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Therapeutic Activities Of Ginger (Zingiber Officinale Rosc.) In Traditional And Modern Medicine : A Literatur Review

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Abstract:
Background*: Ginger (Zingiber officinale Rosc.), a plant from the Zingiberaceae family, has a long history of use as a spice and medicine, dating back over 3000 years. The rhizome of ginger, known for its spicy aroma due to ketones like gingerol, was an essential trade item in ancient times and remains valued in both traditional and modern medicine. The purpose of this literature review is to examine the therapeutic activities of ginger from traditional to modern medicine.*
Materials and Methods*: This literature review presents results by combining data from several studies of similar research topics.*
Results*: The results show that ginger contains active compounds such as 6-gingerol and 6-shogaol, which exhibit antioxidant and anti-inflammatory properties, contributing to its effectiveness in treating viral infections, boosting immunity, reducing nausea, oxidative stress, and inflammation, and showing potential as a natural remedy for fever and arthritis.*
Conclusion: *In addition to its antioxidant and anti-inflammatory properties, ginger also has pharmacological activities as an antipyretic and antiarthritic agent. It is widely used in Traditional Chinese Medicine and modern practices for its diverse biological activities, including antimicrobial, anticancer, neuroprotective, and cardiovascular benefits. The findings highlight ginger's potential as a valuable additive in the food and pharmaceutical industries.*
Key Word*: Ginger ;Antioxidant ;Biological activities ;Bioactive compounds*

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I. Introduction

Ginger (*Zingiber officinale* Rosc.) is a plant belonging to the *Zingiberaceae* family. Its name "*Zingiber*" is derived from the Greek "*Zingiberi*" and Sanskrit "*Singabera*," which refer to its horn-like shape resembling a deer antler. The term "*Officinale*," from the Latin "*Officina*," signifies its historical use in medicine and pharmacy[1]. The position of the ginger plant in the systematics (taxonomy) of plants is as follows[2] :

Image 1. *Zingiber officinale* Rosc.

Kingdom.	: *Plantae*
Subkingdom	: *Tracheobionta*
Superdivision	: *Spermatophyta*
Division	: *Magnoliophyta*
Class	: *Liliopsida*

Subclass : *Zingiberidae*
Order : *Zingiberales*
Family :*Zingiberaceae* Martinov
Genus : *Zingiber* Mill.
Specis : *Zingiber officinale* Roscoe

Ginger has been utilized, either by itself or in combinations, as a spice or treatment in ancient formulas found in manuscripts of Iranian Traditional Medicine (ITM). This plant is native to India and is grown in various regions including South and Southeast Asia, Africa, Latin America, and Australia[3]. Ginger's spicy aroma comes primarily from ketones, especially gingerols. The main part of ginger that is consumed is the rhizome, this spice has a history dating back over 3000 years and was used as a flavoring agent long before written history. Ginger was a crucial trade item, exported from India to the Roman Empire over 2000 years ago for its medicinal properties. Even after the Roman Empire fell, ginger remained highly valued in Europe, controlled by Arab merchants for centuries[4].

In traditional medicine, ginger has been widely acclaimed for its various therapeutic properties. Historical texts and manuscripts from various cultures document its use in treating a variety of ailments. In Iranian Traditional Medicine, for example, ginger has been used to treat digestive disorders, respiratory issues, and inflammation. It has also been prescribed as an aphrodisiac and a general tonic to improve overall health and vitality. Similarly, Ayurvedic medicine, which originates from India, utilizes ginger for its carminative properties, which help in relieving gas and bloating, and as a remedy for colds and coughs. Traditional Chinese Medicine (TCM) also holds ginger in high regard, particularly for its warming properties that help to invigorate the spleen, stomach, and lungs, thereby promoting digestion and alleviating respiratory problems[5].

Modern scientific research has validated many of the traditional uses of ginger, shedding light on its active compounds and their mechanisms of action. The key bioactive compounds in ginger include gingerols, shogaols, paradols, and zingerone. Gingerols, which are the primary pungent compounds in fresh ginger, have been found to possess potent antioxidant and anti-inflammatory properties. They play a significant role in reducing oxidative stress and inflammation, which are underlying factors in many chronic disease[6]. One of the most well-documented therapeutic applications of ginger in modern medicine is its efficacy in alleviating nausea and vomiting. Ginger has been found to be particularly effective in reducing symptoms of nausea associated with pregnancy (morning sickness), chemotherapy, and postoperative recovery. Studies have shown that ginger can inhibit serotonin receptors and exert antiemetic effects without significant side effects.

II. Methods

This literature review presents results by combining data from several studies of similar research topics. This method collects all relevant research on a particular topic and design. Literature reviews are the gold standard for discovering, compiling, analyzing, and summarizing the best available data on preclinical and clinical topics. The results of literature reviews provide the most reliable evidence base for the development of reliable clinical guidelines (and their recommendations) and clinical decision making. They follow a structured research process that requires the use of rigorous procedures to ensure that the results are reliable and relevant to the end user. The result is a literature review that is considered the basis of medical evidence. This research was conducted by reviewing a total of 23 journals, and 10 of them fit the inclusion criteria. The inclusion criteria of this article review are national and international journals published in the last 10 years (2014-2024) in Indonesian and English. Articles that discuss the active compounds and pharmacological activities of ginger were also considered as inclusion criteria. Strategic search keywords were “therapeutic” or “ginger” plus “traditional” or “modern”.

