

A BRIEF UPDATE ON USE OF GARLIC AS FOLKLORE MEDICINE: A REVIEW

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ABSTRACT

Garlic [*Allium sativum*] is the oldest of all cultivated plants. That played a role in folk medicine from ancient period. Garlic has been used as culinary and medical purpose for thousands of years. It is a remarkable plant, which has multiple beneficial effects. In this review article, we will discuss the clinical use of this agent in the treatment and prevention of many types of disease. *Allium sativum* has a variety of biological and pharmacological activities such as antioxidant, anticoagulation, antihypertensive, antimicrobial, antibiotic, antiparasitic, antimycotic, antiviral, antitumoral, anti-aging, antiplatelet, detoxifies heavy metals, fibrinolysis, hypolipidaemic (lipid-lowering) and immune enhancer and modulator.

KEYWORDS: Garlic, *Allium sativum* L. Activity of garlic, Uses of garlic.

INTRODUCTION

Garlic consists of fresh or dried compound bulbs of *Allium Sativum* Linn. (Family- *Lilliaceae*).^[1] Garlic consists of several individual bulblets, known as 'cloves.' These individual bulblets are enclosed in a membranous bag that is whitish or purplish in color.^[2] It has noted a pungent odor and spicy flavor, which is caused by organic sulphur compounds. These compounds reportedly possess antibacterial properties, which have played a role in folk medicine from the immemorial time.^[3] Extensive research work has been carried out on the health promoting and medicinal properties of garlic. *Allium sativum* has shown a variety of biological activities including antioxidant, cancer prevention, liver protection, immunomodulation and reduction of cardiovascular disease risk factors. Garlic is characterized by medicinal properties due to the content of over thousand biologically active compounds. Garlic has an unusually high concentration of sulfur containing compounds. Sulfur compounds, including allicin were confirmed to be the main active components in the bulb of the garlic plant. Allicin has the wide range of biological and pharmacological activities, such as anticoagulation, antihypertensive, antimicrobial, antibiotic, antiparasitic, antimycotic, antiviral, antitumoral, anti-oxidant, anti-aging, antiplatelet, detoxifies heavy metals, fibrinolysis, hypolipidaemic (lipid-lowering) and immune enhancer and modulator etc.^[4,5]

HISTORY

Garlic (*Allium sativum*) is among the oldest of all cultivated plants. It has been used as a spice, food and

folklore medicine for over 4000 years, and is the most widely researched medicinal plant. According to the Bible, the Jewish slaves in Egypt were fed garlic and other allium vegetables, apparently to give them strength and to increase their productivity. In ancient Greece, garlic was consumed to treat intestinal and lung disorders. As early as 1858, Louis Pasteur reported the antibacterial properties of garlic. In India, garlic has been used for centuries as an antiseptic lotion for washing wounds and ulcers. During World War II, garlic was used to treat the wounds of soldiers. Many workers have researched on garlic's insecticidal, antimicrobial, antiprotozoal and antitumor activities. Since the passage of the Dietary Supplement Health and Education Act (DSHEA) of 1994 by the U.S. Congress, it has been claimed *Allium sativum* that garlic dietary supplements possess health benefits. According to the recent pharmacological findings, garlic is a preventive rather than therapeutic.^[6,7]

CLASSIFICATION

Botanists classify all true garlics under the species. There are two subspecies; *Ophioscorodon*, or hard-necked garlics (*Ophios* for short) and *Sativum*, or softnecked garlics.

A number of different plant species of the genus *Allium* are known as Wild Garlic: *Allium nigrum* (Black Garlic), *Allium tuberosum* (Chinese Chive, Oriental), *Allium canadense* (Meadow Garlic; Wild Garlic), *Allium pendulinum* (Italian Garlic), *Allium ramosum*, *Allium senescens* (German Garlic), *Allium tuberosum* (Chinese Chives), *Allium vineale* (Wild Garlic; Crow Garlic;

Stag's Garlic), *Allium ursinum* (Ramsons), *Allium canadense* (Wild onion), *Allium triquetrum* (Three-cornered leek).^[8]

Taxonomic position of *Allium*^[9]

1. Class – *Liliopsida*,
2. Subclass – *Liliidae*,
3. Superorder – *Liliianae*,
4. Order – *Amaryllidales*,
5. Family – *Alliaceae*,
6. Subfamily – *Allioideae*,
7. Tribe – *Allieae*,
8. Genus – *Allium*.

