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THERAPEUTIC BENEFITS OF ZINGIBER OFFICINALE: A COMPREHENSIVE REVIEW

Ghanshyam Mali
Student, Department of Pharmacy, Faculty of Pharmaceutical Science, Mewar University, Chittorgarh, Rajasthan, India

Md Zulphakar Ali
Assistant Professor, Department of Pharmacy, Faculty of Pharmaceutical Science, Mewar University, Chittorgarh, Rajasthan, India

Dr. Himani Tiwari
HOD, Department of Pharmacy, Faculty of Pharmaceutical Science, Mewar University, Chittorgarh, Rajasthan, India

Prof. (Dr.) Kaushal K Chandrul
Dean, Department of Pharmacy, Faculty of Pharmaceutical Science, Mewar University, Chittorgarh, Rajasthan, India

Abstract: The root of the ginger plant, Zingiber officinale, is widely used in medicine. The use of ginger in the treatment of both infectious and non-communicable illnesses is highlighted in Ayurvedic literature. Modern developments in analytical chemistry, cytology, and microbiology support the use of ginger in a variety of medical diseases, corroborated by literature on Ayurveda. With particular attention to Ayurvedic guidelines, the current study reviewed the ethnomedical value of Z. officinale, including its antiviral, radioprotective, anti-inflammatory, anticancer, and antioxidant properties. According to both Ayurvedic and contemporary principles, ginger may effectively treat viral infections and revitalize the body during sickness circumstances. This is achieved by stimulating hunger, boosting immunity, and reinforcing the body's compromised physiological systems. The study goes into further detail on this point. The active chemicals found in ginger, including zingerole, zerumbone, 6-gingerole, 6-shogaol, and 6-paradol, are what rejuvenate the body by physically re-strengthening it and improving enzyme functions and harmonizing circulation.

Key words: ginger, antipyretic, anti-inflammatory, anticancer, antioxidant.

1. INTRODUCTION

Because of its nutritional richness and traditional therapeutic uses, the rhizome of Zingiber officinale is widely utilized for both medical and culinary purposes worldwide. For both infectious and noncommunicable disorders, Z. officinale is prescribed alone or in combination by the majority of traditional and alternative medical systems, including Ayurveda, Siddha, Unani, Homeopathy, Tibetan, and Chinese medicine, among others. [1] Antimicrobial, anticancer, antioxidant, antidiabetic, nephroprotective,

hepatoprotective, larvicidal, analgesic, anti-inflammatory, and immunomodulatory properties of the plant are the main areas of research. [2–11]

Ginger is primarily recommended in Ayurvedic literature for enhancing appetite (Deepani), relieving constipation (Bhedini), appetizer (Ruchya), clearing the throat and tongue (jihwa kanta vishodhanam), balancing circulation (Anulomana), cardio-protective (Hrudya), enhancing digestion (Pachana), dissolving calculi (Ashmadoshahara), nutritious (Vrishya), improving voice (Swarya), relieving cough (Kasahara), relieving asthma (Swasahara), analgesic (Sulahara), absorption of water through alimentary channel (Grahi), relieving coldness (Sheeta Prashamana), anti-edematous (Shotha Hara), pain management (Vedana Sthapana), nerve stimulant (Nadi Uttejaka), appetizing (Rochana), relieve thirst (Truptighna), restore proper circulation (Vatanulomana), alleviate [11]

Fig. 1. *Zingiber officinale*

Ginger is widely used in loss of appetite (Agnimandya), asthmatic conditions (Svasa), bloated stomach (Adhmana), rheumatoid conditions (Amavata), anemic conditions (Pandu), liver associated conditions and disorders (Udararoga), vomitings (Chardi), swollen joints (Sandhi Shotha), fatigue (Avasada), back pains (Kati Shoola), mal-digestions (Ajeerna), flatulence (Koshta Vata), malabsorption syndrome (Grahani), stomachache (Udara Shoola), piles (Arsha), weakness in heart functions (Hrud Dourbalya), heart disorders (Hrud Roga), elephantiasis (Sleepada), allergies (Sheetapitta), throat associated disorders (Kanta Roga), cough (Kasa), Hiccough (Hikka), common cold (Pratishya), injuries (Kshata), malnutrition (Ksheena), fever due to infections (Vishama Jwara), chronic fever (Jeerna Jwara), lethargy and physical weakness (Samanya Dourbalya), physical weakness due to delivery (Prasavottara Dourbalya), chronic osteoarthritis conditions (Jeerna Sandhi Vata), headaches (Shira Shoola), pain due to nervous disorders (Vata Nadi Shoola), diabetes (Prameha), loss of speech (Swara Bhanga) and otalgia (Karna Shoola). [12-13]

With particular attention to Ayurvedic guidelines, the current study reviews the ethnomedical value of Z. officinale, including its antiviral, radioprotective, anti-inflammatory, anticancer, and antioxidant properties.

