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RESEARCH ARTICLE

ORIGIN, TAXONOMY, BOTANICAL DESCRIPTION, GENETICS AND CYTOGENETICS, GENETIC DIVERSITY, BREEDING AND CULTIVATION OF GARLIC

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ABSTRACT

This study Garlic belongs to the Family Alliaceae, Subfamily Allioideae**,** Tribe Allieae**,** Genus *Allium* and Species *Allium sativum.* The word *garlic* derives from Old English, *garlēac*, meaning *gar* (spear) and leek, as a 'spear-shaped leek'. Indian Name of garlic are Assamese : Naharu Hindi : Lasun, Lessan, Lahsun Bengali : Rashun Gujarati : Lasan Kannada : Bellulli Kashmiri : Ruhan Malayalam : Vellulli Marathi : Lusson Oriya : Rasuna Punjabi : Lassan, Lasun Sanskrit : Lashuna Tamil : Ullipundu, Vellaippundu Telugu : Velluri Urdu : Lassun, Leshun. Garlic belongs to the "*Lilliaceae*" family and its botanical name is "*Allium sativum Linn*". It is known by several many names in different parts of India like "Lahsun" in Hindi and Urdu, "Rasun" in Bengali, "Rasuna" in Oriya, "Naharu" in Assamese, "Lasan" in Gujarati and Punjabi, "Lusoon" in Marathi, "Belluli" in Kannada and Malayalam, "Lahsuna" in Sanskrit , "Rahan" in Kashmiri, "Ullipundu" in Tamil and "Velluri" in Telugu. Foreign Name of garlic are Spanish : Ajo French : Ail German : Knoblanch Swedish : Vitlok Arabic : Thum Dutch : Knoflook Italian : Agilio Portuguese : Alho Russian : Chesnok Japanese : Ninniku Chinese : Suan. Garlic is a fundamental component in many or most dishes of various regions, including eastern Asia, South Asia, Southeast Asia, the Middle East, northern Africa, southern Europe, Eastern Europe and parts of Latin America. Latin American seasonings, particularly, use garlic in sofritos and mofongos. Oils can be flavored with garlic cloves. These infused oils are used to season all categories of vegetables, meats, breads, and pasta. Garlic, along with fish sauce, chopped fresh chilis, lime juice, sugar, and water, is a basic essential item in dipping fish sauce, a highly used dipping sauce condiment used in Indochina. In East and Southeast Asia, chili oil with garlic is a popular dipping sauce, especially for meat and seafood. Tuong ot toi Viet Nam (Vietnam chili garlic sauce) is a highly popular condiment and dip across North America and Asia. In some cuisines, the young bulbs are pickled for three to six weeks in a mixture of sugar, salt, and spices. In eastern Europe, the shoots are pickled and eaten as an appetizer. Laba garlic, prepared by soaking garlic in vinegar, is a type of pickled garlic served with dumplings in northern China to celebrate the Chinese New Year. Garlic is essential in Middle Eastern and Arabic cooking, with its presence in many food items. In the Levant, garlic is traditionally crushed together with olive oil, and occasionally salt, to create a Middle Eastern garlic sauce called Toum. While not exclusively served with meats, toum is commonly paired with chicken or other meat dishes such as shawarma. Garlic is also a key component in some hummus varieties, an Arabic dip composed of chickpeas, tahini, garlic, lemon juice, and salt. Lightly smoked garlic is used in British and other European cuisine. It is particularly prized for stuffing poultry and game, and in soups and stews. Emulsifying garlic with olive oil produces *aioli*. Garlic, oil, and a chunky base produce *skordalia*. Crushed garlic, oil, and water produce a strong flavored sauce, mujdei. Blending garlic, almond, oil, and soaked bread produces *ajoblanco*. *Tzatziki*, yogurt mixed with garlic and salt, is a common sauce in Eastern Mediterranean cuisines. Garlic is a species of bulbous flowering lants in the genus *Allium*. Its close relatives include the onion, shallot, leek, chives, Welsh onion, and Chinese onion. Garlic is native to central and south Asia, stretching from the Black Sea through the southern Caucasus, northeastern Iran, and the Hindu Kush; it also grows wild in parts of Mediterranean Europe. There are two subspecies and hundreds of varieties of garlic. Garlic has been used for thousands of years as a seasoning, culinary ingredient, traditional medical remedy; it was known in many ancient civilizations, including the Babylonians, Egyptians, Romans, and Chinese, and remains significant in many cuisines and folk treatments, especially across the Mediterranean and Asia. Garlic propagates in a variety of climates and conditions and is produced globally; China is by far the largest producer, accounting for over two thirds (73%) of the world's supply in 2021. Garlic oil is the volatile oil derived from garlic. It is usually prepared using steam distillation, and can also be produced via distillation using ether. It is used in cooking and as a seasoning, a nutritional supplement, and also as an insecticide. Garlic oil is typically prepared using steam distillation, where crushed garlic is steamed with the resultant condensation containing the oil. Garlic oil contains volatile sulfur compounds such as diallyl disulfide, a 60% constituent of the oil. Steam-distilled garlic oil typically has a pungent and disagreeable odor and a brownish-yellow color. Its odor has been attributed to the presence of diallyl disulfide. To produce around 1 gram of pure steam-distilled garlic oil, around 500 grams of garlic is required. Undiluted garlic oil has 900 times the strength of fresh garlic, and 200 times the strength of dehydrated garlic. Ether can also be used to extract garlic oil. A type of garlic oil involves soaking diced or crushed garlic in vegetable oil, but this is not pure garlic oil; rather it is a garlic-infused oil. Garlic is cultivated worldwide. It has a long history of use both in foods and for health purposes. Ancient writings from Egypt, Greece, and India describe its use for a variety of health problems, such as headache, pneumonia, throat conditions, and gastrointestinal disorders. Currently, garlic is promoted as a dietary supplement for various purposes, including helping to manage high blood cholesterol, high blood pressure, and diabetes; preventing various types of cancer; and enhancing immune function. Garlic may also be used topically (applied to the skin). Garlic supplements may reduce levels of total cholesterol and low-density lipoprotein (LDL) cholesterol to a small extent in people who have high blood cholesterol levels. Limited evidence suggests that garlic supplements may reduce blood pressure to a small extent in people who have high blood pressure. Garlic supplements may reduce blood sugar to a small extent in people with diabetes. Consuming garlic does not seem to reduce the risk of stomach cancer. It's uncertain whether garlic influences the risk of colorectal cancer. Dietary supplements that contain garlic have been promoted as boosters for the immune system, particularly during cold and flu season. A 2022 review identified only two studies that suggest a possible benefit, and both studies included only small numbers of people and had weaknesses in the research. Garlic, taken orally, has been used safely in research studies that lasted as long as 7 years. Some forms of garlic used topically also seem to be safe. However, fresh raw garlic may not be safe when used topically. It can cause severe skin irritation and chemical burns. Side effects of garlic consumed orally include breath and body odor, abdominal pain, flatulence, and nausea. Some people have allergic reactions to garlic. Taking garlic supplements may increase the risk of bleeding. If you take garlic supplements, make sure to tell your health care providers. This is especially important if you are going to have surgery or if you take medicines, such as anticoagulants or aspirin, that may also affect bleeding. If you take anticoagulants, aspirin, or any other medicine, talk with your health care provider before using garlic or other herbal products; some herbs and medicines interact in harmful ways. Garlic may not be safe for use during pregnancy or while breastfeeding when taken orally in amounts greater than those found in foods. Little is known about the safety of using garlic topically during pregnancy or while breastfeeding. Take charge of your health—talk with your health care providers about any complementary health approaches you use. Together, you can make shared, well-informed decisions.

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INTRODUCTION

Garlic belongs to the Family Alliaceae, Subfamily Allioideae**,** Tribe Allieae**,** Genus *Allium* and Species *Allium sativum* (Bionity, 2025; Wikidoc, 2025). The word *garlic* derives from Old English, *garlēac*, meaning *gar* (spear) and leek, as a 'spear-shaped leek' (Wikipedia, 2025). Indian Name of garlic are Assamese : Naharu Hindi : Lasun, Lessan, Lahsun Bengali : Rashun Gujarati : Lasan Kannada : Bellulli Kashmiri : Ruhan Malayalam : Vellulli Marathi : Lusson Oriya : Rasuna Punjabi : Lassan, Lasun Sanskrit : Lashuna Tamil : Ullipundu, Vellaippundu Telugu : Velluri Urdu : Lassun, Leshun (Indianspices, 2025). Garlic belongs to the "*Lilliaceae*" family and its botanical name is "*Allium sativum Linn*". It is known by several many names in different parts of India like "Lahsun" in Hindi and Urdu, "Rasun" in Bengali, "Rasuna" in Oriya, "Naharu" in Assamese, "Lasan" in Gujarati and Punjabi, "Lusoon" in Marathi, "Belluli" in Kannada and Malayalam, "Lahsuna" in Sanskrit , "Rahan" in Kashmiri, "Ullipundu" in Tamil and "Velluri" in Telugu ((Indianet, 2025). Foreign Name of garlic are Spanish : Ajo French : Ail German : Knoblanch Swedish : Vitlok Arabic : Thum Dutch : Knoflook Italian : Agilio Portuguese : Alho Russian : Chesnok Japanese : Ninniku Chinese : Suan (Indianspices, 2025). In local language it was also known as : Assamese : Naharu Hindi : Lasun, Lessan, Lahsun Bengali : Rashun, Gujarati : Lasan, Kannada : Bellulli, Kashmiri : Ruhan, Malayalam : Vellulli, Marathi : Lusson, Oriya : Rasuna, Punjabi : Lassan, Lasun, Sanskrit : Lashuna, Tamil : Ullipundu, Vellaippundu, Telugu : Velluri , Urdu : Lassun, Leshun, Spanish : Ajo French, Ail German : Knoblanch, Swedish : Vitlok, Arabic : Thum, Dutch : Knoflook Italian : Agilio, Portuguese : Alho, Russian : Chesnok, Japanese : Ninniku, Chinese : Suan (Justgot, 2025).

Depending on what's in them, how they're intended to be used, and how they're administered (orally or topically), herbal products are regulated in a variety of ways. Many herbal products intended for oral use are marketed as dietary supplements. The rules for making and distributing dietary supplements are less strict than those for drugs. Unlike drugs, dietary supplements are not approved by the U.S. Food and Drug Administration (FDA) before they are sold to the public. When public health concerns arise about the safety of a dietary supplement or an ingredient including an herb, the FDA can take action to protect the public. Manufacturers and distributors of supplements are responsible for evaluating the safety and labeling of their products before marketing to ensure that they meet all regulatory requirements (NCCIH, 2025). Garlic has been regarded as a force for both good and evil. A Christian myth considers that after Satan left the Garden of Eden, garlic arose in his left footprint, and onion in the right. In Europe, many cultures have used garlic for protection or white magic, perhaps owing to its reputation as a potent preventative medicine. Central European folk beliefs considered garlic a powerful ward against demons, were wolves, and vampires. To ward off vampires, garlic could be worn, hung in windows or rubbed on chimneys and keyholes. Colloidal silver is often used as antibacterial agent. As with silver, the association of garlic to evil spirits may be based on the antibacterial, antiparasitic value of garlic, which could prevent infections that lead to delusions, and other related mental illness symptoms. In Northeastern India, it is believed that garlic mixed with water spread around the home will keep snakes from entering (Bionity, 2025).

Types of Garlic: There are different types of garlic with their specific feature (PW, 2023).

- **Softneck garlic**: Often found in markets, this is the most common type of garlic with soft skin and creamy white colour.
- **Silver garlic**: It has a pink tint on its outer covering and has a very pungent aroma.
- **Artichoke garlic**: It has a mild flavour with large and fewer cloves
- **Hardneck garlic**: It has a hard, woody stalk with a purple colour of the outer skin.

Garlic is a fundamental component in many or most dishes of various regions, including eastern Asia, South Asia, Southeast Asia, the Middle East, northern Africa, southern Europe, Eastern Europe and parts of Latin America. Latin American seasonings, particularly, use garlic in sofritos and mofongos. Oils can be flavored with garlic cloves. These infused oils are used to season all categories of vegetables, meats, breads, and pasta. Garlic, along with fish sauce, chopped fresh chilis, lime juice, sugar, and water, is a basic essential item in dipping fish sauce, a highly used dipping sauce condiment used in Indochina. In East and Southeast Asia, chili oil with garlic is a popular dipping sauce, especially for meat and seafood. Tuong ot toi Viet Nam (Vietnam chili garlic sauce) is a highly popular condiment and dip across North America and Asia. In some cuisines, the young bulbs are pickled for three to six weeks in a mixture of sugar, salt, and spices. In eastern Europe, the shoots are pickled and eaten as an appetizer. Laba garlic, prepared by soaking garlic in vinegar, is a type of pickled garlic served with dumplings in northern China to celebrate the Chinese New Year. Garlic is essential in Middle Eastern and Arabic cooking, with its presence in many food items. In the Levant, garlic is traditionally crushed together with olive oil, and occasionally salt, to create a Middle Eastern garlic sauce called Toum. While not exclusively served with meats, toum is commonly paired with chicken or other meat dishes such as shawarma. Garlic is also a key component in some hummus varieties, an Arabic dip composed of chickpeas, tahini, garlic, lemon juice, and salt. Lightly smoked garlic is used in British and other European cuisine. It is particularly prized for stuffing poultry and game, and in soups and stews. Emulsifying garlic with olive oil produces *aioli*. Garlic, oil, and a chunky base produce *skordalia*. Crushed garlic, oil, and water produce a strong flavored sauce, mujdei. Blending garlic, almond, oil, and soaked bread produces *ajoblanco*. *Tzatziki*, yogurt mixed with garlic and salt, is a common sauce in Eastern Mediterranean cuisines (Wikipedia, 2025). The Egyptians believed in garlic. The Codex Ebers, a medical text dating to 1,500 B.C., mentions garlic as a remedy for skin diseases, poisoning, heart problems, and tumors (Pacchioli, 1999). Intact cloves of the stuff were found preserved in Tutankhamenís tomb. In the Old Testament, the desert-wandering Israelites sadly remember "the fish which we did eat in Egypt so freely, and the pumpkins and melons, and the leeks, onions, and garlic." (Pacchioli, 1999). Hippocrates prescribed garlic for protecting the skin, and Greek athletes ate it before competing in the first Olympic Games. In ancient China and Japan,