TYPES OF GARLIC

One taxonomic classification divides the garlic species (*Allium sativum*) into two subspecies (*A. sativum ophioscorodon* and *A. sativum sativum*). These subspecies are commonly referred to as hardneck garlics (*A. sativum ophioscorodon*) and softneck garlics (*A. sativum sativum*).^[10,11]

(a) Softneck Types

Softneck garlics, so named because they do not produce a seed stalk. There are two sub-classes of softneck garlics-silverskin and artichoke. Silverskin garlic is so named because of the whitish (silver) color of the bulb. Artichoke garlic receives its name from the arrangement of the cloves within the bulb, which overlap one another, similar to the scales composing an artichoke bud. The most widely grown in the United States, *California Early* and *California Late*.^[11]

(b) Hardneck Types

Hardneck garlics are characterized by their tendency to produce a stiff flower (or seed) stalk. The inflorescence, however, contains sterile flowers so that the plant does not produce any true seeds. The seed stalk of some hardneck varieties may be topped with a cluster of small fleshy buds called bulbils. There are several sub-classes of hardneck garlic-Rocamboles, Roja, Continental, Porcelain and Asiatic. Hardneck garlics range in color from paper-white (Porcelain type) to brownish-red (Rocamboles and Roja types). Most types display some amount of reddish or brownish color.^[11]

(c) Elephant Garlic

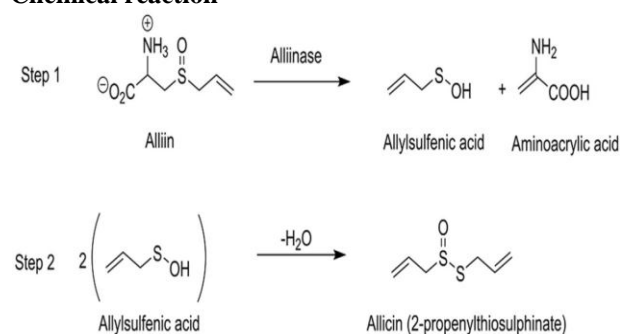
Elephant garlic (also called great-headed garlic) is not a true garlic, but rather, a type of leek which produces very large cloves. It produces a bulb which may consist of a

cluster of several cloves, as does garlic, or a single massive bulb that is surrounded by a number of small bulblets. Elephant garlic also produces a large seed stalk. The flavor of the elephant garlic clove is milder than the true garlics, but stronger than onion.^[11]

CHEMICAL COMPOSITION

Garlics contains the amino acid Alliin ($C_6H_{12}NO_3S$) which is odourless and can be converted to a compound called Allicin. When the garlic is crushed or otherwise damaged the alliin react with enzyme Alliinase, also found naturally in garlic. Alliinase acts as catalyst resulting in the transformation of Alliin to Allicin.^[6, 10, 12]

Chemical reaction



Besides this garlic also contains 0.1-0.36% of a volatile oil. these volatile compounds are generally considered to be responsible for most of the pharmacological properties of garlic. It contains at least 33 sulfur compounds along with alliin, allicin, ajoene, allylpropl, diallyl, trisulfide, sallylcysteine, vinylthiines, S-allylmercaptocystein and other sulfur compounds, peptides, steroids, terpenoids, flavonoids and phenols have increasingly been identified as possible active ingredients Besides sulfur compounds garlic contains 17 amino acids and their glycosides, arginine and others. Minerals such as selenium and enzymes and others. Allicin (diallyl thiosulfinate or diallyl disulfide) Ajoene is a garlic-derived compound produced most efficiently from pure allicin.^[13]

Chemical data^[14]