III. Result

From a total of 23 articles that have been screened out, 10 of them fit the inclusion criteria. Based on the process of searching and browsing data from the literature, most of them mention that ginger has pharmacological activity as an antioxidant, antipyretic and antiarthritic.

Table no. 1 Bioactive compounds and pharmacological activities of ginger (*Zingiber officinale* Rosc.)

Reference	Method	Bioactive Compounds	Pharmacological Activities
Nam *et al.*, 2024	LC/MS analysis and DPPH	Quercetin 3-O-rutinoside-7-O-rhamnoside and chloramphenicol 3-O-rutinoside-7-O-rhamnoside .	Antioxidant
Nurani, *et al.*, 2023	Phytochemical tests and DPPH	Gingerol and Shogaol	Antioxidant
Chi *et al.*, 2023	Gas chromatography-mass spectrometry and DPPH	Camphene, β-phellandrene, α-citral, eucalyptol, sesquiphellandrene, α-farnesene, α-pinene	Antioxidant

Gabriella and Fathiyah, 2020	Docking	10- Gingerol, 10- Shogaol and Acetaminophen	Anti-inflammatory and antipyretic
Hamza *et al., 2024*	HPLC, DPPH assay and FRAP assay	Saponin, 6-gingerol and 6-shogaol	Antioxidant and anti inflammatory
Amalia and Sabila, 2021	Phytochemical screening and Folin-Ciocalteau method	Alkaloids, flavonoids, phenolics, tannins, terpenoids, and steroids	Antiarthritic
Susila *et al.*, 2014	Univariate analysis and bivariate analysis	Oleoresin, essential oils, and flavonoids	Antioxidant and anti inflammatory
Mojani *et al.*, 2014	HPLC, DPPH radical scavenging assay	Gingerol, Shogaol, and flavonoids	Antioxidant
Sandrasari *et al.*, 2023	HPLC	6-gingerol, 6-shogaol, paradol and zingerone	Antioxidant
Again *et al.*, 2022	Ultrasound-assisted extraction (UAE) in terms of crude yield (CY), as well as total phenolic content (TPC), 1,1-diphenyl-2-picrylhydrazyl (DPPH), and ferric reducing-antioxidant power (FRAP)	Gingerol and Shogaol	Antioxidant

IV. Discussion

Antioxidant

Several studies have demonstrated the potent antioxidant activity of ginger (*Zingiber officinale*). The bioactive compounds, primarily 6-gingerol (at concentrations ranging from 0.1 to 2.5 mg/g) and 6-shogaol (at concentrations ranging from 0.01 to 0.5 mg/g), are effective in scavenging free radicals and reducing oxidative stress. The ultrasound-assisted extraction of Bentong ginger resulted in high yields of total phenolic content and demonstrated significant antioxidant activity, measured using DPPH and FRAP assays. This suggests that ginger can play a crucial role in protecting cells from oxidative damage and maintaining overall health by neutralizing harmful free radicals[16] .Moreover, the antioxidant properties of ginger extend beyond just the phenolic compounds. The rhizomes contain various other compounds, such as zingerone and paradol, which contribute to its overall antioxidant capacity. Found that the combination of red ginger at concentrations ranging from 10 to 50 mg/g) with secang wood (*Caesalpinia sappan*) (at concentrations ranging from 5 to 25 mg/g) enhances the antioxidant effects due to synergistic interactions between their respective phytochemicals[12] .This combination could potentially be developed into a more effective antioxidant therapy. Additionally, the incorporation of ginger into daily diets can have practical health benefits. Regular consumption of ginger tea, for example, has been associated with lower markers of oxidative stress in human studies. This dietary practice aligns with traditional uses of ginger in various cultures for promoting health and longevity. Continued research into the antioxidant mechanisms of ginger could lead to novel applications in preventing and managing diseases associated with oxidative stress, such as cardiovascular diseases and neurodegenerative disorders.

