

**ETHNOPHARMACOLOGY, PHARMACOGNOSY AND PHYTOCHEMICAL PROFILE  
OF *ALLIUM SATIVUM L.*: A REVIEW**

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**Summary**

The present work is directed towards the extensive study of ethanopharmacology, Pharmacognosy and Phytochemistry of *Allium sativum.L* (Garlic) which has proved to be a gift for the treatment of various diseases and disorders. From the ancient times garlic along with its culinary uses has been reported for its wide spectrum of biological activities in the ayurvedic formulary. The present review is an attempt made to reveal the current research status of the garlic. This may be used in the treatment of various life threatening diseases and disorders in future.

**Key words:** *Allium sativum*, garlic, ethanopharmacology, pharmacognosy and phytochemistry.

### Introduction

Medicinal plants from ancient time were considered as the God's gift to human beings as they are having profound use in the treatment of various dreadful diseases and disorders. Many of them are mentioned in Ayurvedic formulary and all other official books on herbal drugs. In India folk medicines practices are totally unrevealed in relation to the use of rare medicinal plants and plant products. Garlic had been reported with many medicinal values from ancient times.<sup>1</sup> Garlic (*Allium sativum*) is a species in the onion genus, *Allium*. Its close relatives include the onion, shallot, leek, chive, and rakkyo.<sup>2</sup> Dating back over 6,000 years, garlic is native to central Asia, and has long been a staple in the Mediterranean region, as well as a frequent seasoning in Asia, Africa, and Europe. The ancestry of cultivated garlic is not definitively established. According to Zohary and Hopf, "A difficulty in the identification of its wild progenitor is the sterility of the cultivars", though it is thought to be descendent from the species *Allium longicuspis*, which grows wild in central and southwestern Asia.<sup>3</sup> *Allium sativum* grows in the wild in areas where it has become naturalised. It is having two varieties; while botanists classify garlic under the umbrella of the species, *Allium sativum*, there are also two main subspecies Ophioscorodon, or hard necked garlic includes porcelain garlics, rocambole garlic, and purple stripe garlics and *Sativum*, or soft necked garlic, includes artichoke garlic, silverskin garlic, and creole garlic. In one type the bulb consists of many cloves while the other has only one clove. The healing properties of garlic as an antiviral and anti bacterial agent is now backed with scientific evidence. Scientists have shown that the compounds in garlic are good for heart. They lower blood pressure, reduce cholesterol production in the liver, suppress harmful cholesterol and raise level of the beneficial high-density lipoproteins in the blood. The daily dose recommended is about 6g, equivalent to two or three cloves.<sup>4</sup> Garlic is also extensively used for curing 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.<sup>5</sup>

### CULTIVATION

Garlic is easy to grow and can be grown year-round in mild climates. It is cultivated in well-drained moderately clay loamy soil. While sexual propagation of garlic is indeed possible, nearly all of the garlic in cultivation is propagated asexually; by planting individual cloves in the ground.<sup>6</sup> Garlic is hardy perennial with narrow flat leaves & bears white small flowers & bulbils. The cultivation of drug is done generally in the month of September to late in October. In cold climates, cloves are planted in the fall, about six weeks before the soil freezes, and harvested in late spring.<sup>7</sup> It takes about four months for harvesting. Garlic plants are usually very hardy, and are not attacked by many pests or diseases. Garlic plants are said to repel rabbits and moles. Two of the major pathogens that attack garlic are nematodes and white rot disease, which remain in the soil indefinitely once the ground has become infected. There are different types or subspecies of garlic, most notably hardneck garlic and soft neck garlic. The latitude where the garlic is grown affects the choice of type as garlic can be day-length sensitive. Hard neck garlic is generally grown in cooler climates; soft neck garlic is generally grown closer to the equator. For cultivation, about 300kg of bulbs per hectare are required & yield per hectare is about 8000 kg.

**Synonyms:** *Allium sativum* L.

**Sanskrit** : Lasuna, Rosona, Yovanesta, **English** : Garlic, poorman's treacle, **Hindi** :  
Lashan, lahsun, **Arabic** : Saun Taum , **German** : Knoblauch, Lauch , **Greek** :  
Allidion, Skorodon, **Italian** : Aaglio, **Urdu** : Lehsun , **Malayalam:** Veluthulli.



