# Ginger on Human Health: A Comprehensive Systematic Review

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**Abstract: Rhizomes are the stiff, swollen underground branching stems of the perennial herb ginger. The leaves and rhizomes of ginger create a fragrant aroma when sliced or bruised. The rhizomes are dug up once the leafy portions have dried. The plant's underground stem, or rhizome, is known as Zingiber officinale, and it has long been used medicinally in Asian, Indian, and Arabic herbal traditions. Ginger is considered a herbal remedy in many cultures. For millennia, people have used it to treat a wide range of illnesses, including as inflammation, digestive problems, heart problems, and even the plague. No matter how it is prepared—it can be sliced, diced, minced, or served raw—the rhizome keeps the distinct "heat" that has made it a medicinal mystic. Since eating the root led people to perspire, ginger has traditionally been used to treat fevers and stave off illnesses. That also helps since it raises body temperature and increases metabolism, but ginger is known to have other health benefits. Due to its anti-inflammatory qualities, ginger helps ease the symptoms of arthritis and other physical aches and pains. It enhances blood circulation as well. Through an increase in saliva and other digestive fluid production, it calms upset stomachs and facilitates healthy digestion. Increasing digestive speed aids in the kidney and intestines' removal of toxins from the body. Since eating the root led people to perspire, ginger has traditionally been used to cure fevers and ward off illnesses. Ginger offers numerous health benefits in addition to increasing body warmth and metabolism, which helps. Ginger's anti-inflammatory qualities help to reduce the symptoms of arthritis and other physical aches and pains. It also facilitates better blood circulation. By boosting the production of saliva and other digestive fluids, it calms upset stomachs and encourages healthy digestion.**

**Key Words: Ginger, phenylalkylketones, pharmacology, gingerol**

## INTRODUCTION

India has a vast geographical area with a rich culture of medicinal plants, with over two thousand species and potential skills for Unani, Siddha, and Ayurvedic conventional medical treatments. Plants have been utilized by humans for thousands of people's treatment of different illnesses years. [1] Many developing countries' rural areas still depend on conventional medicine for their basic medical care needs and have established themselves in daily life existence. In comparison, these medications are safer and less expensive than modern or manufactured medication. [2] Herbal medications are a primary need in both industrialized and underdeveloped nations as a source of primary healthcare because of their vast range of quality activities related to biology and medicine, large safety margins and lower expenses. Ginger is one of the most popular spices in the world; it is widely used plants in Asia, Australia and other many countries. [3] For centuries, ginger has been eat up in different process by Asia’s native peoples, mostly in India and China, both as spice and sweetner as well as a herbal remedy for treating variety of disease. Ginger has been used by the Chinese for at least 2500 years to cure rheumatism, bleeding disorders, and as an antinausea medicine. Additionally, it was used to cure toothaches, snakebite, baldness, and ailments of the respiratory system. [4] Using Traditional Chinese Ginger is regarded as a strong, dry, and warming yang herb to treat conditions brought by cold, damp weather. Ginger is frequently used in India's ancient medication, Ayurveda, can obstruct lower cholesterol, increased clotting (heart disease) help fight arthritis. [5] Ginger has been used in several disorder like digestive disorder (indigestion, constipation, nausea),

headache, cold and cough. More recently, attention has focused on the potential effects of ginger on blood coagulation, inflammation, pain, and cancer. However, metabolic illnesses have received less attention like diabetes. [6] It has been thoroughly investigated for its therapeutic qualities using advanced scientific methods, and numerous bioactive chemicals have been extracted from various plant parts. More specifically, ginger is thought to have medicinal properties in traditional Chinese, Indian, and Ayurvedic medicine. [7] It is a treatment for clearing up coughs because it acts as an expectorant, causing mucus to loosen and discharge. Ginger is also used to relieve nausea, reduce discomfort, and vomiting, poisoning, and to aid in the process of digesting.[8] Currently, ginger has anti-oxidant, anti-cancer, anti-inflammatory, anti tumor properties and efficacious qualities in the prevention and management of cardiovascular and gastrointestinal disorders of the blood, lungs, and nervous system have been as evidenced by a number of studies. [9,10]

