

## Review article:

### Nutritional benefits and pharmacological effects of ginger: an overview

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#### Abstract

Ginger the rhizome of the *Zingiberofficinale* is used worldwide as a cooking spice, condiment and herbal remedy. It is primarily used as an anti-inflammatory, a pain remedy, a warming remedy and a cholesterol-lowering herb. Randomized controlled trials support its use in preventing nausea. Case studies suggest usefulness in treating migraines and inflammatory arthritis, but no randomized trials have been reported. Given its long history of use as a food, ginger is presumed safe for supplemental use. Fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and 12.3% carbohydrates. The active components of ginger are reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive.

**Keywords:** Anti-inflammatory, Ginger, cholesterol-lowering, neuro-protective.

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#### Introduction

Ginger has been used by traditional Chinese and Indian medicine for over 25 centuries.<sup>[1]</sup> Ginger was brought to Mexico by the Spaniards and later introduced to Jamaica, the latter currently being one of the world's foremost producers of this species.<sup>[2]</sup> In recent times, ginger has been introduced into various tropical countries where diverse chemotypes have been developed.<sup>[3]</sup> Ginger (*Zingiberofficinale Roscoe*) is a member of the *Zingiberaceae* family of plants. The English term 'ginger' originated from Sanskrit word 'Sringavera' which means horn-like. The underground stem (rhizome) is used for preparation of ginger. This rhizome can be processed into a powder, syrup, volatile oil, and oleoresin. The rhizome contains fats, carbohydrates, protein, fiber, water, and volatile oil. It has been a part of healing strategies in Asia, India, Europe, and the Middle East for centuries for treatment of such disorders as arthritis, stomach upset, asthma, diabetes, and menstrual irregularities, to name a few.<sup>[4]</sup> According to a 2010 study published in the "Journal of

Microbiology and Antimicrobials", ginger proved to have higher antimicrobial power than conventional antibiotics against two strains of staph infections. Ginger is thought to have anti-inflammatory properties, sometimes used to treat arthritis. Ginger has been used for its herbal properties, which are especially helpful in easing stomach and motion sickness. This herb has been effective in controlling nausea and vomiting. It is hypothesized to work by changing serotonin receptors in the digestive tract. Ginger appears to work like ibuprofen for menstrual pain, according to one of the study.<sup>[5]</sup>

The main aim to write this review is to give insight on *Zingiberofficinale* about its valuable nutritional and pharmacological properties which will help students and researchers to get the overall information about its published nutritive and pharmacological properties for their further research.

#### Nutritional Composition

Most of the food components including macro- and micro-nutrients play important role as a nutraceutical, and provides potential health benefits (Bernal *et al*

2010). Dietary fiber, polyunsaturated fatty acids (PUFA), proteins, amino acids, minerals, vitamins and other bioactive compounds are considered as beneficial nutrient components (Andlauer and Fürst, 2002). Fresh ginger contains 80.9% moisture, 2.3% protein, 0.9% fat, 1.2% minerals, 2.4% fibre and

12.3% carbohydrates. The minerals present in ginger are iron, calcium and phosphorous. It also contains vitamins such as thiamine, riboflavin, niacin and vitamin C. The composition varies with the type, variety, agronomic conditions, curing methods, drying and storage conditions.<sup>[6]</sup>



Figure 1: Ginger plant and rhizome

Table 1: Nutritional composition of ginger (per 100g)

Constituent	Value	Constituent	Value
Moisture	15.02 ± 0.04	Ash (g)	3.85 ± 0.61 (4.53)
Protein (g)	5.087 ± 0.09(5.98)	Calcium (mg)	88.4 ± 0.97 (104.02)
Fat (g)	3.72 ± 0.03 (4.37)	Phosphorous (mg)	174±1.2 (204.75)
Insoluble fibre (%)	23.5 ± 0.06 (27.65)	Iron (mg)	8.0 ± 0.2 (9.41)
Soluble fibre (%)	25.5 ± 0.04 (30.0)	Zinc (mg)	0.92 ± 0 (1.08)
Carbohydrate (g)	38.35 ± 0.1	Copper (mg)	0.545±0.002 (0.641)
Vitamin C (mg)	9.33 ± 0.08 (10.97)	Manganese (mg)	9.13 ± 001 (10.74)
Total carotenoids (mg)	79 ± 0.2 (9296)	Chromium (µg)	70 ± 0 (83.37)

All value in this table represent the mean ± SD (n = 4). Figures in the parenthesis represent the dry weight values.

