



Review Article

GARLIC: A PUNGENT WONDER FROM NATURE

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ABSTRACT

Garlic (*Allium sativum* L.) is one of the most important bulb crop grown in India. The bulb contains a colorless, odorless and water soluble compound called alliin. It is widely used as a condiment throughout India. Garlic contains enzymes, vitamin B, flavonoids and certain minerals. It is a good source of antioxidants and protein. Commercial varieties of garlic are vegetatively propagated because of sexual sterility. It is the core ingredient of the Mediterranean region and is used very frequently in Asian, African and European cooking. It is broadly classified into two main categories: hard neck and soft neck garlic. The plant is sown in autumn and the ripen crop is harvested in summer. Garlic has been utilized globally for thousands of years both food as well as medicine. It normalizes the cholesterol and reduces the risk of heart disease and arthritis. It provides protection against various types of cancers. Garlic is a wonder remedy for treating fever, coughs, headache, stomach ache, hemorrhoids, asthma and bronchitis, low as well as high blood sugar and snakebites. Thus, garlic is a rich source of bioactive compounds, which meets the basic nutritional needs of an individual in day to day life.

Keywords: Garlic, Alicin, Cholesterol, Vegetative propagation

INTRODUCTION

Garlic is a small underground bulb crop. Botanically it is known as *Allium sativum* and is a member of Alliaceae or Liliaceae family¹. Due to its strong odoriferous nature garlic is commonly known as stinking rose. Garlic is the oldest cultivated herb. Its origin is linked to central Asia². Sumerians were the first to utilize it as medicine. Garlic as a whole is called either head or knob. But the individual part is known as the garlic clove. Alicin is the active constituent of garlic³. It is formed on crushing, or cutting the garlic clove. Alicin gives garlic its pungent flavor along with ample of health benefits. Garlic is also rich in protein, calcium, magnesium, iron, potassium, zinc, arginine, saponins, polyphenols and selenium⁴. Moreover, it is an abundant source of certain vitamins like vitamin A, vitamin B6 and B1 and vitamin C. Garlic is commonly used as a spice and condiment in the various cuisines of the world. It is an indispensable ingredient in Asian, French and Italian cooking. It is broadly classified into two main categories: hard neck and soft neck. Garlic is cultivated in India in the plains during the months of October to March. In the northern hills it is grown during September to June and in southern hills from May to October. It is propagated only vegetatively⁵. Garlic is a natural health promoter and a wonder drug available from the nature's lap. Media in the form of newspaper articles, health magazines, social networking site, health website, T.V,⁶ etc., provide information regarding various aspects of garlic. It possesses anti-cancer, anti-viral, anti-oxidant and anti-inflammatory property. Garlic is effective in the treatment of the cardiovascular diseases and lowering cholesterol levels. It is really beneficial in ailments like arthritis, gout, stroke, cataract etc. This has gained it the title of super food.

Folklore of Garlic

The letter garlic is derived from the old English word garleac i.e. spear leek. The 'gar' means spear (referring to spear shaped leaves) and "leac" means leek¹. The origin of garlic dates back from 5000 to 6000 years⁴. It is a native to Central Asia. But it is difficult to trace the country of its origin. De Candolle, in his article on the Origin of Cultivated Plants, considered that it was apparently indigenous to the southwest of Siberia. Then, it spread to southern Europe and become naturalized, and is said to be found wild in Sicily. It is the core ingredient of the Mediterranean region and used very frequently in Asian, African and European cooking⁷. Garlic is considered as a force of both good and evil. There are myths in central Europe that garlic repels vampires, demons and were wolves and protects against the Evil Eye. In the Philippine people believed that garlic is used to drive away monsters. Garlic was placed by the ancient Greeks (Theophrastus relates) on the piles of stones at cross-roads as a supper for Hecate. In the account of Korea's establishment as a nation, a bear was transformed into human by eating the sacred food given by Hwanung consisting of 20 cloves of garlic and a bundle of mugwort. Further, there is a Mohammedan legend stating that, when Satan stepped out from the Garden of Eden after the fall of man, Garlic sprang up from the spot where he placed his left foot and Onion from that where his right foot touched. Alexander Neckam (12th century writer) recommended it as a palliative for the heat of the sun in field labor. In the middle Ages, plague-phobic Europeans ate whole cloves of garlic to protect them from the curse of Black Death. During 18th century in France gravediggers use to crush the whole garlic in wine. They had a strong belief that by consuming this preparation, they would protect themselves from the deadly disease called plague. In 1722, garlic formed the principal ingredient in the 'Four Thieves' Vinegar,' which was adapted for protection