**Fig.1.** *Allium sativum* L (Garlic)

### **General appearance**

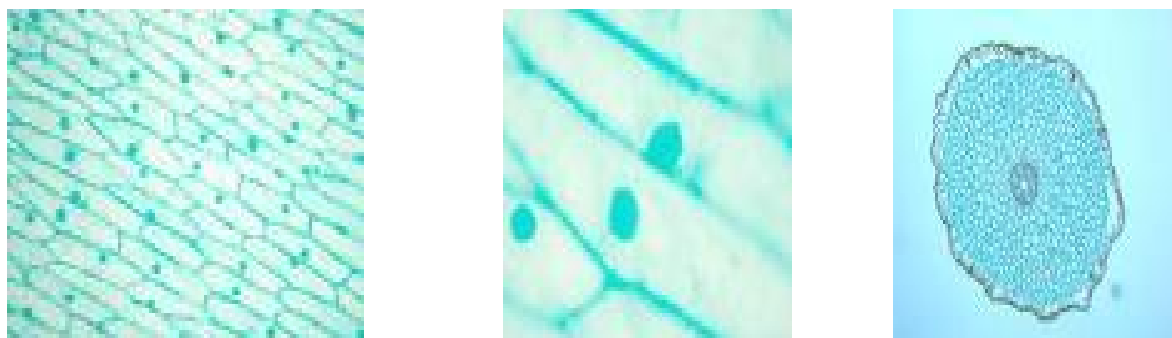
*Allium Sativum* L consists of several outer layers of thin sheathing protective leaves which surround an inner sheath. The latter enclose the swollen storage leaves called “cloves”. Typically, the bulb possesses a dozen sterile sheathing leaves within which are 6–8 cloves bearing buds making a total of 10–20 cloves. and 20–40 well-developed but short and embedded roots. The cloves are asymmetric in shape, except for those near the centre (1).

### **Organoleptic properties:**

Odor strong, characteristic alliaceous taste very persistently pungent and acrid.

### **MICROSCOPIC CHARACTERISTICS**

The bulbs show a number of concentric bulblets; each is 5–10mm in diameter and consists of an outer scale, an epidermis enclosing a mesophyll free from chlorophyll, a ground tissue and a layer of lower epidermal cells. Dry scales consist of 2 or 3 layers of rectangular cells having end walls with a broadly angular slant. These cells contain many rhomboid crystals of calcium oxalate. The upper epidermal cells next to the dry scale layer consist of a single layer of rectangular to cubical cells next to which are several layers of large parenchymatous cells. Among these cells are interspaced many vascular bundles, each of which consists of xylem and phloem arranged alternately. Lower epidermis consists of cubical cells which are much smaller than the upper epidermal cells. The same arrangement of tissues is met within different bulblets, 2 or 3 of which are arranged concentrically.



**Fig.2: Microscopical characteristics of *Allium sativum L.***

#### **Powder characteristics:**

Powdered plant material appears pale buff to grayish or purplish white, with characteristic aromatic alliaceous odor and taste. It is characterized by the presence of sclereids of the epidermis of protective leaves, thin epidermis of storage cells, latex tubes, swollen parenchyma cells with granular contents, and lignified narrow spiral and annular vessels.

#### **GEOGRAPHICAL DISTRIBUTION**

*Allium sativum L.* is probably indigenous to Asia but it is commercially cultivated in most countries.

#### **PHARMACOLOGICAL ACTIVITIES**

##### **1. Antilipemic (cholesterol lowering):**

Garlic can prevent blood clotting and increase the rate at which blood clots are broken down, but large amounts- ten or more cloves a day- may have to be eaten before any effect is noticed.<sup>8</sup>

##### **2. Antihypertensive**

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).<sup>9,10</sup>

##### **3. Antibiotic**

Garlic is a broad spectrum antibiotic, killing a wide variety of bacteria. Dr. Tariq Abdullah, a prominent garlic researcher stated in the August 1987 issue of Prevention: "Garlic has the broadest spectrum of any antimicrobial substance that we know of — it is antibacterial, antifungal, antiparasitic, antiprotozoan 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. Garlic appears to have antibiotic activity whether taken internally or applied topically. Researchers found that the urine and blood serum of human subjects taking garlic had activity against fungi (Caporaso et al 1983).

**4. Anti-tumor Effects:**

According to Hikino H *et al* in 1986, 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.

**5. 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 (responsible for cold sores), and human cytomegalovirus (a common source of secondary infection in AIDS.) Garlic will also cure or improve the symptoms of a variety of viral diseases in humans or animals.<sup>11</sup>

**6. Antimicrobial Activity:**

Garlic is believed to possess antimicrobial properties 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<sup>[24]</sup>. Several studies recommend garlic as an alternative form of treatment or prophylaxis in cases of infections especially gastrointestinal infections.<sup>12</sup>

**7. Anthelmentic:**

It has also reported that garlic is useful in the treatment of intestinal worms. Sulfurous 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.)