garlic was thought to provide energy, lift depression, and improve male potency; in India it was used to treat arthritis and leprosy (Pacchioli, 1999). Milner, the ebullient former president of the American Society for Nutritional Sciences and one of the early investigators of garlicís inhibitory effects on cancer, was well-suited as master of ceremonies for the three-day event. Its object, he said, was to move beyond belief to a better understanding of garlicís properties. To separate the medicine from the mystique (Pacchioli, 1999). Even more rapid has been the rise of garlic as a dietary supplement. According to industry figures, Americans spent $200 million on garlic supplements in 1997, an increase of 33 percent from 1995. That figure is projected to climb steeply as part of a larger trend toward herbal remedies and "biomedicinals," including gingko, green tea, echinacea, St. Johnís Wort, and a host of other plant-derived products, many adopted from traditional Oriental medicine (Pacchioli, 1999). It is big business all right, but garlic is indisputably serious science too. Another major sponsor of the gathering was the National Cancer (Pacchioli, 1999). First are the epidemiologic studies that link garlic intake with lowered disease rates across populations. The strongest data in this regard come from a survey of two regions in northern China where dietary consumption of garlic in truly massive quantities—five to ten cloves per day!—has been connected with a markedly low incidence of stomach cancer. Similar studies involving lesser amounts of garlic have been undertaken in Sweden, Italy, and the Netherlands, with consistent,if less pronounced, results: lower rates of various gastrointestinal cancers (Pacchioli, 1999). Lastly, there have been a handful of human clinical trials, most involving adding garlic supplements to the diets of men (less commonly, women) with slightly elevated levels of cholesterol and noticing reduction in those levels and in other cardiovascular risk factors like blood pressure (Pacchioli, 1999). To begin with, a clove of garlic contains upwards of 200 known chemical compounds, roughly split between over 100 sulfur compounds—some of them water-soluble, others oily—and a balance of saponins,proteins, and carbohydrates (Pacchioli, 1999). In the case of garlic and cardiovascular disease, for example, the first clinical trials, completed in the 1980s, uniformly showed that garlic lowers cholesterol levels and other cardiac risk factors by up to 20 percent. More recent, more tightly controlled studies, however, have reported distinctly checkered results (Pacchioli, 1999). All garlic is not alike. Forget for a moment that there are over 150 varieties of *Allium sativum*, from purple-striped Russian Skuri to red-tipped Persian Star (Pacchioli, 1999). It showed that the application of heat negates the anti-cancer properties activated by enzymes released when fresh garlic is chopped or crushed. Let that same chopped garlic sit for 10 minutes before you cook it, however, and it retains its cancer-fighting ability (Pacchioli, 1999). Geography is another variable. Garlic harvested from the northern Japanese is land of Hokkaido may have different qualities from that grown in northern California or Russian Georgia. Even two bulbs drawn from different ends of the same field can have distinct chemical properties (Pacchioli, 1999). Aged garlic extract is produced by slicing fresh garlic and placing it in an alcohol bath for up to 20 months, which leaves the odorless water-soluble sulfur compounds. Garlic oil supplements, on the other hand, contain mostly the fat-soluble compounds that are associated with odor (Pacchioli, 1999). Capsules of garlic powder may vary in content depending on how the garlic is dried, how it is milled, and how much it is extended with inert "carriers." "Thereís a whole variety of processing methods for each type," Milner said, "any of which might have significant impact." No wonder, then, that the results obtained in research can vary, even be contradictory (Pacchioli, 1999). aponins, the other major class of compounds in garlicís make-up, look like a reasonably good bet for bioactivity too. Hiromichi Matsuura of the University of Illinois College of Pharmacy has shown that some saponins bind with cholesterol, and suggests that these may be responsible for garlicís cholesterol-lowering effect (Pacchioli, 1999). There ís always selenium, a compound well-known (thanks to the work of Milner and others in the late 1980s) as a powerful anti-carcinogen. Selenium is present in garlic, although probably not in high concentrations. Still, Milner says, there is evidence to show that taking garlic and selenium together provides stronger anti-tumor protection than taking either one alone (Pacchioli, 1999). Benjamin Lau, professor of micro-biology, immunology, and surgeryat Loma Linda Medical School, reported that garlicís benefit with regard to cholesterol has to do with its preventing the oxidation of LDL, or "bad," cholesterol. ("We think of LDL as the bad guy," Lau noted, "but the real culprit is oxidized LDL."). Donald Lamm, a urological surgeon at West Virginia University, showed that garlic can boost the immune system following surgery for bladder cancer, effectively reducing the recurrence of tumors (Pacchioli, 1999). Gowsala Sivam, a cancer researcher at Bastyr University in Bothell, Washington, has demonstrated that moderate amounts of raw garlic can kill Helicobacter pylori, a common bacterium whose presence in the stomach has been linked to both ulcers and stomach cancer. The finding is especially significant, she suggested, because of very high (and growing) rates of resistance by this bacterium to standard antibiotics (Pacchioli, 1999). Garlic was missing—and maybe that was understandable. But there was something more. Nobody but me seemed to miss it. The place was awash in respect for garlic; cold-eyed clinical respect; esteem for what garlic could do,for what it might be worth (Pacchioli, 1999).

Garlic (*Allium sativum* L.) bulbous medicinal monocot plant grown in India, used for various cuisine recipes (Mahajan *et al.,* 2017). It is diploid (2n = 16) in nature, classified under genus *Allium*, family Alliaceae (Mahajan *et al.,* 2017). Compare to world's yield potential, Indian garlic cultivar produce less yield due to short day climatic condition (Mahajan *et al.,* 2017). Further even though crop propagated through clonal selection, maintains variability in agro-morphological traits. Still for creating variability through biotechnological approach is in progress however induction of flowering in garlic is on prime agenda (Mahajan *et al.,* 2017). Among biotic stresses crop majorly suffer from purple blotch, stemphyllium disease and thrips. Viral infection is important issue behind degenerating quality of seed material and indirectly reducing yield potential (Mahajan *et al.,* 2017). In crop production, garlic shows good response to fertigation. In India mechanization in garlic planting is pre requisite to accelerate the crop demand in world's industrial market as value added processed products including allicin have high demand (Mahajan *et al.,* 2017). There are few traders involve in garlic marketing and exporting still much future trusts are ahead for increasing area, yield potential, combating biotic and abiotic stress, enhancing nutrient uptake and its proper marketing (Mahajan *et al.,* 2017). Garlic *(Allium sativum* L.*)* is one of the important bulbous crops grown and used as a spice or a condiment throughout India. Original abode of garlic is said to be Central Asia and Southern Europe especially Mediterranean region (Mahajan *et al.,* 2017). Garlic becomes exclusively vegetatively propagated by cloves or bulbils. Most of the garlic from Central Asia belongs to the rather diverse *longicuspis* group (large bolting plants, many small topsets, to some extent still fertile cultivars) (Mahajan *et al.,* 2017). They might have been the genetic pool from which the other cultivar groups developed-the *subtropical* and *Pikinense* subgroups

(smaller plants, few large topsets)-which possibly developed under the special climatic conditions of South, South-East and East Asia; the *Mediterranean sativum* group (bolting and non-bolting types, large topsets); and the *Ophioscorodon* group from Central and East Europe (long coiling scapes, few large topsets) (Mahajan *et al.,* 2017). Garlic has been associated with the healing process in India from the time of the first available written records. Three ancient medical traditions, *i.e.*, Tibbi, Unani and Auryvedic, made extensive use of garlic as a central part of the healing efficacy of plants (Mahajan *et al.,* 2017). The leading surviving medical text, *Charaka-Samhita*, recommends garlic for the treatment of heart disease and arthritis 2000 years ago as listed (Mahajan *et al.,* 2017). Garlic was also observed to have a diuretic effect. It is now well recognized that garlic, appropriately used, will reduce blood pressure, improve elevated serum cholesterol, decrease platelet aggregation and protect vascular endothelial cells from damage by LDL; all of these effects are of potential cardiac benefit (Mahajan *et al.,* 2017). Some religious sects did not permit the consumption of garlic or onions, rather as the Greeks and Romans proscribed garlic in the temples (Mahajan *et al.,* 2017). Garlic either was not permitted or fancied by the upper Brahmin classes, whereas in other cases, it was applied externally to help repair cuts, bruises and infections, and it comprised one of a number of perceived aphrodisiacs available from natural plant sources (Mahajan *et al.,* 2017).

Garlic (*Allium sativum* L.) is one of the most important vegetables throughout the world, with a total harvested area of 1.437.690 ha and an annual production of 24.255.303 tonnes of dry bulbs (Martins, Petropoulos and Ferreira, 2016). Commonly used for culinary purposes, garlic is also interestingly appreciated due to its therapeutic and medicinal properties, both in traditional and modern medicine (Martins, Petropoulos and Ferreira, 2016). Being consumed either as raw vegetable (fresh leaves or dried cloves), or after processing in the form of oil, extract and even powder, pronounced differences in the chemical composition and, consequently, the content in bioactive compounds are observed between the various (Martins, Petropoulos and Ferreira, 2016). Onions are a perennial herb that are composed of roots, a stem, and leaves. Roots are the part that is present underground. The onion stem is also underground, and it develops into a bulb (Venkatakrishnan et al., 2019). The bulb consists of a reduced stem and axillary buds surrounded by inner fleshy scale leaves and outer dry scales (skin) (Venkatakrishnan et al., 2019). Depending on the variety and growth stage, onion bulbs have different shapes such as spherical, globular, flat, and conical (Venkatakrishnan et al., 2019). Onion color also varies from white, yellow, or red. Leaves are hollow, green, parallel-veined foliage with a fleshy sheathing base arising from the underground stem (Venkatakrishnan et al., 2019). The dry garlic bulb is a storage structure that can be separated into small parts called cloves (Venkatakrishnan et al., 2019) (Venkatakrishnan et al., 2019). Described garlic as composed of stem, pseudo-stem, leaves, cloves, and bulb. The true stem of garlic is underground, while the pseudo-stem is above ground with overlapping sheaths of leaves. Leaves are the part that appears above the ground and they are only the blade parts of the foliage leaves (Venkatakrishnan et al., 2019). Cloves are composed of different kinds of leaf primordia that make up the skin and flesh of the clove. The cloves are densely packed, elongated side bulbs that are the main economic organ. Fresh leaves and pseudo-stems can also be consumed by humans (Venkatakrishnan et al., 2019). The garlic bulb is a survival trait that stores energy for future growth. Depending on the variety, genetic traits, and cultivar type, garlic bulbs size ranges from 4.5 to 7.6 cm and contain 4–60 cloves of various shapes and sizes (Venkatakrishnan et al., 2019).

Garlic is one of the healthy foods. Originally from Asia, garlic (*Allium sativum*) is a vegetable. It is actually a grouping of tiny bulblets (garlic cloves) (Admin, 2021). The more tender and clear the garlic is, the more pleasant and smooth it will taste (Admin, 2021). It belongs to the bulbous flowering plant and absorbs the sulfur from the soil (Admin, 2021). Garlic Bulbs have a strong pungent taste and a peculiar odour and are cultivated as spices and tonics (Admin, 2021). It has a long history of cultivation and has been cultivated and used since the Egyptian and Greek eras (Admin, 2021). The bulbs are spherically enlarged, wrapped in a white or crimson thin film, and the inside is divided into several small bulbs. The leaves are greyish-white green and wither in summer and dormant. Seeds are not produced, seedlings are formed in the flowers, which fall to the ground and propagate (Admin, 2021). Small bulbs are planted in the fall and harvested in the early summer of the following year (Admin, 2021). Garlic belongs to the Ayurvedic time or before Ayurveda times. There are many health benefits linked with garlic use. Better digestive, heart health, detoxification, etc are the major benefits of garlic (Admin, 2021). Garlic contains various medicinal ingredients that work for fatigue recovery, energy enhancement, and cosmetology (Admin, 2021). Allicin, the active compound in garlic. It has strong antibacterial and antifungal properties. The odour and flavour from the garlic are caused by the Allicin. Allicin is a compound that is converted from the compound alliin by the action of the enzyme alliinase when garlic is chopped or damaged and is a different type of amino acid from the ones that make up proteins (Admin, 2021). It is not a very stable compound. It lost its properties when left untreated or cooked. Well, being rich in nutrition, garlic holds more than 60% water and the main ingredient is carbohydrates with 30% (Admin, 2021). It is very rare in vegetables and is also characterized by its high protein content (Admin, 2021). Solo Garlic: It is a type when garlic has a single clove. It is also known as single bulb garlic, pearl garlic, etc. Solo garlic is approximately 25 to 50 mm in diameter (Admin, 2021). Softneck Garlic- Softneck garlic has many cloves in one garlic. It is large in size and does not develop a flowering stalk. They are adaptable and simple to use (Admin, 2021). Hardneck Garlic- Hardneck garlic contains large cloves. It is easier to peel and use. Hardnecks produce a flowering stem, or scape, that becomes woody as it matures (Admin, 2021). Jumbo Garlic: Strictly speaking, jumbo garlic is a different species from garlic and is considered to be a member of the leek, but it looks exactly like garlic that is many times larger. The scent is not very strong (Admin, 2021). Garlic Leaves: Garlic leaves is a type of garlic, but it is harvested with green and soft leaves that come before the bulbs. The leaves from the garlic plant are also used for eating, cooking and medicinal purposes. The leaves are green and elongated like large garlic chives, and the cross-section is V-shaped from the base to the middle. Leaf garlic can be eaten not only on the leaves but also on the round stems and bulbs. The leaves also have a garlic-specific flavour but are not as strong as garlic (Admin, 2021). Garlic is one of the herbs that belong to the oldest and medicinal herbs category. Thousands of years have passed since it was first used. In ancient history, Egypt and India were native to garlic about 5000 years ago (Admin, 2021). Garlic was used by Babylonians 4500 years ago and by the Chinese 2000 years ago, according to clear evidence (Admin, 2021). Garlic travelled from Ancient Egypt to the Indus Valley's great civilizations. It continued to China from there (Admin, 2021). Garlic has

long been used to treat bronchitis, hypertension, TB (tuberculosis), liver diseases, diarrhoea, flatulence, colic, intestinal worms, rheumatism, diabetes, and fevers in the Middle East, East Asia, and Nepal (Admin, 2021). Garlic was brought to the New World by the French, Spanish, and Portuguese. In today, Garlic is a crop that is commonly farmed for fresh markets by numerous small-scale growers for local markets (Admin, 2021).

Garlic is a bulbous herb and one of the oldest cultivated plants (Chanda and Dikshit, 2023). It is used as a food item for culinary purposes and spice and is also regarded as traditional medicine in different parts of the world (Chanda and Dikshit, 2023). Garlic not only adds taste to foods but also helps to make them digestible (Chanda and Dikshit, 2023). It has high nutritional values and possesses different valuable minerals, vitamins and many other substances that contribute health benefits to human beings (Chanda and Dikshit, 2023). It contains sugar, protein, fat, calcium, potassium, phosphorous, sulphur, iodine, fibre, silicon, and vitamins (Chanda and Dikshit, 2023). Garlic has many functional benefits like antimicrobial, anticancer, antioxidant and anti-diabetic activity (Chanda and Dikshit, 2023). Researchers worldwide are interested in ascertaining garlic's medicinal properties due to its broad-spectrum therapeutic uses in human health (Chanda and Dikshit, 2023). Unbelievably, common herbs can significantly impact a massive effect on your general health if taken in the proper amounts with consistency (PW, 2023). Consuming 1-2 garlic cloves daily may have health benefits, but consuming more can have adverse reactions like foul breath, heartburn, stomach problems, and others (PW, 2023). It's best to consume moderately (PW, 2023). The scientific name of garlic is *Allium sativum* which is a perennial plant and belongs to the Amaryllis family. It is an edible bulb (PW, 2023). Garlic plants often grow to a height of 60 cm depending on the kind. The bulb is covered with membranous skin and encloses up to 15-20 edible bulblets called cloves (PW, 2023). The bulbs have a powerful onion-like strong aroma because of a chemical named allicin inside it and have a pungent taste which adds a nutty flavour to food (PW, 2023). It was and is now also used traditionally for health and culinary purposes by people in many parts of the world, including the Egyptians, Greeks, Romans, Chinese, and Japanese (PW, 2023). The plant grows wildly in Italy and southern France and is native to Central Asia (PW, 2023). It is not usually eaten raw excluding for medicinal purposes. It is widely used for its flavouring nature in cooking and medicinal properties (PW, 2023). Garlic was valued highly for its therapeutic benefits in ancient and mediaeval times, and it was also carried as a protection against demons and other evils. The plant was used in traditional and folk medicine in many places, and there is some evidence that it may help prevent heart disease (PW, 2023). Garlic has been farmed in Mesopotamia for at least 4,000 years, according to numerous ancient records. Thousands of years ago uses of garlic in China and Egypt were found. The Tutankhamun tomb contained some well-preserved garlic (c. 1325 BC) (PW, 2023). It is believed that it was consumed by ancient soldiers, sailors, and rural classes of ancient Greek and Romans (PW, 2023). In English cuisines, the usage of Garlic is seen as very rare but Mediterranean Europe has garlic as its common ingredient (PW, 2023).

Although it is one of the most important ingredients in all of the culinary arts, garlic nevertheless seems to mystify us when it comes to classifying it—is it an herb, spice, or vegetable? The simple answer is that garlic is a member of the lily family, along with onions, shallots, and leeks (Alfaro, 2023). Its intense and unique flavor and aroma make it a mainstay of cuisines around the world, nearly indispensable in just about every form of Asian, European, African, Latin American, and North American cooking (Alfaro, 2023). Most of the garlic sold in the United States comes from China with a small percentage grown in California. Garlic is often cooked, but can also be incorporated raw into recipes (Alfaro, 2023). Garlic grows underground in the form of a bulb. (Its long green shoots produce flower stalks called garlic scapes, which can be eaten) (Alfaro, 2023). Covered in an inedible papery skin, the bulb, or head as it is more often referred to, is comprised of individual sections called cloves, and there can be anywhere from 10 to 20 cloves per head (Alfaro, 2023). These cloves are themselves enclosed in a paperlike skin, which needs to be removed, and the pale yellowish flesh within is the part of the garlic that is used in cooking and can be cut in a variety of ways (Alfaro, 2023). Garlic, which is inexpensive, is generally used as a flavoring ingredient in recipes rather than as the main ingredient itself. An exception to this is roasted garlic, which can be eaten as a spread or condiment (Alfaro, 2023). Garlic has been an integral part of our kitchen since times immemorial that uplifts the zest and aroma of the meal (Netmeds, 2023). The famous Greek physician Hippocrates used garlic extensively to treat a host of health maladies and even modern medicine vouches for its impressive beneficial qualities (Netmeds, 2023). The research reveals that this humble spice has some real wellness incentives like shielding against the common cold and the ability to control blood pressure and cholesterol levels (Netmeds, 2023). This ubiquitous prized spice has a modified stem known as a bulb that encloses 10-20 pale white to yellow cloves (Netmeds, 2023). Garlic is a staple ingredient in kitchens across the world, being a quintessential ingredient in a rich array of culinary delights, it also packs a boast of nutrients with amazing curative and medicinal qualities (Netmeds, 2023). Garlic is the perfect ingredient to optimize your overall health and well-being (Netmeds, 2023). Garlic is a perennial plant in the Allium family, each segment of the bulb is called a clove (Netmeds, 2023). The plant is indigenous to central Asia but also grows widely in Italy and southern France. It has a powerful aroma and pungent taste (Netmeds, 2023). The plant grows to about 2 feet tall and leaves usually arise from a short hard stem above the bulb (Netmeds, 2023). It is cultivated as an annual crop and is propagated by planting cloves or top bulbils, though seeds can also be used (Netmeds, 2023). The unbelievable health benefiting actions of garlic are attributed to sulfur compounds, which is formed when a garlic clove is chopped, crushed, or chewed (Netmeds, 2023). Though the most well-known compound is allicin, it is an unstable compound that is briefly present in fresh garlic (Netmeds, 2023).