The flavor of ginger rhizome is influenced by volatile oils and with pungent strong phenolic chemicals such gingerols, zingerone, and shogaols, and the odor of the plant. Both volatiles and non-volatile, these are two major types of volatiles for fresh ginger. [11,12] Monoterpene, and sesquiterpene the hydrocarbons that give ginger its unique flavor among the volatiles were flavor and odor. Parasols, zingerone, shogaols, and gingerols are instances of aromatic chemicals that are not volatile. [13,14] The primary ingredients in ginger include when gingerols are transformed into shogaol, zingerone, parasol, and provide distinctive aroma and taste. Zingerone and shogaol are present in big amounts in fresh ginger and tiny quantity in-store products. 6-gingerol and 6-shogaol exhibits pharmacological effects, such as analgesic, antipyretic, antitussive, and effects of hypotension. [15,16]

Due to the amazing health benefits of ginger, a number of pharmacological studies have been carried out recently. For that reason, in this review, outlined that advantageous qualities for health, in addition to the the components' bioactivities and potential routes of its essential components. [17]

## BOTANICAL DESCRIPTION

Kingdom : Plantae
Division : Magnoliophyta
Class : Liliopsida
Order : Zingiberales
Family : Zingiberaceae
Genus : Zingiber
Species : Zingiber officinale var. Roscoe

## PLANT DESCRIPTION

Ginger is one the most popular spices in the world and comes from the underground stem of the ginger plant. The ginger plant has a thick, branched rhizome with brown outer layer and yellow centre that has a spicy, citrusy aroma. It is a perennial plant that grows upright to a height of one to three feet. The sheathing bases of the two-ranked leaves encircle the stem, which is situated around 12 inches above the ground. Rhizomes that grow horizontally, laterally flattened, and having branching pieces. The texture of the entire rhizome is striated and robust. Its dimensions are 2 cm thick, 1.5 to 6 cm wide, and 5 to 15 cm long. Cultivating ginger plants in warm, humid climates. It thrives in areas with rich soil and shade. The ideal growing conditions for the ginger plant are deep, loose, well-drained soil with a pH of 5.5 to 6.5. There should be a lot of accessible organic matter in the soil, nutrition and calcium. [18]


Fig 1: Ginger rhizome with fresh shoots Fig 2: Young ginger rhizome

## MEDICINAL PROPERTIES

Ginger is believed to have medicinal properties in Indian and Ayurvedic medicine. Because of its expectorant properties, which help to break up and release mucus, it is used as a cough relief medication. In addition, ginger helps with digestion, relieves pain, and treats nausea, vomiting, and poisoning. Currently , research has shown that ginger can effectively prevent and treat gastrointestinal, cardiovascular, pulmonary, and neurological illnesses.[19] Several pharmacological activities was observed, including

antiemetic, anti- inflammatory, analgesic effect, reducing osteoarthritis, antioxidant, anticancer, antithrombotic, hypolipidemic and hypoglycaemic effects, antineoplastic, anti-infective, hepatoprotective and immunomodulatory effects.[20]