### Chemistry

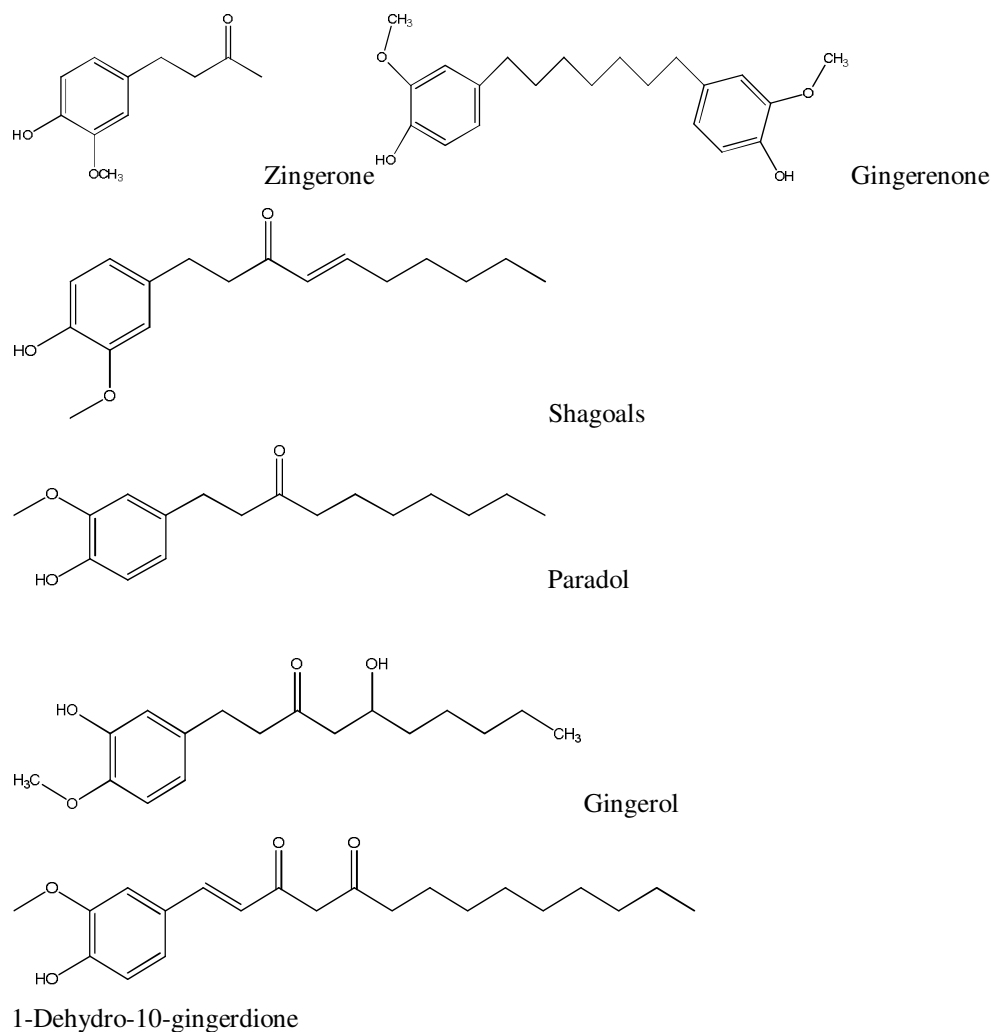
In the fresh ginger rhizome, the gingerols were identified as the major active components and gingerol [5-hydroxy-1-(4-hydroxy-3-methoxy phenyl) decan-3-one of the most abundant constituent in the gingerol series. The powdered rhizome

contains 3-6% fatty oil, 9% protein, 60-70% carbohydrates, 3-8% crude fiber, about 8% ash, 9-12% water and 2-3% volatile oil. The volatile oil consists of mainly mono and sesquiterpenes, camphene, beta-phellandrene, curcumene, cineole, geranyl acetate, terphineol, terpenes, borneol,

geraniol, limonene, linalool, alpha-zingiberene(30-70%), beta-sesquiphellandrene (15-20%), beta-bisabolene (10- 15%) and alpha-farnesene. In dried ginger powder, shogaol a dehydrated product of gingerol is a predominant pungent constituent.

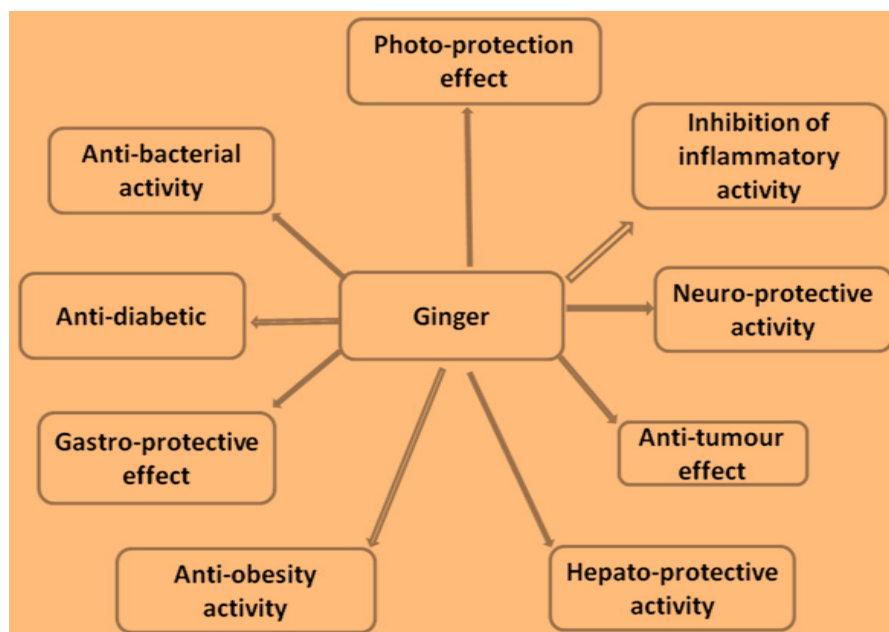
Oleoresin, which is isolated by acetone and ethanol extraction, contains 4-7.5% of dried powder, pungent

