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Phytochemical Composition of Zingiber Officinale Roscoe

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Abstract:
Ginger is rich in active ingredients such as phenolic and terpene compounds. Phenolic compounds in ginger are mainly represented by gingerols, shogaols and paradols. In fresh ginger, the main polyphenols are gingerols such as 6-gingerol, 8-gingerol and 10-gingerol. 6-Gingerol is the most pharmacologically active among these compounds. 6-Gingerol is the most pharmacologically active among these compounds. Data collected from the experimental (in vitro or in vivo) and clinical studies discussed in this review indicate that ginger extract and [6]-gingerol exert their effects through important mediators and cell signaling pathways, including Bax/Bcl2, p38/MAPK, Nrf2. , p65/NF-κB, TNF-α, ERK1/2, SAPK/JNK, ROS/NF-κB/COX-2, caspase-3, -9 and p53.

Keywords: Ginger, Phenolic compounds in ginger, 6-gingerol, 8-gingerol and 10-gingerol..

Introduction

Ginger is rich in active ingredients such as phenolic and terpene compounds. Phenolic compounds in ginger are mainly represented by gingerols, shogaols and paradols. In fresh ginger, the main polyphenols are gingerols such as 6-gingerol, 8-gingerol and 10-gingerol. Upon heat treatment or long-term storage, gingerols can be converted to the corresponding shogaols. After hydrogenation, shogaols can be converted to paradols. Ginger is also rich in other phenolic compounds such as quercetin, zingerone, gingerenone-A, and 6-dehydrogingerdione. In addition, there are several terpene components in ginger, such as β-bisabolene, α-curcumene, zingiberene, α-farnesene, and β-sesquifellandrene, which are considered the main constituents of ginger essential oils. In addition, ginger also contains polysaccharides, lipids, organic acids, and raw fibers [1].

We are the first to report HPTLC analysis of ginger extract and analysis of their active components with comparative antioxidant, anti-inflammatory and xanthine oxidase inhibitory activity. Five fractions were obtained using solvents of different polarity with a selective extraction procedure from ginger rhizomes, and were found to reveal a difference in biological activity compared to the studied parameters. Ethyl acetate extract (EAE) showed significant antioxidant activity as measured by DPPH, FRAP

and H 2 O 2 analysis (IC 50 ± SEM [μg/mL]: 6.8 ± 0.6, 12 ± 0.2 and 20 ± 2.5 respectively). In the xanthine/xanthine oxidase system, the antioxidant potential of EAE and water extract (AE) (% inhibition: 76% and 74%, respectively) was higher than that of ethanol extract (EE), diethyl ether extract (DEE), and n-butanol extract (NBE). In terms of anti-inflammatory activity, EAE showed greater inhibition of lipoxidase (80%) and β-glucuronidase (78%) compared to hyaluronidase (46%) and diene conjugates (37%). Chromatographic analysis showed that several main substances are responsible for the biological activity of ginger, including 6-gingerol, 6-shogaol and 6-paradol. Compound 6-gingerol showed high FRAP-reducing activity (IC 50 ± SEM [μM]: 5 ± 0.4). 6-gingerol also significantly inhibited the activity of xanthine oxidase (85%), lipoxidase (87%), β-glucuronidase (85%) and hyaluronidase (56%), respectively. These results indicated that ginger rhizome fractions and its active constituents have promising antioxidant, anti-inflammatory, and anti-gout properties and could be used as a potential natural remedy for oxidative stress and inflammation-related diseases following successful in vivo and clinical trials [2].

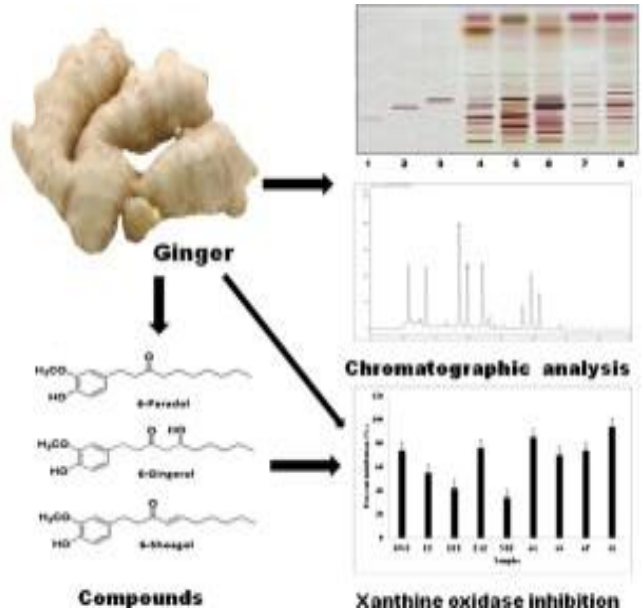

Figure 1. Chromatographic analysis

Ginger is composed of several bioactive compounds that contribute to its known biological activity. Ginger has been found to contain a variety of biologically active compounds, including phenolic compounds, terpenes, lipids, and carbohydrates. Therefore, its pharmacological effects are largely associated with phenolic compounds and terpenes, collectively known as gingerols [3,4].