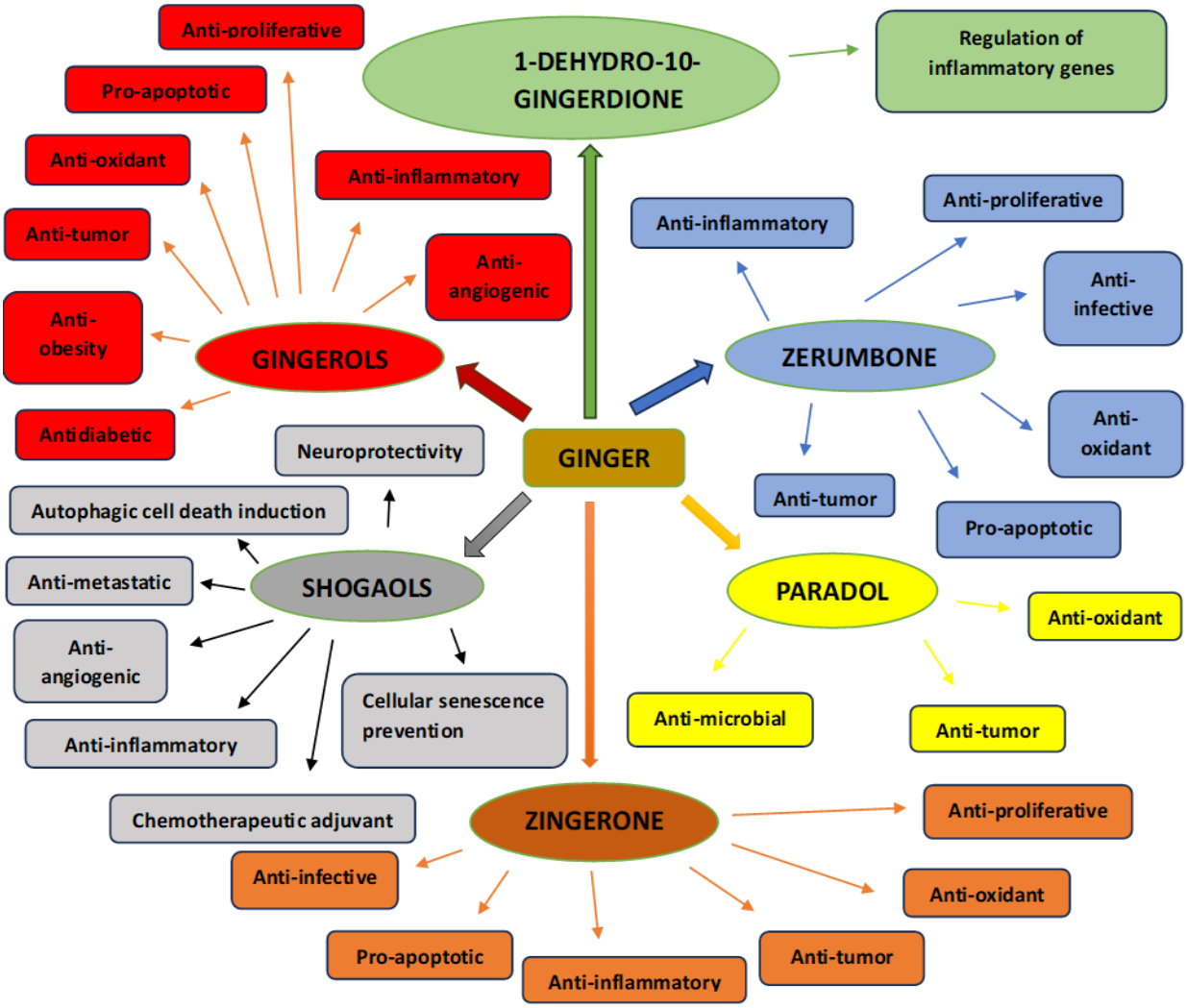


*Fig* 3 : Illustration of the wide range of the health effects of ginger. A great range of those natural products' beneficial effects for the human organism have been verified and investigated at a molecular and mechanistic basis. Emphasis is given in this review on the antioxidant, anti-inflammatory, and anticarcinogenic properties of ginger.

## PHARMACOLOGICAL ACTIVITY OF GINGER

1. Anti-cancer activity

Studies have been conducted on the potential of ginger and its components to prevent cancer in a variety of cell types. Z. officinale contains bioactive compounds like 6-gingerole, 6-shogaol, 6-paradol, and zerumbone, it can prevent or control malignancies of the colon, stomach, ovaries, liver, breast, and prostate. It also has anti-inflammatory and anti-tumorigenic properties. There is evidence that ginger exerted the antitumor effects on colon cancer cells by inhibiting their proliferation, stopping the G0/G1 phase, lowering DNA synthesis, and bringing about apoptosis.[20,21]

In human colon cancer cells, ginger functions as a strong growth inhibitory agent, and the research supports the possibility of ginger's chemopreventive ability . The active ingredient may be the cause of the cytotoxic impact. Intestinal Azoxy Methane Induced

In rats, carcinogenesis was markedly inhibited by Gingerol is administered through eating. Enzymes including glutathione reductase, glutathione transferase, and glutathione peroxidase are activated by Z. officinale, which also inhibits the development of colon cancer.[22]

2. Anti-oxidant activity

Consuming ginger in rats, reduces lipid peroxidation and increases the activities of glutathione, glutathione reductase, glutathione peroxidase, and glutathione-S-transferase. It also reduces the activity of superoxide dismutase and catalase. Compared to an untreated group of Wistar albino rats, supplementation with ginger before ischemia resulted in a lower total oxidants levels and a higher total antioxidant capacity that regularized glutathione peroxidase and superoxide dismutase activities. Overall, 5% of those administered ginger report reduced kidney damage from ischemia-induced oxidative stress.[23,25]

Ginger, which is rich in phytochemistry, has components that scavenge free radicals components created in biological systems. Certain free radicals are necessary for the creation of energy during the oxidation process. An increase in free radical production indicates oxidative stress, which can harm DNA. [26,27]

