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PHYTO - PHARMACOGNOSTICAL PROPERTIES, AND PHARMACOLOGICAL ACTIVITY OF SHUNTHI (ZINGIBER OFFICINALE ROSCOE): A COMPREHENSIVE REVIEW

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ABSTRACT:
Shunthi or Zingiber officinale Roscoe is a plant that has been used for long time in Ayurveda. It is used in many diseases such as Amavata, Vibandha, Agnimandya, Shotha, Grahni, etc. Ancient literature has described several aspects of Shunthi, including its synonyms, Rasa Panchaka, therapeutic actions, recommended dosages, and contraindications. It exhibits Katu rasa, Laghu Snigdha Guna, Ushna Virya, Madhura Vipaka, and has a Kaphavatahara effects. Currently, there is a growing interest in ginger that focuses in identification and isolating its chemical components, as well as validating its pharmacological effects on different systems with the help of modern tools. The purpose of this article is to explore Shunthi in Ayurvedic literature and to validate it by using current research. According to recent studies, ginger acts as an antioxidant, anti-inflammatory, analgesic & anti-microbial agent. Researchers give an example of how Shunthi works using traditional pharmacology and biochemistry.

KEYWORDS: Shunthi, Zingiber officinale, Ginger, Phytochemical, Pharmacological.

INTRODUCTION

Dry ginger or Shunthi (Zingiber officinale Roscoe), is one of the most valuable medicinal plants described in Ayurveda and other traditional systems of medicine, belonging to the family Zingiberaceae and obtained from the dried rhizome of ginger. Shunthi has been used as a dietary spice, flavoring agent, and medicinal herb since ancient times because of its significant therapeutic properties, which are described in Ayurveda as alleviating Kapha and Vata Dosha and digesting Ama, making it one of the most valuable drugs in Ayurveda and widely used in the management of digestive disorders, respiratory diseases, musculoskeletal conditions, and various inflammatory ailments.

Shunthi is also mentioned by several synonyms, namely Vishvabheshaja, Mahaushadha, and Nagara, in classical Ayurvedic texts, suggesting its widespread use and diverse therapeutic applications. In Ayurveda, Shunthi is classified as having Katu Rasa, Laghu and Snigdha Guna, Ushna Virya, and Madhura Vipaka, and is known to have Deepana, Pachana, Grahi, Shulahara, Kasahara, and Hridya actions, which renders it essential in many formulations. [1]

Several bioactive constituents found in the rhizome of Zingiber officinale have attracted considerable scientific interest in recent decades, and phytochemical studies have identified gingerols, shogaols, zingerone, paradols, flavonoids, terpenoids, and volatile oils, which are responsible for the diverse biological activities that have been proven experimentally and clinically, including anti-inflammatory, analgesic, antioxidant, antimicrobial, anti- arthritic, antiplatelet, cardioprotective, neuroprotective, and immunomodulatory activities, and corroborate many of its traditional therapeutic uses. [2]

A thorough understanding of Shunthi's pharmacognostic traits, phytochemical composition, and pharmacological activities is crucial given its wide medicinal value and mounting scientific evidence. Thus, the goal of this review is to gather and evaluate the information that is currently available about Shunthi (Zingiber officinale Roscoe) from both modern scientific research and traditional Ayurvedic literature.

2. MATERIAL AND METHODS

A comprehensive literature review was carried out to collect information on Shunthi and Zingiber officinale. The review included traditional sources such as original Ayurvedic texts, and the Indian Ayurvedic Pharmacopoeia, as well as scientific databases like Science Direct, PubMed, and Google Scholar.

3. Botanical Description of (Shunthi) Zingiber officinale

Shunthi (Zingiber officinale) is a stout tuberous rhizome perennial herb with erect leafy stems 0.6 to 1.2 m. high. Leaves narrow, distichous, subsessile on the sheaths, linear- lanceolate, 1-2 cm. wide, glabrous. Flowers greenish with a small dark purple or purplish black lip, in radical spikes 3.8-7.5 cm. long and 2.5 cm. diam. On peduncles 15-30 cm. long.