2. ANTIVIRAL EFFECT

In respiratory mucosal cell lines, fresh rhizome of Z. officinale has been demonstrated to have an antiviral impact against Human Respiratory Syncytial Virus (HRSV) infection by reducing HRSV-induced plaque formation. As a result, high Z. officinale concentrations may encourage mucosal cells to release IFN-β, which works to prevent viral infections by inhibiting internalization and attachment of the virus. [14] This

effect is quite helpful in treating fever and mucus-secreting common colds (pratishya), as well as managing problems from asthmatic disorders and coughs.

It is believed that Z. officinale's lyophilized juice extract has antiviral properties against the Hepatitis C virus. Z. officinale has been shown in this particular study to be effective in blocking the replication of the Hepatitis C virus within infected Hep G2 cells by affecting viral RNA [15]. Additionally, a different study explains that Z. officinale is effective in lowering levels of the Hepatitis C virus, α-fetoprotein, and liver function markers like Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) in Egyptian HCV patients. [16] The aforesaid discovery confirms the usage of ginger in liver illnesses and infectious ailments related with the liver, since Ayurveda advises using ginger in udara roga (liver associated diseases issues).

Z. officinale aqueous extract has been shown to have antiviral properties against Feline Calcivirus, which acts as a stand-in for Human Norovirus in alimentary canal illnesses brought on by foodborne pathogens. [17] According to the guidelines found in authentic Ayurvedic literature, ginger is frequently utilized to treat alimentary channel diseases. Ginger has been suggested in particular for flatulence, constipation, appetite loss, and the need for an appetite booster. Ginger can also be used to treat digestive disorders and problems related to poor absorption. Ayurveda elaborates on the use of ginger in managing difficulties from foodborne virus infections, in addition to its antiviral properties in foodborne illnesses.

Z. officinale contains allicin, an active component that includes antiinfluenza cytokines. Z. officinale is hence efficient against influenza A (H1N1) as an antiviral agent. [18] Z. officinale Rosc has been shown to have a macrophage-mediated inhibitory impact on the development of the Influenza A/Aichi/2/68 virus. This shows that Z. officinale may be helpful in activating macrophages, which in turn produces TNF-α. [19]

Herpes simplex virus type 2 (HSV-2) of genital origin mostly affects Z. officinale essential oil prior to adsorption, most likely by interaction with the viral envelope. [20] Another study examined the in vitro susceptibility of acyclovir-resistant clinical isolates of Herpes simplex virus type 1 (HSV-1) to essential oil of ginger. The results showed a high level of virucidal activity against both acyclovir-sensitive strains and acyclovir-resistant clinical isolates of HSV-1, and significantly decreased plaque formation. [21]

3. RADIOPROTECTIVE EFFECT

Z. officinale rhizome hydroalcoholic extract given orally to mice has been shown to protect against gamma radiation-induced illness and death because of phytochemical effects including dehydrogingerone and zingerone. Furthermore, in tumor-bearing mice, zingerone specifically shields normal tissues from radiation's tumoricidal effects. [22]

Rats with radiation-induced conditioned taste aversion show gastro-protective activity against Z. officinale rhizome hydro-alcoholic extract. Rats' saccharine reaction was dramatically inhibited when a hydro-alcoholic extract of Z. officinale was administered one hour before to 2-Gy gamma radiation. According to [23] and Sharma et al., the lipid peroxidation and superoxide-anion scavenging abilities of Z. officinale's hydro-alcoholic extract, together with its antioxidant capabilities, have the neurobehavioral effectiveness to modify radiation-induced taste aversion with radio-protective qualities. [24]

Ayurvedic medicine attributes a significant portion of ginger's benefits to its ability to stimulate appetite and prevent appetite loss. Ayurveda has emphasized pain management (analgesic effect), physical pain relief, and physical weakness reduction as ways to restore physic. Ginger might thus be used to treat physical weakness brought on by radiation exposure.