Diallyl disulfide and s-allyl cysteine are other compounds that hold a key role in garlic wellness incentives (Netmeds, 2023). The sulfur compounds present in garlic are readily absorbed in the system, exhibiting potent biological impacts (Netmeds, 2023). Garlic (*Allium sativum* L.) has been subject of fascination and research for centuries, owing to its diverse culinary and medicinal properties which further afftects its agronomic significance (Thakur et al., 2024). Among the plethora of compounds found in garlic, allicin an organosulfur compound (OSC), has emerged as a focal point of interest for researchers and health enthusiasts alike. Allicin is known for its powerful antimicrobial, antioxidant, and cardiovascular benefits, rendering garlic a potent natural remedy and a valuable addition to realm of alternative medicine (Thakur et al., 2024). Allicin's synthesis, bioavailability, and

mechanism behind its medicinal effects has also been discussed. Furthermore, the impact of various drying techniques on the allicin content of garlic has been examined (Thakur et al., 2024). As the understanding of allicin's health benefits continues to evolve, this comprehensive review contributes valuable insights into optimizing garlic's drying methods to preserve and enhance the allicin content, thus maximizing its therapeutic potential (Thakur et al., 2024). Garlic (*Allium sativum* L.), a member of the Allium genus, holds a prominent position in culinary traditions across the globe. Numerous titles, some of which are still in use today, have been given to garlic, including "stinking rose," "nectar of the gods," "Russian penicillin," "natural antibiotic," "herbal viagra," "herbal talisman," and "snake grass" (Thakur et al., 2024). The versatility of garlic across multiple sectors including agriculture, food industry, cosmetics and personal care, nutraceuticals, veterinary medicine, biological pest control, traditional medicinal, etc. highlights its significance as a valuable crop with wide well-known culinary and medicinal uses (Thakur et al., 2024). Garlic is still used today to treat coughs and bronchitis, prevent atherosclerosis, and treat high blood pressure, much as it was used extensively during World War I to prevent 'gangrene'. Garlic has received particular attention in contemporary health care due to the common idea that garlic aids people stay healthier (Thakur et al., 2024). Sale of garlic in several western nations are on par with those of prescription medications. China, India, Spain, Egypt, Argentina, Italy, and the United States are the principal producers of garlic. India is one of the leading garlic producing country as it has favorable agro-climatic conditions for garlic cultivation, and it is grown in various states across different region (Thakur et al., 2024). The garlic producing states in India are Madhya Pradesh (1849.47 tonnes), Rajasthan (416.3 tonnes), Uttar Pradesh (227.34 tonnes), Gujarat (94.56 tonnes) and Punjab (92.64 tonnes) (Thakur et al., 2024). Garlic is typically planted from cloves, which are individual segments of the bulb. Planting is usually done in the fall, several weeks before frost (Thakur et al., 2024). It thrives in well-draining soil that is rich in organic matter. The ideal climate for garlic cultivation is cool to cold, as it requires a period of cold temperature (vernalization) to initiate bulb formation. Garlic are known for their strong and penetrating aroma along with their distintive flavour (Thakur et al., 2024). There are several garlic varieties, each with unique characteristics, flavours, and uses. The two main types of garlic are soft neck (*Allium sativum* var. sativum) inludes California Early, California Late, and Silverskin and hard neck (*Allium sativum* var. ophioscorodon) includes Rocambole, Porcelain, and Purple Stripe. Garlic is useful crop with dicerse bioactive compounds in all of its parts (Thakur et al., 2024). The primary parts of garlic include the bulb, cloves, and scapes (flower stalks). Each part contributes to the distinct aroma, flavor, and medicinal properties of the plant. Bulb contains allicin, ajoene, saponins, cloves contain alliin, flavonoids and scapes contain protein, enzymes and antioxidants (Thakur et al., 2024). Garlic's rich phytochemical composition mainly allicin, ajoene and compounds containing sulfur allows it to display a wide spectrum of biological functions. These bioactive components contribute to various health benefits including antibacterial and antifungal activities, antioxidant activity, cardiovascular support, boost immune system, anti-inflammatory effects, anticancer potential, antiviral activity, digestive benefits, detoxification support, improve bone health (Thakur et al., 2024). Because fresh garlic has a high-water content (over 75 %), it rots quickly, reducing its shelf life and causing monetary losses. Effective processing techniques are required to maintain nutritional value and extend shelf life. 90 % of the water in food can be removed by drying procedures, which also delays microbial growth-related spoilage, minimize water-mediated degradation reactions, and save transportation costs (Thakur et al., 2024). Currently, agricultural product drying methods are primarily classified as thermal and non-thermal. Hot air drying and infrared drying the main thermal drying techniques whereas vacuum freeze drying and microwave drying has both thermal and non thermal effect. Though, different dehydration techniques have varying effects on the target food's qualitative attributes (Thakur et al., 2024). Convective hot air-drying is a popular technique for dehydrating garlic, however because of its continuous exposure to high temperatures, it can have a negative effect on quality characteristics and nutraceutical components (Thakur et al., 2024). Newly developed and innovative methods have recently attracted a lot of attention due to their ability to provide faster drying times and greater quality (Thakur et al., 2024). In comparison to traditional hot air drying, microwave drying has benefits such as faster drying times, less heating, and lower spoiling risk (Thakur et al., 2024). However, moisture diffusion models must be created for industrial application. The lack of liquid water and low temperatures during freeze-drying, on the other hand, minimize flavor and aroma losses, producing high-quality products (Thakur et al., 2024). Garlic has demonstrated its potential antibacterial activity against a wide range of microorganisms. Similar to this, in recent years research has focused on the allelopathic functions of garlic and the mechanisms supporting the physiological activity of chemicals produced from garlic in the fields of agricultural production and safeguarding (Thakur et al., 2024). Garlic is a treasure trove of bioactive compounds, with allicin being one of the most prominent and well-studied components. Many civilizations have long utilized garlic as a seasoning and for its potential to prevent and treat illnesses. Based on its potent and diverse effects, garlic is one of the best foods for preventing disease and has undergone extensive research into its health advantages as depicted in Table 1. Numerous sulfur-containing chemicals and non-sulfur compounds have dominated (Thakur et al., 2024). One of the most famous OSC generated from garlic is called allicin [S-(2-propenyl) 2-propene-1-sulfinothioate]. After mechanical crushing, allicin accounts for over 70 % of the total thiosulfinates found in the cloves. The Allicin content of chopped raw garlic is substantial, at about 37 mg/g (Thakur et al., 2024).

Allium sativum L., commonly known as garlic, is a species in the onion family Alliaceae (Wikidoc, 2025). Garlic has been used throughout recorded history for both culinary and medicinal purposes (Wikidoc, 2025). It has a characteristic pungent, 'hot', flavour that mellows and sweetens considerably with cooking. A 'head' of garlic, the most commonly used plant part, comprises numerous discrete 'cloves'. The leaves and stems are sometimes eaten, particularly while immature and tender (Wikidoc, 2025). Harvest garlic when approximately one third, but less than half of the leaves turn brown. Start by digging one plant to check the garlic for maturity. Cloves should be plump and fill the skin (Myers, 2025). Immature garlic does not store well, while over-mature bulbs are more subject to disease. Don't discard but rather use immature garlic as soon as possible (Myers, 2025). Cure the garlic you plan to store for three to four weeks in a warm, well-ventilated location. Once dried, remove soil, long roots and only the damaged outermost layer of papery skin with a brush of your gloved hand. Cut off the tops, being careful not to damage the papery covering that protects the cloves (Myers, 2025). Store the garlic in a cool location with good air circulation and out of direct sunlight to prevent resprouting. Properly harvested and cured garlic will last for up to eight months (Myers, 2025). Garlic

can also be frozen. Place the whole bulb, individual cloves, or peeled, chopped cloves in a single layer in a plastic freezer bag. Use frozen garlic to flavor your favorite recipes within three to four months for the best flavour (Myers, 2025). Garlic has been cultivated around the world for thousands of years and is found in almost every cuisine on the planet (KEW, 2025). Its aromatic bulbs are renowned for their distinctive flavour and medicinal properties (KEW, 2025). Garlic bulbs were found in the tomb of ancient Egyptian pharaoh Tutankhamen (KEW, 2025). Garlic is one of the most commonly used spices in India (Indianet, 2025). The garlic is composed of individual cloves enclosed in a white parchment-like skin. Each clove of garlic is encased in its own covering of papery skin (Indianet, 2025). Garlic is cultivated and widely used in almost every culture in the world for its myriad medicinal as well as culinary values. Garlic is cultivated in all over India and the states of Madhya Pradesh, Gujarat, Odisha, Rajasthan, Karnataka, Tamil Nadu, Maharashtra and Bihar are the premium producers of Garlic in India (Indianet, 2025).

China is the world's largest producer of garlic, growing more than 20 million tonnes annually. With its ideal climate, vast agricultural land, and efficient farming systems, China supplies more than 70% of the global garlic market. Garlic farming plays a significant role in rural economies, especially in provinces like Shandong and Henan (Kaur, 2025). China ranks first in global garlic production, yielding approximately 20,688,005 tonnes each year. Chinese garlic is widely exported and used around the world in homes, restaurants, food factories, and even pharmaceutical products (Kaur, 2025). China produces about 20.7 million tonnes of garlic annually. The majority of this output comes from eastern provinces with fertile soil and well-developed irrigation. China is also home to Jinxiang County, known as the 'Garlic Capital of the World' (Kaur, 2025). Garlic-Producing Countries in the World (in Tonnes) (Kaur, 2025).

1	China	20,688,005
2	India	3,266,023
3	Bangladesh	548,907
4	Egypt	490,418
5	South Korea	318,220

Note: Figures are based on FAO 2023–2024 agricultural estimates.

Countries like Russia, Uzbekistan, Ukraine, and the United States also contribute meaningfully to global garlic output. Though their production is smaller, they cater to both local and export markets with regional varieties (Kaur, 2025). Garlic was used in ancient Egypt and Rome as both a food and a medicine. It was even worn around the neck to ward off evil spirits (Kaur, 2025). When garlic is chopped or crushed, it releases allicin, a natural compound with powerful antibacterial and antifungal properties (Kaur, 2025). Not all garlic is white! Varieties like Purple Stripe and Rocambole are prized for their bold flavour and are often used in gourmet dishes (Kaur, 2025). Jinxiang County in China grows and exports more garlic than any other region globally. It hosts international garlic expos and trade fairs (Kaur, 2025). Garlic has even made its way into space! It was one of the first spices tested on space missions due to its potential immune-boosting effects (Kaur, 2025). Garlic is one of the most popularly used vegetable in the Indian cuisine. It is called as Lassan or Lahsun in Hindi (Boeckmann, 2025). This vegetable is called by several names in different parts of India as per their regional language. Garlic is used throughout the globe for both culinary and medicinal purposes (Boeckmann, 2025). Garlic is cultivated in most parts of India especially in the states of Madhya Pradesh, Gujarat, Orissa, Rajasthan, Karnataka, Tamil Nadu, Maharashtra and Bihar being the premium producers of garlic in India (Boeckmann, 2025). Garlic has various uses and widely used for culinary purposes all over the world. It is used as condiment in various food items in Indian and Asian cuisines. It is mainly used for preparing chutneys, pickles, dips and curry powder, adding in curries, meat preparations, sauces or ketchups. The raw garlic is used in making of garlic powder, garlic salt, garlic vinegar, garlic bread. Garlic rasam is a very popular dish prepared in southern India and said to be very good for flatulence (Boeckmann, 2025). Garlic is widely cultivated in warm and mild climates throughout India. It is quite easy to cultivate garlic, as the plant can be grown year-round. Garlic is a bulbous perennial plant having narrow flat leaves. The plant bears small white flowers and bulbils and the bulb comprises 6 to 30 smaller bulblets called cloves. The bulb remains surrounded by a thin white or pinkish papery sheath. Garlic has a stronger flavor in comparison to onion (Boeckmann, 2025). Garlic requires well-drained, moderately clayey and argillaceous soil and a high elevation (900 to 1200 meters) to grow properly. It also requires a cool moist period during its growth and a relatively dry period during the maturing of crop (Boeckmann, 2025). Normally, garlic takes about 4 to 5 months to mature. It is grown as a late season irrigated crop. Garlic is easy to grow and can be grown year-round in mild climates (Boeckmann, 2025). In cold climates, cloves are planted in the ground in the fall, about six weeks before the soil freezes and harvested in late spring (Boeckmann, 2025). Garlic plants can be grown close together, leaving enough room for the bulbs to mature, and are easily grown in containers of sufficient depth (Boeckmann, 2025). When selecting garlic for planting, it is important to pick large heads to separate cloves from. This plant's bulb is the most commonly used part and is divided into numerous fleshy sections called cloves (Boeckmann, 2025). The cloves are used for consumption (raw or cooked), or for medicinal purposes, and have a characteristic pungent, spicy flavor that mellows and sweetens considerably with cooking (Boeckmann, 2025). India is one of the major exporters of garlic bulbs, dehydrated garlic, garlic powder and garlic oil, etc. all over the world. The main harvesting season of garlic in India is the months of December to January and the marketing season is during the months of February to March (Boeckmann, 2025). India mainly exports garlic to the countries like Sri Lanka, USA, UAE, Kuwait and Saudi Arabia. Garlic is grown globally where China is the largest producer of garlic, with approximately 10.5 million tonnes (23 billion pounds) annually, accounting for over 77% of world output. India (4.1%) and South Korea (2%) follow, with Russia (1.6%) in fourth place and the United States (where garlic is grown primarily as a cash crop in every state except for Alaska) in fifth place (1.4%) (Boeckmann, 2025). This leaves 16% of global garlic production in countries that each produces less than 2% of global output (Boeckmann,

2025). According to the traditional Indian Ayurveda, garlic is one of the most effective antimicrobial herbs and has anti-bacterial, anti-fungal, anti-viral and antiseptic properties (Boeckmann, 2025). It also is carminative and gastric stimulant. It can aid in digestion and absorption of food and is also given in flatulence (Boeckmann, 2025). In modern Allopathic treatment, garlic is used in a number of patented medicines and other preparations. The active principle in garlic is an antibiotic named allicin (Boeckmann, 2025). Garlic is used in treatment of diseases like running cold, saliva formation, chronic bronchitis, respiratory catarrh, whooping cough, bronchitic asthma, influenza, chronic diarrhea, pulmonary tuberculosis, rheumatism, impotence (Boeckmann, 2025). It can also fight infection, reduce cholesterol, protect against heat diseases and stroke, control diabetes, and prevent cancer (Boeckmann, 2025). Garlic is a wonderful seasoning (ginger garlic paste) to add aroma, taste, and nutrition to your dishes. It is usually recommended using raw chopped or pressed garlic in many of the dishes (Boeckmann, 2025). It is best to add it towards the end of the cooking process to retain the maximum amount of flavor and nutrition. Garlic taste excellent when applied to breads which creates a variety to classic dishes such as garlic bread, garlic toast, bruschetta, crostini and canapé (Boeckmann, 2025). Native to central Asia over 5000 years, garlic is one of the oldest cultivated plants in the world. Ancient Egyptians seem to have been the first to cultivate this plant that played an important role in their culture (Boeckmann, 2025). Garlic was not only bestowed with sacred qualities and placed in the tomb of Pharaohs, but it was given to the slaves that built the Pyramids to enhance their endurance and strength (Boeckmann, 2025). Garlic was introduced into various regions throughout the globe by travellers and explorers. By the 6th century BC, garlic was known in both China and India, the latter country using it for therapeutic purposes (Boeckmann, 2025). Garlic is claimed to help prevent heart disease (including atherosclerosis, high cholesterol, and high blood pressure) and cancer. Garlic is used to prevent certain types of cancer, including stomach and colon cancers. Garlic is also alleged to help regulate blood sugar levels (Boeckmann, 2025). Regular and prolonged use of therapeutic amounts of aged garlic extracts lower blood homocysteine levels and has shown to prevent some complications of diabetes mellitus. Additionally, garlic is an excellent source of manganese. It is also a very good source of vitamin B6 and vitamin C (Boeckmann, 2025). In addition, garlic is a good source of protein and thiamin (vitamin B1) as well as the minerals phosphorus, selenium, calcium, potassium, and copper (Boeckmann, 2025).