Stamen dark purple, as long as the lip, rather shorter than the corolla. It is cultivated throughout the Sub-Himalayan tracts of Uttar Pradesh, occasionally cultivated in Bihar and Orissa, West Bengal, Himachal Pradesh, Madhya Pradesh, Gujarat, Deccan, Karnataka and Kerala and run wild in some places in Western Ghats. [3]

4. Taxonomical classification [4]

Kingdom - Plantae
Class -Monocotyledons
Series - Epigynae
Family – Zingiberaceae
Genus – Zingiber
Species - officinale

5. Phytochemicals

Based on phytochemical studies, the ginger rhizome contains a variety of biologically active compounds that offer therapeutic benefits. Zingiber officinale is known to contain essential oils, phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, saponins, steroids, terpenoids, and tannins as the main group of phytochemicals. [5]

Table No. 1: Major phytochemical Constituents of Zingiber officinale Rhizome [6-16]

Category	**Class of Compound**	**Major Constituents**	**Significance**
Volatile Constituents	Sesquiterpene hydrocarbons	Zingiberene, ar- Curcumene, ß-Bisabolene, (-)-ß-Sesquiphellandrene, (E, E)-ά-Farnesene	Major aroma-producing compound: contribute to anti-inflammatory and antioxidant activities
	Monoterpene hydrocarbons	ά-Pinene, Camphene, Myrcene, ά-Phellandrene, ß- Phellandrene, Limonene	Responsible for characteristic fragrance and flavor
	Oxygenated Monoterpenes	1,8- Cineole, Linalool, Borneol, ά-Terpineol, Citronellol	Contribute to aroma and therapeutic effects
	Aldehydes	Neral, Geranial	Provide citrus- like aroma and flavor
	Alcohols	Geraniol	Aromatic and pharmacologically active constituent
	Esters	Bornyl Acetate, Citronelly Acetate	Enhance fragrance and flavor profile

	Ketones	6-Methyl-5-hepten-2-one, 2-Undecanone	Contribute to volaile oil composition
	Other Sesquiterpenes	ά-Copaene	Minor aromatic constituent
Non- Volatile Constituents	Gingerols	6-Gingerol, 8- Gingerol, 10- Gingerol	Principle pungent compound: anti-inflammatory, analgesic, antioxidant
	Gingerdiols	Various gingerdiol derivatives	Contribute therapeutic effects
	Shogaol	6- Shogaol, 8- Shogaol, 10- Shogaol	Formed during drying and heating: more pungent than gingerols
	Zingerone	Zingerone	Formed by degradation of gingerols: contributes medicinal activity
	Paradols	Paradol, Dihydroparadol	Possess antioxidant and anti-inflammatory properties
	Gingerdiones	1-Dehydro-gingerdiones	Bioactive phenolic compounds
	Diarylheptanoids	Various derivatives	Associated with antioxidant and anti-inflammatory effects
	Acetylated Derivatives	Acetyl gingerols, Acetyl gingerdiols	Modified phenolic compounds
	Other Novel Phenolics	Isogingerols, isoshogaols, hydroxy-shogaols, Methoxy-gingerols	Enhance the pharmacological profile of ginger

6. Synonyms

Table no. 2: Synonyms of Shunthi (Zingiber officinale Roscoe) [17]

S.No.	Synonyms	Features for identification
1.	Shunthi	The dried rhizome that alleviated Kapha and Vata dosha and helps in the digestion of Ama.
2.	Ushna	Highlights its heating property and ability to produce warmth.
3.	Vishva	Suggests its rapid many systemic actions owing to its potent pharmacological properties.
4.	Utkala	Refers to the sharp and potent nature of the rhizome.
5.	Katubhadra	Signifies its excellence among pungent drugs.
6.	Nagara	Refers to its widespread commercial availability and common is in daily life.
7.	Avakchatra	Denotes the umbrella like spreading nature of its leaves.
8.	Ahicchatraka	Indicates the resemblance of its inflorescence to the hood of a serpent.
9.	Shringavera	Named for its horn- shaped rhizome.
10.	Mahaushadha	Indicates its status as a highly efficacious medicinal plant with diverse therapeutic actions.
11.	Vishvabheshaja	Reflects its universal acceptance and extensive medicinal use.

7. Rasa - Panchaka of Shunthi (Zingiber officinale Roscoe) [18]

- Rasa - Katu
- Guna - Laghu, Snigdha
- Virya - Ushna
- Vipaka - Madhura
- Doshakarma – Kaphavatahara
- Karma - Dipana, Pachana, Grahi, Hridya, Vibhandhahara, Swarya, Ruchya, Shulahara, Kasahara, Vrishya
- Part use - Dried Rhizome

8. Identity, Purity and Strength [19]

- Foreign matter – not more than 1 percent
- Total Ash – not more than 6 percent
- Acid -insoluble ash – not more than 1.5 percent
- Alcohol soluble extractive – not less than 3 percent
- Water soluble extractive - not less than 10 percent