against the plague. Soldiers of World Wars I and II were given garlic to prevent gangrene¹. It was also used as an antiseptic and was applied to wounds to prevent infection. Garlic was even used as currency due to its high rates during this era. In ancient Greece and Rome, garlic was employed for repelling scorpions, dog bites and bladder infections⁴. Clay sculptures and paintings of garlic and its bulbs, dating back to about 3200 B.C, have discovered by archaeologists in Egyptian tombs in El Mahasna. The Egyptians worshiped garlic, whose evidences are easily seen in the tomb of Tutankhamen in form of clay models of garlic bulbs². Moreover, they fed garlic to the slaves, who were building the Great Pyramid of Giza, for boosting their stamina. Egyptian papyrus (dating from 1,500 B.C.) recommends garlic as a cure for over 22 common ailments. Apart from this, its aphrodisiacal power has also been utilized through the ages. From Ancient Egypt garlic spread to the advanced ancient civilizations of the Indus Valley (Pakistan and western India today). Then, it made its way to China⁴. Its use in China dates back to 2000 BC. In ancient India the upper classes avoided garlic because of its strong odor. Monks, widows and adolescents could not eat garlic because of its stimulant quality. Practice of hanging garlic, lemon and red chili at the door or in a shop to ward off potential evil, is still very common in India. Some Hindus believe that during "Samudramathan" when Devas and Asuras were fighting for nectar, two Asuras stealth nectar in their mouth. The God cuffed the heads of those Asuras before they could swallow the nectar¹. As a result nectar fell down on the earth from their mouths in drops. This, later grew into what we today call garlic. In the Middle East, East Asia and Nepal, garlic has been used to treat bronchitis, hypertension (high blood pressure), TB (tuberculosis), liver disorders, dysentery, flatulence, colic, intestinal worms, rheumatism, diabetes, and fevers⁴. The French, Spanish and Portuguese introduced garlic to the New World. Garlic was rare in traditional English cuisine. It was in the first quarter of the 20th century, when garlic was found in ethnic dishes in U.S. During 1920's garlic was referred as Bronx vanilla, halitosis, and Italian perfume. It was in 1940, when garlic gained its value as a major ingredient rather than a minor seasoning agent. The ancient Greek physician Hippocrates (circa. 460-370 BC) promoted the use of garlic for treating respiratory problems, parasites, poor digestion and fatigue². Garlic was used as performance enhancing agent in sports by original Olympic athletes in Ancient Greece⁴. Hence, garlic has been utilized globally for thousands of years both as a food as well as medicine.

Botanical Description

Garlic is a member of genus *Allium* (Table 2). It is closely related to the onion, rakkyo, chive, leek, and shallot². Botanically garlic is known as *Allium sativum* and belongs to family Alliaceae or Liliaceae¹. It is an underground perennial bulb and grows up to 1.2 m (4 ft) in height. Garlic as a whole is called either head or knob. But the individual part is known as the garlic clove/bulblets, that weighs 1 g (approximately). On plantation clove matures into a bulb. Therefore, garlic is a bulbous plant¹. The compound bulb is only part that is eaten and is used for medicinal purpose. Each bulb is made up of 4-20 cloves. They are grouped together between the membranous scales and are enclosed in a thin white, mauve or purple skin, which holds them in a sac. Leaves of garlic are elongated, contracted and flat. The flowers are hermaphrodite in nature. They are whitish in color and are

placed at the end of a stalk rising direct from the bulb. The flowers of garlic are grouped together in a globular head (umbel), with an enclosing kind of leaf or spathe. Among them are small bulbils. Pollination occurs by bees and other insects. Garlic differs in size, pungency and color according to its varieties.