Allium sativum L., commonly known as garlic, is a species in the onion family Alliaceae. Its close relatives include the onion, the shallot, and the leek (Bionity, 2025). Garlic has been used throughout recorded history for both culinary and medicinal purposes. It has a characteristic pungent, spicy flavor that mellows and sweetens considerably with cooking (Bionity, 2025). A bulb of garlics, the most commonly used part of the plant, is divided into numerous fleshy sections called cloves. The cloves are used as seed, for consumption (raw or cooked), and for medicinal purposes (Bionity, 2025). The leaves, stems (scape) and flowers (bulbils) on the head (spathe) are also edible and most often consumed while immature and still tender. The papery, protective layers of 'skin' over various parts of the plant and the roots attached to the bulb are the only parts not considered palatable (Bionity, 2025). From the earliest times garlic has been used as a food. It formed part of the diet of the Israelites in Egypt and of the labourers employed by Khufu in constructing the pyramid. Garlic is still grown in Egypt, but the Syrian variety is the kind most esteemed now (Bionity, 2025). It was consumed by the ancient Greek and Roman soldiers, sailors and rural classes and, according to Pliny the Elder by the African peasantry. Galen eulogizes it as the "rustic's theriac" (cure-all) and Alexander Neckam, a writer of the 12th century recommends it as a palliative of the heat of the sun in field labor (Bionity, 2025). Early in the 20th century, it was sometimes used in the treatment of pulmonary tuberculosis or phthisis. Garlic was rare in traditional English cuisine and has been a much more common ingredient in Mediterranean Europe (Bionity, 2025). Garlic was placed by the ancient Greeks on the piles of stones at cross-roads, as a supper for Hecate and according to Pliny, garlic and onions were invoked as deities by the Egyptians at the taking of oaths (Bionity, 2025). The inhabitants of Pelusium in lower Egypt, who worshipped the onion, are said to have had an aversion to both onions and garlic as food (Bionity, 2025). To prevent the plant from running to leaf, advised bending the stalk downward and covering with earth; seeding, he observes, may be prevented by twisting the stalk (Bionity, 2025). A member of the onion family, this staple of Mediterranean cooking is simple to grow in a warm sunny site with well-drained soil (RHS, 2025). It's grown from cloves, which are best planted in autumn, and is ready to harvest the following year, in late spring and summer (RHS, 2025). Hardy, sun-loving garlic is an increasingly popular crop, as it needs minimal maintenance, takes up relatively little space and produces reliable harvests (RHS, 2025). Started off from cloves rather than seed, it needs no cosseting. It usually requires a spell of cold to form a good bulb, so is generally planted in autumn to overwinter outdoors (RHS, 2025). Simply keep weeds at bay and water during prolonged dry spells, and you'll be harvesting your own garlic from late spring onwards, depending on the variety (RHS, 2025). Garlic stores well for several months, so you can grow plenty to use as needed, and benefit from garlic's many health-boosting properties (RHS, 2025). Garlic is grown from cloves – the small individual segments in a bulb of garlic. However, planting garlic bought from a supermarket is not recommended (RHS, 2025). Although more expensive, they should produce a reliably good crop. There are two main types of garlic – hardneck and softneck (RHS, 2025). *Hardneck garlic* are fleshy, rounded, underground storage organs, usually sold and planted while dormant (RHS, 2025). When a vegetable plant starts flowering and forming seeds, often prematurely, making the crop unusable – salad leaves may turn bitter and root crops fail to swell (RHS, 2025). *Softneck garlic* produces smaller, more tightly packed cloves. Stores for longer – if planted in autumn it will keep well into the following winter, if planted in spring it will keep until the middle of the following spring (RHS, 2025).

This bulb-shaped veggie is part of the onion family, which also includes chives, leeks, and scallions. Unlike its kin, a garlic bulb is made up of many smaller pieces called cloves. So-called wild garlic is similar, but not the same plant. Neither is elephant garlic, which is really a kind of leek (Newman, 2025). Garlic doesn't have much of a smell until you peel, crush, or chew the cloves. That releases the sulfur compounds that give raw garlic its famous odor and flavor. Cooking mellows the taste. If you don't like what it does to your breath, chew on raw mint leaves, apples, or lettuce right after you eat a garlicky dish (Newman, 2025). Just where and when garlic first appeared is a mystery. Experts believe it was most likely in Central Asia. Records show that people in India and Egypt grew it more than 5,000 years ago, which makes it one of the earliest farmed crops. Later, it spread to China and into Southern Europe. Almost all garlic produced in the U.S. is grown in California (Newman, 2025). The Greeks loved garlic so much

they offered bulbs as gifts to the gods. But garlic breath was a reason to be kicked out of a temple. The early physician Hippocrates used garlic to treat parasites, as a laxative, and as a diuretic. For the Romans, garlic was a spice and a food. They used to treat tuberculosis, fever, and other diseases. A mix of garlic juice and thyme, when rubbed on the body, was said to protect people from snake bites (Newman, 2025). The English used a mix of garlic, honey, and sometimes alcohol to treat colds, fever, and diarrhea. The French believed garlic saved hundreds of lives from the plague in 1720. Well into the 20th century, garlic was used to protect people from cholera, typhoid fever, and diphtheria. In the flu outbreak of 1917-1918, Americans wore garlic necklaces to keep the illness away (Newman, 2025). According to legend, if a vampire's chasing you, you can change its mind with garlic. That's probably because crushing a clove produces allicin, which creates garlic's famous sulfurous smell. In the Middle Ages, folks in Slavic countries where the vampire legend was born considered garlic a weapon against demons. But it's also possible that garlic's reputation as a disease fighter gave it this supporting role in one of history's most enduring legends (Newman, 2025). Buy it fresh. Look for plump bulbs with tight skin that's isn't frayed or loose. Avoid garlic with mold or sprouts -- that's a sign that it's old. Store it in a cool, dark spot with good ventilation, such as a pantry. Garlic will keep for a few months. But use it within a week to get the most flavor and nutrients (Newman, 2025). Most of the credit goes to allicin, the oil that gives garlic its sulfurous flavor and smell. It's also antibacterial. But garlic has more than 40 other healthy compounds, such as arginine, oligosaccharides, flavonoids, and selenium. Experts say any of them, or mixtures of them, could be why garlic supports good health (Newman, 2025). Some studies show that garlic might help people with heart disease. It may lower cholesterol and blood pressure, keep arteries flexible, and help prevent blood clots and the buildup of plaque. It might also reduce the risk of stroke. While not as effective as medicine, garlic may have a role as a side treatment. It might also lower blood sugar in people with diabetes (Newman, 2025). Many claims about garlic's health benefits aren't proven by science. That includes the use of garlic for colds, flu and other viruses, sore throats, Alzheimer's, or to boost the immune system. While some studies show that people who eat more garlic have lower rates of some cancers, more research is needed (Newman, 2025). An essential ingredient around the world, garlic can be used to add flavour to a wide variety of dishes (BBC, 2025). A bulb composed of many individual cloves enclosed in a thin white, mauve or purple skin, it's quite fiery, pungent and crunchy when raw. As it cooks it becomes more mellow and creamy (BBC, 2025). It's mainly available dried, but fresh (also known as 'wet' or 'green') garlic, which has a mild flavour, can also be found in some stores in season (BBC, 2025). Dried garlic is sold either loose, in bunches or plaited into strings; generally speaking, the smaller the bulb, the stronger the flavour (BBC, 2025). Solo garlic (just one large clove) and the large-bulbed elephant garlic are also available, though the latter is, in fact, more closely related to the leek, and has a very mild flavour and soft texture (BBC, 2025). Using your fingers, divide the whole bulb into individual cloves (if you don't want to use the whole bulb, just pull away the number of cloves you need and leave the rest of the bulb intact, as it will last longer that way). Remove any green shoots, as they taste bitter (BBC, 2025). For crushed garlic, either use a garlic press (you don't have to remove the skin) or lay the blade of a large knife on top of the clove and press it down hard with the heel of your hand. Then remove the skin. If you'd like to break it down even further, sprinkle with some salt and crush it again (BBC, 2025). For chopped garlic, peel the skin off, then slice. You can then remove the skin. If any of the cloves have small green shoots, remove them before chopping, as they taste bitter (BBC, 2025). Kept in an open container in a cool, dry place, dried, unbroken garlic bulbs will last for a couple of weeks. Separated cloves will keep for up to 10 days. Wet garlic should be kept in a cool, dark place and will last up to a week (BBC, 2025). Use dried garlic raw in dressings, salsas and butters; roast whole bulbs (25 mins) or individual cloves (20 mins) to serve with roast meat; fry (slowly, for just a couple of minutes) to use as the base for sauces, casseroles, soups. Roast fresh garlic (25 mins) (BBC, 2025).

Garlic is among the oldest known horticultural crops. In the Old World, Egyptian and Indian cultures referred to garlic 5000 years ago and there is clear historical evidence for its use by the Babylonians 4500 years ago and by the Chinese 2000 years ago. Some writings suggest that garlic was grown in China as far back as 4000 years ago (Simon, 2025). Garlic grows wild only in Central Asia (centered in Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) today. Earlier in history garlic grew wild over a much larger region and, in fact, wild garlic may have occurred in an area from China to India to Egypt to the Ukraine (Simon, 2025). This region where garlic has grown in the wild is referred to as its "center of origin" since this is the geographic region where the crop originated and the only place where it flourished in the wild (Simon, 2025). Although we sometimes hear about "wild garlic" elsewhere in the world, this is the only region where true garlic routinely grows in the wild without the assistance of human propagation (Simon, 2025). There are other plants locally referred to as "wild garlic", but these are invariably other species of the garlic genus (Allium), not garlic itself (Allium sativum). For example, *Allium vineale* is a wild relative of garlic that occurs in North America and is commonly called "wild garlic" (Simon, 2025). The "center of origin" for a plant or animal species is also referred to as its "center of diversity" since it is here that the broadest range of genetic variation can be expected. That is why those of us who have sought to find new genetic variation in garlic have collected wild garlic in Central Asia (Simon, 2025). Once cultivated by the first garlic farmers outside of its "center of origin", what types of garlic did early afficianados grow? In fact, we know almost nothing about the early types of garlic produced (Simon, 2025). No designation of garlic varieties was made in the early writings discovered to date, be it hardneck or softneck, red or white, early or late, local or exotic (Simon, 2025). Throughout its earlier history some have speculated that softneck garlic was the predominant type cultivated although evidence of what would be interpreted as a hardneck type was found interred in Egyptian tombs (Simon, 2025). It was not until garlic was cultivated in southern Europe within the last 1000 years that the distinction between hardneck and softneck was routinely noted (Simon, 2025). Until more ancient writings which describe garlic are found, or old, well-preserved samples are unearthed, we can only speculate about the early types of garlic grown (Simon, 2025). Garlic producers and consumers have come through 5000 years of history growing and eating their crop with little need to specify type or variety (Simon, 2025). In fact it is a rather modern habit of only the last few hundred years whereby more detailed descriptions of varieties have come to be developed for any crop plant (Simon, 2025). Throughout history, humans migrating and travelling through Central Asia and surrounding areas have collected wild garlic (and still do) and carried it with them for later consumption and cultivation (Simon, 2025). In 1989 I was fortunate enough to participate in a germplasm collection expedition seeking garlic and other alliums in nature reserves of Central Asia. We observed

primarily hardneck garlic in the wild, but some softneck plants also occurred (Simon, 2025). It is easy to imagine early garlic connoiseurs migrating beyond the natural range of wild garlic and carrying wild garlic far from its center of origin. Only with cultivation could a supply for subsequent years be assured. And so garlic came to be cultivated (Simon, 2025). The wild hardneck garlic we collected is among the more prolific for production of true garlic seeds. We presume that the vast diversity that has been observed in cultivated garlic goes back to variation generated from sexual reproduction in the wild crop (Simon, 2025). In contrast to wild garlic, garlic in cultivation throughout history has only been propagated asexually by way of vegetative cloves, bulbs, and bulbils (or topsets), not from seed. These asexually propagated, genetically distinct selections of garlic we cultivate are more generally called "clones" (Simon, 2025). Let's say you have two garlic clones, clone A and clone B. Clone A has excellent yield but poor storage ability while clone B stores well but yields poorly. Without an opportunity for interpollination and sexual reproduction, the only way to obtain a garlic clone with high yield and long storage is to wait for the desired mutations(s) to occur in clone A or clone B (Simon, 2025). If these two clones can, however, be interpollinated and set true seed, a very realistic opportunity exists to develop a new line with both desired traits in several generations of progeny selection beyond this cross (Simon, 2025). We conjecture that these clones represent the cumulative array of garlic diversity resulting from sexual reproduction in the wild which has been disseminated from its center of origin throughout history and then been able to successfully produce a crop in the hands of garlic growers around the world today (Simon, 2025). Garlic is crop widely grown for fresh market by many producers on a small scale for local markets and, particularly in the U.S., by a few large-scale producers for processing and fresh sales (Simon, 2025). About one million hectares (2.5 million acres) of garlic produce about 10 million metric tons of garlic globally each year, according to the United Nations Food and Agriculture Organization (Simon, 2025). Although widely cultivated, it is only since routine seed production became possible in the 1980's that garlic can be called a domesticated crop, since a strict definition of domestication is the process of selective breeding of a plant or animal to better meet human needs (Simon, 2025). Clones held by growers today have been maintained as separate entities, but a system to confirm or refute the identity of a given clone has not been established. Only with several seasons of careful field observation can garlic clones be identified, and even then ambiguities often remain. For example, virus infection can dramatically reduce plant size and vigor, and alter leaf color and shape making unequivocal garlic identification impossible (Simon, 2025). Fingerprinting was developed to prove, or disprove, the identity of humans. Today the term "fingerprinting" is used more widely to include evaluation of DNA patterns of any organism. High-profile criminal/legal proceedings have made the concept of fingerprinting (in its broader sense) familiar to the general public in that context. The very same DNA methodologies useful for humans are applicable for any organism (Simon, 2025). What can be learned from garlic fingerprinting? Three situations arise where it would be useful to have an unequivocal means to verify the identity of a garlic clone: identification of existing garlic clones in production, tracking of new garlic clones derived from true seed as they enter and move into production, and development of a garlic lineage (Simon, 2025). For garlic, there is a good likelihood in any large collection that several garlic clones held under different names that, in fact, are identical. Another scenario we often confront is that several clones occur as a mixture under the same name. This brings us to the first motivation for fingerprinting garlic (Simon, 2025). A third rationale for DNA fingerprinting of garlic is more subtle. This methodology not only tells us that clone A is different from clone B and clone C, but it also can tell us how closely related clones A, B, and C are relative to each other (Simon, 2025). Garlic is a compelling and well-appreciated, but little-studied crop. It has a long history in the hands of humans and a significant monetary, health, and social value in modern society. A better understanding of garlic origins and distribution may help us better understand not only garlic, but perhaps our own human history (Simon, 2025).

