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Review Article

Antiobesity Activity of Zingiber Officinale: A Review

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Abstract
Obesity is a metabolic disorder that is linked to a wide spectrum of chronic diseases, increasing comorbidity and mortality significantly. The rhizome of Zingiber officinale Roscoe (Zingiberaceae) is widely used in Indian traditional medicine to cure a variety of ailments. The current study looked at the antiviral, radioprotective, anti-inflammatory, anticancer, and antioxidant properties of Z officinale, with an emphasis on Ayurvedic prescriptions. Metabolic syndromes (MetSs), which include diabetes, dyslipidemia, and cardiovascular disease, have emerged as a prevalent health concern in both industrialised and developing nations in recen t years.
Key words: Antiobesity, Zingiberaceae, Pharmacological Activity

INTRODUCTION

Obesity, which has reached epidemic proportions throughout the world, may lead to a variety of problems (elevated blood pressure, dyslipidemia, and insulin resistance etc.) Obesity is defined by excessive fat buildup, which happens when energy consumption exceeds energy expenditure. To avoid energy imbalance, several ongoing research are actively investigating strategies to reduce energy overconsumption and promote energy dissipation.

Ginger (Zingiber officinale) is a subtropical/tropical herb of the ginger family (Zingiberaceae) that is widely used as a spice and flavouring element, particularly in Asia. Ginger includes Phenolic compounds including gingerols and shogaols, as well as active components like flavonoids and terpenoids.

These components of ginger have been found to have health-promoting properties, according to recent research. In recent years, several physiological effects of ginger supplementation in vivo have been shown, including the antiobesity effects of ginger and several bioactive components in ginger (gingerol and gingerone A, among others).

Furthermore, comprehensive analyses of current clinical studies with ginger supplements found that ginger supplementation reduced low-density lipoprotein cholesterol (LDL-C), total cholesterol (TC), and triglyceride (TG) levels while increasing high-density lipoprotein cholesterol (HDL-C).

LITERATURE AND REVIEW

1) Ahmed, *et al*., (2000)
Ginger significantly lowered lipid peroxidation by maintaining the activities of antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxidase in rats.

2) Agrawal, *et al*., (2001) and Jagetia, *et al*., (2003)
Ginger is effective in the control of a range of bacterial, viral, fungal and parasitic diseases.

Ginger extract (10 mg/kg) intraperitoneally had a dose dependent antimicrobial activity against Pseudomonas aeruginosa, Salmonella typhimurium, Escherichia coli and Candida albicans.

3) Sontakk, *et al*., (2003)
Powdered ginger root in the dose used was found to be effective in reducing nausea and vomiting induced by low dose cyclophosphamide in combination with drugs causing mild emesis.

4) Akhani, *et al*., (2004)
Ginger juice exhibits hypoglycaemic activity in both normal and streptozotocin (STZ)-induced

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diabetic rats.

5)Chrubasik, *et al*., (2007)
Phenylalkylketones or vanillyl ketones of ginger include 6-gingerol 8- gingerol and 10-gingerol, 6-shogaol, 8- shogaol, 10-shogaol and zingerone. 6-paradol, 6- and 10- dehydrogingerdione and 6- and 10-gingerdione have also been identified.

6) El-Abhar, *et al*., (2008)
Zingiber officinale is traditionally used to treat inflammatory gastrointestinal disorders. Ethanolic extract of dried rhizomes of ginger displayed protective effects against acetic acid-induced ulcerative colitis in rats

7) Zick, *et al*., (2008)
Gin-ger including terpenes and oleoresin which called ginger oil. Ginger also constitutes volatile oils approximately 1% to 3% and non-volatile pungent components oleoresin.

Materials and Methods

Plant Materials

Dried Z. officinale fruits were purchased from Local market Kharibaoli,Delhi and authenticated by Dr.H.B.Singh,expert taxonomist,National Institute of Science Communication and Information Resources (NISCAIR),New Delhi, India.

Fig No.1: Flower of Zingiber Officinale

Zingiber officinale Roscoe
Tibbi Name – Adrak, Zanjbeel
English Name – Ginger
Botanical Name – Zingiber officinale Roscoe
Family – Zingiberaceae
Parts Used - Rhizome

Preparation of aqueous Z. officinale extract
All plant materials were washed; shade dried and powdered, then extracted with water in a soxhlet apparatus for 72 hours. The solvent was removed under reduced pressure to give a dry extract, 5% yield w/w with respect to the crude material and stored at - 20°C till experiment was not started. The weighed amount of aqueous extract was suspended in 1% gum acacia in normal saline for pharmacological activity. This extract was used for phytochemical analysis for standardization.