Varieties

Garlic varieties have been renamed many times as they passed among growers and gardeners. Garlic is descendent of *Allium longicuspis*⁴. The "wild garlic", "crow garlic", and "field garlic" of Britain are members of the species *Allium ursinum*, *Allium vineale*, and *Allium oleraceum*, respectively. In North America, *Allium vineale* and *Allium canadense* (meadow garlic/wild onion) are common weeds found in fields. Elephant garlic is one of the best-known garlic (*Allium ampeloprasum*). Single clove garlic (pearl/solo garlic) originated in the Yunnan province of China. Many garlic cultivars have names that indicate where they were traditionally grown or the color of their wrapper, including 'Oregon Blue', 'Chinese Pink', 'Chesnok Red', and 'Spanish Roja'. American garlic, Mexican garlic, and Italian garlic are the 3 major varieties which are available in U.S. The young/immature garlic with a long green top and white bulb is known as Green garlic. The Crow Garlic (*A. vineale*) is widely distributed and common in many districts. Its bulbs are very small. Ramsons (*A. ursinum*) grow in woods. It has small bulbs. It is very acrid in taste and has strong odor. They are generally known as 'Broad-leaved Garlic'. The Field Garlic (*A. oleraceum*) is a rare plant. There are many species of Garlic that are grown in the garden. *A. odorum* and *A. fragrans* have sweet smelling flowers but these have the Garlic scent in their leaves and roots. Thus, Garlic is available in numerous forms. These varieties are the result of random mutations of yesteryears. They can be broadly classified into two main categories: hard neck and soft neck (Table 3). Based on genetic DNA analysis there are 10 major garlic varieties or types within these two categories (Table 4). Climate can have a significant impact on garlic flower stalk formation as well as garlic taste.

Chemical constituents

Garlic contains about 0.1 % volatile oil. This oil is rich in sulphur, but contains no oxygen. The chief constituents of the oil are diallyl disulfide (60 %), diallyl trisulphide (20 %), allyl propyl disulfide (6 %), a small quantity of diethyl disulfide and probably diallyl polysulfide⁸. These sulfur compounds contribute to smell as well as taste of garlic. The active properties of garlic are due to this pungent volatile oil. Garlic bulb comprises of 84.09 % water, 13.38 % organic matter, and 1.53 % inorganic matter. There are 20 kinds of sulfide compounds (e.g., allicin, methyl allyl trisulfide, and diallyl trisulfide) reported in garlic³. Seven organosulfur compounds like Alliin, isoalliin, methiin, cycloalliin, and gamma-l-glutamyl-S-methyl-l-cysteine were also determined in it⁴. Allicin is the chemically and therapeutically active constituent of garlic. Allicin is released only by crushing or chewing raw garlic and cannot be formed from cooked garlic⁹. It is colorless, odorless and water soluble component. Allicin opens the thermo transient receptor potential channel (TRPA1) and TRPV1 (Transient receptor potential vanilloid 1)¹⁰ that is responsible for the burning sensation of heat in raw garlic. Neurotransmitters are released from neurons in the spinal cord to generate pain signals. At the site of sensory nerve activation neuropeptides results in vasodilation, as well