Garlic (*Allium sativum*) is a species of bulbous flowering lants in the genus *Allium*. Its close relatives include the onion, shallot, leek, chives, Welsh onion, and Chinese onion (Wikipedia, 2025). Garlic is native to central and south Asia, stretching from the Black Sea through the southern Caucasus, northeastern Iran, and the Hindu Kush; it also grows wild in parts of Mediterranean Europe. There are two subspecies and hundreds of varieties of garlic (Wikipedia, 2025). Garlic has been used for thousands of years as a seasoning, culinary ingredient, traditional medical remedy; it was known in many ancient civilizations, including the Babylonians, Egyptians, Romans, and Chinese, and remains significant in many cuisines and folk treatments, especially across the Mediterranean and Asia (Wikipedia, 2025). Garlic propagates in a variety of climates and conditions and is produced globally; China is by far the largest producer, accounting for over two thirds (73%) of the world's supply in 2021 (Wikipedia, 2025). Garlic oil is the volatile oil derived from garlic. It is usually prepared using steam distillation, and can also be produced via distillation using ether. It is used in cooking and as a seasoning, a nutritional supplement, and also as an insecticide. Garlic oil is typically prepared using steam distillation, where crushed garlic is steamed with the resultant condensation containing the oil. Garlic oil contains volatile sulfur compounds such as diallyl disulfide, a 60% constituent of the oil. Steam-distilled garlic oil typically has a pungent and disagreeable odor and a brownish-yellow color. Its odor has been attributed to the presence of diallyl disulfide. To produce around 1 gram of pure steam-distilled garlic oil, around 500 grams of garlic is required. Undiluted garlic oil has 900 times the strength of fresh garlic, and 200 times the strength of dehydrated garlic. Ether can also be used to extract garlic oil. A type of garlic oil involves soaking diced or crushed garlic in vegetable oil, but this is not pure garlic oil; rather it is a garlic-infused oil (Wikipedia, 2025a.). Garlic is cultivated worldwide. It has a long history of use both in foods and for health purposes. Ancient writings from Egypt, Greece, and India describe its use for a variety of health problems, such as headache, pneumonia, throat conditions, and gastrointestinal disorders (NCCIH, 2025). Currently, garlic is promoted as a dietary supplement for various purposes, including helping to manage high blood cholesterol, high blood pressure, and diabetes; preventing various types of cancer; and enhancing immune function. Garlic may also be used topically (applied to the skin) (NCCIH, 2025). Garlic supplements may reduce levels of total cholesterol and low-density lipoprotein (LDL) cholesterol to a small extent in people who have high blood cholesterol levels (NCCIH, 2025). Limited evidence suggests that garlic supplements may reduce blood pressure to a small extent in people who have high blood pressure (NCCIH, 2025). Garlic supplements may reduce blood sugar to a small extent in people with diabetes (NCCIH, 2025). Consuming garlic does not seem to reduce the risk of stomach cancer. It’s uncertain whether garlic influences the risk of colorectal cancer (NCCIH, 2025). Dietary supplements that contain garlic have been promoted as boosters for the immune system, particularly during cold and flu season (NCCIH, 2025). A

2022 review identified only two studies that suggest a possible benefit, and both studies included only small numbers of people and had weaknesses in the research (NCCIH, 2025). Garlic, taken orally, has been used safely in research studies that lasted as long as 7 years. Some forms of garlic used topically also seem to be safe. However, fresh raw garlic may not be safe when used topically. It can cause severe skin irritation and chemical burns (NCCIH, 2025). Side effects of garlic consumed orally include breath and body odor, abdominal pain, flatulence, and nausea. Some people have allergic reactions to garlic (NCCIH, 2025). Taking garlic supplements may increase the risk of bleeding. If you take garlic supplements, make sure to tell your health care providers. This is especially important if you are going to have surgery or if you take medicines, such as anticoagulants or aspirin, that may also affect bleeding (NCCIH, 2025). If you take anticoagulants, aspirin, or any other medicine, talk with your health care provider before using garlic or other herbal products; some herbs and medicines interact in harmful ways (NCCIH, 2025). Garlic may not be safe for use during pregnancy or while breastfeeding when taken orally in amounts greater than those found in foods. Little is known about the safety of using garlic topically during pregnancy or while breastfeeding (NCCIH, 2025). Take charge of your health—talk with your health care providers about any complementary health approaches you use. Together, you can make shared, well-informed decisions (NCCIH, 2025). Garlic, (*Allium sativum*), perennial plant of the amaryllis family (Amaryllidaceae), grown for its flavourful bulbs (Britannica, 2025). The plant is native to central Asia but grows wild in Italy and southern France and is a classic ingredient in many national cuisines (Britannica, 2025). The bulbs have a powerful onionlike aroma and pungent taste and are not usually eaten raw. Garlic plants grow about 60 cm tall (Britannica, 2025). Depending on the variety, the long leaves typically arise from a short hard stem above the bulb or emerge from a softer pseudostem made up of overlapping leaf sheaths. The bulb is covered with membranous skin and encloses up to 20 edible bulblets called cloves (Britannica, 2025). The spherical flower cluster is initially enclosed in a pair of papery tapered bracts; the bracts split open when the green-white or pinkish flowers bloom. Flower stalks sometimes arise bearing tiny bulbils (tiny secondary bulbs that form in place of flowers) and sterile blossoms. Garlic is usually grown as an annual crop and is propagated by planting cloves or top bulbils, though seeds can be also be used (Britannica, 2025).

ORIGIN AND DISTRIBUTION

Native: Iran, Kazakhstan, Kirgizstan, Tajikistan, Turkmeni stan, Uzbekistan (KEW, 2025). Introduced: Albania, Algeria, Amur, Austria, Baleares, Baltic States, Bangladesh, Belarus, Bosnia and Herzegovina, Cambodia, Canary Islands, Central European Russia, China North-Central, China South-Central, China Southeast, Corse, Croatia, Cuba, Czech Republic, Dominican Republic, East European Russia, Egypt, Ethiopia, France, Galápagos, Germany, Greece, Haiti, Hungary, Illinois, India, Iraq, Italy, Jamaica, Kentucky, Korea, Leeward Islands, Libya, Mexico Central, Mexico Northwest, Mexico Southeast, Mexico Southwest, Montenegro, Morocco, New York, North Macedonia, North European Russia, Northwest European Russia, Pakistan, Poland, Primorsky Krai, Puerto Rico, Romania, Sardinia, Serbia, Seychelles, Sicily, Slovakia, Slovenia, South European Russia, Spain, Switzerland, Tennessee, Thailand, Trinidad-Tobago, Tunisia, Turkey, Ukraine, Vermont (KEW, 2025). The ancestry of cultivated garlic, is not definitely established: "a difficulty in the identification of its wild progenitor is the sterility of the cultivars. *Allium sativum* grows in the wild in areas where it has become naturalised; it probably descended from the species *Allium longicuspis*, which grows wild in south-western Asia. The 'wild garlic', 'crow garlic' and 'field garlic' of Britain are the species *Allium ursinum*, *Allium vineale* and *Aleum oleraceum*, respectively. In North America, '*Allium vineale*, known as 'wild-' or 'crow garlic', and *Allium canadense*, known as 'meadow-' or 'wild garlic' and 'wild onion', are common weeds in fields (Bionity, 2025). Garlic is a native of West Asia and Mediterranean area. China, Korea, India, USA, Spain, Argentina and Egypt are the major garlic growing countries. Garlic prefers cool weather and grow in a well-drained, moderately clay loam at higher elevation (900 to 1200 mtrs) (Indianspices, 2025). Since the ancient times, Garlic has been used as a valuable condiment for foods in India. Garlic has a special mention in the Hindu mythology. According to Hindu mythology, the gods and the demons once churned the sea, using earth as the axis and divine snake Basuki as the rope. Many precious materials came out due to churning of the sea. Along with the materials, a pot of nectar also came out and consuming the nectar was believed to have capacity to make one immortal. The gods and demons fought against each other for this pot and eventually, the gods took possession of the pot. The King of gods, Indra took the pot to heaven for distributing to gods. However, he first offered it to his wife Sachi, before distributing to others. After consuming it, Sachi could not digest the nectar and thus vomited. A drop of her vomit fell from heaven on the earth and a small plant emerged from that drop. This plant is known as Garlic. According to Hindu Mythology, Garlic is foul smelling because it had emerged from vomit. The mythology also mentioned that Garlic has several medicinal virtues, as it had emerged from heavenly nectar (Indianet, 2025). Garlic is believed to have originated in Central Asia (China). It then spread to the Mediterranean region in ancient times and was already known in Egypt by 3000 BC. Today, garlic is cultivated across the globe at latitudes ranging from 5 to 50 in both the northern and southern hemispheres (Plantvillage, 2025). Garlic cultivation originated in Egypt and then spread to Asia and finally spread to Europe and the United States. China at present is the world's largest producer of garlic and India ranks second in production (Justgot, 2025). The ancestry of cultivated garlic, according to Zohary and Hopf, is not definitely established: "a difficulty in the identification of its wild progenitor is the sterility of the cultivars." *Allium sativum* grows in the wild in areas where it has become naturalised; it probably descended from the species *Allium longicuspis*, which grows wild in south-western Asia. The 'wild garlic', 'crow garlic' and 'field garlic' of Britain are the species *Allium ursinum*, *Allium vineale* and *Aleum oleraceum*, respectively. In North America, '*Allium vineale*, known as 'wild-' or 'crow garlic', and *Allium candadensis*, known as 'meadow-' or 'wild garlic', are common weeds in fields (Wikidoc, 2025).

TAXONOMY

Garlic (*Allium sativum* L.) is a diploid species ($2n=2x=16$) in the subgenus *Allium* of the Alliaceae (formerly in the Liliaceae, and then the Amaryllidaceae). The edible underground stem is the composite bulb made of numerous smaller bulbs called cloves. The other cultivated plants in this subgenus are leek, usually tetraploid, and elephant garlic, usually hexaploid ($2n=2x=48$) (both *A.*

ampeloprasum L.). Variation in plant type, bulb size, bulb weight, colour, coat layer, leaf length and width, growth habit, stress resistance, number of leaves, ability to flower, adaptation to different environmental conditions has been reported in garlic and this has been attributed to its apomictic nature which leads to the existence of extensive somatic mutations, chromosomal aberrations and genome plasticity. On the basis of flowering, there are three types- (i) Non bolting types –these do not form flower stalks, or do so only rarely, only primary cloves form (ii) Incomplete bolting types- these usually produce a flower stalk the terminal terminal of which (bulbils) often remains enclosed in pseudostem. Some of these types form a second set of cloves within the primary cloves, and may be confused with non-bolting types (iii). Complete bolting types- these bolt readily, producing a scape that terminates in an inflorescence containing sterile flowers and top sets (bulbils). Till date public sector has led to the release of approximately 20-25 varieties. Garlic is an erect herb, biennial, normally grown as an annual, up to 60 cm in height. Roots are adventitious. Stem is very short, condensed and flattened. Garlic has solid, flattened, V- shaped, longitudinally folded leaf blade with keel like lower surface. Garlic foliage leaf bases do not store food. Only bladeless storage leaf of the clove performs this function. Garlic is a compound bulb formed by many bulblets or cloves. Each clove originates from a lateral bud. The number of cloves varies in the range of 10 to 50; however, 15-20 cloves are commonly produced. Each clove consists of two mature leaves one is a paper-thin protective cylindrical sheath that encloses a single second thickened storage leaf that contains a small central vegetative bud. The storage leaf, accounting for most of the clove size, is fleshy and bladeless (Mahajan *et al.,* 2017). The genus Allium Linnaeus, 1753 (tribe Allieae) contains about 800 species worldwide of which almost 38 species are reported in India, including the globally important crops (onion, garlic, leek, shallot) and many wild species. A satisfactory chromosomal catalogue of Allium species is missing which has been considered in the review for the species occurring in India (Bhowmick et al., 2023). Identification of the wild progenitor of common garlic is difficult due to the sterility of its many cultivars, which limits the ability to cross test with wild relatives. Genetically and morphologically, garlic is most similar to the wild species *Allium longicuspis*, which grows in central and southwestern Asia. However, because *A. longicuspis* is also mostly sterile, it is doubtful that it is the ancestor of *A. sativum*. Other candidates that have been suggested include *A. tuncelianum*, *A. macrochaetum*, and *A. truncatum*, all of which are native to the Middle East. *Allium sativum* grows in the wild in areas where it has become naturalized. The "wild garlic", "crow garlic", and "field garlic" of Britain are members of the species *A. ursinum*, *A. vineale*, and *A. oleraceum*, respectively. In North America, *A. vineale* (known as "wild garlic" or "crow garlic") and *Allium canadense* (known as "meadow garlic", "wild garlic", or "wild onion") are common weeds in fields. So-called elephant garlic is actually a wild leek (*A. ampeloprasum*) and not a true garlic. Single clove garlic (also called pearl or solo garlic) originated in the Yunnan province of China (Wikipedia, 2025).

Subspecies and varieties

There are two subspecies of *A. sativum*, ten major groups of varieties, and hundreds of varieties, or cultivars. *A. sativum* var. *ophioscorodon* (Link) Döll, called *Ophioscorodon* or hardneck garlic, includes porcelain garlics, rocambole garlic, and purple stripe garlics. It is sometimes considered to be a separate species, *Allium ophioscorodon* G.Don. *A. sativum* var. *sativum*, or softneck garlic, includes artichoke garlic, silverskin garlic, and creole garlic. There are at least 120 cultivars originating from Central Asia, making it the main center of garlic biodiversity (Wikipedia, 2025).

BOTANICAL DESCRIPTION

Garlic is a perennial flowering plant that is native to Central Asia, South Asia and northeastern Iran. It grows from a bulb, with a tall, erect flowering stem that reaches up to 1 m. The leaf blade is flat, linear, solid, and approximately 1.25–2.5 cm wide, with an acute apex. The plant may produce pink to purple flowers from July to September in the Northern Hemisphere. The bulb has a strong odor and is typically made up of 10 to 20 cloves. The cloves close to the center are symmetrical, and those surrounding the center can be asymmetrical. Each clove is enclosed in an inner sheathing leaf surrounded by layers of outer sheathing leaves. If garlic is planted at the proper time and depth, it can be grown as far north as Alaska. It produces hermaphroditic flowers. It is pollinated by butterflies, moths, and other insects (Wikipedia, 2025). Garlic is widely used around the world for its pungent flavor as a seasoning or condiment. The garlic plant's bulb is the most commonly used part of the plant. With the exception of the single clove types, garlic bulbs are normally divided into numerous fleshy sections called cloves. Garlic cloves are used for consumption (raw or cooked) or for medicinal purposes. They have a characteristic pungent, spicy flavor that mellows and sweetens considerably with cooking. The distinctive aroma is mainly due to organosulfur compounds including allicin present in fresh garlic cloves. The leaves and flowers (bulbils) on the head (spathe) are sometimes eaten. They are milder in flavor than the bulbs, and are most often consumed while immature and still tender. Immature garlic is sometimes pulled, rather like a scallion, and sold as "green garlic". When green garlic is allowed to grow past the "scallion" stage, but not permitted to fully mature, it may produce a garlic "round", a bulb like a boiling onion, but not separated into cloves like a mature bulb. Green garlic imparts a garlic flavor and aroma in food, minus the spiciness. Additionally, the immature flower stalks (scapes) of the hardneck types are sometimes marketed for uses. Inedible or rarely eaten parts of the garlic plant include the "skin" covering each clove and root cluster. Immature scapes are tender and edible. They are also known as "garlic spears", "stems", or "tops". Scapes generally have a milder taste than the cloves. In garlic, the scape (the flowering stalk) emerges before the bulb fully develops. The scape is the first visible sign of growth above ground, while the bulb develops underground. Garlic leaves are a popular vegetable in many parts of Asia. The leaves are cut, cleaned, and then stir-fried with eggs, meat, or vegetables. Garlic powder is made from dehydrated garlic and can be used as a substitute for fresh garlic, though the taste is not quite the same. Garlic salt combines garlic powder with table salt Garlic is widely used around the world for its pungent flavor as a seasoning or condiment. The garlic plant's bulb is the most commonly used part of the plant. With the exception of the single clove types, garlic bulbs are normally divided into numerous fleshy sections called cloves. Garlic cloves are used for consumption (raw or cooked) or for medicinal purposes. They have a characteristic pungent, spicy flavor that mellows and sweetens considerably with cooking. The distinctive aroma is mainly due to organosulfur compounds including allicin present in fresh garlic cloves. The leaves and flowers (bulbils) on the head (spathe) are sometimes eaten. They are milder in flavor than the bulbs, and are most often consumed while immature and still tender. Immature

garlic is sometimes pulled, rather like a scallion, and sold as "green garlic". When green garlic is allowed to grow past the "scallion" stage, but not permitted to fully mature, it may produce a garlic "round", a bulb like a boiling onion, but not separated into cloves like a mature bulb. Green garlic imparts a garlic flavor and aroma in food, minus the spiciness.. Additionally, the immature flower stalks (scapes) of the hardneck types are sometimes marketed for uses. Inedible or rarely eaten parts of the garlic plant include the "skin" covering each clove and root cluster. Immature scapes are tender and edible. They are also known as "garlic spears", "stems", or "tops". Scapes generally have a milder taste than the cloves. In garlic, the scape (the flowering stalk) emerges before the bulb fully develops. The scape is the first visible sign of growth above ground, while the bulb develops underground. Garlic leaves are a popular vegetable in many parts of Asia. The leaves are cut, cleaned, and then stir-fried with eggs, meat, or vegetables. Garlic powder is made from dehydrated garlic and can be used as a substitute for fresh garlic, though the taste is not quite the same. Garlic salt combines garlic powder with table salt (Wikipedia, 2025).

