

Review Article

Traditional Health Boosters: Onion, Ginger and Garlic

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²SDP College for Women, Ludhiana-141008**Abstract**

Gingerol is the principal bioactive compound present in ginger which possesses antioxidative and anti-inflammatory properties. Garlic (*Allicin*) primarily contains sulphur and helps in treatment and prevention of hypertension, thrombosis, hyperlipidemia, atherosclerosis, diabetes and other metabolic diseases. Quercetin present in onion provides protection against cataracts, cardiovascular disease and cancer. Studies reported that onion contains large amounts of flavonoid quercetin, therefore, it provides protection against many chronic diseases ranging from common cold to heart disease, diabetes, osteoporosis and other diseases. Cited literature concluded that incorporation of healthy foods in daily diet plays significant role, having beneficial health effects and providing protection against many diseases.

Keywords: *Allicin*, Antioxidative, Gingerol, Quercetin

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Introduction

Ginger (*Zingiber officinale* Rosc.) originated in South East Asia and belongs to the family Zingiberaceae. It is used as a spice, condiment (add flavor to food) and traditional herbal medicine in many countries [1]. Anciently incorporated in traditional ayurvedic medicines in India but recently, it is used as a common herbal treatment for nausea in both Asian and western countries [2, 3] Ginger has high potential for treating a number of ailments such as digestive problems like constipation, indigestion and ulcer, vomiting, cardiovascular disorders like atherosclerosis and hypertension, degenerative disorders like arthritis and rheumatism, diabetes mellitus and cancer. Its anti-inflammatory and antioxidative properties help to control the ageing process as well as treat some infectious diseases due to its antimicrobial potential [4].

The principal bioactive compound present in garlic is Allicin and main constituent is sulphur which gives its characteristic odour due to activation of alliinase enzyme after crushing or chopping of raw garlic. Temperature beyond 60°C inactivates Allinase. Garlic bulb comprises about 0.9 and 1.8 per cent of g-glutamylcysteines and alliin (**Table 1**) [5]. Garlic and its products have been found beneficial for metabolic diseases such as atherosclerosis, cardiovascular, diabetes hyperlipidemia, hypertension and thrombosis conditions. During the earliest Olympics in Greece, garlic was served to athletes for improving stamina. The ancient greek military diet contained garlic supposedly to provide strength for battle. Garlic was recommended for the treatment of respiration and digestion related problems, diarrhea and worm infestation in ancient Chinese medicine [6].

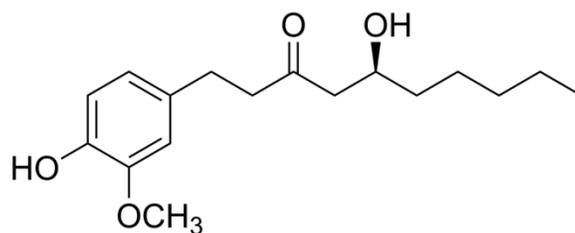
Table 1 Effects of garlic on lipid levels of hyperlipidemic subjects

Trial type	Interval of medication	Garlic form and dosage	Result
Randomized, double-blind, placebo-controlled trial	4 weeks/12 Weeks	Garlic extract	No decrease in high density lipoprotein, total cholesterol, and triglycerides
Clinical trial	42 days	Raw garlic and 5gm twice a day	Decreased low density lipoprotein, total cholesterol and triglycerides Increased high density lipoprotein level

The onion (*Allium cepa*) - bulb onion, common onion and garden onion - is the most widely cultivated species of the genus *Allium*. The fleshy bulb growing below the ground level is basically used for food and medicinal purposes. Onion acts as antidepressant. Anxiety and depression can be lowered with highly oxidative species of onion. Protection of brain from depression and anxiety might be possible with the polyphenols present in onion [7].

Ginger

In India, ginger is one of the most commonly used ingredients in popular dishes; therefore it is said to be an integral part of Indian cuisine. Mainly, ginger was consumed in pickle form, added in tea, cookies and cakes particularly to add flavor [8]. Anciently incorporated in traditional Ayurvedic medicines in India but recently, it is used as a common herbal treatment for nausea in both Asian and western countries. Fresh ginger is grouped into volatiles and non-volatiles. Volatiles include sesquiterpene and monoterpenoid hydrocarbons which provide the distinct aroma and taste to ginger and non-volatile are pungent compounds such as gingerols, paradols, shogaols and zingerone. It constitutes nearly 1 to 3 per cent of volatile oils and non-volatile pungent components [2, 3].



Gingerol

A nonvolatile pungent compound shogaol has strong anti-inflammatory and antioxidant effects on human health and can be used as a curative agent [9] in gout and rheumatic disease of joints. On the contrary, it showed controversial results among subjects with osteoarthritis. With the consumption of ginger extract, Altman and Marcussen [10] found a significant reduction in symptoms of osteoarthritis of the knee. Similarly, the positive effect of supplementation of ginger among osteoarthritis subjects was reported [11]. They showed significant results only in first period of treatment. Furthermore, supplementation of 2 g ginger for a period of 11 days helps to cure muscle pain. Therefore, moderate to large reduction in muscle pain was reported with the consumption of raw and heat treated ginger on daily basis.