as inflammation. It is digested in the body to produce sulfenic acid, which reacts with dangerous free radicals faster than any other known compound. Alliinase, an enzyme in garlic, catalyzes the synthesis of allicin (diallyl thiosulfinate). The sulfur compounds of garlic metabolize to form allyl methyl sulfide. It directly passes to blood and is excreted in lungs and skin. It is for this reason that odor of garlic is present for the long time. Non-sulfur compound present in the garlic are phytoalexin (allixin), which might be effective in cancer prevention. The fermented product of garlic had a higher content of riboflavin, α -tocopherol, but a lower thiamin level than the unfermented product. Ascorbic acid was totally lost during the fermentation. The oil macerate of garlic contain iso-E-10-devinylajoene, Z-10-devinylajoene, and three or five thiosulfinates, which are effective on *Helicobacter pylori* bacteria¹¹, which causes gastric or duodenal ulcer. Other health-promoting compounds present in garlic are enzymes, vitamins (Vit-B1, B2, B3, B5, B6, B9 and C) arginine-rich proteins, minerals (calcium, iron magnesium, manganese, phosphorus, potassium, sodium, zinc, selenium), saponins, oligosaccharides, dietary fibers and flavonoids.¹²

Cultivation and Collection

Garlic is cultivated in India in the plains during the months of October to March. In the northern hills it is grown during September to June and in southern hills from May to October.

Soil

Garlic grows very well in sandy loam or loam soil. Well drained soil rich in high amount of organic matter provides the most ideal texture for garlic development. Excessive wetting must be avoided. The physical properties of the soil are enhanced by adding green manure to it. The ideal pH of the soil should range from 6 to 7. Loose growing soil beds should be made available for proper growth of the garlic.

Fertilizers

Tissue analysis is the most common method employed to diagnose suspected nutrient deficiencies. This helps to adjust the supply of the fertilizers according to the demands of garlic development.

Nitrogen

Garlic cultivation requires moderate to high amount of nitrogen. Ammonium sulfate, urea or blood meal is the sources of nitrogen that can be incorporated in the soil beds in early fall before plantation. If required amount of nitrogen is applied in the form of compost, then additional supply of nitrogen is not needed. Yellowing of the garlic plant, thin stems and low yields are common symptoms of nitrogen deficiency.

Phosphorus and potassium

The Bray P1 test (soil pH \leq 7.4) and the Olsen test (soil pH $>$ 7.4) are performed on soil before planting to know the requirements of phosphorus and potassium. Phosphorus deficiency leads to stunted growth and dark green to purple coloration of leaves. Marginal scorching of the older leaves is the Symptom of potassium deficiency.

Calcium and magnesium

Their concentration is usually low in acidic soil, which is fulfilled liming of soil.

Micronutrients

Manure or compost addition to the garlic beds supplies the adequate micronutrients for its growth.

Plantation

The yield of garlic depends on the area, weather conditions, spacing and variety used. In garlic, cloves are used for propagation. They are purchased as bulbs from garlic growers or producers. Individual cloves must be separated from the bulb two days before planting. They should be planted with the pointed side up. The base of the clove should be planted 1 to 2 inches below the soil surface. They are planted 2 to 4 inches deep, where winters are severe. A few leaves may sprout from the clove after plantation, but they stop growing when cold weather arrives. The root as well as shoot development in garlic demands cold treatment for optimum growth. Therefore, plantation is generally done in either late weeks of September or early weeks of October. Under ideal conditions roots are developing. During the first hard freeze (28°F) shoots emerge from the clove but inside the soil. It is in the month of late March or early April, when shoots emerge from the ground. Poorly developed bulbs, weak shoots and lack of scape development in hard neck garlic are the consequences of inadequate cold treatment to the garlic. Moreover, spacing is an important factor that affects the yield of the garlic. Low yield of larger bulbs is produced if spacing is farther apart and vice-versa. Generally, larger bulb produces the largest clove. Sometimes two cloves fused together to form a large clove called double clove. But it is poor in shape. Therefore, good bulb size as well as yield is obtained if cloves planted in double row beds are 30 inches apart on centre and 6 inch spacing is provided within and between the rows of garlic bed. Some varieties of garlic have more number of cloves per bulb (Table 4). Yield of garlic is further improved by using herbicides to control the weeds. Therefore variation in growing conditions affects the garlic production (Figure 1).

Mulching

Weed free straw mulch is used to cover the rows of garlic. This practice is done to moderate the soil temperature, to minimize the affect of fluctuating temperature of winters and early spring and to protect the crop from weeds. Therefore, within 3 -5 weeks after plantation rows of garlic should be covered with a 3-4 inch layer of mulch. It is removed in the spring season in April.