Anti-inflammatory

Ginger's anti-inflammatory properties have been well-documented in various studies. The key compounds, 6-gingerol and 6-shogaol, inhibit the production of pro-inflammatory cytokines and enzymes. Explored the therapeutic potential of ginger oil against inflammatory processes and found that it significantly reduces inflammation by modulating the NF-κB signaling pathway. The study used a concentration of 100 µg/mL of ginger oil, which was found to be effective in reducing inflammation by inhibiting the activation of NF-κB and suppressing the production of pro-inflammatory cytokines[17] . Furthermore, Rahayu et al. (2023) confirmed the anti-inflammatory activity of red ginger extract in a murine model, showing a marked reduction in acute inflammation[18] .The optimal dose for red ginger extract in reducing acute inflammation is 175 mg/kgBB/day. This dose is effective in inhibiting alveolar proliferation, resulting in more balanced alveoli and reduced inflammation. To the inhibition of pro-inflammatory mediators, ginger also affects the expression of genes related to inflammation. Studies have shown that ginger, at concentrations of 10-100 µg/mL, can downregulate the expression of COX-2 and iNOS, enzymes that play critical roles in the inflammatory process. This molecular action further underscores the potential of ginger as a natural anti-inflammatory agent. The comprehensive approach of targeting multiple pathways makes ginger an effective option for managing inflammatory conditions. Furthermore, clinical studies have provided evidence supporting the use of ginger in inflammatory diseases. For example, patients with osteoarthritis who consumed 1000mg of ginger supplements daily in divided doses (500mg twice a day) reported significant reductions in pain and improvements in joint function compared to those who received a placebo. It's important to consult with a healthcare professional before starting any new supplement to determine the appropriate dosage and usage for individual needs. These findings suggest that ginger could be a valuable complementary therapy in the treatment of chronic inflammatory diseases, enhancing the effects of conventional treatments and possibly reducing the need for pharmaceutical anti-inflammatory drugs.

Antipyretic

The antipyretic effects of ginger are attributed to its ability to modulate inflammatory responses. Ginger essential oils, particularly gingerol (10-50 mg/kg) and shogaol (1-10 mg/kg), have demonstrated significant antipyretic effects in animal studies, reducing fever induced by yeast or lipopolysaccharide[5] .These compounds reduce fever by inhibiting the synthesis of prostaglandins, which are mediators of inflammation and fever. This aligns with traditional uses of ginger in various cultures for treating fever and other related symptoms. Further investigation into the molecular mechanisms reveals that ginger affects the central nervous system's regulation of body temperature. By modulating hypothalamic pathways, ginger can effectively reduce fever without causing adverse effects commonly associated with synthetic antipyretics. Concentrations of 0.5-1 ppm are detectable by smell, 2-3 ppm cause mild irritation, and concentrations of 4-5 ppm are intolerable for most people. This natural approach provides a safer alternative for fever management, especially in vulnerable populations such as children and the elderly. Additionally, the integration of ginger into herbal remedies for fever has been practiced for centuries. The combination of ginger with other antipyretic herbs could enhance the overall therapeutic effect, providing a holistic approach to fever management. Future research should focus on optimizing these combinations and understanding the interactions between different bioactive compounds to maximize the antipyretic potential of ginger.

Antiarthritic

The potential of ginger as an antiarthritic agent is supported by its ability to alleviate inflammation and oxidative stress in joint tissues. Conducted a phytochemical screening and found that the total phenolic compounds in red ginger and secang wood Total Phenolic Compounds (TPC) 12.5 mg GAE/mL (Gallic Acid Equivalent per milliliter) and Total Phenolic Compounds (TPC): 8.2 mg GAE/mL exhibit significant antiarthritic activity[9] .The study suggested that these compounds could be beneficial in the preliminary treatment of arthritis by reducing joint pain and swelling. Animal studies have shown that ginger extracts can protect cartilage from degradation. In a model of osteoarthritis, ginger supplementation led to a reduction in cartilage erosion and an improvement in joint structure. Specifically, the study found that a concentration of 100 mg/kg of ginger extract per day was effective in reducing cartilage degradation and improving joint health. This concentration was achieved by administering the ginger extract orally to the animals in the study, which demonstrated the potential therapeutic benefits of ginger in managing osteoarthritis. This positive effect was induced by the anti-inflammatory and antioxidant properties of ginger, which helped to mitigate the progression of osteoarthritis by reducing the degradation of cartilage and promoting its regeneration. These findings are promising for the development of ginger-based therapies aimed at slowing the progression of arthritis and preserving joint function. Clinical trials involving human participants have also demonstrated the efficacy of ginger in managing arthritis symptoms. Patients with rheumatoid arthritis who consumed ginger supplements experienced reductions in pain and morning stiffness. The recommended dose is 250 mg of ginger three to four times a day, taken with food to minimize gastrointestinal side effects. It is essential to start with a smaller dose, such as 200 mg a day, and gradually increase as needed. Patients should avoid taking more than 4 grams (4,000 mg) of ginger per day. These outcomes highlight the potential of ginger as a complementary therapy in arthritis treatment, offering a natural alternative to traditional pharmaceuticals with fewer side effects.

V. Conclusion

Ginger has been valued in both traditional and modern medicine across various cultures for its therapeutic properties, highlighting the active compounds in ginger such as gingerol and shogaol, which exhibit significant antioxidant and anti-inflammatory effects. Ginger is effective in reducing nausea, oxidative stress, and inflammation, and shows potential as a natural remedy for fever and arthritis.

This study confirms that ginger (*Zingiber officinale* Rosc.) possesses various significant pharmacological activities, primarily attributed to its active compounds such as 6-gingerol, 6-shogaol, 6-paradol, zingerone, and zerumbone. These compounds are responsible for enhancing enzyme actions and balancing circulation by rejuvenating the body and strengthening physical health. Ginger has pharmacological activities as an antioxidant, anti-inflammatory, antipyretic, and antiarthritic. The combined use of ginger with other herbs may enhance its therapeutic benefits, making it a valuable complementary therapy for various ailments.

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