



There are basically several kinds of ginger: dried ginger, preserved ginger, and fresh root ginger. Additionally, shogaol and gingerol have been identified due to their anti-inflammatory and antibacterial properties. Studies on cell cultures indicate the antioxidant features of ginger. It is inaccessible, therefore, if the antioxidant constituents of ginger are readily available to humans after utilization and whether they have any impact on oxidative stress markers in humans in vivo.

KEYWORDS: Zingiber officinale, gingerols, shagaols, zingerones, anti-inflammatory, antioxidant

INTRODUCTION:

Throughout recorded history, mankind has depended on medicinal plants for the treatment of various kinds of illnesses. Since they were initially reliant on plants for nutrition, humans were shielded from physiological perils (Butt et al., 2009). Plant-based Bioactive substances comprise polyphenols, phytosterols, biologically active proteins, and biogenic amines, carotenoids, etc., are good for human health, particularly diabetes, cancer, heart disease, and immune system dysfunction, in addition to those who have gastrointestinal issues, as well as a neurological illness. High consumptions of plant-based meals are recommended by healthy diet guidelines, such as consuming at least 400 g of fruits and vegetables per day (Samtiya et al., 2021). According to the latest information compiled by the World Health Organization (WHO), 80% of people around the entire globe get their primary treatment from medicinal plants (Saadony et al., 2023). By supplying nutrition that includes carbs, proteins, oils that are consumable, nutritional fiber, antioxidants, and minerals in the form of grains, vegetables, and fruits, plants fulfill an essential role in the global food chain (Ramady et al., 2022).

Ginger is one of the earliest examples of these versatile medicinal plants. It was identified as *Zingiber officinale* by Foster (2000) after being described by English botanist William Roscoe in 1807 (Caktek et al 2000) Ginger, or *Zingiber officinale*, is native to East and South Asia and is a member of the Zingiberaceae family. (Laelago Ersedo et al., 2023). About 1,300 species and 53 genes belong to the Zingiberaceae family, which can be distinguished by its tuberous or non-tuberous rhizomes. (Zang et al., 2021). Originally from the Indo-Malayan region, ginger (*Zingiber officinale* Rosc.) is now frequently employed as a spice and medicinal herb in many distinct

countries. (Kizhakkayil, & Sasikumar, 2011). The plant is called Sringavera in Sanskrit; its generic name, Zingiber, originates from the Greek zingiber, which is derived from the Sanskrit name of the spice, Singabore; the Latin name, Zingiber, means built like a horn and alludes to the roots, which resemble a deer's hooves. (Shahrajabian & Cheng 2019). India, China, Nigeria, Indonesia, Bangladesh, Thailand, the Philippine Islands, Jamaica, and other nations cultivate ginger. Similarly, Australia, Fiji, Brazil, Sierra Leone, and Japan harvest it. United States, Japan, Saudi Arabia, and the Kingdom of Great Britain. When it comes to the area covered by ginger, Nigeria comes in first place with roughly 56.23% of the world's total area. India comes in second with 23.6%, China with 4.47%, Indonesia with 3.37%, and Bangladesh with 2.32%. Regarding the production of ginger, India is in first place, accounting for approximately 32.75% of global production. China comes in second with 21.41%, followed by Nigeria (12.54%), Bangladesh, and other countries leading the global market by spice production (Danik et al.,2017).

In Chinese, Ayurvedic, and Unani-Tibb medicine, ginger is extensively utilized (Gunathilake & Rupasinghe, 2015). Due to the large volumes of purchases, ginger is one of the most commonly utilized spices in China and one of the primary spices supplied to the European market (Han et al.,2024). Ginger has been regularly used to season meals in Korea for about a thousand years now (Daily at el.,2015). Furthermore, it conceals the taste of medications, stimulates the gall bladder to secrete bile, diminishes arthritis pain in the joints, assists with managing lung and heart conditions, clears the throat, and cures cough and cold. In addition to these, it's employed in curry powder and hot beverages like tea, wine, and beer brewed with ginger (Kumar & Sharma, 2014). The Food and Agriculture Organization of the United Nations (FAO) estimates that 426,032 tones of ginger originated in China in 2014; at \$439.8 million in value to be exported, this corresponded to 5% of China's total vegetable export value (wang et al., 2014). Its global market is projected to reach \$4.8 billion by 2027 at a compound annual growth rate of 5.4% (Chukwudi,2023).