BATANICAL DESRIPTON

Garlic is a hardy, bulbous, rooted, perennial plant with narrow flat leaves and bears small white flowers and bulbils. The compound bulb consists of 6 to 34 bulblets called ‘cloves’ which are surrounded by a common, thin, white or pinkish papery sheet. Garlic has a strong flavour and taste (Indianspices, 2025). Garlic is one of the most used crops among the cultivated Allium species. It is a perennial flowering plant that grows from a bulb that contains outer layers of thin, whitish sheaths or skin that enclose various lobes known as cloves. One garlic bulb may contain 10 to 20 edible cloves that are asymmetrical in shape, except for the small ones, which are close to the center. Cloves, which are also covered by protective whitish skin, have a distinctive smell (Plantvillage, 2025). Garlic consists of fresh or dried bulbs of the botanical plant *Allium sativum*. It’s cultivated worldwide. The bulb or clove is the part of the plant that’s used most often. But sometimes garlic oil is used. Garlic is best stored hung in a dry place. Garlic contains alliin. When this is ground, it makes the strong-smelling, potent antibacterial agent allicin. Garlic may have antibacterial effects. It’s also said to protect against atherosclerosis and stroke. This is because it keeps platelets from sticking together. It may also lower high blood pressure and cholesterol (Plantvillage, 2025). Garlic consists of fresh or dried bulbs of the botanical plant *Allium sativum*. It’s cultivated worldwide.

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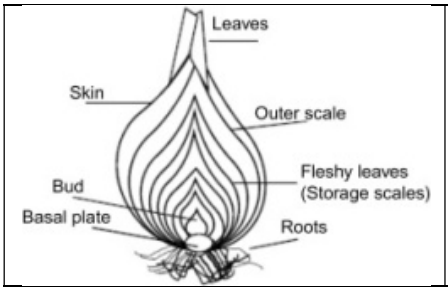
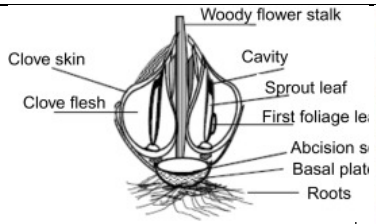
<table>
<tr><td> 
</td><td> 
</td><td>  </td></tr>
<tr><td>Major parts of onion</td><td>Major parts of garlic</td><td>Planting clove</td></tr>
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Clove</td><td>Bulb and Cloves</td><td>Bulb and Cloves</td></tr>
</table>

Continue ……

Bulb and Cloves

Bulb and Cloves

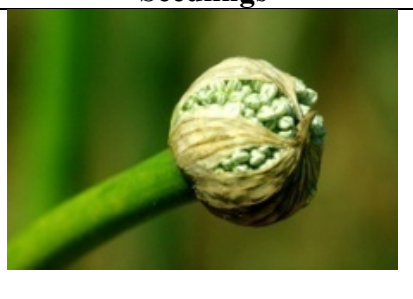
Cloves

Sprout emerging

Seedlings

Scapes

Scapes



Flower Head

Flower Head

Flower Head

Beginning to turn yellow

Left to dry

Fig. 1. Botanical Desrciption

GENETICS AND CYTOGENETICS

Garlic (*Allium sativum*) exhibits significant genetic diversity and has been studied using various molecular markers to understand its genetic makeup and relationships with other *Allium* species. Cytogenetic studies focus on the structure and behavior of chromosomes, which can be used to identify and differentiate garlic varieties. Genetic Diversity: Various molecular markers, including RAPD (Randomly Amplified Polymorphic DNA), SSR (Simple Sequence Repeat), and SRAP (Sequence-Related Amplified Polymorphism), have been used to assess genetic diversity in garlic. These markers reveal a high level of genetic variation within garlic populations. Cluster analysis, often based on similarity matrices derived from molecular marker data, helps group garlic genotypes based on their genetic relatedness. Gene banks play a crucial role in preserving garlic genetic resources, and studies have been conducted to evaluate the diversity within these collections. Research has identified distinct genetic populations within garlic, with some showing higher bulb weight. Cytogenetics: Garlic's chromosome number is typically 2n=16, but aneuploidy (abnormal chromosome number) and polyploidy (multiple sets of chromosomes) can occur (AIO, 2025).

Garlic belongs to the *Allium* genus, which includes more than 750 species divided into more than 60 taxonomic groups. It is cultivated in many countries throughout the world for the bulb and used as a spice and functional food. The plant vegetatively propagates. This review will focus on origins, biology, analysis of genetic diversity, pharmacological properties of garlic. It appears from this synthesis that the *Allium sativum* species is derived from *Allium longicuspis* and is native to Central Asia. Studies on the analysis of genetic diversity through morphological markers revealed a wide variation in the color, shape and number of cloves and the ability to flower. Biochemical markers such as Esterase (EST), Phosphoglucomutase (PGI), Malate Deshydrogenase (MDH), and Diaphorase (DIA as well as molecular markers such as *Random Amplified Polymorphic DNA* (RAPD), *restriction fragment length polymorphism* (RFLP), *Amplified Fragment Length Polymorphism* (AFLP), and *Simple Sequence Repeats* (SSRS) *Inter-Simple Sequence Repeat* (ISSR) were successfully used. RFLPs or RAPD are the most used for assessing genetic variability within asexually reproducing garlic species. Work using SSRs markers is limited in garlic relative to other crops (Agbo So *at al.,* 2021)

GENETIC DIVERSITY

Garlic (*Allium sativum*) exhibits a high level of genetic diversity, particularly among its wild relatives, though cultivated garlic displays less variation due to its vegetative propagation. This diversity is crucial for breeding programs aimed at improving garlic varieties. Studies using molecular markers like SSRs and ISSRs have helped reveal the extent of genetic variation and structure within garlic populations. While cultivated garlic is less diverse than its wild relatives, it still shows considerable variation, especially when considering different cultivars and geographic origins. Techniques like SSR (simple sequence repeat) and ISSR (inter-simple sequence repeat) markers have been used to assess genetic diversity in garlic, revealing the number of alleles, polymorphic loci, and genetic similarity among accessions. Morphological characteristics, such as bulb size, clove number, and foliage traits, can also be used to evaluate genetic diversity, but these traits can be influenced by environmental factors. Studies have identified distinct genetic populations within garlic, with some populations showing higher diversity than others. Understanding garlic's genetic diversity is essential for developing new varieties with improved traits like disease resistance, yield, and storage quality. Garlic genetic resources contain rare alleles that can be valuable for future breeding programs. Studies have identified specific garlic accessions with high levels of genetic diversity, which could be used for garlic improvement (AIO., 2025).

BREEDING

Propagation: The method of propagating garlic from planting cloves is called division. Asexual propagation of garlic for production purposes requires cool temperatures that can vary depending on the cultivar. Hardneck varieties require long cold temperature exposure whereas softneck varieties thrive in milder climates. This cold climate is required for the process of vernalization, a form of stratification of the cloves necessary for the development of multiple-clove bulbs. Solo garlic is the result of garlic grown without the process of vernalization (Wikipedia, 2025).

Germplasm resources: In India, ICAR-NBPGR nominated ICAR-Directorate of Onion and Garlic Research (DOGR), Rajgurunagar as a National Active Germplasm Site (NAGS) for collection and conservation of garlic germplasm. Presently, ICAR-DOGR holds almost 700 garlic ecotypes in field gene bank. All this genotypes are characterized by 25 agro-morphological traits. This entire germplasm collection is collected through exploration and collection trips throughout India. Besides ICAR-DOGR, National Horticultural Research and Development Foundation, Nasik; MPKV, Rahuri; ICARVPKAS, Almora; and Junagadh Agricultural University, Junagadh; also involve in garlic germplasm maintenance. However, CITH, Srinagar act as active germplasm site for long day garlic genotypes. Based on temperature and day-length response, garlic has been classified as having long-day and short day varieties. It has also been classified as having hard neck and soft neck varieties. Hard-neck varieties bolt and flower but these flowers are usually sterile, while softneck varieties do not flower *at al*l. Hard neck varieties cannot be braided for storage whereas soft neck varieties can be braided and stored. Hard neck (long- day varieties) is characterized by big bulbs, less number of cloves (10-15), ease of peeling and, generally, have low storage life. Typical examples are Agrifound Parvati and Chinese garlic. Because of big size, their productivity is higher and these fetch a good price in local and international markets. Soft-neck (short-day) varieties are characterized by small bulbs, more number of cloves (20-45), more aroma and are, generally, good storer. The short day garlic grown in plains of North India, western India and hills of Nilgiris suffer from degeneration

effects, small size of clove and susceptibility to diseases, pests and finally low yield. Therefore, improvement is needed to solve these problems. At ICAR-DOGR, core set of entire garlic has been developed which comprises 46 garlic accessions. These accessions represent variability of total 625 entire collection of ICAR-DOGR garlic accessions. These set containing accessions with high-low yield, bigger-small clove, high-less allicin, high-low TSS, three type of plant architecture, thin and wide leaf width, three range of leaf colour. Besides maintaining garlic germplasm in field, ICAR- DOGR also developed a protocol for *in vitro* slow growth conservation at ambient temperature where established plantlets can be slow growth conserved up to four months. This will be alternate conservation strategy for field gene bank, as in the field, crop can be devastated due to natural calamities. Work on enhancing conservation period (*in vitro* at normal temperature) up to six months is in progress (Mahajan *et al.,* 2017).

Breeding: Garlic is second most important bulb crop after onion. It is an important spice crop belonging to family Amaryllidaceae. Despite the importance of crop, very limited breeding work has been done so far.' As a first step of Systemic breeding programme, collection and evaluation of germlasm is required. Clonal selection of local existing types in various regions is the important method of improvement. Estimation of correlation and path analysis are useful in developing suitable selection criteria for selecting desired plant type or developing high yielding varieties. Improvement techniques like polyploidy, mutation breeding and tissue culture have helped in improving the garlic traits (Agrawal *et al,,* 2003). The demand for garlic products with specific characteristics and constant increase in garlic production require the breeding of this crop and its adaptation to different climatic conditions. Commercial garlic varieties are propagated vegetatively due to their complete sterility.

New varieties have been selected only from existing living collections, natural or induced mutations. Garlic fertility has been restored in the last decades, and research and breeding have undergone rapid progress. Currently, breeding in garlic is developing in three main directions: 1) conventional vegetative selection from variable germplasm collections; 2) breeding and selection from sexually-reproduced populations; and 3) employment of biotechnological tools. Novel methods of genome editing and marker-assisted breeding are not available in garlic yet, and therefore, fertility restoration, hybridization, and seed production are the most important goals in future breeding. The variability of seed-producing garlic lines is already available, but breeding and propagation from seed are still far from the commercial stage. Large investments are required for the development of seed-propagated garlic and breeding via hybridization, but the advantages of this approach for the future improvement of modern garlic are evident. Cleaning from viruses and diseases and in vitro propagation of outstanding varieties can improve the existing garlic cultivars (Kamenetsky-Goldstein and Shemesh-Mayer, 2024).

Selection: Breeding methods for development of garlic are limited to clonal and mutagenesis among conventional methods, and somaclonal variation among biotechnological approaches. In India, most varieties have been developed through clonal selection and one or two through introduction. National Horticultural Research and Development Foundation (NHRDF) has been at the forefront of garlic research (with maximum number of varieties developed under their research programmes), followed by agricultural universities, *viz.,* Gujarat Agricultural University (GAU), Punjab Agricultural University (PAU), MPKV, Rahuri. Later on ICAR-Directorate of Onion and Garlic Research, NHRDF and State Agricultural University started working and few more varieties have been developed under All India Network Research Project on Onion and Garlic. Yield potential of all these varieties is in typical range and percent increase over check varieties is not crossing due to clonal selection. Clonal propagation method in garlic limits use in application of conventional breeding method through crossing. Except few accessions from place of origin of garlic all are exclusively clonally propagated. In India, two long day type accessions are showing flowering where pollens are sterile in nature. Hence, there is urgent need to study on restoration of fertility in flowering garlic and induce flowering in other types of garlic for varietal improvement. The environmental conditions might be allowed for fertility restoration and seed production in bolting type of garlic.

Assessed 32 garlic genotypes for bolting behavior using molecular marker and find 10 bolting accessions which further can be used for imposing environmental manipulation Sartificially for flowering study. DRDO, 2005 reported from Ladakh that the garlic under long day photoperiod (14-16 hrs.) bolts and produces aerial true to type bulbils. A long photoperiodic requirement of these genotypes was evident from the non-flowering of same garlic varieties under northern parts of India during April-July with 13 hours photoperiod. The scientists of different institutes including ICAR-DOGR have now started induce the genetic variability through irradiation treatment, mutagens and *in vitro* somaclone development. Some promising lines were studied for variability and stability. The germplasm collections at the NHRDF were considerably augmented by introducing 475 accessions from exotic and indigenous sources in garlic. The significant progress has taken place during the past three and half decades in development of ten high yielding varieties.

During the course of evaluation/investigation/study of germplasm several genotypes selected for further recommendation for varieties development and also several technology developed and demonstrated to farmers fields (Mahajan *et al.,* 2017). Garlic (*Allium sativum* L.) is one of the relevant strategic vegetable commodities in the world. Since garlic is a widely known sterile crop, developing new cultivars has relied mainly on clonal selection. Determining genetic variability among the local accessions of garlic is a vital step in a garlic breeding program. In the presented study, 14 local garlic accessions incurred evaluation for their genetic variability based on morphological traits and SSR markers. The results showed that local accessions displayed high genetic variability based on the morphological and molecular characteristics. Principle component analysis (PCA) indicated that 75.26% of total variation came from four PCs mainly determined by the traits, *viz.,* plant height, number of leaves, leaf length, leaf width, degree of leaf waxiness, intensity of anthocyanin coloration at the base of the pseudo-stem, bulb diameter, leaf density, cross-section shape of leaf, and the shape of the basal plate. Molecular analysis based on 10 SSR markers revealed that high allelic variation (2-12 alleles) was evident among garlic accessions (Aswani et al., 2024).

Table: List of garlic varieties developed by different organization in India (Mahajan *et al.,* 2017).

No. Organisation and Varieties.

1. MPKV, Rahuri. Godawari (P), Sweta (W), Phule Baswant (P)
2. IARI, New Delhi. Pusa Sel – 10
3. HAU, Hissar. HG 1 (W), HG 2 (W)
4. NHRDF, Nasik. Short day - G-1 (W), G-41 (W), G-50 (W), G-189 (W), G-282 (W), G-323 (W), W-384 (W), W-386. Long day- G-313 (P), G-404 (W), W-408 (W)
5. VPKAS, Almora. Long day- VLG 1 (W), VGP-5 (W), VL-6 (W), VL-7 (W),
6. ARU, Almora. ARU 52 (W)
7. PAU, Ludhiana, Punjab. Garlic –1, Garlic 56-4 (W)
8. GAU, Gujarat. GG-1 (W), GG-2 (W), GG-10 (W)
9. ICAR-DOGR, Rajgurunagar. Bhima Omkar (W), Bhima Purple (P)
10. TNAU, Coimbatore. Ooty 1 (W)
11. DARL, Long day. DARL 52 (W)
12. Bihar Agril. College, Sabour. RAUG-5 (W)
13. ICAR-CITH, Srinagar. CITH-G-1 (P), CITH-G-2 (P), CITH-G-3 (W)
14. *W= White coloured bulb P= Pink coloured bulbs*

Table Recommendation for varietal release (Mahajan *et al.,* 2017).