Botanical Description Ginger is herbaceous rhizomatous perennial, reaching up to 90 cm in height under cultivation. Rhizomes are aromatic, thick lobed, pale yellowish, bearing simple alternate distichous narrow oblong lanceolate leaves. The herb develops several lateral shoots in clumps, which begin to dry when the plant matures. Leaves are long and 2 - 3 cm broad with sheathing bases, the blade gradually tapering to a point. Inflorescence solitary, lateral radical pedunculate oblong cylindrical spikes. Flowers are rare, rather small, calyx superior, gamosepalous, three toothed; open splitting on one side, corolla of three sub equal oblong to lanceolate connate greenish segments.

Phytochemical Properties

Fig No.2: Rhizome of Zingiber Officinale

The constituents of ginger are numerous and vary depending on the place of origin and whether the rhizomes are fresh or dry but to summarize the major components that have been implicated in the pharmacological activities of the crude drug. This antioxidant activity in ginger is due to the presence of polyphenol compounds (6-gingerol and its derivatives) (Herrmann, 1994). The chief active constituents of ginger are Volatile oil (zingiberene, curcumene, farnesene, zingiberol, D-camphor), Shogaols, Diarylheptanoids, Gingerols, Paradol, Zerumbone, 1-Dehydro-(10) gingerdione, Terpenoids and Ginger flavonoids.

Ginger also constitutes volatile oils approximately 1% to 3% and non-volatile pungent components oleoresin. Phenyl alkylketones or vanillyl ketones of ginger include 6-gingerol 8- gingerol and 10-gingerol, 6-shogaol, 8- shogaol, 10-shogaol and zingerone.

Pharmacological Activity

Ginger is the herbal treatment for colds and other viral infections, poor appetite, digestive problems, arthritis and headache. Ginger and its constituents have antiemetic, antithrombotic, anti-inflammatory and antioxidant effects. The major pharmacological activity of ginger appears to be due to gingerol and shogaol.

AntidiabeticActivity

Diabetes mellitus is known as a severe metabolic disorder caused by insulin deficiency and/or insulin resistance, resulting in an abnormal increase in blood glucose. Prolonged hyperglycemia could accelerate protein glycation and the formation of advanced glycation end products.

Antitussive Effects

(6)-shogaol, generally more potent than (6)-gingerol, has exhibited antitussive effects.

Anti-ulcer Effects

The phenolic content in aqueous extract of ginger is reported to have potential ulcer preventing ability, aqueous extract of ginger will also reduce free radicals damage during ulceration. Hence, ginger is used as ulcer preventive agent.

Immunomodulatory Effects

In vitro evidence indicates that ginger has immunomodulatory effects and is an effective antimicrobial and antiviral agent.

Lipid Effects (Wang, C.C. *et al*., 2003)

Oral ingestion of ginger extract has been shown to have hypocholesterolemic, hypolipidemic, and antiatherosclerotic effects in cholesterol-fed rabbits and in rats. Inhibition of LDL oxidation and attenuated development of atherosclerosis has also been observed in apolipoprotein E-deficient mice.

Cardiovascular Effects (Wang, C.C. *et al*., 2003)

In vitro research indicates that gingerols and the related shogaols exhibit cardio depressant activity at low doses and cardiotonic properties at higher doses. Both (6)-shogaol and (6)-gingerol, and the ginger diones, are reportedly potent enzymatic inhibitors of prostaglandin, thromboxane, and leukotriene biosynthesis.