TABLE:01 BOTANICAL CLASSIFICATION OF GINGER:

KINGDOM	PLANTAE
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PHYLUM	Tracheophyta
CLASS	Liliopsida
ORDER	Zingiberales
FAMILY	Zingiberaceae
GENUS	Zingiber
SPECIE	Zingiber officinale

Compounds of ginger:

Ginger rhizomes are given fatty oils (3-6%), proteins (9%), carbs (60-70%), crude fiber (3-8%), ash (8%), water (9-12%), and volatile oil (2-3%) (Mahboubi,2019). In recent years, ginger hydro-ethanol compounds are frequently used as antioxidant, hepatoprotective, nephron-protective, anti-inflammatory, anticancer, and diabetic agents. (Mbaveng, & Kuete, 2017). Ginger can be served in hundreds of ways, such as powdered, dried, and hot; pickled or conserved in syrup or saline; caramelized or crystallized; condensed into nutritional oil; abstracted with solvents to yield oil extracts; or ground into a paste. Ginger can be used for making pickles, sweets, gingerbreads, cookies, soups and stews puddings, cocktails, soft drinks, and other food processing products (Singletary, 2023). Based on its distinct sensory qualities of ginger which can be described as pungent, smoky aromatic, lemon-like, warm, camphoraceous, or nutmeg-like, depending on the specific type and genotype studied ginger stuff is prevalent in an extensive array of cuisines (Taveras et al.,2022).

The best soil types for growing ginger are well-drained soils like clay, sandy, red, lateritic loam, and warm moderately humid temperatures. On average, ginger is planted in March to May when pre-monsoon thunderstorms fall. On average, March and April are the most favorable months to plant, but if you plant in February, March, or early April when there are early summer showers, you may avert disease and maximize production (Munda et al., 2018). Research over the past twenty years has primarily focused on foods labeled as low-fat, low-calorie, and healthy diet. Regular consumption, when accompanied by a balanced diet, may offer health advantages beyond conventional nourishment. These foods are referred to as functional foods

(Granato et al.,2022). The rhizome of *Kaempferia parviflora* (Zingiberaceae), commonly referred to as black ginger, has been consumed for centuries in Asian cultural medicine, especially in Thailand, for both culinary and medicinal purposes. While the fresh rhizome is used to brew liquor, the dried one is then chopped up and used as tea bags. It has been used in a range of dietary supplement items, including pills, capsules, tablets, and medical liquor or whiskey plus honey. Black ginger is said to help treat diabetes, stomach ulcers, asthma, food allergies, dysentery, diarrhea, and gout (Toda et al., 2016). It has been reported that more than 100 chemical compounds have been extracted from ginger (Ali et al.,2008).

Ginger is stuffed with minerals, especially potassium, calcium, phosphorus, salt, and iron (Ogunola et al.,2010). Its chief vitamin content is thiamine, riboflavin, niacin, and vitamin C (Parthasarathy, 2008). Fresh ginger is divided into two main categories: volatiles and non-volatiles, each of which contributes differently to a particular bitterness. Ginger obtains its distinctive aroma and scent from volatiles such as monoterpenoid hydrocarbons and sesquiterpene. On the other hand, gingerols, shogaols, paradols, and zingerone are examples of non-volatile pungent drugs (Jolad et al.,2004). The principal volatile constituents of the chemical-based are α -zingiberene (22.29%), β -sesquiphellandrene (8.58%), α -farnesene (3.93%), β -bisabolene (3.87%), and α -curcumin (2.63%). The two strongest potentially pungent compounds are [6]-gingerol (9.38%) and [6]-shogaol (7.59%). Furthermore, because zingerones (9.24%) are generated whenever gingerols or shogaols are heated, they also exist in significant amounts (Zhan et al., 2008). Multiple studies indicate that multiple inherent chemical elements, such as 6-gingerol, 8-gingerol, 10-gingerol, 6-shogaol, 6-hydroshogaol, and oleoresin, are present in ginger beneficial effects on health (Ma et al., 2021). 6-gingerol has been shown to have antioxidant and anti-inflammatory actions, to minimize cytokine fabrication, and to promote angiogenesis (Schwertner & Rios 2007). Gingerols can be converted into complementing shogaols by performing heat treatment or preserving them for a long time. You may turn shogaols into paradols by hydrogenation (Stoner, 2013). A further investigation indicated that ginger may reduce blood levels of TNF- α and hs-C-reactive protein (hs-CRP) in diabetic patients (Muhlujj et al. (2013) confirmed this conclusion. By diminishing MDA, oxidative stress, and TNF- α levels in patients with tuberculosis, extracts of ginger may benefit in concert with antituberculosis medication (Kulkarni & Deshpande 2016). Rhizomes of

ginger are chewed by women as carminatives for treating bloating as well as during sickness, condition, and confined space, as in conventional healthcare (Hussein et al.,2017).

Neuroprotective properties of ginger:

It has been demonstrated that the active ingredients in ginger, such as 6-gingerol and 6-shogaol, have anticancer potential by boosting BAX expression, suppressing NF- β DNA binding activity, and inhibiting COX-2 expression. Ginger's ability to reduce oval cell growth and caspase-8 expression—both of which are necessary for triggering apoptosis and inhibiting the Bcl-2 protein—confirms its anticancer qualities. Additionally, ginger extract was found to strengthen 5-FU's anticancer activities against colon cancer in a prior study. In the previous study, therapy with ginger extract enhanced apoptosis in comparison to treatment with 5-FU alone. When ginger extract and Gelam honey were paired together, the anticancer impact of 5-FU was substantially improved (Mohd Sahardi & Makpol 2019).