9. Pharmacological actions and scientific evidence of Shunthi –

- Anti- inflammatory and Analgesic – Research on ginger essential oil revealed its ability to inhibit interactions between leukocytes and endothelial cells. Additionally, the action of ginger essential oil on reducing leukocyte chemotaxis in vitro and leukocyte migration in vivo may be attributed to its effect on the inhibition of prostaglandin release [20]. Gingerols effectively block the production of both prostaglandin and leukotrienes in RBL- 1 cells [21]. It has been demonstrated that ginger is effective in reducing cytokines that are produced and released at locations of inflammation [22].It has been suggested that the anti-inflammatory effects may result from the suppression of various inflammatory mediators, including serotonin, kinins, eicosanoids, and other cytokines that play a role in the inflammatory process [23].The pain- relieving and anti- inflammatory properties of ginger ethanolic extract may be attributed to the presence of the [6]- gingerol compound [24]. Ginger was consumed for five days with a dose of 500 mg taken three times a day, leading to a reduction in the intensity and duration of pain experienced by students suffering from primary dysmenorrhea likely due to the inhibition of prostaglandin synthesis [25].
- Anti- oxidant Activity – Antioxidants are substances or groups of substances that can safely interact with free radicals and stop the chain reaction before important molecules get damaged. They work through various ways: first, by removing substances that start the process of peroxidation, second, by binding to metal ions so they can't create harmful reactive species or break down peroxides, third, by neutralizing superoxide radicals to stop peroxide formation, fourth, by stopping the chain reaction of auto- oxidation, and\ or by lowering the amount of oxygen in a specific area [26]. Zingerone exerts a direct apoptogenic effect by reducing oxidative stress in the smooth muscles of the intestine [27]. Ginger is known for being rich in antioxidants. It has a unique ability to remove harmful substances such as reactive oxygen species, free radicals, peroxides, and other damaging oxidants. The active compound found in ginger, including gingerols, shogaols, zingerone, and others, contribute to its antioxidant properties. It also works by inhibiting an enzyme called xanthine oxidase, which plays a key role in producing reactive oxygen species. Research has shown that zingerone can help protect DNA in laboratory settings from oxidative damage caused by stannous chloride [28].
- Anti- arthritic activity – Eugenol from ginger reduced joint and paw swelling in rats with mycobacterial arthritis. The anti- arthritic and anti- inflammatory effects may be because eugenol inhibits the release of oxygen free radicals and prostaglandins [29]. 6- Gingerol, 8-Gingerol, and 10- Gingerol function as effective agents in scavenging DPPH, superoxide, and hydroxyl radicals. Among these, 8- Gingerol demonstrated the strongest interaction with the targets of rheumatoid arthritis, including COX -II, TNF- ALPHA, MCSF, IF-1BETA, and MMP9 [30]. Extracts from ginger help reduce inflammation associated with arthritis by inhibiting the production of pro- inflammatory cytokines and chemokines by synoviocytes, chondrocytes, and leukocytes [31]. Study on patient with rheumatoid arthritis, indicating that consuming ginger may help reduce symptoms of arthritis and musculoskeletal conditions. This effect is believed to occur because

ginger inhibits the cyclooxygenase and lipoxygenase pathways, which may lead to decreased production of PGE2 and leukotriene B4 [32].

