

Allium sativum (Garlic): The Folk and Modern uses- Part I

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Abstract

The present paper discusses some of the most recent aspects of *Allium sativum*, Garlic, such as; the vernacular names in different countries and region; its historical uses in different parts of the world; its uses in India, its main chemical constituents and its modern uses.

Keywords: *allium sativum*, garlic, spices

Introduction

Genus *Allium* has 700 species about 30 are found in India. The region of diversity for *Allium* (Origin) is said to be Central Asian region, (Esquinas, Alcazar, 2004). The species which are cultivated in India are mainly three- *A. cepa* (Onion) and *A. sativum* (Garlic), *A. ascalonicum*, L. (Shallot) are largely cultivated.

The garlic (*Allium sativum*-Family: *Alliaceae*) is a perennial plant with narrow leaves and a compound bulb consisting of several small bulb-lets or cloves, varying from 10-50 which are enclosed in a thin, white or pinkish sheath. The plant produce both seeds and bulb-lets. All parts of the plant, inflorescence, leaves, cloves have been used from earliest time as a condiment or spice for flavouring soup, sausages and salads and also used in folk-and traditional medicine as it possess antiseptic and bactericidal properties.

Different vernacular names of different region & culture: In Mesopotamia, about 1047-1087 B.C Its Sumerian name is 'se shar' and in Greek 'skordon', (Thorwald Jurgen 1962,p.167). and in Ramses IIIrd period, in Eber's Papyrus' its name is *Khidajana*. It is known *Ail* (French), *Aglio* (Italian), *Knoblauch*, (German) *Shoomin*, (Hebrew), *Skordon*, (Greek); *Thum*, *Taum*, *Theriac*, *al-faqara*, *Saum* (Arabic), *Chesnok* (Russian), *Seer* (Persian),

In India, its 'Sanskrit names have been possibly taken from Amarsingh's 'Amar kosh' brought out in 600 A.D. at the time of king Vikramaditya. Amarsingh was one of the the 'Nava-ratnas' or 'nine special courtiers' of Vikramaditya. The Sanskrit names are; *Mahaushadha*, *Lashunaha*, *Granjanaha*, *Aristaha*, *Mahakandaha*, *Rasonakaha*, *Amarkosha*, (2001,p.228) and *Ugragandha*, *Malechakanda*, *Yavanishta* (Garga, Dhanwantri, 1971). In Quran, the holy book of Muslims, it is named, *Fum*, and pronounced as *Soomiha*, (Farooqi, 2004).

In India, it is known in different regions by different names: *Ruhan* (Kashmir); *Lassan* (Panjabi); *Lashan* (Kumaoni); *Naharu* (Assami); *Roshum* (Bengali); *Lashan* (Gujrati); *Belulli*, *Velluli* (Malayalam); *Lusoon*, *Lasun* (Marathi); *Rasuna* (Oria); *Shunam* or *Ullipundu* or *Vellaippundu* (Tamil); *Viluli* or *Velluri*, *Vellulli-tella-gadda* (Tel), *Lossun* (Konkani), *Gokpas* (Tibetan). WHO, (1999,p.16) has cited some very interesting names, such as; 'camphor of the poor'; 'nectar of the gods'; 'poor man's or rustic treacle'.



Figure1. Garlic flowering stock (Umbel)

Use in past in Mesopotamia and Egypt.: The earliest use of garlic, in record, dates back to Assyrians about 2200-2100 B.C, when the oldest medical book, was written in cuneform tablets, which included about 250 plant, animal and mineral drugs used for medicinal purpose in Mesopotamia. This writing was deciphered by R. Campbell Thompson. and was published in 1923 as 'Assyrian Herbal' after 20 yrs of his research work. and, in this garlic and onion were also present. Its ancient name is 'khidajana' and which was mentioned earlier, in 'Eber's Papyrus., Lewis & Lewis-Elvin (1977) state that it was applied externally in indurations. and in 'Papyrus Harris' it is that mentioned it was one of the offerings made by Ramses IIIrd (about 1047-1087 B.C.) to the Gods of Thebes.