**8. 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.<sup>13</sup>

**9. 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.)<sup>13</sup>**10. 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.<sup>13</sup>**11. 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.<sup>14, 15, 16, 17, 18, 19, 20, 21, 22</sup>

**12. 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.<sup>21</sup>

### 13. Reduction of Serum Homocysteine

Hyperhomocysteinemia (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 hyperhomocysteinemia caused by severe folate deficiency reported by Yeh, Y., Yeh, S. et al. 1999.

### 14. 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,  $\alpha$ -lipoic acid, vitamin E, coenzyme Q10, and  $\beta$ -carotene.<sup>23</sup>

### 15. Liver-Protective/Detoxification Effects

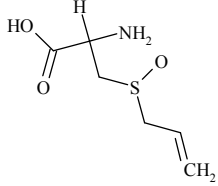
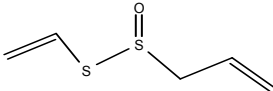
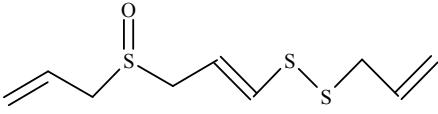
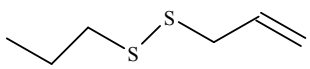
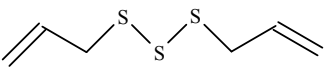
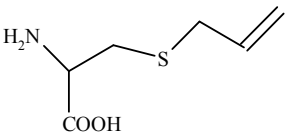
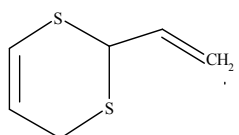
It has been reported that aged Garlic Extract have liver protective effects. It has demonstrated *in vivo* from the liver toxins: carbon tetrachloride, paracetamol (acetaminophen) and bromobenzene by Amagase, H. et al. 2000. It has been shown to inhibit both the formation and bioactivation of liver carcinogenic nitrosamines and has prevented the mutagenic effects of aflatoxin B1.<sup>24</sup>

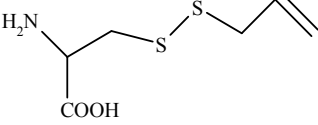
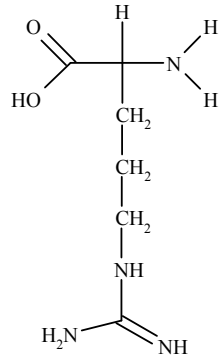
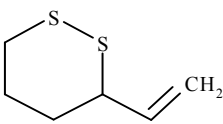
### 16. Antioxidative and Radioprotective Effects

Borek, C.J. Nutret 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. They have been shown to protect white blood cells from radiation damage, liver cells from lipid peroxidation and vascular endothelial cells from oxidant injury. 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<sub>5</sub> to protect the heart from cardiotoxic, anticancer drug doxorubicin, to protect the kidneys from the antibiotic gentamicin.<sup>20</sup> Besides 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.

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. Garlic contains at least **33 sulfur compounds** along with aliin, 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 sulfure compounds garlic contains **17 amino acids** and their glycosides, arginine and others. **Minerals** such as selenium and enzymes, and others. **Allicin** (diallyl thiousulfinate or diallyl disulfide) **Ajoene** is a garlic-derived compound produced most efficiently from pure allicin

Phytochemical constituents <sup>25</sup>

Sr.No	Chemical constituent	Structure
01	Aliin	
02	Allicin (2-Propene-1-sulfinothioic acid S-2-propenyl ester)	
03	Ajoene	
04	Allylpropyll	
05	Diallyl trisulfide	
06	S-allylcysteine,	
07	vinylthiines	

08	S-allylmercaptocystein	
09	Arginine	
10	3-vinyl-(4H)-1,2-dithiin	

### Conclusion

Garlic (*Allium sativum* .L) has been reported with the various biological activities from ancient times it is well known to all as it's wide use as a spice or condiment in Indian and continental cuisine. Along with this many researcher has been tried to find the various pharmacological actions of garlic bulb extract which shows fruitful results in the treatment of various life threatening diseases and disorders' The concept of research in this review is directed to provide a brief spectrum of garlic in medicines.

