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A Review on Medicinal Uses of *Zingiber officinale* (Ginger)

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ABSTRACT

Rhizome of *Zingiber officinale* (ginger) is extensively used in medicinal purpose. Ayurveda literatures highlight administration of ginger in both of communicable and non-communicable diseases. Recent advances in analytical chemistry, cytology and microbiology recommend application of ginger in various disease conditions as well as recommendations in Ayurveda literature. The current study focused on review ethno medicinal value of *Z. officinale* including antiviral effect, radioprotective effect, anti-inflammatory effect, anticancer effect and antioxidant effect with special reference to Ayurveda recommendations. The study elaborates; ginger is effective in viral infections and revitalizing the body at disease conditions according to both of Ayurveda and modern concepts through enhancing appetite, immunity and re-boosting weakened physiological functions of the human body. Active ingredients which available in ginger such as 6-gingerole, 6-shogaol, 6-paradol, zingerone and zerumbone are responsible in upgrading enzyme actions and balancing circulation through rejuvenating the body with physical re-strengthening.

Key Words: ginger, antipyretic, anti-inflammatory, anticancer, antioxidant

INTRODUCTION

Rhizome of *Zingiber officinale* is widely used in both of medicinal and culinary purposes in globally due to its ethno medicinal and nutritious value. Most of traditional and complementary systems of medicine such as Ayurveda, Siddha, Unani, Homeopathy, Tibetan and Chinese etc. prescribe *Z. officinale* individually or as a combination in both of infective and non-communicable diseases. ^[1] The plant is mostly investigated for antimicrobial, anticancer, antioxidant, antidiabetic, nephroprotective, hepato-protective, larvicidal, analgesic, anti-inflammatory and immunomodulatory activities. ^[2-11]

In Ayurveda literature ginger is mostly recommended for enhancement of appetite (Deepani), alleviate constipation (Bhedini), appetizer (Ruchya), clear the

tongue and throat (jihwa kanta vishodhanam), balancing circulation (Anulomana), cardio-protective (Hrudya), enhance digestion (Pachana), dissolve calculi (Ashmadoshahara), nutritious (Vrishya), improve voice (Swarya), alleviate cough (Kasahara), alleviate asthma (Swasahara), analgesic (Sulahara), absorption of water through alimentary channel (Grahi), alleviate coldness (Sheeta Prashamana), anti-edematous (Shotha Hara), pain management (Vedana Sthapana), nerve stimulant (Nadi Uttejaka), appetizing (Rochana), alleviate thirst (Truptighna), restoration of proper circulation (Vatanulomana), alleviate pains (Shoola Prashamana), alleviate hemorrhoids (Arshoghna), anti-pyretic (Jwaraghna) and alleviate stagnate mucous (Sleshma Hara). ^[11]

Ginger is extensively 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), mal-absorption 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]

The current study focuses on review ethno medicinal value of *Z. officinale* including antiviral effect, radioprotective effect, anti-inflammatory effect, anticancer effect and antioxidant effect with special reference to Ayurveda recommendations.

Antiviral effect

Fresh rhizome of *Z. officinale* has been proven with an antiviral effect against Human Respiratory Syncytial Virus (HRSV) infection via decreasing HRSV-induced plaque formation in respiratory mucosal cell lines. Therefore, high concentration of *Z. officinale* could stimulate mucosal cells to secrete IFN- β which responsible in counteracting viral infections by reducing viral attachment and internalization.^[14] This effect is much beneficial in the management of common cold (pratishya) and fever associated with

mucous secretions and management of complications due to cough and asthmatic conditions.

The lyophilized juice extract of *Z. officinale* is considered as containing antiviral effect against Hepatitis C viral infection. In the particular study, it has been proven that the *Z. officinale* is effective in inhibiting the viral replication inside the Hepatitis C virus infected Hep G2 cells by affecting viral RNA^[15] as well as, another study elaborates that *Z. officinale* is effective in decrease of Hepatitis C virus loads, level of α -fetoprotein and markers relevant to liver functions such as Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) in Egyptian HCV patients.^[16] Ayurveda recommends administering ginger in udara roga (liver associated diseases conditions), therefore the above finding clarifies the uses of ginger in liver disorders and infective conditions associate the liver.