S.N.	CHEMICAL CONSTITUENT	FORMULA	PERCENTAGE
1.	amino acid, Alliin	$C_6H_{12}NO_3S$	1%
2.	Allicin	$C_6H_{10}OS_2$	0.5%
3.	1,3 dithiane	$C_4H_8S_2$	2.03%
4.	Disulfide, di-2-propenyl	$C_6H_{10}S_2$	14.30%
5.	1-Propene,3,3'-thiobis-	$C_6H_{10}S$	3.93%
6.	Trisulfide, methyl 2-propenyl	$C_4H_8S_3$	10.88%
7.	3-vinyl-[4H]-1,3-dithiin-	$C_6H_8S_2$	1.01%
8.	2-vinyl-[4H]-1,3-dithiin-	$C_6H_8S_2$	1.64%
9.	Trisulfide, di-2-propenyl	$C_6H_{10}S_3$	46.52%
10.	3-vinyl-[4H]-1,2 dithiin1 chloro-4-(1-ethoxy)-2-methylbut-2-ene	$C_6H_8S_2$	1.52%

11.	Disulfide,-methyl 2-propenyl	$C_4H_8S_2$	1.71%
12.	Diallyl disulfide	$C_6H_{10}S_2$	7/15%
13.	3-vinyl-[4H]-1,2 dithiin	$C_6H_8S_2$	2.76%
14.	Sulfide, methyl-2-butenyl	$C_8H_{17}S_3$	0.66%
15.	Octane, 4brom-	$C_8H_{17}Br$	4.16%

USES

1. Antimicrobial

The antimicrobial properties of garlic were first described by Pasteur (1958) and since then, many researches had demonstrated its effectiveness and broad spectrum antimicrobial activity against many species of bacteria, viruses, parasites, protozoan and fungi. Garlic is more effective with least side effects as compared to commercial antibiotics; as a result, they are used as an alternative remedy for treatment of various infections. Previously conducted researches confirmed that garlic is not only effective against Gram positive and Gram negative bacteria but also possess antiviral and antifungal activities.^[1, 13, 15, 18, 19]

2. Antibacterial

Garlic extract inhibits the growth of Gram positive and Gram negative bacteria. Its antibacterial activity is mainly due to the presence of allicin produced by the enzymatic activity of alliinase on alliin.^[13] Garlic that can control a variety of organisms. Louis Pasteur was the first to describe the antibacterial properties of garlic juice. Garlic is nicknamed 'Russian penicillin' for its widespread use as a topical and systemic antimicrobial agent, Several studies recommend garlic as an alternative form of treatment or prophylaxis in cases of infections especially gastrointestinal infections.^[13, 18, 19, 20, 21]

3. Antifungal

According to Ledezma, Shams *et al.* Ajoene is an active compound found in garlic which plays a great role as topical antifungal agent. garlic has been shown to inhibit growth of fungal diseases as equally as the drug ketoconazole, when tested on the fungi *Malassezia furfur*, *Candida albicans*, *Aspergillus*, *Cryptococcus* and other *Candida* species. Ajoene is an active compound found in garlic which plays a great role as topical antifungal agent. A report from a Chinese medical journal delineates the use of intravenous garlic to treat a potentially fatal and rare fungal infection of the brain called *Cryptococcus meningitis*.^[15, 18]

4. Antiviral

Two independent researchers in Japan and Romania have found that garlic is able to protect living organisms from the influenza virus. Most recently, a double blind placebo controlled study has shown significant protection from the common cold virus.^[13] Josling *et al.* Chinese studies with viral infections in bone marrow transplant patients have demonstrated a "potent antiviral activity". Adetumbi and Lau *et al.* in 1983 reported that Garlic or its constituents will directly kill influenza, herpes, ovaccinia (cowpox), vesicular stomatitis virus and human cytomegalovirus (secondary infection in

AIDS.), Coxsackie virus species. Garlic will also cure or improve the symptoms of a variety of viral diseases in humans or animals.^[13, 18]

5. Anticancer

According to Galeone *et al.* Garlic has several synergistic effects that either prevent or possibly may fight cancer. The action of garlic has been attributed to stimulate immune effector cells including T-cell and natural killer cells. garlic has a great role in cancer prevention especially in relation to digestive tract cancers. Human population studies have shown that, regular intake of garlic reduces the risk of esophageal, stomach and colon cancer. This was thought to be due to the antioxidant effect of allicin in reducing the formation of carcinogenic compounds in the gastro-intestinal tract. Netherlands cohort study found a significant decrease in the development of stomach cancer in those consuming garlic.^[1, 6, 15]