Garlic line VGP-5 of VPKAS, Almora identified for Zone I.
Garlic line G-189 from NHRDF identified for Zone III, IV and VI.
Garlic \ line NRCRG-1 (316) of DOGR identified for Zone III and VI.
Garlic line G-408 of NHRDF identified for Zone I.
Garlic line Mukteshwar Selection-2 of CITH identified for Zone I.
Garlic line CITH-1 of CITH, Srinagar identified for Zone I.
Garlic line G-313 from NHRDF identified for Zone I.
Garlic line G-384 of NHRDF identified for Zone II.
Garlic line G-386 from NHRDF identified for zone –II.
Garlic line CITH-G-3 of CITH identified for release in Hill Zone-I.
Garlic line VGP-5 of VPKAS, Almora identified for Zone I.
Garlic line G-189 from NHRDF identified for Zone III, IV and VI.
Garlic line NRCRG-1 (316) of DOGR identified for Zone III and VI.
Garlic line G-408 of NHRDF identified for Zone I.
Garlic line Mukteshwar Selection-2 of CITH identified for Zone I.
Garlic line CITH-1 of CITH, Srinagar identified for Zone I.
Garlic line G-313 from NHRDF identified for Zone I.
Garlic line G-384 of NHRDF identified for Zone II.
Garlic line G-386 from NHRDF identified for zone –II.
Garlic line CITH-G-3 of CITH identified for release in Hill Zone-I.

Ooty 1: Released during 1991. Selection from germplasm. Yield: 17 t/ha. Duration: 120-130 days.. Bulb is dull white in colour. Average bulb weight is 30-40 grams. Resistance to Thrips & tip drying (TNAU, 2025).

Ooty 2: Released during 2019. NHRDF varieties

- i.e. Agrifound White , Yamuna Safed , Yamuna Safed-2 , Yamuna Safed-3 , Yamuna Safed-4, Yamuna Safed-5 , Agrifound Parvati , and Agrifound Parvati-2 and Yamuna Safed-8. Varieties developed by ICAR-DOGR
- Bhima Omkar, Bhima Purple.
- Other institution varieties
- Godavari,Shweta,Phule Baswant,GG 4,VL Garlic 1,VL Lahsun 2
- local types
- Singapore red, Rajali, Tabiti, Cerole, Madrasii, Mettupalayam
- (TNAU, 2025).

Varieties: It is difficult to identify the wild primogenitor of common garlic due to the presence of numerous cultivars (clones). This makes it difficult to classify the clones. Despite this, there are two well-known garlic varieties, namely, cv. group Ophioscorodon, also known as hard-necked garlic, and cv. group Common Garlic, commonly referred to as soft-necked garlic. While the cv. group Common Garlic has a straight stalk, the cv. group Ophioscorodon, on the other hand, has a curvy scape. In addition, hard-necked garlic is best suited for the northern climate, while soft-necked garlic flourishes in southern climates. The two varieties do well in Kenya, although the soft-necked is more commonly planted (Plantvillage, 2025). Elephant garlic **(**Allium ampeloprasum**)** is often sold as garlic, but is actually more closely related to leeks. It produces a big bulb with a small number of very large cloves, which have a mild flavour. It needs a long, warm. The period of time when an individual plant is in active

growth. This will depend on the local climate and light levels, and can vary between different plants, although it is broadly from spring to autumn.growing season to produce a good crop and is best planted in October. The cloves sometimes don't divide, producing just a slightly larger single-clove (solo) bulb. Early planting often reduces the occurrence of solo bulbs. You can either eat solo bulbs or re-plant them the following autumn – they will usually go on to produce a multi-clove bulb (RHS, 2025). 'Cristo': A softneck variety with pure white bulbs. Has a strong flavour but a light aroma. Stores well. The RHS Award of Garden Merit (AGM) helps gardeners choose the best plants for their garden. Wild bees and other pollinators are in decline. The Plants for Pollinators initiative helps gardeners easily identify plants that encourage them back into the garden. 'Germidour': A well known and reliable softneck variety. Large bulbs with a fairly mild, but rich flavour. The RHS Award of Garden Merit (AGM) helps gardeners choose the best plants for their garden. Wild bees and other pollinators are in decline. The Plants for Pollinators initiative helps gardeners easily identify plants that encourage them back into the garden. 'Laurtrec Wight': Originally from Lautrec in France, this is a classic hard necked variety. White skinned bulbs with deep pinky-purple cloves (RHS, 2025).

Types: Before you choose a variety of garlic, you need to consider your climate, which determines whether you plant a hardneck or softneck variety. Then you need to consider your cooking because different varieties have different taste profiles, from mild to sweet to bold to spicy! (Boeckmann, 2025).

Hardnecks are the best choice for Northern gardeners. This variety is extremely cold hardy for harsh winters. These grow one ring of fat cloves around a hard stem, with fewer but larger cloves per bulb than softnecks. Bonus! Hardnecks produce flower stems, aka "scapes," which must be cut to encourage the bulbs to reach their full potential. The scapes themselves are an early summer treat, delicious if chopped into salads or added to stir-fries (Boeckmann, 2025). Popular hardneck varieties: 'Music' (on the mild side yet rich and mellow); 'Chesnok Red' (mild and sweet, creamy texture when roasted); 'Early Italian' (sweeter flavor that won't overpower dishes); 'German Red' (robust, classic garlic flavor which cooks love); 'Spanish Roja' (strong and hot, heirloom with classic garlic flavor) (Boeckmann, 2025).

Softnecks are more common with Southern gardeners, growing well in warm climates with warm winters. They have more intense flavors and tend to grow bigger bulbs with smaller cloves per bulb because energy is not being diverted to top-set bulblets like hardnecks. They do not have scapes, but they store better than hardnecks. Like their name suggests, they have necks that stay soft after harvest and, therefore, are the types that you see braided together (Boeckmann, 2025). Popular softneck varieties: 'California White Early' (classic moderate garlic flavor, most popular grocery store type, harvest in spring); 'California White Late' (harvest in summer); 'Inchelium Red' (wonderful but mild garlic flavor, superior storage life); 'Silver White' (classic garlic, great storage, excellent for beginner); 'Lorz Italian' (hot and zesty heirloom, popular with cooks) (Boeckmann, 2025).

Elephant Garlic: Elephant garlic isn't a true garlic, but it is grown similarly to hardneck varieties, requiring a long, cool growing season in zones 3 through 9. Most types take about 90 days to harvest once growth starts. Despite its size, it has quite a mild flavor, more similar to onion and shallots than traditional garlic. Bulbs and cloves are large (up to one pound each!), with just a few cloves to a bulb (Boeckmann, 2025).

Uses

Because of sulfur compounds circulating in blood, consumed garlic may act as a mosquito repellent, although there is no scientific evidence of its efficacy (Wikipedia, 2025). Furthermore, garlic is widely valued for its medicinal importance as it contains bioactive constituents that are believed to help the body fight viral, fungal, and bacterial infections, among other health benefits such as lowering blood sugar and cholesterol levels, among others. In addition, garlic extracts have pesticide properties that play a vital role in protecting plants from some pests and diseases like African armyworm, downy mildew, and rice bugs, among others. While it is beneficial in organic farming, its use as a pesticide should be moderated as it can kill beneficial soil bacteria and insects due to its broad-spectrum effects (Plantvillage, 2025). Garlic is primarily used for flavoring food and can be dried, ground or powdered for this purpose (Plantvillage, 2025). Some animal studies suggest that garlic may improve insulin release, but there is no evidence to support this effect in humans. Other studies show that garlic may improve the elasticity of the aorta. It may also keep atherosclerotic plaque from forming. There is some evidence that says garlic can slightly lower cholesterol levels. But recent research done by the National Center for Complementary and Integrative Health found that garlic has no effect on cholesterol. Some research shows that taking garlic by mouth can modestly reduce blood pressure. This effect was seen in people with high blood pressure. It was also seen in people with normal blood pressure. The evidence indicates that garlic, when used with a knowledgeable healthcare provider, can help lower blood pressure in people with hypertension (Garilli, Southard and Wojcik, 2025). There may be benefits that have not yet been proven through research. Some reports suggest that garlic may help prevent or treat cancer. Garlic contains allicin. This is a strong antibiotic. It's released when cloves are crushed or chewed. Garlic has been used as an antiseptic, antibacterial, and antifungal agent. It may help the body resist or destroy viruses and other microorganisms. It does this by boosting the immune system. Garlic is also claimed to fight infections. It may also build up strength. Garlic may also have laxative effects. Garlic may also help treat these issues: Chronic bronchitis. Chronic mucus in your nose and throat (catarrh). Recurrent colds and respiratory infections. Chronic earaches. Sore throat. Sinus problems. Flu. Yeast infections and Intestinal worms (Garilli, Southard and Wojcik, 2025). Garlic is available fresh or dried in oral capsule form. The enteric-coated capsules are easiest for the body to absorb. It also comes as an extract and as odorless supplements. The quality of commercial forms of garlic varies a lot. Use garlic exactly as directed on the label (Garilli, Southard and Wojcik, 2025).

Garlic is a preferred condiment for flavouring various dishes like mayonnaise, salad dressings, pickles, curry powders, marinades, sauces, soups, stews, curried vegetables, and meat preparations. Raw garlic is used to make garlic products like garlic powder,

garlic salt, garlic oil, and garlic vinegar. When storing fresh garlic, keep whole heads of garlic unpeeled, in an open container preferably in a cool, dry place, away from direct sunlight. Garlic cloves can be stored in the freezer for several months while chopped garlic should be refrigerated. While storing garlic in the refrigerator, keep it in an airtight container to prevent the odor of garlic from affecting other foods (Justgot, 2025). According to Central European folklore, garlic was believed to ward off evil, including demons, were wolves, and vampires. Garlic plays a symbolic role in Nowruz, Persian New Year. Nowruz is a celebration of the arrival of spring and marks the first day of the Iranian calendar. One tradition performed on this day involves decorating a Haft-sin table with seven items beginning with the letter 's' in Farsi, each representing a hope for the new year. Garlic is one of them, to represent medicine and good health (KEW, 2025). Every part of the garlic plant is edible. It is widely used around the world as a seasoning. The strongly aromatic bulb is the most popular part of the plant. It is used either fresh or as a dry powder or oil. Crushing or grinding the fresh garlic cloves intensifies their flavour and aroma. Garlic flower stalks (scapes) and leaves are also sometimes used in cooking, and immature, green garlic bulbs can be found in some Southeast Asian and Chinese dishes (KEW, 2025). Garlic has many uses. It is mostly used for culinary purposes and people all over the world use it as a condiment for different food items. In India and other Asian countries, it is used in several food preparations like chutneys, pickles, curry powders, curried vegetables, meat preparations, tomato ketchup, etc. The raw garlic can also be used in the manufacturing of garlic powder, garlic salt, garlic vinegar, garlic cheese croutons, garlic potato chips, garlic bread (Indianet, 2025). Besides the culinary usages, garlic is also well known for having numerous valuable medicinal properties. Garlic is considered one of the oldest medicines in the world and is used in making remedies for various ailments and physiological disorders. According to Ayurveda and Unani medicine, it can aid in digestion and absorption of food and is also given in flatulence. Garlic is used in treatment of the diseases like running cold, saliva formation, chronic bronchitis, respiratory catarrh, whooping cough, bronchial asthma, influenza, chronic diarrhoea, pulmonary tuberculosis, rheumatism, impotence, etc. It can also fight infection, reduce cholesterol, protect against heart diseases and stroke, control diabetes, and prevent cancer (Indianet, 2025). Garlic is widely used around the world for its pungent flavour, as a seasoning or condiment. Depending on the form of cooking, the flavor is either mellow or intense. It is often paired with onion, tomato, or ginger. The parchment-like skin is much like the skin of an onion, and is typically removed before using in raw or cooked form. An alternative is to coat heads of garlic and roast them in the oven. The garlic softens and can be extracted from individual cloves by squeezing one end. Oils are often flavored with garlic cloves. Commercially prepared oils are widely available, but when preparing garlic-infused oil at home, there is a risk of botulism if the product is not stored properly. To reduce this risk, the oil should be refrigerated and used within one week. Manufacturers add chemicals and/or acids to eliminate the risk of botulism in their products. In Chinese cuisine, the young bulbs are pickled for 3–6 weeks in a mixture of sugar, salt and spices. In Russia and the Caucasus, the shoots are pickled and eaten as an appetizer. Immature scapes are tender and edible. They are also known as 'garlic spears', 'stems', or 'tops'. Scapes generally have a milder taste than cloves. They are often used in stir frying or prepared like asparagus. Garlic leaves are a popular vegetable in many parts of Asia, particularly Chinese, Vietnamese, Cambodian and Korean cuisines. The leaves are cut, cleaned and then stir-fried with eggs, meat, or vegetables. Garlic is essential to several Mediterranean dishes. Mixing garlic with eggs and olive oil produces aioli ("garlic and oil" in Provençal). The Spanish variant does not use eggs. Garlic, oil, and a chunky base produce skordalia (from the Greek and Italian names of garlic). Blending garlic, almond, oil and soaked bread produces ajoblanco (*ajo blanco* is Spanish for "white garlic") (Wikidoc, 2025).

Garlic is widely used around the world for its pungent flavor as a seasoning or condiment. The garlic plant's bulb is the most commonly used part of the plant. With the exception of the single clove types, garlic bulbs are normally divided into numerous fleshy sections called cloves. Garlic cloves are used for consumption (raw or cooked) or for medicinal purposes. They have a characteristic pungent, spicy flavor that mellows and sweetens considerably with cooking. The distinctive aroma is mainly due to organosulfur compounds including allicin present in fresh garlic cloves and ajoene which forms when they are crushed or chopped. A further metabolite allyl methyl sulfide is responsible for garlic breath. Other parts of the garlic plant are also edible. The leaves and flowers (bulbils) on the head (spathe) are sometimes eaten. They are milder in flavor than the bulbs, and are most often consumed while immature and still tender. Immature garlic is sometimes pulled, rather like a scallion, and sold as "green garlic". When green garlic is allowed to grow past the "scallion" stage, but not permitted to fully mature, it may produce a garlic "round", a bulb like a boiling onion, but not separated into cloves like a mature bulb. Green garlic imparts a garlic flavor and aroma in food, minus the spiciness. Green garlic is often chopped and stir-fried or cooked in soup or hot pot in Southeast Asian and Chinese cookery, and is very abundant and low-priced. Additionally, the immature flower stalks (scapes) of the hardneck are sometimes marketed for uses similar to asparagus in stir-fries (Wikipedia, 2025). Inedible or rarely eaten parts of the garlic plant include the "skin" covering each clove and root cluster. The papery, protective layers of "skin" over various parts of the plant are generally discarded during preparation for most culinary uses, though in Korea immature whole heads are sometimes prepared with the tender skins intact. The root cluster attached to the basal plate of the bulb is the only part not typically considered palatable in any form. An alternative is to cut the top off the bulb, coat the cloves by dribbling olive oil (or other oil-based seasoning) over them, and roast them in an oven. Garlic softens and can be extracted from the cloves by squeezing the (root) end of the bulb, or individually by squeezing one end of the clove. In Korea, heads of garlic are heated over the course of several weeks; the resulting product, called black garlic, is sweet and syrupy, and is used in the US, Europe and Australia, either produced domestically or imported. Garlic may be applied to different kinds of bread, usually in a medium of butter or oil, to create a variety of classic dishes, such as garlic bread, garlic toast, bruschetta, crostini, and canapé. The flavor varies in intensity and aroma with the different cooking methods. It is often paired with onion, tomato, or ginger (Wikipedia, 2025). Numerous cuneiform records show that garlic has been cultivated in Mesopotamia for at least 4,000 years. The use of garlic in China and Egypt also dates back thousands of years. Well-preserved garlic was found in the tomb of Tutankhamun (c. 1325 BC). It was consumed by ancient Greek and Roman soldiers, sailors, and rural classes and, according to Pliny the Elder by the African peasantry. Garlic was placed by the ancient Greeks on the piles of stones at crossroads, as a supper for Hecate (Theophrastus, *Characters, The Superstitious Man*). Garlic was rare in traditional English cuisine (though it is said to have been grown in England before 1548)

but has been a common ingredient in Mediterranean Europe. Translations of the c. 1300 Assize of Weights and Measures, an English statute generally dated to the 13th century, indicate a passage as dealing with standardized units of garlic production, sale, and taxation—the hundred of 15 ropes of 15 heads each but the Latin version of the text may refer to herring rather than garlic. Garlic oil is used as a dietary supplement or digestive aid commonly sold in capsules, which may be diluted with other ingredients. Some commercial preparations are produced with various levels of dilution, such as a preparation that contains 10% garlic oil. There is no clinical research confirming health effects of consuming garlic oil. Stabilized garlic flavor blend is a proprietary mixture of dehydrated garlic powder infused with garlic oil, which increases the flavor of the garlic powder. Garlic oil can be used as an insecticide, diluted with water and sprayed on plants (Wikipedia, 2025a).