Introduction in Europe and its uses: It was most probably introduced into Europe from Italy by Roman colonisers. Garlic is used chiefly in hypertension and arteriosclerosis, flatulence, intestinal catarrh of infectious aetiology and for its anthelmintic action. It is also effective in

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treating bronchitis and the common cold. It is mostly used for seasoning purpose, Stary & Jirasek (1973).

Introduction in India and its uses: We know it well that there existed trade between Mesopotamia, Egypt and India about 3000 B.C., i.e., during Mohanjodaro period, and which is still continued. The sharing of their mutual medicinal knowledge and the trade of herbal drugs, like; cinnamon, ginger, pomegranate, calamus, sandal-wood and even

licorice, asafoetida was quite common. It is very possible that *Allium sativum* (Garlic) and *Allium cepa* (Onion) was introduced into India during that period. Later, the bulbs as seed were brought and grown. In India, the Arabian traders, (Muslims) were known as 'Malecha' and the Greeks, the army men of Alexander the Great, (300 B.C.), who attacked India, were known as 'Yavans' must have brought and used Garlic in their cooking as a condiment and also as a medicine. Therefore, it was



Figure 2. Bulbs of Garlic

called as Malecha kanda meaning 'the tuber of the Malecha' and later as *Yavanishita* 'meaning 'Liking of the Yavans'. However, the therapeutic value of the garlic was already recognized since, Hippocrates (460-357 B.C.) prescribed eating garlic in uterine tumors and Bower's manuscript (450 AD) from India recommended garlic in abdominal tumours, Lewis & Lewis-Elvin (1977).

Garlic was also adopted in Ayurvedic system of medicine, in India and so a number of medicines were prepared. (Dymock, et al 1891) listed the uses of Garlic as follows;

1. Garlic is used as a condiment and medicine by the Hindus. In the Raja Nighanta it is described under the name of *Rasona*, and bears many synonyms indicative of its properties, such as *Ugra-gandha* strong smelling, *Mahaushadha* 'the great medicine' as it is supposed to be a panacea, *Bhuta-ghna*, the destroyer of the demons, *Lasuna*, etc.

2. The Hindus considered it to be a tonic, hot, digestive, aperient, cholagogue, and alterative; useful in cough and phlegmatic affections, fever, swellings, gonorrhoea, piles, leprosy, colic, rheumatism, and worms. During its use the diet should consist of wine, meat, and acidic foods.

Uses in Facial paralysis, Hemiplegia, Sciatica, Paraplegia, and Convulsive affections: A decoction of garlic in milk is given in small

doses in hysteria, flatulence, sciatica, and heart disease. A compound garlic powder called 'Svalparasona pinda', which contains garlic, asafoetida, cumin, rock salt (Lahori salt), sendha salt, ginger, long pepper, and black pepper in equal proportions, is given in doses of about twenty grains, every morning with a decoction of the root of the castor oil plant, in facial paralysis, hemiplegia, sciatica, paraplegia, and convulsive affections.

3. Anti allergy agent: Garlic juice is applied externally as a counter-irritant. (Anti allergy?)

However, (Sharma, 1976) has compiled the day to day uses of Garlic in a publication, '*Vaidya Raj Lashun*' in which he has listed about 125 day to day uses in diseases and ailments.

In Ayurveda the following preparations are prepared and sold in the market; *rason-vati*, *rason-pind*, *rasonastak*, *lasunyadighrita*, Dey (1980).

Not only, in Ayurveda, but also in folk-medicine Garlic is used variously in different parts of the country. In Maharashtra, (D. Souza, 1993, p.269) has mentioned that in ear-ache and pus in ear, three flakes of garlic taken and boiled in three table spoons of til oil cooled and three drops are put in the ear; in cough and cold 3 flakes are put into one cup of water, which is heated and one cup is taken in the morning and one in the evening; in poor digestion 5 garlic flakes, 2 green chillies and little salt are ground into a paste and then it is fried in 3 teaspoon of til oil and is taken for seven days.

In Quran: In Quran, Garlic and Onion are well mentioned in *Sura II (Baqara-the Heifer)*. Verse:61. It is mentioned that the Prophet did not like its smell and also stated that those who take raw garlic may not come to the Mosque. It is stated that Prophet also recommended Garlic in several diseases, (Farooqi, 2003 & 2004).