Aqueous extract of *Z. officinale* was proven with antiviral effect against Feline Calcivirus, a surrogate for Human Norovirus when in alimentary channel infections due to foodborne causes.^[17] Ginger is widely used in alimentary channel disorders under the instructions given in Ayurveda authentic literatures. Especially, in flatulence, constipation, loss of appetite and needs of appetite enhancer, ginger has been recommended. Additionally, ginger is applicable for mal-absorption conditions and digestive diseases. Other than the antiviral effect of ginger in foodborne disorders, Ayurveda elaborates application of ginger in management of complications in foodborne viral infections.

Allicin is an active ingredient which contains in *Z. officinale*, consists with anti-influenza cytokines. Hence, *Z. officinale* is effective as an antiviral agent against influenza A (H1N1).^[18] Macrophage mediated inhibitory effect of *Z. officinale* Rosc on the growth of Influenza A/Aichi/2/68 virus was already studied and which suggests *Z. officinale* is beneficial in

macrophage activation leading to production of TNF- α .^[19]

Essential oil of *Z. officinale* is affected genital origin Herpes simplex virus type 2 (HSV-2) mainly before adsorption probably by interacting with the viral envelope.^[20] In another study, acyclovir-resistant clinical isolates of Herpes simplex virus type 1 (HSV-1) were analyzed in vitro for their susceptibility to essential oil of ginger and found high level of virucidal activity against acyclovir sensitive strains and acyclovir resistant HSV-1 clinical isolates and reduced plaque formation significantly.^[21]

Radioprotective Effect

Oral administration of hydroalcoholic extract of *Z. officinale* rhizome for mice are effective in protecting against gamma radiation induced sickness and mortality due to phytochemical actions such as dehydrogingerone and zingerone. As well, zingerone selectively protects the normal tissues against the tumoricidal effects of radiation in tumor bearing mice.^[22]

The hydro-alcoholic extract of *Z. officinale* rhizome depicts gastro-protective action against radiation induced conditioned taste aversion in rats. Administration of hydro-alcoholic extract of *Z. officinale* one hour before 2-Gy gamma radiation was significantly effective in blocking the saccharine response of rats^[23] as well as Sharma et al, suggests that neurobehavioral efficacy of hydro-alcoholic extract of *Z. officinale* and its antioxidant properties effect in modulate radiation induced taste aversion with radio-protective properties due to the lipid peroxidation and superoxide-anion scavenging ability.^[24]

Appetite enhancing effect and alleviation of loss of appetite is a major function of ginger according to the Ayurveda. Pain management (analgesic) effect, alleviation of physical pains and restoration of physic through reducing physical weakness has been mentioned in Ayurveda. Therefore, physical weakness in

radiological exposures could be managed through administering ginger.

Anti-inflammatory Effect

Z. officinale is highly effect in inflammations associated with alimentary channel such as colitis. The plant responsible with poshatidylinositol-3-kinase (PI3K), protein kinase B (Akt) and the nuclear factor kappa light chain enhancer of activated B cells (NF- κ B), as well as 6-shogaol responsible in protective effects against tumor necrosis factor α (TNF- α) induced intestinal dysfunction in human intestinal cell models.^[25] In physically, promote attenuate inflammation at post-exercise elevation of cytokines such as plasma IL-1 β , IL-6 and TNF- α .^[26] In inflammatory bowel disease, *Z. officinale* is highly effective, because of protein kinase B (Akt) and the nuclear factor kappa light chain enhancer of activated B cells (NF- κ B) contains. As a result, an enhancement in anti-inflammatory cytokines and a decline in pro-inflammatory cytokines could be observed. Therefore, an applicable remedy is available at inflammatory bowel disease.^[27]