- Anti- bacterial activity – Ginger extract has been found to inhibit the growth of certain bacteria, which were collected from throat and nostril swaps of patients, including staphylococcus aureus, streptococcus pyogenes, streptococcus pneumoniae, and Hemophilus influenzae [33].
- Anti- microbial activity – The antibacterial properties of plant extracts and oils can be beneficial for preserving both raw and processed foods, as well as for use in the pharmaceutical industry and as alternatives to conventional medicines and natural healing methods [34]. Ginger essential oil and oleoresins contain a significant amount of phenolic compound like eugenol, shogaols, zingerone, ginger diols, and responsible for the antimicrobial effects of ginger against F. moniliform and various Aspergillus species [35]. The essential oil extracted from ginger was tested for its ability to inhibit the growth of certain microorganisms, including Aspergillus Niger, Saccharomyces cerevisiae, lactobacillus acidophilus, and Bacillus cereus. This testing was carried out using the paper agar diffusion method to assess antimicrobial activity [36].
- Anti- platelet aggregation activity – Significant anti- platelet aggregation activity was shown by 6-GN and 6- SG, while 10-GN suppressed Ca2+- dependent contraction in media containing high levels of potassium [37]. The aggregation and release reaction of rabbit platelets induced by arachidonic acid and collagen were inhibited by 6 -GN at concentrations ranging from 0.5 to 20 IM. Additionally, 6-GN also reduced the formation of thromboxane B2 and PG D2, which are produced as a result of arachidonic acid, at concentrations between 0.5 and 10IM [38].
- Anthelmintic activity – Aqueous extracts from the rhizome of Zingiber officinale were tested for their anthelmintic effects against the earthworm pheretima posthuma. The finding showed that the extract at a concentration of 100mg\ ml has significant anthelmintic activity [39]. Methanolic extracts of Zingiber officinale were evaluated for their in vitro anthelmintic properties. The result indicated that Zingiber officinale was able to kill all the test worms, haemonchus contortus, within two hours of exposure, demonstrating 100% effectiveness [40].
- Cardiovascular activity – Ginger can help prevent different heart diseases by reducing the formation of blood clots, which might lead to reduce plaque buildup or thrombosis. It can also help clear blockages in the blood vessels, which lowers peripheral vascular resistance and reduces blood pressure. Additionally, ginger may assist in lowering high cholesterol levels, contributing to a healthier heart [41]. An early study discovered that [6]-, [8], and [10]- gingerol has a dose- dependent positive inotropic effect on isolated guinea pig left atria. Additionally, the compound ‘gingerol’ was found to increase the activity of the Ca2+- pumping ATPase in fragmented sarcoplasmic reticulum derived from mammalian skeletal and cardiac muscle [42].
- Neuroprotective activity – Ginger and its components are important for protecting the nervous system. The exact way ginger works to provide this protection is not completely understood. However, it is believed that the neuroprotective effects of ginger are due to the presence of certain compounds, such as phenolic and flavonoid substances. A significant study has found that 6-shogaol, a compound in ginger, has neuroprotective properties in cases of temporary global ischemia by reducing the activity of microglia [43].Another study supports the idea that ginger helps protect the nervous system by improving the brain’s antioxidant defenses and reducing levels of MDA to normal ranges in diabetic rats [44].
- Immunomodulatory activity – The positive effects of ginger in helping to treat coughs, colds, and flu may be connected to its ability to support the immune system. However, there is limited research on how ginger might influence the immune system [45]. One study found that rainbow trout fed a diet with 1% dried aqueous ginger extract for three weeks showed on improvement in their non- specific immune response [46].

DISCUSSION

Shunthi (Zingiber officinale Roscoe) has been used extensively in Ayurveda for centuries because of its exceptional medicinal qualities. It is referred to as Deepana, Pachana, Shulahara, and Kaphavatahara in classical Ayurvedic texts, suggesting that it is beneficial for conditions related to poor digestion, Ama formation, Shool, and Vata-Kapha aggravation. It is interesting to note that numerous conventional assertions are now backed by contemporary scientific research. The pharmacognostic properties of Shunthi, such as its unique morphology, physicochemical parameters, and organoleptic features, are crucial in guaranteeing the crude drug's authenticity and quality. For standardization and adulteration prevention, these parameters are especially helpful. Phytochemical research has identified a number of bioactive compounds in Shunthi, including gingerols, shogaols, zingerone, paradols, flavonoids, and volatile oils, with gingerols and shogaols being considered the primary active compounds responsible for the majority of their pharmacological effects. The change in gingerols into shogaols during drying could explain the medicinal value of the dried rhizome in Ayurveda and may result in an increase in the biological activity of the drug.

Shunthi has been shown to exhibit anti-inflammatory and analgesic effects, largely due to the inhibition of prostaglandins, leukotrienes, and other inflammatory cytokines, providing a scientific basis for its use in painful conditions such as primary dysmenorrhea, arthritis, and other inflammatory diseases, as well as its antioxidant activity that neutralizes free radicals and reduces oxidative stress, which may be important in its protective effects against chronic inflammatory and degenerative diseases. This activity is attributed to the presence of gingerols, shogaols, and zingerone.

Shunthi has been reported to possess antimicrobial, antibacterial, antiplatelet, cardiovascular, neuroprotective, and immunomodulatory properties in several studies, suggesting that Shunthi may have a much wider range of therapeutic applications than as a home remedy and digestive stimulant, although large-scale clinical studies are needed to prove its efficacy and safety for different medical conditions in spite of promising preclinical data.

CONCLUSION

One of the most significant medicinal plants mentioned in Ayurveda, Shunthi (Zingiber officinale Roscoe) is well-known throughout the world for its therapeutic qualities. Its rich phytochemical composition, diverse pharmacological activities, and pharmacognostic qualities are highlighted in this review.

It contains bioactive compounds such as gingerols, shogaols, zingerone, and volatile oils, which provide anti-inflammatory, analgesic, antioxidant, antimicrobial, cardiovascular, neuroprotective, and immunomodulatory properties. These findings not only validate its traditional Ayurvedic use but also highlight its potential role in modern healthcare.

Shunthi's medicinal significance is highlighted by the strong correlation between contemporary scientific evidence and traditional Ayurvedic descriptions. To strengthen the current evidence and fully explore its therapeutic potential, more clinical research and standardization studies are necessary.

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