Some common uses in Europe: It is anthelmintic, diuretic, and also a febrifuge in intermittent fevers. If mixed with salt and oil it heals up amputations and other wounds, In World War I this practice was very much used with the wounded soldiers who had lost their limbs. When mixed with honey it is a useful remedy for soft blotches, damp head ulcers, scabies, etc. The juice is used in deaf-ears. Garlic cloves alone or mixed with parsley and olive oil is taken as a remedy to clean the urinary bladder of sand and stone (bladder stone) and is supposed to drive away abdominal swellings,

Various indigenous uses: Garlic can easily be placed among the panaceal herbal drug as it is used in different parts of the world with various uses. (Keller, 1978) quoted by (Foster & Tyler, 2000),

Uses in Japan & China: In Japan it is known as *Ninniku* and in China as *Ta-suan* and used as stomachic, intestine regulating, tonic, aphrodisiac and with anthelmintic properties. The crushed bulb is applied to the affected area in syphilitic skin diseases, (Takeda, Chobu, 1971).

Uses in Nigeria (Africa): In Nigeria it is called as *Taffanmuwa* and chewed in cough and cold. In North Nigeria respiratory and infectious diseases worms, skin diseases, etc., (Oliver-Bever, 1986, p.44).

Uses in India: The bulb is used as a vermifuge, diuretic, carminative, expectorant and stimulant. Oil is used for skin rashes, as ear drops, in atonic dyspepsia, flatulence and colic. Decoction of garlic with milk is



Figure 3. Fully ripened Garlic cloves.

used in small doses for heart disease. In Kerala, hypercholesterolemic patients are being advised by their physicians to use 10-15 gms garlic daily. In Indian homes, except for few sects of Hindus, use of garlic in several food preparations as a condiment. The oil in which the garlic-cloves are fried is a popular remedy for ear ache. In some parts of India, ladies, after child birth use garlic in large quantities. It is also used in tooth ache. From the above statement it can be seen that the use of garlic acts as prophylactic in several ailments & diseases and it is claimed that use of garlic has many beneficial effects.

Parts used: Presently, the cloves from the bulb, dried flowers, clove- dried powder, garlic-salt and its essential oil are used in medicine and the leaves and the cloves are used in culinary and for seasoning purpose.

Dried flowers of Garlic are used in diabetes: It has organic sulphur compounds The ethyl-ether extract 58% of dried flower head acts to the standard of tolbutamide, (the medicine of diabetes), Oliver-Bever,(1986,p.256.)

Garlic powder: The cloves are dehydrated and powdered. The powder has the same chemical composition and pharmacological activity except it does not have the allicin, the pungent principle. The pungency could also be regenerated by adding fresh enzyme or fresh crushed garlic in small quantity, (Pruthi, 1976,p.128).

Garlic salt: It is prepared by mixing rapidly garlic powder: 20 parts; refined pulverised salt,78 parts and anti-caking agent, 2 parts thus total 100 parts, (Pruthi, 1976).

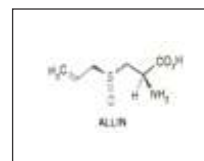
Its oil or essential oil: On steam distillation of crushed garlic at atmospheric pressure, the major odour producing principle allicin is decomposed down to diallyldisulphide and other sulphides. This explains, why the volatile oil of garlic consists chiefly of disulphides. However, pure allicin can be isolated by steam distillation at reduced pressure. It may also be clarified that the mother precursor allin does not posses bactericidal activity. It is only allicin, which has the bactericidal activity. The inhalation of of garlic oil or garlic juice has been recommended in case of pulmonary tuberculosis, rheumatism, sterility and impotency, (Pruthi, 1976).