Irrigation

Optimum irrigation must be provided for the high yield of garlic. It depends on the type of soil employed. To aid the root growth, cloves are watered for about 3 weeks after planting. Irrigation is the most critical stage during bulbing, which is in the month of mid May, late June or early July. Lack of irrigation at this stage results in smaller bulbs; therefore, irrigation should be enough so as to maintain the water holding capacity to almost 50 %. It should be stopped about 2 weeks before harvest to avoid staining in bulb wrappers and to prevent diseases.

Removal of Scapes

Scapes are removed as soon as the curling is initiated in the plant. This focuses all the garlic's energy into bulb growth. The immature scapes are edible and are sold in the market. Little evidence suggests that garlic bulbs are stored well if scapes are not removed from them.

Weed Control

Garlic plant is very easily affected by the weeds. Therefore proper weed control is required to prevent the significant loss in the yield. Use of green manure crop, straw mulch and application of herbicide before plantation are some methods that will greatly reduce the weeds.

Insects

Onion thrips, Onion maggot, Armyworms and Wireworms are few insects that infect garlic crop. Nematodes also infect the garlic crop in the stem and bulb. Spraying of insecticides and pesticides, crop rotation and plantation of garlic crop at a distance from grass are some ways of avoiding pests. The infected plant should be removed from the field and then burned.

Diseases

Garlic diseases are either soil-borne or seed-borne. The common diseases of garlic include white rot, fusarium, pink root, botrytis, penicillium molds, rust and viruses. They can be controlled with proper rotation and planting disease-free cloves.

Harvesting and Curing

Different varieties of garlic mature at different rates. For example Tuban, Asiatic, Artichoke, Rocambole and Creole mature early, whereas Glazed Purple Stripe, Purple Stripe, Marbled Purple Stripe, Porcelain and Silverskin mature late. Garlic harvest extends from late June to mid July or first week in August. Harvest is usually optimum when more than half of the leaves remain green. If the cloves fill the skins after cutting bulbs into the half, then the bulbs are ready to harvest. The bulbs should be dug with the shoots and roots attached to them. There is no need to wash the bulbs if the soil is not wet. The plant is left for 3 to 4 weeks for curing. After that soil is brushed off. But in case the soil is wet, bulbs are washed and then allowed to cure for a few weeks. After tying the bulbs in the bundles of 10 to 15 they are allowed to dry in the well ventilated room. After 3 to 4 weeks of curing, the shoots and roots dried down. The tops are cut about one-half to one inch above the main bulb. The roots are trimmed close to the base of the bulb. Bulbs are cleaned by removing the outermost skins. They are then graded into the following diameter sizes: < 2 inches, 2 to 2.5 inches, 2.5 to 3 inches, and > 3 inches. 2.5 inches and larger are considered as Premium bulbs.

Propagation

Garlic (*Allium sativum*) is one of the oldest cultivated plants of all, being widely recorded in ancient Chinese, Indian, Sumerian and Egyptian cultures. During its cultivation history in different regions, garlic was adapted to various climates and selected for cold resistance, bigger bulbs or higher pungency. In order to obtain a larger bulb, flower stalks were often removed or clones with reduced flowering potential were selected. Thus, the thousands of years of active selection by man resulted in the loss of garlic fertility, and today garlic varieties are completely sterile. They don't produce seeds and are propagated only vegetatively. In modern garlic varieties, the presence of vegetative topsets (bulblets), which develop in garlic inflorescence, is one of the major causes of the inability of this plant to develop normal flowers and true seeds¹³. The effect of the explants source, differences in cultivar sources, culture medium and use of somatic embryogenesis has been tried to develop an efficient