3. Anti-Diabetic Effect

Numerous research have demonstrated the preventative and therapeutic benefits of ginger and other herbs for diabetes. Located in Australia, the University of Sydney discovered that ginger had glycemic effects for those with type 2 diabetes. An investigation demonstrated that using ginger extracts could boost the muscle cells' absorption of glucose without the need of insulin, so it could aid in regulating high blood blood sugar levels. One more diabetes clinical study individuals who took in 3 grams of dry ginger for 30 days shows that blood sugar and LDL cholesterol, as well as triglycerides considerably decreased. An investigation into ethanolic Zingiber officinale extract taken orally for 20 days generated a significant anti-hyperglycemic impact ($P < 0.01$) in rats with diabetes. Additionally, it was discovered that the ethanolic extract of ginger decreased body weights, total cholesterol, and Triglycerides, free fatty acids, LDL cholesterol, phospholipids, glucose, and insulin. In general, Ginger increases insulin, which helps with diabetes.[28,30] Overall, the release and sensitivity of carbohydrates enhance lipid profiles and metabolic enzymes. The glycemic index (GI) of ginger is extremely low, therefore meaning that it eventually breaks down into shape glucose and does not rise in blood sugar as foods with a high GI do. A few more Studies revealed that ginger has a protective effect against problems related to diabetes. Additionally, ginger can shield a diabetic's liver. kidneys, the brain, and the spine, and lessen the possibility of cataracts, a typical side effect of the illness.[29]

4. Anti-Nausea effect of ginger

Ginger has been used historically as a remedy for nausea and vomiting. In addition, it has an antiemetic property known as a carminative effect, that helps in break up and expel intestinal gas. When ginger and vitamin B6 were evaluated for efficacy, researchers found that they were just as successful in lowering nausea and minimize the number of vomiting fits you have while pregnant.[30]

5. Gastrointestinal effect of ginger

Peptic and duodenal ulcers are just two of the gastrointestinal disorders that ginger is particularly effective in treating. Imbalance is typically the cause of ulcers between inflammatory and defensive elements such as pepsin and acid and *Helicobacter pylori*; ginger is helpful due to its anti-inflammatory properties. Ginger behaves and shields the stomach mucosa from many ulcer-causing agents. Ginger is also quite helpful when because of its antioxidant properties, ulcer genesis. [31]

6. Anti-Inflammatory Effects

Ginger is one of the traditional herbs that helps strengthen the body's immunological response by reducing swelling, inflammation, and discomfort. The use of ginger and its compounds in numerous nations to strengthen their defenses. Numerous studies that evaluate ginger's efficaciousness in individuals with osteoarthritis have contentious outcomes. The investigation revealed the Ginger extract has a notable impact on reducing the signs of osteoarthritis. 6-Shogaol is a strong antioxidant and anti-inflammatory effects employed as a gout treatment medication as a rheumatic arthritis in the joints. Numerous It was reported by researchers that 6-gingerol extract of dried ginger has shown powerful analgesic effects and anti-inflammatory properties. Ginger is efficient in treating people who are suffering due to hypoalgesia. [33] For 11 days, these researchers used ginger supplements to treat 36 patients' muscle pain. They confirmed that the regular ingestion of uncooked and heated Ginger

caused moderate-to-significant drops in aches in the muscles. Furthermore, ginger possesses an anti-quality of microbes, which helps in the therapy of infections-related disorders. It generates radicals when there are reactive oxygen species (ROS) metabolism, that surpasses the level of antioxidants of a living organism that causes oxidative stress. It is essential to neurodegenerative illnesses, heart conditions, cancer, and the aging process. Inflammatory conditions such as esophagitis, hepatitis, and gastritis, among others brought on by contagious substances like viruses, bacteria, and occasionally parasites impacted by agents, both chemical and physical, such as heat, acid, smoke from cigarettes and foreign particles, which are considerd as risk factors for human cancer.[34]

7. Cardiovascular effect

One of ginger's most important properties is its antiarrhythmic action. The research demonstrates how ginger affects blood lipid levels in both humans and animals. The results indicate that ginger Significantly lowers plasma cholesterol levels in animals, but not in suffering patients from any kind of cardiac condition, including coronary artery illness. Studies reveal that ginger has antithrombotic effect, in vitro study, its extract prevents the release of thromboxane-B2 (TXB2) and platelets synthesis.[35] In addition, gingerdione and shogaol prevents the production of 5-HETE, or hydroxyeicosatetraenoic acid, and Arachidonic acid produces prostaglandin-E2 (PGE2). Dehydroparadol and gingerol enhanced the blocking the cyclooxygenase enzyme. Ginger protects coronary heart disease and is utilized as an antiplatelet treatment. Using this method, ginger has less effective than aspirin; yet, it has less adverse effects compared to aspirin. The purpose of Aspirin is preventing the effects of arachidonic acid on COX, platelet aggregation, and release activity; ginger functions in the same way as the mechanism of action. Thus, it was proposed that the development of potent gingerol analogs has been used as in place of aspirin treatment to prevent ischemic heart disease. [36]