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### References

1. B. Hiyasat, D. Sabha, K. Grotzinger, J. Kempfert, J. W. Rauwald, F. W. Mohr, S. Dhein, Ant platelet activity of *Allium ursinum* and *Allium sativum*, *Pharmacology*, Vol. 83, No. 4. (2009), pp. 197-204.
2. Bergner, Paul. *The Healing Power of Garlic*. Rocklin, CA: Prima Publishing, 1995
3. Edzard Ernst The efficacy of herbal medicine an overview 2005 Blackwell Publishing *Fundamental & Clinical Pharmacology* 19 (2005) 405–409.
4. Augusti KT, Sheela CG. Antiperoxide effect of S-allyl cysteine sulfoxide, an insulin secretagogue, in diabetic rats. *Experientia* 1996; 52(2):115-120.



5. "SmallFarmNewsArchive".Sfc.ucdavis.
6. "The Cult of the Cloves". *New York Times*. September 29, 2010.
7. Lau, B., Lam, F. *et al.* 1987. Research Excerpts from *Nutr.Res.* 7:139-149.
8. Auer W, Eiber A, Hertkorn E, et al. Hypertension and hyperlipidaemia: garlic helps in mild cases. *Br J ClinPract Suppl* 1990; 69:3-6.
9. Silagy CA, Neil HA. A meta-analysis of the effect of garlic on blood pressure. *J Hypertens* 1994; 12:463-8.
10. Tsai Y, Cole LL, Davis LE, et al. Antiviral properties of garlic: *In vitro* effects on influenza B, herpes simplex and coxsackie viruses. *Planta Med* 1985; (5):460-461.
11. Sadeghian, K.Ghazvini, Antimicrobial Activity of Garlic Extract against Shigella, *Iran J. Med. Sci.* 2002; 27(3):142-144.
12. Prafulla Mane, Rahul Mayee, Kavita Atre, Medicinal properties of *Allium sativum* (garlic): a review <http://www.ijpr.com/2011/pub/arti/vov-3/issue-2/April/017>.
13. Ali M. Mechanism by which garlic (*Allium sativum*) inhibits cyclooxygenase activity. Effect of raw versus boiled garlic extract on the synthesis of prostanoids. *Prostaglandins Leukot Essent Fatty Acids* 1995; 53(6):397-400.
14. Teranishi K, Apitz-Castro R, Robson SC, et al. Inhibition of baboon platelet aggregation *In vitro* and *in vivo* by the garlic derivative, ajoene. *Xenotransplantation* 2003; 10(4):374-379.
15. Apitz-Castro R, Cabrera S, Cruz MR, et al. Effects of garlic extract and of three pure components isolated from it on human platelet aggregation, arachidonate metabolism, release reaction and platelet ultrastructure. *Thromb Res* 1983; 32(2):155-169.
16. Srivastava KC, Tyagi OD. Effects of a garlic-derived principle (ajoene) on aggregation and arachidonic acid metabolism in human blood platelets. *Prostaglandins Leukot Essent Fatty Acids* 1993; 49(2):587-595.
17. Boullin DJ. Garlic as a platelet inhibitor. *Lancet* 1981; 1(8223):776-777.
18. Jamaluddin MP, Krishnan LK, Thomas A. Ajoene inhibition of platelet aggregation: possible mediation by a hemoprotein. *Biochem Biophys Res Communicat* 1988; 153(1):479-486.
19. Rendu F, Daveloose D, Debouzy JC, et al. Ajoene, the antiplatelet compound derived from garlic, specifically inhibits platelet release reaction by affecting the plasma membrane internal microviscosity. *Biochem Pharmacol* 1989; 38(8):1321-1328.
20. Oshiba S, Sawai H, Tamada T, et al. [Inhibitory effect of orally administered inclusion complex of garlic oil on platelet aggregation in man]. *Igaku no Ayuma* 1990; 155(3):199-200.
21. Ali M, Bordia T, Mustafa T. Effect of raw versus boiled aqueous extract of garlic and onion on platelet aggregation. *Prostaglandins Leukot Essent Fatty Acids* 1999; 60(1):43-47.
22. Aged Garlic Extract™ Research Excerpts from Peer Reviewed Scientific Journals & Scientific Meetings Ohnishi, S.T., Ohnishi, T., et al. 2000. *Nutrition* 16: 330-338.
23. Amagase, H. et al. 2000. Ch. 6. Phytochemicals and Phytopharmaceuticals. AOCS Press, Champaign, Illinois, pp.62-78.
24. Borek, C. Recent Advances on the Nutritional Benefits Accompanying the Use of Garlic as a Supplement. Newport Beach, CA. November 15-17, 1998.
25. Amagase, H. et al. 2000. Ch. 6. Phytochemicals and Phytopharmaceuticals. AOCS Press, Champaign, Illinois, pp.62-78.