Chemical constituents: The chemistry of Garlic has been extensively investigated and the investigations are still continued with the chemistry of complicated transformed sulphur compounds, which are generally not found

in nature, and with the pharmacological and clinical studies. However, the chemical investigation have been reviewed by(Raj & Parmar,1978) and WHO,(1999) and the same is represented as follows:

The bulb contains the only one sulphur compound known as allin but in presence of allinase enzymes present in the tissue at once transforms it into allicin, which is responsible for the peculiar garlic-smell of the bulb. The chemistry of the compounds in the bulb according to WHO,(1999) is as under :

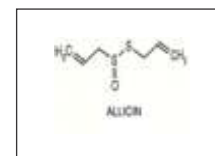
- I. Allin,(Cysteine sulfoxide) an odorless, non volatile, crystalline substance having no bactericidal activity and the non-volatile γ -glutamyl-cysteine peptides, which make up more than 82% of the total sulfur compound contents, of garlic.



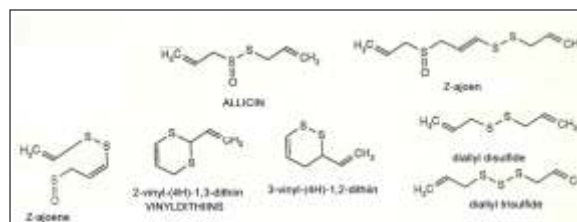
- ii. As soon as when, the bulb is crushed or cut allin comes in contact of the enzyme allinase found in the vacuoles of the crushed, cells it reacts with allin, and hydrolyses and condensed soon it is converted into an oily substance called allicin,

- iii. Allylsulfenic acid or allyl 2-propenethiosulfinate, which has an irritating odour, It bears the gram-positive and gram-negative bacteriocidal pharmacological properties. However, the non-volatile γ -glutamyl-cysteine peptides does not react with the enzyme allinase and remains as such.

- iv.



Allicin is extremely odoriferous pungent with peculiar garlic smell and is unstable product and will undergo additional reaction to form other derivatives or compounds depending on environmental and processing conditions such as; compounds like, E-ajoene, Z-ajoene, and vinyldithiins (2-vinyl-(4H)-1,3-dithin, 3-vinyl(4H)-1,2 dithin and its reduced sulfides (diallyl disulfide, diallyl trisulfide), however these are not naturally occurring compounds, (WHO,1999).



- v. Thioglycoside: It is also reported and which is a biologically active component. Garlic also contains glucosinolates in addition to sulphides and Diallyldisulphide and

- vii. Allicin with combining with vitamin B1 forms allithiamine, which is a stable substance resistant to aneurinase, a vitamin B1 decomposing enzyme produced by several intestinal bacteria. It is quickly absorbed from the intestinal tract and reduced to vitamin B1 in the body. Absorption of vitamin given by mouth is limited, while allithiamine is practically without any limit. Allithiamine gives a garlic odour to the breath as it split into vitamin B1 and allylmercaptane in the body.
- viii. However, thiamine propyl-disulfide in which the allyl radical is replaced with the propyl radical, gives less garlic odor than does allithiamine and thiamine tetrahydrofurfuryldisulfide, and is available also in the market of Japan under the name Alinamin A. It is a odourless and retain the same vitamin B1 activity as allithiamine, (Takeda Chobu, 1971).
- ix. Other known garlic compounds are S-Methyl Cysteine, S-Allyl-cysteine and S-methyl, S-ethyl, S-Allyl and S-Butyl derivatives of cysteine sulphoxide, S-ethyl-L-Cysteine sulphoxide and S-Butyl-L-Cysteine sulphoxide.
- x. The skin of garlic contains pectic substances, in addition to proteins, lipids, lignin, mannitol, rhamnose, galactose, and small amount of Arabinose.
- x. Other compounds reported are; Alliin homologs, fatty acids such as palmitic, oleic, linoleic and linolenic in addition to polyenoic acid, flavanols, such as glucosides of Kaempferol and Quercetin, in small amount.
- xi. The metals are also present such as; selenium 0.30 µg/g., .Fe varied from 10-20 mg/100 g. absolute dry weight, Cu-0.92 mg/100 g. clove wt. Al-2.86 mg/100 g.clove wt., Crtraces, Ni-4.2 mg/100 g. clove wt., Mn-traces, and Sr-38.2 mg/100 g.clove wt.
- xii. The Garlic young leaves: Young leaves of garlic contain Sulphur amino acids and peptides Cysteine, methionine, S-Allyl-L-Cysteine sulphoxide, (Raj & Parmar (1978).
- xiii. The Garlic roots : These contain S-Methyl-L-Cysteine sulphoxide in addition to many unidentified sulphur containing amino compounds.
- xiv. The Garlic seeds : The seeds contain; endogenous gibberellins, carbohydrates, cytokinin type hormones, polysachharides.