6-Gingerol is the most pharmacologically active among these compounds. Data collected from the experimental (in vitro or in vivo) and clinical studies discussed in this review indicate that ginger extract and [6]-gingerol exert their effects through

important mediators and cell signaling pathways, including Bax/Bcl2, p38/MAPK, Nrf2. , p65/NF-κB, TNF-α, ERK1/2, SAPK/JNK, ROS/NF-κB/COX-2, caspase-3, -9 and p53. This suggests that ginger derivatives in the form of an extract or isolated compounds exhibit appropriate antiproliferative, antitumor, invasive, and anti-inflammatory activity [5].

Several studies have explored and reflected that ginger is commonly used as a medicinal spice as it has various medicinal properties [6].

Ginger has been reported to have medicinal properties such as antimicrobial, antifungal, antiviral, antioxidant, anti-inflammatory, and anti-cancer effects [7].

Zingiber officinale zingerone gingerols and paradol) and terpenoids (zingiberene, zingiberol, bisabolene and galanolactone). Gingerols are chemically converted into shogaol, zingerone and alkanals (hexanal, octanal and decanalal). Shogaol can be converted to paradol. Zingiberene is the main terpenoid in ginger. Curcuminoids (kassumunin A and B) and homologues of gingediol and gingediacetate are also present [8].

The biomolecules in ginger have various mechanisms of action which include: (1) inhibition of eicosanoids [inhibits the formation of thromboxanes, prostaglandins (prostaglandin F, prostaglandin E), and leukothienes], (2) serotonin antagonism, (3) substance P release, and (4) Ca. Shogaol inhibits 5-HETE synthesis, while gingerol and dehydroparadol inhibit cyclooxygenase. Gingerol inhibits the synthesis of prostaglandins and leukotrienes. Acetone extract of ginger inhibits 5-HT (a transmitter involved in cognitive, emotional and physiological processes). Galanolactone 2α 2 and prospaglandin D 2 Ca 2+ /ATPase modulation. Gingerdione inhibits the synthesis of 5-HETE (hydroxyeicosatetraenoic acid) and prostaglandin E 2 (a diterpenoid), shogaol, dehydrogingerdione and gingerol inhibit the neurotransmitter 5-HT.

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It also contains 1-3% essential oils. In animal studies, gingerols have been shown to increase gastrointestinal motility and have analgesic, sedative, antipyretic, and antibacterial properties. The active gingerol has a pungent odor, and the essential oil also contains sulfur-containing compounds such as allicin, alliin, and ajoene. In addition, it contains enzymes such as allinase, peroxidase and myrosinase. The antibiotic properties of allicin are well known in traditional medicine. Allicins have fibrinolytic activity, which reduces platelet aggregation by inhibiting prostaglandin E2. Compounds in ginger also increase levels of antioxidant enzymes, including superoxide dismutase and glutathione peroxidase, which may be helpful in inflammatory responses caused by viral infections. Anti-influenza agents have been isolated from Z. officinale [9].

Ginger rhizomes also contain amino acids, proteins, proteolytic enzymes, lipids (6-8%), sterols, fiber, vitamins (ascorbic acid, niacin, thiamine, riboflavin), starch (about 50%), mucus, monosaccharides and inorganic substances. . There is information about the presence in the rhizome of flavonoids (kaempferol, rutin, naringenin), tannins (catechin and epicatechin), saponins and alkaloids [2]. However, the presence and quantitative content of specific types of biologically active substances may differ significantly depending on the place of cultivation of the plant.

Monographs on dried raw materials of ginger rhizomes are included in the pharmacopoeias of the United States (USP), Europe, Great Britain, China, Japan and India [3,5]. According to the requirements of the European Pharmacopoeia (EPh) 7.0 and USP 32, ginger rhizome is standardized for the content of gingerols and gingerdiones (not less than 0.8%), the content of shogaols (not more than 0.18%), essential oil (not less than 1.8 ml in 100 d), starch (not less than 42%), extractives soluble in alcohol (not less than 4.5%), and extractives soluble in water (not less than 10%) [10].

The antimicrobial activity of 6-, 8-, and 10-gingerols against Mycobacterium avium and M. tuberculosis was studied in vivo. The most active inhibitor growth of both microorganisms turned out to be 10-gingerol. Ginger also has an antimicrobial effect on gram-positive bacteria (Staphylococcus epidermidis, Staphylococcus aureus), gram-negative bacteria (Klebsiella sp., Enterococcus sp., Proteus sp., E. Coli and Pseudomonas florescent) and a fungicidal effect on the fungus Candida albicans. The analysis used dry extracts obtained on the basis of methanol and n-hexane, containing

zingiberene (9%, 6% respectively), β-bisabolene (4%, 5%), α-farnesene (11%, 7%), β-sesquifellandrene (9%, 13%), α-curcumene (14%, 0%), gingerol (25%, 23%) and shogaol (18%, 25%). At the same time, solutions of extracts at a concentration of 50 mg/ml showed the best effects.

Antioxidant action is characteristic of all phenolic compounds of ginger, however, 6-shogaol has the highest activity due to the α, β unsubstituted keto group of the molecule [30]. There is information about the action of 6-shogaol and ginger rhizome terpenoids as antitumor agents [11].

Conclusion

According to the analysis of scientific publications, the rhizome of ginger officinalis is a promising raw material for the creation of medicines. Ginger has a rich chemical composition, so the rhizome has a whole spectrum of pharmacological activity: anti-inflammatory, analgesic and diaphoretic effects, antiemetic effect, stimulates and improves digestion, reduces blood cholesterol levels, exhibits expectorant, hypotensive and antioxidant effects.

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