callus inducing and regeneration protocol. Garlic is a monocot with diploid number of chromosomes $2n = 16$ ¹⁴. Commercial varieties of garlic are vegetatively propagated because of sexual sterility. Cultivation *in vitro* was beneficial and is widely applied for improvement of *Allium* species in a number of countries. The main benefits of this technology are production of virus and disease free seedling material¹⁵, increased efficiency of propagation¹⁶, germplasm conservation¹⁷ and storage and transfer of garlic germplasm¹⁸. Some of the popular cultivars of garlic are Hisar-2, G-282 and HG-17. G-282 is early-maturing cultivar of garlic. It was developed by mass selection technique from local collection obtained from Tamil Nadu in 1990. It was released in 1999 for growing all over the country but has performed well in northern and central part of India. The bulb consists of 15-16 cloves, is creamy white in color and bigger in size having a diameter of 5-6 cm. The variety has gained wide popularity in garlic growing areas such as Haryana, Gujarat, Rajasthan and Uttar Pradesh, India. It is suitable for export and its yield ranges between 175-200 q/ha. HG-17 bulbs are white and medium sized having 28-32 cloves per bulb. It yields about 100-125 q/ha. This variety is tolerant to purple blotch disease. The planting rate of cloves of garlic under Haryana conditions is about 150 to 200 kg/acre which considerably increases the cost of production. Commercial varieties of garlic are vegetatively propagated because of their sexual sterility. Traditional vegetative propagation has main disadvantage: a low coefficient of multiplication¹⁶. This multiplication rate needs to be enhanced. Use of micropropagation technology promises to reduce the cost of production by multiple shoot formation from one clove¹⁹.

Storage

Garlic is stored at room temperature with relative humidity ranging from 60 % to 70 %. Domestically, garlic is stored warm and dry to keep it dormant. Fresh garlic is stored in cool and dark place. It is traditionally hung in strands called plaits or grapes. Unbroken bulbs are stored for 8 weeks. But individual cloves will remain fresh only for 3 to 10 days. Peeled cloves may be stored in wine or vinegar in the refrigerator. If the tops of the garlic are not removed then it will stay fresh for longer time. Avoid refrigeration as garlic may sprout or become bitter.

Uses of Garlic

Therapeutic uses

Garlic has been employed for management of blood pressure²⁰, atherosclerosis, high cholesterol²¹, heart attack and coronary heart disease. Anti-aging and Anti-hyperlipidemic²² effect of garlic has also been reported by the researchers. It is found to be effective in treatment of lung cancer, prostate cancer, breast cancer, stomach cancer and colorectal cancer²³. Aged garlic has more potent immunomodulatory effects than raw garlic. Garlic is an effective therapeutic candidate to prevent the recurrent aphthous ulcer. Conditions like gout²⁴, rheumatoid arthritis²⁵, osteoarthritis, diabetes, allergic rhinitis, traveler's diarrhea, pre-eclampsia, bacterial and fungal infections, cold and flu are also known to be cured by garlic. Other uses of garlic include treatment of fever, whooping cough, headache, stomach ache, sinus congestion, psoriasis, hair loss and hemorrhoids. Syrup of garlic is very precious medication for asthma and chronic bronchitis. Moreover, it is used for fighting stress and fatigue. Further, it is found to be effective in preventing beriberi and scurvy. Garlic is also employed as

a poultice for scrofulous sores. Anthrax in cattle is also prevented by garlic. Garlic bulb infusion is said to be effective in epilepsy. The juice and milk of garlic is used as a vermifuge. Physicians recommend the inhalation of garlic oil in ailments such as pulmonary tuberculosis, sterility, impotency and red eyes. (Figure 2)

Culinary uses

Garlic is widely used around the world for its pungent flavor as a seasoning or condiment. It is a key ingredient of most dishes of eastern Asia, South Asia, Southeast Asia, the Middle East, northern Africa, southern Europe and South and Central America. Garlic is commonly used in combination with onion, tomato, or ginger. The bulb is the most commonly used part of the plant. But other parts for e.g. leaves and flowers/bulbils on the spathe are also edible. The immature scapes of the hard neck and elephant garlic are used in stir-fries. The sweet and syrupy black garlic is used in Korea, United States, United Kingdom and Australia. The oils infused with garlic are used to season vegetables, meats, breads and pasta. Garlic is use to create a variety of classic dishes such as garlic bread, garlic toast, bruschetta, crostini, aioli, skordalia and ajoblanco. In Eastern Europe, the shoots are pickled and eaten as an appetizer. The young bulbs are kept in a mixture of sugar, salt, and spices for three to six weeks and used as pickle. Lightly smoked garlic is becoming increasingly popular in British and European cuisine.