6. Reduces high blood pressure/hypertension

(McMahon and Vargas, *et al.*, 1993) Using 2400 mg garlic tablet containing 31.2 mg allicin has high dose reduced diastolic pressure by 16 mmHg after 5 h of administration. A meta-analysis made on pooled data from 415 patients showed also reduction of 7.7 mmHg diastolic pressure.^[13] Schulz V. *et al.*, in the year 1997 reported the antihypertensive activity of garlic powder. It showed a significant reduction in systolic blood pressure (SBP) and in diastolic blood pressure (DBP).^[11] Aqueous garlic extract and its individual components, allicin and ajoene also open K^+ channels, causing a membrane hyperpolarization and thus lead to a decrease of the Ca^{2+} inward current into the vascular smooth muscle cell and finally induce vasodilation resulting from intracellular Ca^{2+} decrease. due to a direct relaxant effect on smooth muscles.^[1, 14, 17, 22]

7. As natural blood thinner

According to Ernst & Fukao *et al.* studied that. Platelets and fibrin play great role in blood clotting and higher amount of fibrin in blood can cause heart attack. Garlic constituents can reduce fibrin formation and also help reduce the fibrin existing in the blood even better than aspirin. Ajoene, a sulfur compound found in garlic seems to be responsible for its anti-clotting effect. It is believed that the addition of garlic to a diet can help to increase the breakdown of fibrin from 24 to 30% in people.^[15, 17]

8. As natural immunity booster

Garlic has containing amino acids and other compounds that seem to initiate increased activity in the immune system. which stimulates immune function by making macrophages or killer cells more active. Abdullah *et al.*

Preliminary studies in humans, using an alliin standardized garlic powder preparation, have demonstrated positive effects on immunoreactions and phagocytosis. Another human study was conducted with an unrefined garlic extract (5 to 10 g/day) which was given to HIV/AIDS patients. For the seven patients who completed the 12 weeks study, there was a major increase in the natural killer cells activity from a seriously low mean value.^[13, 17]

9. Antiparasitic

Kalyesa *et al.*, 1975 & Mirelman *et al.*, 1987 studied that Many herbalists worldwide recommend garlic as a treatment for intestinal parasites. In some cultures, children infested with helminthes are treated with enemas containing crushed garlic. One of the traditional Chinese medical treatments for intestinal diseases is an alcoholic extract of crushed garlic cloves. Allicin exhibits anti-parasitic activity against major human intestinal parasites such as *Entamoeba histolytica*, *Ascaris lumbricoides* and *Giardia lamblia*. *Entamoeba histolytica*, the human intestinal protozoan parasite, is very sensitive to allicin, as only 30 µg/ml of allicin totally inhibits the growth of amoeba cultures.^[13]

10. Treat cardiovascular disease

When blood supply becomes restricted, a certain portion of the heart is deprived of oxygen and leads to heart attack. which are directly impacted by the therapeutic action of garlic. Bordia *et al.* has studied that The relevant role of garlic in coronary heart disease was done on rabbits and found that even pre-existing atherosclerotic deposits and lesions could actually be reversed if garlic was consistently consumed.^[13, 16, 17]

11. Atherosclerosis and hyperlipidaemia

Lau's Health claims advertizing that Garlic has ability to lower cholesterol level and decrease lipid per oxidation in order to inhibit plaque formation. It has an ability to suppress low density lipoprotein (LDL) and an increased resistance of LDL to oxidation. As more researches were conducted newer processes to extract garlic, recent study of 15 hypercholesterolemia patients evaluated a material produced from garlic fermented with the mold *Monascus pilosus*. This preparation significantly reduced serum total cholesterol and low density lipoprotein cholesterol levels when checked at 2 and 4 weeks after treatment beginning. After 60 days of supplementation, low-density lipoprotein, serum triglyceride and very low density lipoprotein, were reduced by 21, 37 and 36.7%, respectively.^[1, 13, 16, 17]