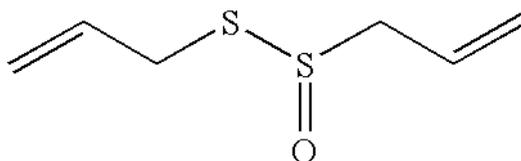
There is therapeutic benefit of ginger among type 2 diabetic subjects by lowering the level of fasting serum glucose. Still, the mechanism behind which bioactive compound present in ginger is responsible for its antidiabetic efficacy is unknown and improves glucose tolerance remains uncertain. Even though the predominant pungent compound in ginger i.e. 6-gingerol, is liable for all of its benefits [12]. A ginger extract (100 to 800 mg/kg body weight) lowered blood glucose levels by 24 to 58 per cent in Type 1 diabetic rats [13] and ginger or gingerol improved glucose regulation, insulin secretion and lipid profiles among type 2 diabetic rats [14]. In high fat diets, the use of ethanolic extract of ginger reduced levels of free fatty acids, glucose, insulin, low density lipoprotein cholesterol, phospholipids, total cholesterol, triglycerides and body weights [15]. Moreover, ginger does not show direct effect on diabetes was reported [16]. However it indirectly acts by destroying factors that lead to impaired glucose control.

Ginger known as popular remedy for various gastrointestinal problems like morning sickness, bloating, colic, diarrhea, dyspepsia, flatulence, gas formation, heartburn, loss of appetite and upset stomach. Supplementation of ginger up to 2, 500 mg/d is beneficial for the treatment of nausea during pregnancy [17]. Wild ginger rhizome was used by Native Americans to regulate heartbeat and menstruation. It acts directly on the gastrointestinal system to reduce nausea and can also be used to prevent nausea arising during chemotherapy, motion sickness and surgery [18].

Active component present in ginger functions as a laxative and antacid medication and usually helps to keep the body warm for boosting the circulation and lowering high blood pressure. Due to its warming effect, ginger works as antiviral for cold and flu treatment [19]. Indian Ayurvedic medicinal system recommended ginger because of its digestive property [20]. In addition, it also acts as a pain reliever for arthritis, chest, low back, menstrual, muscle soreness and stomach pain and treatment of bronchitis, cough and upper respiratory tract infections. It is also recommended for patients with joint problems as an anti-inflammatory agent [1].

Garlic

Garlic powder and aged garlic extract have been found more effective in lowering serum total cholesterol levels, whereas garlic oil helps to lower serum triglyceride levels [21]. Raw garlic powder tablets and aged garlic powder had no effect on plasma low density lipoprotein concentrations among moderate hypocholesterolaemia patients in a study lasting 6 months [22]. Excess consumption of garlic can cause unpleasant odors on both breath and skin and also cause allergic reactions. Raw garlic can also cause contact dermatitis [23].



Allicin

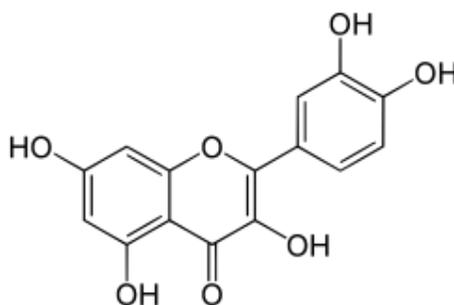
Garlic extracts also have an antihypertensive property. Among hypertensive subjects, significant reduction was obtained after consumption of garlic oil for a period of 16 weeks [24]. [25] Similarly, authors conducted a study among hypertensive subjects and revealed that supplementation of 250 mg of garlic pearls for 2 months helped to decrease the level of blood pressure and risk of cardiovascular disease and also biomarkers which are responsible for oxidative stress in blood. Due to its antioxidant properties and positive effect on lipid levels, garlic can be used as a tentative treatment along with antihypertensive drug [26]. Supplementation of garlic reduced both systolic and diastolic blood pressure among hypertensive adults [27]. Another trial conducted among subjects with blood pressure values of more than 140 mmHg found significant reduction in systolic blood pressure (16.3 mmHg) and diastolic blood pressure (9.3mmHg) with consumption of garlic (900 mg) containing 2.4 mg salicystine for a period of 12 weeks [28].

Furthermore, garlic also has an antidiabetic effect comparable to that obtained by administration of antidiabetic drugs found on animals with drug or fructose induced diabetes reviewed [29- 31]. Presence of volatile sulfur compounds such as alliin, allicin, ajoene, allyl mercaptan, diallyl disulfide, diallyl trisulfide, diallyl sulfide and S-allyl cysteine in garlic were the main ameliorating factors of diabetes mellitus. Garlic extracts have been found effective in reducing insulin resistance [32]. Metformin and garlic treatment was conducted in diabetic subjects for 12 weeks and concluded reduction in fasting blood glucose (FBG); substantial change was noticed in FBG in case of metformin supplemented with garlic in comparison with metformin alone [33].