Garlicinins, a new compound : Nohara et al (2012) has found out several novel sulfides from acetone extracts and identified these and named as garlicinins B1(1), C1(2) and C1(2), and D(3) and they have the ability to control macrophage activation, and their structures were also characterised. The mechanism of these sulfoxides compounds production is also discussed. The discovery of these novel new compounds may open new chemistry to the Allium sulfide field and future pharmacological investigations aid the development of natural, healthy foods and anticancer agents that could potentially prevent or combat disease.

Infections and infestations, which includes the antibacterial and antifungal activities of alimentary system and skin: According to Etkin, Nina L. (1981), it contains volatile or essential oil, which contains allicin, which has demonstrated a strong antibacterial activity; salivine accelerate healing of wounds; fungicidal and anti-parasitic activities.

The fresh garlic juice, the essential oil, water and ethanol extracts inhibit

the in vitro and were found to be effective against a number of pathogenic bacteria and fungi such as; Bacillus sp., Staphylococcus aureus, Shigella sonnei, Erwinia carotovora, Mycobacterium tuberculosis, Escherichia coli, Pasteurella multocida, Proteus sp., Streptococcus faecalis, Pseudomonas aeruginosa, Candida sp., Cryptococcus sp., Rhodotorula rubra, Torulopsis

sp. Trichosporon pullulans and Aspergillus niger. As stated earlier, its antimicrobial and antibacterial activity is attributed to allicin. Ajoene and diallyl trisulfide also have the antibacterial and antifungal activities, (WHO, 1999, p21.).

Antibacterial activity of the essential oils: Though, numerous works are available on the antimicrobial activity of the essential oils (EOs) of garlic in vitro but in this study the EOs from Allium sativum (garlic) and A. porrum (leek) has revealed that it is good against the most dreaded microbes like; Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli. The main constituents of garlic essential oil are; diallyl monosulfide, diallyl disulfide, diallyl trisulfide and diallyl tetrasulfide. It is suggested that the presence of the allyl groups is fundamental for these sulfide derivatives, (WHO, 1999, p21.).

Anthelmintic or Anti-worm activity: Garlic has been used in the treatment of the round worm (Ascaris strongyloides) and hookworm (Ancylostoma caninum and Necator americanus.). Allicin appears to be the active anthelmintic constituent, and diallyl disulfide was not found effective., (WHO, 1999p.21).

A Bulgarian preparation from garlic called 'Satal' is shown to be hypotensive, in that it reduces the arterial pressure to normal values, which is attributed to the action of active sulphur components contained in garlic and thus the chemical constituents are used as a blood pressure depressant. The sulphur containing amino acids of garlic are found to reduce the plasma and liver cholesterol level in the experimental rats fed with hypercholesterolemic diet and long term feeding of aqueous extract lowered the protein and lipid levels and increased the free amino acid levels.

In human beings, the oral administration of aqueous extract for 2 months, reduced lipid levels in serum and liver. Both the juice and the essential oil of garlic were found to have significant protective action against fat induced increase in serum cholesterol and plasma fibrinogen and decrease in fibrinolytic activity as well as coagulation time. The aqueous extract reduces the arterial blood pressure in rats cats, dogs and human beings. Supplementation of garlic to rabbits fed

cholesterol revealed significant lower levels of total, free and ester cholesterol and phospholipids and thus the reduction in the atherosclerosis.

In Lead Poisoning : The Bulgarian preparation 'Satal' was found to be a drug for treating occupational lead poisoning. In workers suffering from chronic lead poisoning, garlic had a beneficial prophylactic action.

Pesticidal Activity: Crude extract and the oil from garlic was shown to be larvicidal in some insects. The larvicidal principle was identified as Diallyl disulphide and Diallyl trisulphide.