substances namely gingerol, shogaol, zingerone and paradol. The oleoresin has also been found to contain zingiberol, the principal aroma contributing component as well as zingiberene, gingediol, diarylheptanoids, vitamins and phytosterols.<sup>[7]</sup>



**Figure 2:**Chemical structure of active constituents of *Zingiberofficinale*.

## Pharmacological Effects



**Figure 3: Ginger and its constituents shows role in diseases prevention.**

### Anti-oxidant action

Ginger and some specific constituents have demonstrated antioxidant effects in several cell culture systems.<sup>[8-11]</sup> Furthermore, there are animal studies showing that ginger extracts and individual ginger constituents such as [6]-gingerol can protect several tissues and organs against damage due to a variety of oxidation-inducing stressors like ultra violet B (UVB) and COX-2 idiom a promising therapeutic agent against UVB induced skin disorders, has been studied both in-vitro & in-vivo.<sup>[12-19]</sup> In rats, ginger extract also ameliorated acetic acid induced ulcerative colitis, likely due to its antioxidant and anti-inflammatory actions.<sup>[20]</sup> It also has a protective role to toxicity and lethality against some agent like carbon-tetra chloride, cisplatin etc.<sup>[21]</sup>

### Anti- inflammatory

In Indian ayurvedic medicine, ginger is used as an anti-inflammatory herb. Ginger also shows a vital role in the suppression/inhibition in synthesis of pro-

inflammatory cytokines such as IL-1, TNF- $\alpha$ , and IL-8.<sup>[22]</sup>

### Anti tumor

Ginger also acts as antitumor via modulation of genetic pathways such as activation tumour suppressor gene, modulation of apoptosis and inhibition of VEGF. Study suggests that ginger extract may bring to bear its antitumor effects on colon cancer cells by suppressing its growth, striking the G0/G1- phase, reducing DNA synthesis and inducing apoptosis.<sup>[23]</sup>

### Effect on migraine

500-600mg of ginger powder administration at the onset of migraine for 3-4 days at interval of 4 hours, reported to provide relief from migraine attack<sup>[24]</sup>

### Neuro protective activity

The neuroprotective effect is partly attributable to an antagonistic action of ginger root extract on monosodium glutamate effect, so the monoamines content was increased. From these results, we can say

that the ginger extract has a neuroprotective role against monosodium glutamate toxicity effect [25]

#### **Effect on Osteoarthritis**

A highly purified and standardized ginger extract had a statistically significant effect on reducing symptoms of Osteoarthritis of the knee. This effect was moderate. There was a good safety profile, with mostly mild GI adverse events in the ginger extract group [26]

#### **Hepato-protective effect**

Earlier investigators based on experimental findings have shown that, ginger and its constituents play a significant role in hepato-protection. An important study on ginger showed its protective effect against the CCl<sub>4</sub>-induced hepatotoxicity.[27]

#### **Anti- diabetic**

Several animal studies indicate that ginger may be beneficial in lowering problematic blood glucose and lipid concentrations. Specific extracts of ginger lowered blood glucose, cholesterol, and triglyceride levels and increased high-density lipoprotein cholesterol concentrations.

#### **Antimicrobial effects**

Ginger has strong antibacterial and to some extent antifungal properties. In vitro studies have shown that

active constituents of ginger inhibit multiplication of colon bacteria. These bacteria ferment undigested carbohydrates causing flatulence. This can be counteracted with ginger. It inhibits the growth of *Escherichia coli*, *Proteus sp*, *Staphylococci*, *Streptococci* and *Salmonella*.

#### **Summary and Conclusion**

The present study provides a strong base on the nutritional value of ginger with the presence of high amounts of dietary fiber, unsaturated fatty acids, essential amino acids and essential minerals with lower levels of heavy metal contaminants.

Based on the current body of scientific literature, ginger demonstrates some promising health benefits. It can be concluded that ginger shows an important effect in the suppression of NFκB, COX-2, and LOX, induction of apoptosis, activation of tumor suppressor gene and also modulates various biological activities. Ginger and their constituents create optimism towards the novel therapeutic strategy. Future research should focus on clinical trials to investigate its effectiveness and their exact role in modulation of molecular path-ways.

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