8. Anti-Convulsant activity

According to the study, the ginger extract exhibits anticonvulsant properties. The seizure threshold was considerably raised by ginger therapy. Ethanolic extract of

ginger significantly increased the duration of the onset of myoclonic seizures significantly reduced the risk of generalized clonic and raised the forelimb tonic extension seizures lasting 2 to 24 hours prior to the induction of pentylenetetrazole compared with control group. Based on the outcomes that the ginger ethanolic extract has anticonvulsant properties, maybe via a combination antioxidants having both an excitatory and inhibitory system mechanisms, calcium channel, and oxidative stress inhibition. The results of the study showed that the anticonvulsant properties of ginger rhizome ethanolic extract are dose dependant. In Switzerland, ginger rhizome ethanolic extract was used orally. The results were compared with albino rats. The rhizome of ginger has shown significant reduction in the tonic hind limb's duration extension implying an anticonvulsive impact.[37]

9. Anti-hypertensive activity

The results of the study showed that ginger affected the activities of adenosine deaminase, acetylcholinesterase, and eptonucleotidases in cerebral synaptosomes from N-nitro L-arginine methyl ester cortex rats given hydrochloride were hypertensive. N-nitro L-The ATP was raised with arginine methyl ester hydrochloride, because both adenosine deaminase and AMP hydrolysis and the cerebral cortex's acetylcholinesterase activities rats' synaptosomes. Preparation using the rhizome of ginger stopped these changes by lowering ATP and Acetyl CoA, adenosine deaminase, and AMP hydrolysis cholinesterase activity in the brain cortex and a corresponding a rise in nitric oxide levels, this investigation showed that Rhizomes of ginger disrupt the purinergic and Cholinergic neurotransmission within the cerebral cortex of rats with hypertension. In animals with hypertension, ginger often produces a dose-dependent hypotensive effect. Moreover, ginger resulted in vasodilation in rabbits and rats after artificial demonstrated vasoconstriction and calcium channel blocking action akin to that of verapamil. The only human study to treat hypertension found a cooperative outcome between nifedipine and ginger. Research on animals has shown that ginger quickens the Ca+2 -rate of pumping without altering its efflux, by means of initiating Ca+2 ATPase sarcoplasmic reticulum . This result was particularly visible in the atrial muscle of guinea pigs. Ginger can additionally promote the beneficial inotropic impact of by encouraging the adrenal glands to release adrenaline.[35,36]

10. Anti-coagulant activity

Using the Chrono Log whole blood platelet aggregometer, the anti-platelet activity of the ginger

components was determined in vitro. Inhibiting cyclooxygenase-1 impact of 8-paradol and its analogs was investigated using
a test kit for cyclooxygenase-1 inhibitors. 8-gingerol, 8-Analogs of gingerol, 8-paradol, and shogaol showed anti-platelet actions.[37] The inhibitory cyclooxygenase-1 Compared to gingerol, 8-paradol has a stronger active ingredient. The results indicate that a component of gingerol and its compounds have stronger anti-platelet properties than aspirin in the circumstances outlined in this 8-Paradol, a ginger root's natural component, was discovered to be the strong inhibitor of cyclooxygenase-1 and anti-aggregator of platelets. The working mechanism underpinning platelet aggregation caused by acetic acid inhibition could be connected to a reduction in Enzymatic cyclooxygenase-1/thromboxane synthase action. The anticoagulant impact of various amounts of ginger aqueous extract was investigated in vitro using normal human blood samples by prothrombin time measurement. Different amounts of aqueous extract made from ginger boosted prothrombin and prevented the development of clots moment.[34,36]

## CONCLUSION

Throughout history, ginger has been widely utilized for its numerous natural medical benefits. The benefits of ginger for health are widely recognized. Many different disorders can be treated by it. It's useful components such as shogaol, gingerols, and Paradols are the beneficial components that can stop diabetes, heart disease, and different malignancies mellitus and digestive issues. It has so many significant therapeutic benifits such as antidiabetic action, antioxidant action, anti-cancer, anti-inflammatory etc. The application of ginger is safe and promising health benefits in the past as well as the future. From the above data it is concluded that many more diseases can be cured if we do more research on ginger extraction.

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