Onion

Onions are commonly available in three colors that is yellow, red and white. Yellow onions are full flavoured and are reliable for cooking almost anything. The red onion is favored for fresh uses or in grilling and char boiling. White onions - the traditional onion used in classic Mexican cuisine - have a golden color and sweet flavor when sautéed. Onion seed finds a variety of uses: salads, sprouting, sandwiches, other dishes and powder for seasoning. Onion powder has very strong odor which is made from finely ground, dehydrated onions, mainly the pungent varieties of bulb onions.

A total of 760 Italian patients with non-fatal acute myocardial infarction were selected for the study and found positive association between increased intake of onion and decreased risk of myocardial infarction [34]. Usually urea and creatinine level in the blood increases among diabetics which results in renal dysfunction. A study among alloxin-induced diabetic rats showed reduction in levels of urea in the plasma by 16 per cent with onion as compared to untreated group [35]. Quercetin present in onion provides protection against cataracts, cardiovascular diseases and cancer. In addition to this, other naturally occurring organosulfur compounds help to lower blood pressure and cholesterol levels. The onion bulb has several properties such as anthelmintic, anti-inflammatory, antiseptic, carminative, diuretic, expectorant, hypoglycaemic, hypotensive, stomachic and tonic. It also helps to strengthen the appetite, provides relief from stomach upset and other gastrointestinal disorders. There is evidence that raw onion consumed regularly in the diet promotes general health of human beings, sets off tendencies towards angina, arteriosclerosis and heart attack.



Quercetin

The purple skinned onion is very common variety, almost found in every household and tastes great. Moreover, it has several health benefits, positive effect on the circulatory system, used as a diuretic to decrease swelling, reducing arteriosclerosis by lowering blood cholesterol levels, inhibiting the development of blood clots, treating diabetes and lowering blood sugar levels. Antimicrobial, antioxidant, anticancer and hypoglycemic activity, cardiovascular care and protection from asthma are the chief characteristics of onion [36]. Extract and powder of onion have inhibitory effect against tumor cells. It is beneficial especially among females to decrease the risk of bone injuries. Similarly, hypoglycemic, cardioprotective and hypolipidemic activities were observed (**Table 2**) [37]. Its essential oil possesses significant antimicrobial activity [38]. Onion is a rich source of flavonoids, organic sulfur, polyphenols, saponins and several other secondary metabolites, which are generally responsible for its medicinal activities.

Table 2 Active compound in onion and its therapeutic activity

Activity against disease	Extraction method	Active compounds
Antidiabetic	Aqueous and ethylene extract	Quercetin
Antioxidant	Methanolic extract	Polyphenols
Anti-pathogenic (antifungal & antibacterial)	Aqueous extract, essential oil, ethyl acetate subfractions	Flavonoids, organosulfur compounds
Memory impairments	-	S-alk(en)yl-L-cysteines
Bone fractions	Aqueous extract	γ -Glutamyl peptide
Hepatoprotective		Quercetin aglycone
Renoprotective		-

Onion inhibits bacterial growth and hinders the pro-inflammatory messengers because of various organic sulfur compounds present in it [39]. Ethyl acetate subfractions of onion were found to provide prevention against microbes due to presence of flavonoids [40]. Because of cholesterol lowering activity of onion, it can be included in food on daily basis. [41] Study showed a reduction in low density lipoprotein, total cholesterol and triacylglycerol with increase in concentrations of onion extract whereas methanolic extracts of onion treated hypoxia-induced cell death as well as ischemic heart injury (caused by reduced blood supply) [42]. A trial was conducted on rats fed with sucrose and found significant control in the blood glucose levels with ethylene extracts of onion by inhibiting the activity of α -glucosidase [43].

Osteoporotic fractions among human beings occur because of the resorption of bones; Intake of onion can increase the bone mass with resorption inhibition [44]. [45] concluded that onion acts as anti-resorption agent of bones. Osteoporosis of bones is caused by resorption via the tartrate-resistant acid phosphatase positive multinucleated cells. The findings of the study showed the inhibition of bone resorption with γ -Glutamyl Peptide which was extracted from onion. A significant positive effect was found among premenopausal and postmenopausal non-Hispanic white women (50 years and older) with regular ingestion of onion and also useful for bone related medical issues especially in women. Furthermore, frequent consumption of onion showed 20 per cent less risk of hip fracture among women as compared to non-consumers [46].

Conclusion

Several studies concluded that use of ginger during pregnancy for nausea is very popular remedy. Allicin is the key bioactive compound in garlic and also contains sulphur as a main constituent and recommended for prevention and treatment of cardiovascular and other metabolic diseases such as atherosclerosis, hyperlipidemia, thrombosis, hypertension and diabetes. Quercetin present in onion provides protection against cataracts, cardiovascular disease and cancer. Moreover, the purple skinned onion has several health benefits viz. positive effect on the circulatory system, used as a diuretic to decrease swelling, reduce arteriosclerosis by lowering blood cholesterol levels, inhibit development of blood clots, treat diabetes and is supposed to lower blood sugar levels.

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