12. Antioxidative and Radioprotective Effects

Prasad *et al.*, 1995 reported that whole garlic and aged garlic extract exhibit direct antioxidant effects and enhance the serum levels of two antioxidant enzymes, catalase and glutathione peroxidase¹³. Borek, C.J. Nutret *et al.*, in 2001 has reported that oxygen radical injury and lipid peroxidation are responsible for atherosclerosis, cancer, liver disease and the aging process. Aged Garlic

Extract and its various constituents have demonstrated an array of antioxidant and radio-protective effects in studies. Further, they have been shown to enhance antioxidative enzyme systems in cells. They have been shown to scavenge hydrogen peroxide, to inhibit the formation of TBA-RS, 5 to protect the heart from cardiotoxic, anticancer drug doxorubicin, to protect the kidneys from the antibiotic gentamicin.^[1, 13, 18]

13. Dermatologic applications

Dehghani *et al.* A study examined 43 persons for their topical use of two different garlic extracts for wart and corn treatment. Of these persons, 15 volunteers utilized a water extract of garlic, while 23 volunteers applied lipid extract to appropriate areas twice a day. Five controls applied only a neutral solvent. All lipid extract volunteers experienced complete resolution of wart and 80% of corn within one to two weeks. The water extract seemed to be less potent, with complete dissolution of smaller warts and corns, and only partial dissolution of larger ones. Controls showed no improvement from baseline.^[15]

14. Prevents diabetes

Most of the studies showed that garlic can reduce blood glucose level in diabetic. Eidi *et al.* A study was conducted to evaluate oral administration of garlic extract for 14 days on the level of serum glucose, total cholesterol, triglycerides, urea and uric acid, in normal and streptozotocin-induced diabetic mice. The result of the study showed significant decrease in serum glucose, total cholesterol, triglycerides, urea, uric acid, aspartate amino transferase and alanine amino transferase levels, while increased serum insulin in diabetic mice.^[15, 16, 17]

15. Anti-tuberculosis

Jain *et al.*, studied The anti-tuberculosis activity *in vivo* of garlic oil preparation was demonstrated in a study of guinea pigs which were given an intra-peritoneal dose of 0.5 mg/kg. However, when garlic oil was used, a reduced causative process was noted in the organs involved, indicating that garlic oil administration causes less marked lesions in the viscera of the animals inoculated with tubercle bacilli.^[13]

16. Antibiotic

Garlic is a broad spectrum antibiotic, killing a wide variety of bacteria. "Garlic has the broadest spectrum of any antimicrobial substance that we know of it is antibacterial, antifungal, antiparasitic, antiprotozoal and antiviral." This property belongs to the garlic constituent allicin, which is released when you cut a garlic clove. This is the chemical that gives fresh garlic its strong biting flavor and you need to use fresh garlic to get a reliable antibiotic effect.^[13]

17. Anti-tumor Effects

Animal studies have reported protective effects of garlic against hepatotoxins' cyclophosphamide, adriamycin, methylcholanthrene, gentamicin, 4-nitroquinoline 1-

oxide and bromobenzene. Garlic has demonstrated strong inhibition of cancer development in the presence of known tumor promoters including 12-O More recent studies seem to relate the consumption of garlic with cancer inhibition. Sulphurous components are believed to be responsible to avoid the developing of cancerous cells in stomach, liver, etc.^[13]

18. Diuretic

IT has reported that garlic acts as a diuretic which helps to get rid of body liquids. It may act as a very useful resource in case of rheumatism, gout, arthritis, hidropesia, edemas.^[13]

19. Sickle Cell Anemia

Sickle cell anemia is a genetic disease caused by abnormal hemoglobin. Dense cells, which have an elevated density and possess an abnormal membrane, have a tendency to adhere to blood components such as neutrophils, platelets and endothelial cells, which line blood vessels. Ohnishi *et al.* (2000) found that Aged Garlic Extract (4.0 mg/ml) could inhibit dense cell formation by 50% along with other effective nutrients like black tea extract, green tea extract, pycnogenol, α -lipoic acid, vitamin E, coenzyme Q10, and s-carotene.^[13, 17]