4. ANTI-INFLAMMATORY EFFECT

Z. officinale has a significant impact on gastrointestinal tract inflammations like colitis. The plant that possesses poshatidylinositol-3-kinese (PI3K), protein kinase B (Akt), nuclear factor kappa light chain enhancer of activated B cells (NF-ƒB), and 6-shogaol that has protective effects against intestinal dysfunction in human intestinal cell models caused by tumor necrosis factor α (TNF-α). [25] Physically, reduce inflammation by elevating cytokines such plasma IL-1β, IL-6, and TNF-α after exercise. [26] Because it includes nuclear factor kappa light chain enhancer of activated B cells (NF-ƒB) and protein kinese B (Akt), Z. officinale is very efficient in treating inflammatory bowel illness. Consequently, there was an increase in anti-inflammatory cytokines and a decrease in pro-inflammatory cytokines.Therefore, inflammatory bowel illness offers a suitable treatment. [27]

Z. officinale contains gingerole, which has anti-prostaglandin properties that are helpful for dysmenorrhea patients' menstrual discomfort. [28] Ginger suppresses 5-lipoxygenase production, which, aside from prostaglandins, reduces leukotriene manufacture. Z. officinale's rhizome hexane fraction extract inhibits the overproduction of IL1β and nitric oxide during allergic responses. Z. Officinale hence supports the management and prevention of allergic disorders. [29–30] 6-shagol in Z. officinale is very beneficial for treating gout, a rheumatic joint ailment. [31] The anti-inflammatory properties of ginger are indicated by the improvement of heart function, reduction of pain, management of physical weakness, and stimulation of hunger, all in accordance with Ayurvedic advice.

5. ANTI-CANCER EFFECT

Because Z. officinale contains bioactive compounds including 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. [32–39] Z. officinale inhibits the development of colon cancer by activating enzymes such glutathione reductase, glutathione peroxidase, and glutathione transferase. [40] Zerumbone taken orally inhibits the growth of colonic adenocarcinomas by suppressing colonic inflammation by apoptosis induction, NF-κB and heme oxygenase (HO)-1 expression suppression, and proliferation inhibition. [36] The effects of gingerol and shogaol on TRAIL-induced NF-κB in gastric carcinomas reduce the expression of cIAP1, enhance the activation of caspase-3/7 triggered by TRAIL, and ultimately promote apoptosis. Additionally, gingerol inhibits the cell cycle and induces apoptosis in liver tumors [34]. [41] Gingerol, which has a reasonable level of toxicity, exhibits growth inhibition of human epidermoid carcinoma cells by reactive oxygen species (ROS) mediated death. [42] Active ingredients in Z. officinale have an inhibitory impact on NF-θB activation and reduce VEGF and IL-8 release, which in turn controls ovarian malignancies. [43] Zerumbone also has an impact on the p53 signal pathway, apoptotic body formation, condensed nuclei, and elevated caspase-3 activity in the regulation of pancreatic malignancies. [44]

Enhancing hunger can help maintain healthy circulation, nerve conduction, heart function, and balance digestive and absorptive diseases. This can also strengthen immunity, which helps to prevent aberrant growths and physiological malfunctions.

6. ANTIOXIDANT ACTIVITY

Because zingerone, an active component of ginger, scavenges peroxide and hydroxyl ions and suppresses lipid peroxidation, Z. officinale is beneficial for Parkinson's disease. [45] Due to its anti-inflammatory qualities (by lowering blood C-reactive protein levels) and antioxidant effects (by lowering malondialdehyde levels, lipid peroxidase marker, and raising renal superoxide dismutase activity), ginger has a renoprotective impact in renal failures. [46] Acetaminophen and carbon tetra chloride-induced liver damage in acute liver injuries are prevented. [47]

Ginger promotes an increase in waste production while supporting physiological processes through appropriate digestion, absorption, and circulation. As a result, the body expels a buildup of physical waste products and the immune system is strengthened.

Fig. 2. *Zingiber officinale*

7. CONCLUSION

Despite citing contemporary viewpoints on Zingiber officinale (ginger)'s antiviral, radioprotective, anti-inflammatory, anticancer, and antioxidant activities, Ayurveda supports using ginger to treat a variety of medical ailments. Despite this, there is a substantial body of research supporting the use of ginger in a variety of ailments, with numerous Ayurvedic texts citing complications or related symptoms. Current developments in ethnomedicine and phytochemistry have expanded on the use of ginger in the treatment of viral infections, cancer, and physiological requirements. A comparison of the Ayurvedic literature's advice for using ginger medicinally might be used in contemporary settings to promote health and avoid sickness.

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