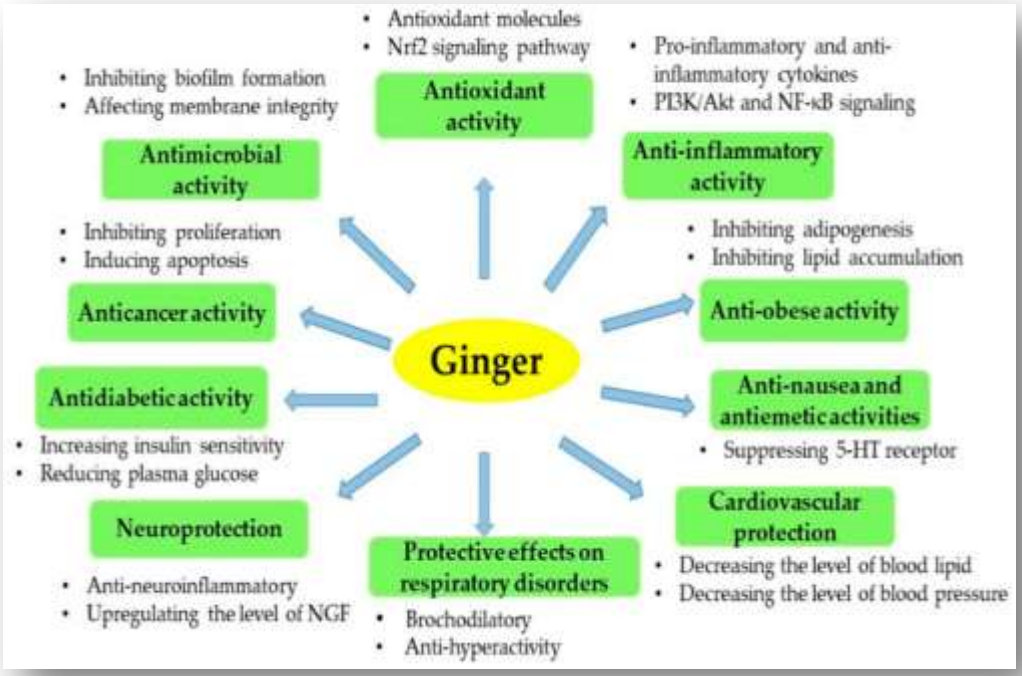

Fig No.3: An Overview of Bioactivity of Ginger

AntioxidentEffect (Wang, C.C. *et al*., 2003; Fuhrman, B. *et al*., 2000; Ma, J. *et al*., 2004)
Antioxidant Ginger is a strong anti-oxidant substance and may either mitigate or prevent generation of free radicals. Ginger, which is the underground stem or rhizome of the plant Zingiber officinale Roscoe, contains polyphenol compounds (6-gingerol and its derivatives), which have a high antioxidant activity.

AntinociceptiveEffects (Ma, J. *et al*., 2004)
(6)-shogaol has produced anti-nociception and inhibited the release of substance P in rats, seemingly via the same receptor to which capsaicin binds. However, it was observed to be 100 times less potent and to elicit half the maximal effect of capsaicin.

Anti-cancer effects (Aggarwal, B.B. *et al*., 2006; Shukla, Y. *et al*., 2007)
The anticancer effects of ginger are thought to be attributed to various constituents including vallinoids, viz. (6)-gingerol and (6)-paradol shogaols, zingerone, and Galanals A and B. Galanals A and B have been found to be potent apoptosis inducers of human T lymphoma Jurkat cells.

Anticoagulant Effects (Desai, H.G. *et al*., 1990; Shukla, Y. *et al*., 2007)
Ginger has been shown to inhibit platelet aggregationand to decrease plateletethromboxane production in (8)-Gingerol, (8)-shogaol, (8)-paradol, and gingerol analogues (1 and 5) exhibited anti-platelet activities. However, its effects in vivo have not been well studied. Anticlotting Ginger reduced the formation of proinflammatory prostaglandins and thromboxane thus lowering the clotting ability of the blood.

Antiemetic Effects (Bhattarai, S. *et al*., 2001; Yamahara, J. *et al*., 1989)
Powdered ginger root in the dose used was found to be effective in reducing nausea and vomiting induced by low dose cyclophosphamide in combination with drugs causing mild emesis.

However, ginger had no significant effect in the antrum or corpus during other phases, except for a significant decrease in the amplitude of antral contractions during phase II of the MMC. Additionally, there was no effect of ginger on duodenal contractions on the "motility index."