In modern uses: Generally, in medicine, it is mentioned as a cure from cancer to tuberculosis but mainly mentioned as a cure of; i. Atherosclerosis and high blood pressure; ii. Supposed to boost

immune system; iii. Inhibits or kills the a broad range of microbes; iv. Active against viruses that causes cold & flues v. As an expectorant.

Note: Atherosclerosis, a cardiovascular disease in which fatty plaques build up in arteries and obstruct blood flow by reducing cholesterol and triglyceride in the blood. Doses: Raw clove per day.

In nutshell, it has been well established that Garlic is beneficial in; i. High cholesterol; ii. Diabetes and blood sugar; iii. In Yeast infection; iv. In boosting immune system;v. Increase absorption of iron and zinc. vi. As an Antioxidant; vii. In cold & flu; viii. As an antifungal;ix. As an anti-parasitic; and as an anti-allergy.

Anticancer uses of Garlic: In dealing with the monumental work on the plants used against cancer throughout the world from the year 1967 to 1971, Hartwell, (1970, p. 133), conducted a world wide survey of plants in various literature of the world, which were used in cancer, and he found that both the species of *Allium sativum* and *cepa* were used against cancer. And, citing Hippocrates had shown that Garlic salve was used in Egypt in indurations of limbs and it was also used in cancer of uterus. Not only this, he had cited that in India it was used in abdominal and glandular tumours with animal fat and butter.

Hippocrates had prescribed that eating garlic is treatment for uterine tumors and in Bower manuscript dating from about A.D. 450 and in India garlic was recommended as a cure for abdominal tumors. Hartwell had reported from the National Cancer Institute, Central Files, that cancer incidents in France is supposedly lowest, where garlic consumption is greatest, that garlic eaters in Bulgaria do not have cancer and that a physician in Victoria, British Columbia, related that he has successfully treated malignancies by prescribing garlic eating, Hartwell, (1970, p. 133). Hartwell (1970) reported that cancer incidence in France is supposedly lowest where Garlic consumption is the greatest.

Recently, a literature survey conducted by Mantle & Wilkin, (2005) reviewed that plants used against cancer, like Mistletoe, Ginseng and Garlic found very promising. It was found that in number of cases of controlled studies it was demonstrated that a protective effect of garlic consumption against human cancers conducted by various workers in different countries is well marked. In U.K. significant decrease in prostate cancer in controlled condition was reported in 328 cases; in France, breast cancer risk in controlled condition was significantly decreased in 345 cases; in Hawaii, the protective effect of garlic consumption on col-rectal cancer in controlled condition was observed in 1192, cases; and similarly, in Switzerland, 223 cases; in Korea 136 cases, showed in decrease of gastric cancer; in China, under case control studies had shown 234 cases, in low risk and 386, cases at high risk, in gastric and oesophageal cancers; and in Italy 382, cases, in gastric cancer. The review concludes that in one way or other way garlic consumption and risk of various types of cancer to be associated with worth a protective effect against stomach and colorectal cancer.

Cancer Prevention: In a recent study undertaken by Wang, Z., et al (2012). demonstrated that Garlic plays a significant role of cancer prevention, but the specific compound and the mechanism is not yet known. In the experiment a study was conducted in which anti-proliferative and pro-apoptotic activities of allicin in murine T-lymphocytes (EL-4) and the mechanism of inducing apoptosis (in vitro) was conducted. It was concluded that allicin induced apoptosis in EL-4 cells and in concentration-dependent manner. It is presumed that the mitochondrial pathway might play a central role.

Discussions & Conclusions: The main scientific claims are: i. It reduces serum cholesterol and triglycerides, ii. Inhibits platelet aggregation (thins blood) and iii. Lowers blood pressure. Presently, so many of experiments have been conducted to verify these claims. According to (Talbot, 2003) the most well-controlled studies have resulted in a lack of beneficial effects In USA the food and Drug Administration has gone so far to issue rulings to prohibit the use of claim for a relationship between garlic, decreased serum cholesterol and the risk of cardiovascular disease. However, the overall conclusion stated by Steiner 1996 quoted by (Talbot, 2003), "dietary supplementation with aged garlic extract has beneficial effects on the lipid profile and blood pressure of moderately hypercholesterolemic subjects".

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