Other uses

Adhesive present in the sticky juice of bulb is used in mending glass and porcelain. A garlic-derived polysulfide is approved for use as a nematicide and insecticide. It protects plants against various infections and used as natural pesticide. Garlic is often grown among flowers or root vegetables as a companion plant to protect other plants from being attacked by pests. Garlic possesses antimicrobial property at temperatures as high as 120°C. Therefore, it is used as a preservative in deep fried foods and meat. A town in Iowa use garlic salt to remove ice from roadways. Fish are

attracted towards the scent of the garlic; therefore it is also used for catching fish. Thus, garlic has been used by humans for both culinary purposes and its therapeutic benefits.

Supplements of Garlic

Garlic supplements are made from whole fresh garlic, dried, or freeze-dried garlic, garlic oil, and aged garlic extracts²⁶. Garlic essential oil, garlic oil macerate, garlic powder, and garlic extract are the four major garlic supplements (Figure 3). It is also used in the form of juice, syrup and tincture. Garlic is used in the form of pills to aid digestion. Wine of garlic is used for treating baldness.

Safety measures

Herbs are used to strengthen the body and treating diseases. But they can interact with other herbs, supplements, or medications. Therefore, they should be taken with care. The U.S. FDA has listed garlic as GRAS (Generally Recognized as Safe). Stomach upset, bloating, bad breath²⁷, body odor, and a stinging sensation on the skin (burns)²⁷ from handling too much fresh or dried garlic are some effects observed with raw garlic. Headache, fatigue, loss of appetite, muscle aches, vertigo, menstrual irregularities and allergies such as an asthmatic reaction or skin rash²⁸ are some rare effects of garlic supplements. Garlic acts like a blood-thinner so it could increase the risk for bleeding²⁷ during or after surgery. Normal amounts of garlic are safe in pregnancy and lactation, but avoid overuse²⁷. Garlic or its supplements may interact with some medications like warfarin²⁷, anti-platelets, cyclosporine, saquinavir, anti-hypertensives, calcium channel blockers, non steroidal anti-inflammatory drugs (NSAIDs), ciprofloxacin, hypoglycemic agents, contraceptive drugs, isoniazid, non-nucleoside reverse transcriptase inhibitors (NNRTIs)²⁷ etc. Herbs like angelica, clove, danshen, ginger, ginkgo, red clover, turmeric, vitamin E etc., slow down blood clotting. Using garlic with these herbs as well as eicosapentaenoic acid (EPA) might increase the risk of bleeding.

Table 1: Synonyms of Garlic

Poor Man's Treacle
Star of Envy
Stinking Rose
The Bulb of the Tree of Life
The Fragrant Pear

Table 2: Botanical Classification of Garlic

Kingdom	Plantae
Order	Asparagales
Family	Amaryllidaceae
Subfamily	Allioideae
Genus	Allium
Species	A.sativum

Table 3: Difference between Hard neck and Soft neck Garlic

Hard neck Variety	Soft neck Variety
<i>Allium sativum</i> var. <i>ophioscorodon</i>	<i>Allium sativum</i> var. <i>sativum</i>
Produce a flower stalk (scape). Flowers usually abort and form "bulbils.	Do not produce a seed stalk. A partial flower stalk may be produced and bulbils will form directly above the bulb.
Less productive	More productive
Closely related to wild garlic	Considered to be the most domesticated varieties
Have small aerial 4 to 12 cloves surrounding the flower stalk	Have 10 to 40 cloves arranged in multiple layers
Difficult to braid	Easy to braid
Cold-tolerant, grown in cooler climate	Less Cold-tolerant, grown closer to equator
Do not store well. May either start to form roots or start to dry out within a few months after harvest.	Can be stored for 6 to 8 months without significant deterioration Generally, has a much longer shelf life
Examples: Rocambole, Purple Stripe, Glazed Purple Stripe, Marbled Purple Stripe, Porcelain, Asiatic, Creole, and Turban	Examples: Artichoke and Silver skin

