200 mg doses. An earlier double-blind study on the effect of ginger on post-operative nausea also failed to demonstrate beneficial effects compared to placebo.<sup>35</sup> Doses of ginger in this study ranged from 0.5-1.0 g ginger extract.

### *Chemotherapy-induced Nausea*

Cancer chemotherapy can cause severe nausea, vomiting, and abdominal discomfort, which can limit therapy. Anticancer agents such as cisplatin, cyclophosphamide, and methotrexate slow gastric emptying.<sup>36,37</sup> In a double-blind study of chemotherapy-induced nausea, 41 patients with leukemia received either ginger or a placebo after administration of compazine.<sup>38</sup> The results showed a significantly greater symptomatic benefit from ginger compared to placebo. In a study on rats, following cisplatin administration, significant inhibition of gastric emptying occurred. The inhibitory effects of gastric emptying were

partially reversed by pretreatment with ginger extract and ginger juice.<sup>39</sup> Similar efficacy of these ginger preparations was also observed in antiemetic studies against cisplatin-induced emesis in dogs.<sup>40</sup>

### Osteoarthritis

Ginger extract has been studied as an alternative to NSAID therapy for arthritic conditions. A randomized, placebo-controlled, crossover study comparing ginger extracts and ibuprofen was performed on 75 individuals with osteoarthritis of the hip or knee.<sup>41</sup> Patients received either 170 mg ginger extract, 400 mg ibuprofen, or placebo three times per day and were followed for three weeks. The study revealed significant improvement in symptoms for both the ginger and ibuprofen groups before crossover; however, at the study's end there was no difference between ginger and placebo. No side effects were noted in the ginger group; however, side effects prompting removal from the study occurred in the ibuprofen group. More studies are recommended using different doses and duration of treatment to assess the efficacy of ginger extract for this condition.

### Drug-Botanical Interactions

No drug interactions are known; however, due to ginger's apparent effect on platelets, it should be used cautiously in individuals using anticoagulants.

### Side Effects and Toxicity

Ginger is on the U. S. Food and Drug Administration's GRAS (generally recognized as safe) list. *The British Herbal Compendium* documents no adverse effects of ginger.<sup>42</sup>

### Dosage

For most purposes a typical dose of ginger is 1-4 g daily, taken in divided doses. To prevent motion sickness, it is best to begin treatment 1-2 days before the scheduled trip and continue dosing throughout the duration of travel. For nausea and vomiting during pregnancy, ginger tea made from fresh ginger root, boiled and diluted to taste, appears to work best.

### Warnings and Contraindications

Despite widespread use of ginger by pregnant women, the safety of this herb has not been formally established. *The Complete German Commission E Monographs* recommends against the use of ginger root for nausea and vomiting of pregnancy; however, American editors, citing thousands of years of use and no pertinent scientific validity for this contraindication, refute this recommendation.

*The German Commission E* also mentions gallstones as a relative contraindication for ginger, without citing a rationale.<sup>43</sup>

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