20. Platelet Effects:

Ali M. Mechanism *et al.* in 1995 reported that Garlic and its derived compound ajoene have demonstrated inhibition of platelet aggregation *in vitro* and in animals and reduction of platelet dependent thrombus formation. Anti-platelet activity may be attributable to garlic constituents including adenosine, allicin and paraffinic polysulfides.^[13, 17]

21. Liver-Protective/Detoxification Effects

H. *et al.* 2000 has been reported that aged Garlic Extract have liver protective effects. It has demonstrated *in vivo* from the liver toxins: carbon tetrachloride, paracetamol (acetaminophen) and bromobenzene. It has been shown to inhibit both the formation and bioactivation of liver carcinogenic nitrosamines and has prevented the mutagenic effects of aflatoxin B1.^[13]

22. Reduction of Serum Homocysteine

Hyper homocysteinemia (high blood level of homocysteine (Hcy) is a well-established risk factor for arteriovascular diseases and folate deficiency contributes to this condition. Yeh *et al.* (1999) found that Aged Garlic Extract effectively reduced hyper homocysteinemia caused by severe folate deficiency.^[13, 17]

23. Vaginal infections

Garlic is one of the best antibiotics. It has bactericidal and fungicidal properties, able to kill or inhibit the growth of microorganisms that could be responsible for infections that cause vaginal irritation, vaginitis or vaginal flow. (Make a suppository placing a garlic in a

gauze and insert it into the vagina) (Eat plenty of garlic). It can also be use to fight scabies.^[13]

24. Glycemic Effects

KT *et al.* in 1996 had reported that SACS (S-allyl cysteine sulfoxide), an antioxidant from garlic, has been found to significantly stimulate insulin secretion from beta cells isolated from normal rats.^[1, 13]

25. Anthelmentic

It has also reported that garlic is useful in the treatment of intestinal worms. Sulphurous components of garlic may be useful to eliminate tapeworms (Make an enema with liquid from the decoction for 15 minutes of 3 g of garlic cloves per liter of water.).^[11]

26. Digestive

It eases digestion by stimulating the liver, the gall bladder and the pancreas although its use should be avoided when existing hyperchloridia (stomach acidity) and also when having frail stomachs (Eat it raw or crushed and mixed with butter.).^[13]

27. Antiatherosclerotic effect

Garlic powder extract inhibits biosynthesis of cholesteryl esters and triglycerides in atherosclerotic cells and it also inhibits the activity of acyl-CoA cholesterol acyltransferase, the enzyme involved in the formation of cholesteryl esters, the main component of the excessive fat accumulated by cells. On the other hand, garlic extract stimulates cholesteryl ester hydrolase that degrades cholesteryl esters in atherosclerotic cells.^[1]

28. Carminative activity

Garlic has demonstrated carminative activity in human studies. It was concluded that garlic sedated the stomach and intestines and relaxed spasm, retarded hyper peristalsis and dispersed gas.^[16]

29. Anti Inflammatory Activity

Garlic showed slight anti-inflammatory activity against formalin arthritis in albino rats. 60 Highly significant anti-inflammatory activity in both Carrageenin induced oedema and granuloma pouch in albino rats were noticed with a commercial preparation in Japan, 'Marutasi' containing garlic and also the alcoholic extracts showed anti inflammatory activity against carrageenin induced rat hind paw oedema, in albino rats.^[16, 18]

Beside this garlic also found profound use in treatment of asthma, arthritis, sciatica, lumbago, backache, bronchitis, chronic fever, tuberculosis, rhinitis, malaria, obstinate skin disease including leprosy, leucoderma, discolouration of the skin and itches, indigestion, colic pain, enlargement of spleen, piles, fistula, fracture of bone, gout, urinary diseases, diabetes, kidney stone, anemia, jaundice, epilepsy, cataract and night blindness etc.^[13]

DISCUSSIONS

This review paper demonstrated some of the benefits, such as medicinal uses of garlic for its potential uses in preventing and curing different diseases and acting as antioxidant for many radicals. Garlic has many health benefits and has been traditionally used worldwide. The wealth of scientific literature supports the proposal that garlic consumption have significant cardio protective effect. Garlic is a magical medicinal herb and if consumed at regular basis, it has got the prophylactic but also curing effect on several diseases.

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