Table 4: Varietal Description of Garlic

Variety	Height (ft)	Scape	Coiling before straightening	Bulbils	Bulbs	Clove skin	Double clove	Storage (months)	Typical named selection
Rocambole	3- 4	Uncurled	2-3 times	Numerous and purple in color	Off-white Purple streak	Brownish and easy to peel	Prone to double clove	4-5	German Red, German Brown, Spanish Roja, Russian Red, Killarney Red, Montana Giant
Purple Stripe	3-5	Uncurled	Forms downward U	Numerous and purple in color	Purple streak Contain 8-12 cloves	Brownish and difficult to peel	Rarely occur	5-7	Chesnok Red, Persian Star
Glazed Purple Stripe	3-5	Uncurled	Full coil	Numerous and intensely purple in color	Purple streak Contain 8-12 cloves	Brownish and difficult to peel	Rarely occur	5-7	Purple Glazer, Red Rezan
Marbled Purple Stripe	3-5	Uncurled	Random coils	Numerous and purple in color	Purple stripes 4-7 cloves	Brownish	Rarely occur	5-7	Siberian, Brown Tempest, Krasnodar Red
Porcelain	4-6	Uncurled	Loose and random coils	Numerous, small, white color	4-6cloves	Difficult to peel	Rarely occur	5-7	Romanian Red, Georgian Crystal, Music, Polish Hardneck, Zemo, Georgian Fire, Northern White, German White, Krasnodar White
Artichoke	-----	-----	-----	Purple	Whitish to purple blush 12-20 cloves	Difficult to peel	-----	6-9	Inchellium Red, California Early, Susanville, California Late, Early Red Italian, Machashi, Red Toch
Asiatic	3	-----	No curling	Dark purple and larger	4-8 cloves	Difficult to peel	Present	5-7	Asian Tempest, Japanese, Wonha, Sakura, Pyong Vang
Turban	-----	Weak	Downward U	Numerous, purple and small	Dark purple, 7-11 cloves	Brownish Easy to peel	Not present	3-5	Red Janice, Blossom, Xian, Tzan, Chinese Stripe
Creole (warm climate)	-----	Weak	Random curls Downward U	small and usually white to pink	8 to 12 cloves	Dark purple, sweet in taste, Difficult to peel	-----	6-8	Ajo Rojo, Burgundy, Creole Red
Silver skin (warm climate)	-----	-----	-----	-----	8-40	Difficult to peel	-----	12	Silver White, Nookota Rose, Mild French, SandH Silver, Idaho Silver



Figure 1: Garlic plant



Figure 2: Therapeutic uses of garlic



Figure 3: Supplements of garlic

CONCLUSION

Garlic (*Allium sativum*) is a vegetable belonging to the Allium class of bulb-shaped plants that includes onions, chives, leeks and scallions. It is one of the oldest cultivated plants of all, being widely recorded in ancient Chinese, Indian, Sumerian and Egyptian cultures. It is used for flavouring in Indian as well as international cuisine. The characteristic odor and flavor of garlic comes from sulphur compounds formed from alliin. In addition to this, garlic also contains protein, enzymes, carbohydrates, flavonoids, vitamins and minerals. These bioactive compounds are responsible for changes in health status. Hard neck and soft neck garlic are the two main categories of garlic. Commercial varieties of garlic are vegetatively propagated because of sexual sterility. Consuming garlic is linked to reduced cancer risk and better cardiovascular health. It is a potent antibacterial agent, insecticide, aids digestion and reduces cholesterol concentration. It is really a wonder drug from nature.

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