Antioxidant and antimicrobial effects of ginger:

By blocking 5-lipoxygenase synthetase, the active substances in ginger, notably gingerol and shogaol, restrict leukotriene and prostaglandin emergence, which adds to the antioxidant advantages of ginger on heart structure (Verma at el., 2004). White wheat flour has low levels of proteins, vitamins, minerals, and phenolic chemicals, which are regarded as crucial active antioxidants, as a result of the extraction approach's removal of the aleurone layer, which retained the flour's nutritional material (Dewettinck at el.,2008). Ginger can build up the immune system and enhance inflammatory responses and antioxidant capabilities, which may assist both the immune system and chicken production (An et al.,2019).

Furthermore, Sahoo and Mishra reported that grill chickens' antioxidative status and gastrointestinal health were considerably enhanced by feed diets enriched with ginger, alone or combined with 1% turmeric (Sahoo et al.,2019).

The antibacterial action of ginger is also connected to the proposed treatment. For instance, in contrast to essential oil obtained from dried ginger, which has a modest amount of volatile compounds (14.4%) which leads to inadequate antibacterial and antifungal operations, the essential oil obtained from fresh ginger stored a higher concentration of oxygenated molecules (29.2%), such as geranial, 1,8-cineole, neral, borneol, and α -terpineol (Beristain Bauza at el.,2019).

Ginger may be relied on to reduce pulmonary inflammation and may help with COVID-19 symptoms due to its anti-inflammatory and immunomodulatory abilities. Multiple investigations have demonstrated that inflammation and inflammation-related disorders such as metabolic syndrome, CVD, and diabetes are caused by upregulation of NF- κ B, STAT, NLRP, TLR, MAPK, mTOR, COX-2, and iNOS.^{13, 87} Once it was shown that a ginger extract (GE) reduced the reactivation of lots of genes involved in the inflammatory response, the pharmacological effects of ginger were further evaluated (Roudsari et al., 2021).

6-Shogaol's anti-inflammatory actions were achieved by reducing the expression of p38MAPK and NF- κ B, which in turn prevented the synthesis of PGE₂ and pro-inflammatory cytokines such IL-1 β , IL-6, TNF- α , and COX-2 (Han et al.,2019).

protection, and Anticancer, cardiovascular antidiabetic effects of ginger:

The basic mechanism by which gingerol, the active ingredient in ginger, regulates various cell signaling pathways linked to cancer is addressed. Those pathways encompass Nuclear Factors (NF-KB), Signal Transducer and Activator of Transcription 3 (STAT3), Activator Protein-1 (AP-1), β -catenin, Progress Factors Receptors (EGFR, VEGFR); Mitogen-Activated Protein Kinases (MAPK); and pro-inflammatory mediators (TNF- α and COX-2). Studies carried out in vitro and in vivo verify the role of gingerol in cancer (Nafees et al 2021).

Human Hela cancer cells served to quantitatively assess the antiproliferative properties of fresh, dried, and steamed gingers. A suitable process ginger extract for cancer chemotherapy avoidance was created by evaluating the link between the steaming process and ingredients and anticancer activity. For its chemopreventive and chemotherapeutic acts on cervical malignancies, steamed ginger could represent a preferable choice (Cheng et al 2009).

We studied how ginger extract served to prevent inflammatory responses, leptin stages, and structural modifications to the heart that are put on by diabetes in heart tissue. Ginger treatment has beneficial properties and guards against diabetes-induced irregularities, according to other researchers' earlier work (Afshari et al 2007) (Shanmugam et al 2011). The alcohol-induced lipid profiles were substantially lowered by ginger treatment, except for high-density lipoproteins.

Moreover, the administration of ginger significantly decreased the increased cardiac biochemical activity associated with alcohol intoxication (Subbaiah et al 2017).

Conclusion:

Natural products are becoming popular because of their plant-based chemistry and safe usage. Worldwide, ginger is utilized as a culinary spice and natural medicine. Ginger is enriched in gingerol, a substance with inflammatory and antioxidant characteristics. Antioxidants and other nutrients in ginger may help treat different diseases like arthritis, inflammation, or various types of infections. It also helps in treating cancer, stomach ulcers, asthma, food allergies, and diabetes. Ginger also helps in digestion and nausea and also eases headaches and migraine.

Future perspective:

Current studies indicate that ginger has a lot of promise for use in medicine, thus the future of this plant seems bright. Ginger has antioxidant and anti-inflammatory qualities that may be very important in the treatment of chronic illnesses including heart disease and arthritis. It has potential to help treat diseases like Alzheimer's and show promise in managing metabolic syndrome, preventing cancer, and protecting neurons. Broader medicinal applications are suggested by the well-established antibacterial, analgesic, and gastrointestinal effects of ginger. The use of ginger in natural and integrative medicine techniques may become increasingly important as research progresses.

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