Anti-Inflammatory Effects (Johji, Y. *et al*., 1985)
Ginger has been found to inhibit prostaglandin biosynthesis and interfere with the inflammatory cascade and the vanilloidnociceptor.Ginger has been shown to share pharmacological properties with non-steroidal anti-inflammatory drugs (NSAIDs) because it suppresses prostaglandin synthesis through the inhibition of cyclooxygenase-1 and cyclooxygenase-2. However, ginger can be distinguished from NSAIDs based on its ability to suppress leukotriene biosynthesis by inhibiting 5-lipoxygenase. The anti-inflammatory mechanisms of ginger are probably associated with the inhibition of Akt and NF-κB activation, an enhancement in anti-inflammatory cytokines, and a decline in proinflammatory cytokines. Notably, the application of ginger nanoparticles has the potential to improve the prevention of and therapy for inflammatory bowel disease

Gastrointestinal Effects (Thomson, M. *et al*., 2002)
There is evidence that ginger rhizome (root) increases stomach acid production. If so, it may interfere with antacids, sucralfate (Carafate), H2 antagonists, or proton pump inhibitors.In addition, (6) shogaol, generally more potent than (6)-gingerol, has inhibited intestinal motility in intravenous preparations and facilitated gastrointestinal motility in oral preparations. Ginger extract has also been reported to inhibit the growth of Helicobacter pylori in vitro.

Weight Loss Effects (Westerterp-Plantenga, M. *et al*., 2006)
Spiced foods or herbal drinks, such as those that contain ginger, have the potential to produce significant effects on metabolic targets, such as satiety, thermogenesis, and fat oxidation. A significant clinical outcomes sometime may appear straightforwardly but also depends too strongly on full compliance of subjects. Thermogenic ingredients, such as ginger, may be considered as functional agents that could help restore a "positive energy balance" and prevent obesity.

Antiarthritic Effect (Funk, J.L. *et al*., 2009)
A well-characterized crude ginger extract wascompared with a fraction containing [6]-gingerol and their derivatives to inhibit joint swelling in an animal model of rheumatoid arthritis, streptococcal cell wall-induced arthritis. Both extracts demonstrated anti-inflammatory activity. The crude dichloromethane extract, containing essential oils and more polar compounds, was more efficacious, when normalized to [6]-gingerol content, in preventing, both joint inflammation and destruction. Non-gingerol components enhance the antiarthritic effects of the more widely studied [6]-gingerol.

Antimicrobial Activities (Johji, Y. *et al*., 1985; Funk, J.L. *et al*., 2009)
In [6]gengerol and [6]–shogaol, isolated from ginger rhizome, demonstrated antiviral activity.[10]-gingerolhas been reported as active inhibitor of M. avium and M. tuberculosis in vitro. Gingerol and related compounds have been investigated for antimicrobial activities. [6]- gingerol and [12]-gingerol, isolated from ginger rhizome, demonstrated antibacterial activity against periodontal bacteria.

Radio Protective Activity (Kim, J.K. *et al*., 2007)
In vitro, pre-treatment with [6]-gingerol reduced UVB-induced intracellular reactive oxygen species levels, activation of caspase-3, -8, -9, and Fas expression. It also reduced UVB-induced expression and transactivation of COX-2. Translocation of NF-κB from cytosol to nucleus in HaCaT cells was inhibited by [6]-gingerol via suppression of IκBα phosphorylation (ser-32). Examination by EMSAs and immunohistochemistry showed that topical application of [6]-gingerol(30 μM) prior to UVB irradiation (5 kJ/m2) of hairless mice, also inhibited the induction of COX-2 mRNA and protein, as well as NF-κB translocation.

Antigenotoxic Activity (Beg, T. *et al*., 2008)
Norethandrolone and oxandrolone were investigated for their genotoxic effect on human lymphocyte chromosomes using chromosomal aberrations and sister chromatid exchanges as parameters and subsequently Genistein and [6]-gingerol were used as antigenotoxic agents to ameliorate the genotoxicity induced by the steroids.

CONCLUSION

Here concluded that, in the current investigation,

we discovered that the body weight of animals treated with Z. officinale was much lower than that of vehicle-treated controls. To summarise, ginger has a wide range of bioactive chemicals, including gingerols, shogaols, and paradols, as well as a wide range of bioactivities, including antioxidant, anti-inflammatory, and antibacterial capabilities. High density lipoprotein (HDL-C) levels were also significantly increased by this extract. These findings indicate that aqueous Z.officinale extract has powerful antiobesity properties. In addition, ginger has the potential to be used as a component in functional foods or nutraceuticals, and it might be used to treat and prevent diseases such as cancer, cardiovascular disease, diabetes, obesity, neurodegenerative diseases, nausea, emesis, and respiratory problems. Total view this review In the future, more bioactive compounds in ginger could be isolated and clearly identified, and their biological activities and related mechanism of action should be further investigated. Well-designed clinical trials of ginger and its various bioactive compounds are warranted to prove its efficacy against these diseases in human beings.

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