Gingerole in *Z. officinale* is containing anti-prostaglandin effects which are beneficial in menstrual pain at dysmenorrhea condition.^[28] Other than the prostaglandin, ginger inhibits leukotriene biosynthesis through suppression of 5-lipoxygenase synthesis. Rhizome hexane fraction extract of *Z. officinale* inhibit excessive production of Nitric oxide and IL-1 β at allergic reactions. Therefore management and prevention from allergic conditions are supported by *Z. Officinale*.^[29-30] 6-shagol in *Z. officinale* is highly effective in gout as a rheumatic disease of joints.^[31]

Restoration of heart functions, pain management effect and management of physical weakness and reestablishing of appetite denote anti-inflammatory activity of ginger referring Ayurveda recommendations.

Anti-cancer Effect

Z. officinale exhibits anti-inflammatory and anti-tumorigenic effects due to its bio active molecules such as 6-gingerole, 6-shogaol, 6-paradol and zerumbone, as a result prevention or control from colorectal, gastric ovarian, liver, breast and prostate cancers is possible. [32-39] *Z. officinale* activates enzymes such as glutathione peroxidase, glutathione S transferase and glutathione reductase and suppress colon carcinogenesis. [40] Oral administration of Zerumbone effects in inhibition of multiplicity of colonic adenocarcinomas through suppression of colonic inflammation due to inhibition of proliferation, induction of apoptosis and suppression of NF- κ B and heme oxygenase (HO)-1 expression. [36] In gastric carcinomas, gingerol and shogaol effect in TRAIL induced NF- κ B, suppresses cIAP1 expression and increases TRAIL induced caspase-3/7 activation which promotes apoptosis [34] as well gingerol is effect in liver cancers by arresting cell cycle and induction of apoptosis. [41] Growth inhibition of human epidermoid carcinoma cells via reactive oxygen species (ROS) induced apoptosis is exhibited by gingerol with considerable amount of toxicity. [42] Active compounds of *Z. officinale* effect in controlling ovarian cancers via inhibition of NF- κ B activation and diminished the secretion of VEGF and IL-8. [43] Zerumbone is also effect in controlling pancreatic cancers through p53 signal pathway, formation of apoptotic bodies, condensed nuclei and the increased activity of caspase-3. [44] Maintaining, proper circulation, nervous conduction, heart functions and balancing digestive and absorptive disorders through enhancing appetite is beneficial in enhancement of the immunity of the body which supports in alleviate abnormal growths and malfunctions of physiological body.

Antioxidant Activity

Z. officinale is effective in Parkinson's disease because zingerone, an active ingredient in ginger scavenged peroxide and hydroxyl ions as well as suppress lipid peroxidation. [45] Ginger consists with renoprotective effect in renal failures because of anti-inflammatory properties by attenuating serum C-reactive protein levels and antioxidant effects by reducing lipid peroxidase marker, malondialdehyde levels and increasing renal superoxide dismutase activity. [46] Carbon tetra chloride and acetaminophen induced liver damages in acute liver injuries are preventing. [47]

Through proper digestion and absorptions, as well as maintaining proper circulations ginger supports elevation of waste productions while physiological functions. Hence accumulation of physical excretions evacuates from the body and immune-enhancement is occurred.

CONCLUSION

Ayurveda recommends *Zingiber officinale* (ginger) to manage various disease conditions in spite of mentioning modern perspectives on antiviral, radioprotective, anti-inflammatory, and anticancer and antioxidant effects. Even though, traditional Ayurveda classics provide strong literature base to administer ginger in various diseases mentioning complication or associated symptoms of many disorders. Recent advances in phytochemistry and ethnomedicinal studies elaborate uses of ginger in viral infections, carcinogenic conditions and physiological needs. Comparing recommendations of ginger in medicinal purpose according to the Ayurveda literatures could be applied in modern scenarios in disease prevention and health promotion.

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