Garlic is widely used around the world for its pungent flavor, as a seasoning or condiment. Depending on the form of cooking, the flavor is either mellow or intense. The parchment-like skin is much like the skin of an onion, and is typically removed before using in raw or cooked form. An alternative is to cut the top off the bulb, coat cloves of garlic by dribbling olive oil (or other oil based seasoning) over them and roast them in the oven. The garlic softens and can be extracted from the cloves by squeezing the (root) end of the bulb or individually by squeezing one end of the clove. Oils are often flavored with garlic cloves. Commercially prepared oils are widely available, but when preparing garlic-infused oil at home, there is a risk of botulism if the product is not stored properly. To reduce this risk, the oil should be refrigerated and used within one week. Manufacturers add acids and/or other chemicals to eliminate the risk of botulism in their products. In Chinese cuisine, the young bulbs are pickled for 3–6 weeks in a mixture of sugar, salt and spices. In Russia and the Caucasus, the shoots are pickled and eaten as an appetizer. Immature scapes are tender and edible. They are also known as 'garlic spears', 'stems', or 'tops'. Scapes generally have a milder taste than cloves. They are often used in stir frying or prepared like asparagus. Garlic leaves are a popular vegetable in many parts of Asia, particularly Chinese, Vietnamese, Cambodian, Laotian and Korean cuisines. The leaves are cut, cleaned and then stir-fried with eggs, meat, or vegetables. Garlic is essential to several Mediterranean dishes. Mixing garlic with eggs and olive oil produces aioli ("garlic and oil" in Provençal). The Spanish variant does not use eggs. Garlic, oil, and a chunky base produce skordalia (from the Greek and Italian names of garlic). Blending garlic, almond, oil and soaked bread produces ajoblanco (*ajo blanco* is Spanish for "white garlic"). Le Tourin is a French garlic soup. In Asia, garlic is fundamental to Korean and Thai cuisine. In Chinese cuisine, it is usually chopped and stir-fried with chopped ginger and other aromatics in oil as the basis of sauces. Japanese cuisine uses very little garlic (Bionity, 2025). Garlic is used for flavouring various dishes practically all over the world. In United States almost half of the produce is dehydrated for use in mayonnaise products, salad dressings and in several meat preparations. Raw garlic is used in the preparation of garlic powder, garlic salt, garlic vinegar, garlic cheese croutins, garlicked potato chips, garlic bread, garlicked bacon etc. Spray dried garlic products, liquid garlic preparations are other products. In India and other Asian and Middle East Countries, garlic is used in pickles, curry powders, curried vegetables, meat preparations etc. Oil of garlic is used as a flavouring agent in soups, canned foods, sauces etc. The other properties are anti-bacterial, fungicidal and insecticidal. In the area of medicine, it is used for various ailments of stomach, skin diseases. It has wider applications in indigenous medicines and is also considered as highly nutritive (Indianspices, 2025).

Nutritional value

Garlic is a herb that has very few calories and is very nutrient-dense. Around 3 grammes of raw garlic, or one clove, has 4.5 calories, 0.2 grammes of protein, and 1 gramme of carbohydrates in addition to the following:

- 2% of the recommended daily intake: manganese.
- 2% of the daily dose: vitamin B6
- 1% of the recommended daily intake: vitamin C
- 1% of the daily value: selenium
- 0.06 grammes of fibre (PW, 2023).

Garlic is an extremely nutritious vegetable with very minimal calories about 4.5 calories, while it offers 0.2 grams of protein, and 1 gram of carbs. It also contains trace amounts of several other vital nutrients. A single clove of about 3 grams of raw garlic provides: Manganese: 2% of the daily value (DV), Vitamin B6: 2% of the DV, Vitamin C: 1% of the DV, Selenium: 1% of the DV, Fiber: 0.06 grams, Sodium: 0.5mg and Zinc: 0.04mcg (Netmeds, 2023). The average garlic bulb has 65 % water, 28 % carbohydrates, 2.3 % OSC, 2 % proteins, 1.2 % free amino acids, 1.5 % fibre and minerals including potassium (93.4–401 mg/100 g), sulfur (183.4 mg/100 g), aluminium (0.47 mg/100 g), iron (1.7–3.11 mg/100 g), sodium (8.93–17 mg/100 g), magnesium (15.4- 25 mg/100 g), zinc (1.53 mg/100 g), copper (1.6 mg/100 g), calcium (181 mg/100 g), phosphorous (153 mg/100 g), selenium (14.2 µg/g), manganese (1.672 mg/100 g) and vitamins including thiamine (0.2 mg/100 g), riboflavin (0.11 mg/100 g), pantothenic acid (0.596 mg/100 g), vitamin B6 (1.235 mg/100 g), folate (3 µg100g) and vitamin C (31.2 mg/100 g) (Thakur et al., 2024). The percentage composition of the bulbs is given by E. Solly (*Trans. Hon. Soc. Loud.*, new ser., iii. p. 60) as water 84.09%, organic matter 13.38%, and inorganic matter 1.53% - that of the leaves being water 87.14%, organic matter 11.27% and inorganic matter 1.59% (Bionity, 2025). Fresh or crushed garlic yields the sulfur-containing compounds allicin, ajoene, diallyl polysulfides, vinyldithiins, and *S*-allylcysteine, as well as enzymes, saponins, flavonoids, and Maillard reaction products when cooked, which are not sulfur-containing compounds. The phytochemicals responsible for the sharp flavor of garlic are produced when the plant's cells are damaged. When a cell is broken by chopping, chewing, or crushing, enzymes stored in cell vacuoles trigger the breakdown of several sulfur-containing compounds stored in the cell fluids (cytosol). The resultant compounds are responsible for the sharp or hot taste and strong smell of garlic. Some of the compounds are unstable and continue to react over time. Among alliums, garlic has by far the highest concentrations of initial reaction products, making garlic much more potent than onion, shallot, or leeks.[16] Although many humans enjoy the taste of garlic, these compounds are believed to

have evolved as a defensive mechanism, deterring animals such as birds, insects, and worms from eating the plant. A large number of sulfur compounds contribute to the smell and taste of garlic. Allicin has been found to be the compound most responsible for the "hot" sensation of raw garlic. This chemical opens thermo-transient receptor potential channels that are responsible for the burning sense of heat in foods. The process of cooking garlic removes allicin, thus mellowing its spiciness. Allicin, along with its decomposition products diallyl disulfide and diallyl trisulfide, are major contributors to the characteristic odor of garlic, with other allicin-derived compounds, such as vinyldithiins and ajoene (Wikipedia, 2025). In the typical serving size of 1–3 cloves (3–9 grams), raw garlic provides no significant nutritional value, with the content of all essential nutrients below 10% of the Daily Value (DV). In a reference amount of 100 g (3.5 oz), raw garlic contains some micronutrients in rich amounts (20% or more of the DV), including vitamins B6 (73% DV) and C (35% DV), and the dietary mineral, manganese (73% DV). Per 100 gram serving, raw garlic is a moderate source (10–19% DV) of the B vitamins, thiamin and pantothenic acid, as well as the dietary minerals, calcium, potassium, phosphorus, and zinc. The composition of raw garlic is 59% water, 33% carbohydrates, 6% protein, 2% dietary fiber, and less than 1% fat (Wikipedia, 2025).

Health Benefits

Highly Nutritious: Despite its small size, there is a lot of garlic nutrition. Having raw, heated and cooked, all provide high nutrition to the body. Garlic is rich in Vitamin C, B6, A, B1, B2, B12, D and E and minerals like manganese calcium, copper, iron, phosphorus, potassium and selenium. The main active compound of garlic is sulfur compounds. Due to this, it has a unique and strong flavour. Being underground fruit, it absorbs a lot of sulfates compounded from the soil and produces powerful health benefits for the human body. Add garlic oil capsules to your diet for more benefits of garlic.

Powerful Antibiotic: Garlic has a potentially powerful antibiotic. It contains a compound called Diallyl Sulfide. This compound is 1000 times more effective than many antibiotics like Campylobacter bacterium. Being good in antibiotics, it is useful in intestinal infections and also reduces the bacteria causing diseases. Garlic prevents us from many serious problems.

Support Immunity System: The antibacterial and antioxidant properties of garlic can be used to fight bacteria and pathogens and prevent the body from illness, including common colds. It is used to boost the immunity system naturally. A better immune system is good for the body. According to a study, it is said that garlic extract is effective against influenza A and B viruses, rhinoviruses, HIV, simple herpes, viral pneumonia, rotavirus and many more.

Powerful Antioxidant: The strong antioxidant component contained in the garlic and garlic extract protects the cells from oxidative damage and free radical attacks. An antioxidant is involved in the ageing process as well as heart diseases and high blood pressure. Basically, garlic activates the antioxidant enzyme that may also reduce common brain diseases.

Heart Protection: Diallyl trisulfide, from the garlic or its extract, helps to protect the heart. The consumption of garlic can be expected to increase the chances of reducing the risk of cardiovascular diseases, such as heart disease and stroke, from various directions. As per many studies, garlic has an important role in suppressing factors that increase the risk of cardiovascular disease, blood pressure. The active sulfur molecules from garlic are believed to be directly involved in vasodilation and lowering blood pressure.

Normalise Blood Sugar Level: Garlic is also known as an antidiabetic effect. Basically, garlic works on insulin, which is a hormone produced by the pancreas and helps the human body use glucose as energy. Garlic works on it and lowers the blood sugar level. The sulfur compound in the garlic controls the activation of insulin that occurs in the liver and promotes insulin secretion from the pancreas and is an effect for the diabetes patient.

Gastrointestinal Health: Gastric has been used for gastrointestinal health for a long time. It is termed as an indigestible food ingredient that improves constipation, heartburn, acidity, bloating and many more. Its antibacterial effect is effective on the host by selectively altering the growth and activity of certain bacteria in the large intestine, improving the health of the host. In addition, it is a type of dietary fibre that is also good for intestinal bacteria and the human body. Garlic is known in Ayurveda for healthy digestion.

Bone Health: It is said that garlic is used to improve bone health, especially in women. As per the study, it is noted that garlic can minimise bone loss by increasing estrogen (female hormone) in women and making bones healthy. It found that "large amounts" of dried garlic extract could alleviate estrogen deficiency. Women should give it a try for their bone health and osteoarthritis problems.

Help in Detoxification: The sulfur compound from the garlic is able to detoxify the body and ward off the heavy metals and toxins from the body. According to a study, the use of garlic may reduce the level of lead from the blood by about 19%. It is effective to reduce the toxicity from the blood, liver, stomach, etc.

Support Long Live: No herb in the world can provide longevity to humans. But a herb that can reduce the risk of failure or death by improving blood pressure, heart problems, and sugar level. In today's generation, heart failure, diabetes are the common reasons for death. A clove of garlic is effective for immunity and many body functions and helps to liver longer. (Admin, 2021).

Reduction of blood pressure: Garlic supplements, particularly aged garlic extract, have been shown to reduce blood pressure in people with hypertension problems. Garlic contains a bioactive sulphur compound, S-allylcysteine, which is responsible for

lowering blood pressure. The deficiency of sulphur results in high blood pressure and Organosulfur compounds present in it can help stabilise blood pressure.

Reduction of heart-related disease: A component of garlic oil, diallyl trisulfide, helps protect the heart after a heart attack and after heart surgery, it helps in better recovery. Garlic prevents cardiovascular diseases by lowering lipids and bad cholesterol in the body. It is largely effective against atherosclerosis disease.

Helps in fighting against infection and building up Immunity: Researchers observed that consumption of an aged garlic extract reduced the severity of colds and flu and also suggested that garlic supplementation enhanced the function of immune cells reducing inflammation and building up immunity.

Reduction of blood sugar level: An experiment conducted on lab animals proved that boiled and raw garlic can decrease blood sugar levels in the body as Garlic is rich in zinc and natural antioxidants. Allicin chemical and other compounds found in garlic increase the level of blood insulin

Cure of Intestinal problems: Garlic helps to naturally cleanse your colon by removing toxins, pathogens and parasites from your body. It has an antibacterial effect on enterobacteria. It is also effective against *H.pylori* infections.

Detoxification against heavy metals in the body: Researchers suggest that Garlic treatment reduces blood lead concentration significantly due to the sulphur presence, and garlic is as effective as a typical medication for lead poisoning such as the drug D-penicillamine.

Lowering Bone related problems: According to a clinical trial, the effect of garlic tablets in improving females experiencing postmenopausal, osteoporosis disease which is a weakening of bones, has shown very good results.

- Garlic consumption can reduce bone disorders and also the oxidative stress associated with many diseases. Garlic oil could suppress ovariectomy-induced bone resorption effectively.

Anticancer property: Garlic can have anticancer or preventative effects according to some observations in clinical trials, including inhibiting the activation of carcinogens(cancer causer). For deactivating carcinogens it works as boosting enzyme reducing inflammation which is related to the development of cancer. Supporting DNA repair effectively inhibiting the growth and spreading of cancer and cancerous cells.
(PW, 2023).

Combats Common Cold: Raw garlic has the incredible potential to fight common colds and coughs. Garlic when taken in the form of supplements is best known to trigger the immune system and keep infections at bay. Several studies have also revealed that adding garlic as part of a healthy meal plan can help one fight against cold and flu.

Controls High Blood Pressure: High blood pressure is one of the contributing factors to the increased risk of heart attack and stroke. Several pieces of evidence have found that garlic supplements have a remarkable impact on decreasing blood pressure in people with uncontrolled hypertension. Garlic is known to promote the synthesis of nitric oxide which dilates the blood vessels and inhibits the angiotensin-converting enzyme action (ACE) that relaxes blood vessels and improves blood flow thereby regulating blood pressure.

Augments Cardiac Health: The presence of the bioactive compound allicin in garlic stops oxidizing LDL cholesterol, thus lowering the total and LDL cholesterol in the blood. Regular addition of garlic to the diet averts the formation of clots in the blood and lowers the incidence of heart diseases.

Boosts Brain Health: Oxidative damage caused by free radicals is one of the contributing factors to ageing. Garlic blessed with powerful antioxidants aids the body's protective mechanisms against oxidative damage. Garlic supplements, when taken in high doses, increase antioxidant activities thus reducing oxidative stress in people with high blood pressure and maintaining lipid profile. The antioxidant activity of garlic helps in reducing the risk of brain problems like Alzheimer's and dementia.

Anti-inflammatory Effects: Chronic inflammation is the root cause of diseases including heart disease, diabetes, cancer, and arthritis**.** The potent anti-inflammatory action of garlic helps to inhibit inflammatory protein activity. Taking garlic supplements is valuable in lowering inflammatory markers, easing pain and fatigue, and improving the health conditions of patients suffering from rheumatoid arthritis.

Improves Endurance: Garlic was valued as one of the earliest "natural performance-enhancing" ingredients. It was largely used in ancient centuries as a traditional remedy to lessen fatigue and increase the energy and stamina of labourers. Sources reveal that garlic supplements were given to Olympic athletes in ancient Greece. Several studies have also disclosed that garlic can significantly improve the symptoms of exercise fatigue.

Lowers Blood Toxicity: arlic imbued with sulfur compounds has been shown to shield the body against organ damage from heavy metal toxicity. A study conducted at a car battery plant, where employees had been exposed to excessive lead, found that taking

garlic supplements lowered lead levels in the blood by 19% and reduced signs of toxicity including headaches and blood pressure. Thus, garlic supplements may help to detoxify heavy metals in the body.

Promote Blood Flow: Garlic is valuable in improving blood circulation, which is effective for treating problems like erectile dysfunction in men. The richness of bioactive compounds in garlic can increase blood flow and blood vessel function. Further, it can also up the levels of nitric oxide, which aids to dilate blood vessels and optimize better blood flow.

Fortifies Bone Health: Adding garlic to the diet regimen may help to lower the onset of osteoarthritis. The presence of the bioactive compound diallyl disulphide in garlic supports maintaining bone density and thus reduce the incidence of bone-related health conditions like osteoarthritis and also strengthens bone health in post-menopausal women.

Good For Losing Weight: Garlic decreases the gene expression responsible for the formation of adipose cells that store fat. Further, it also increases thermogenesis in the body which aids in the burning of fat cells and diminishing LDL (bad cholesterol). Aside from these, bestowed with a wealth of essential nutrients garlic triggers the metabolism and sustains weight.

Garlic Supplements: Garlic supplements are obtained from pounding garlic and collecting its oil, which is then combined with a suitable carrier vegetable oil and sealed in gelatin. Supplements are easily available in the form of soft gels or capsules. It is bequeathed with more than 100 sulphur compounds and powerful antioxidant, anti-inflammatory and anti-bacterial traits.

To Have Raw Garlic: Raw garlic is packed with a treasure trove of nutrients than cooked, which is why doctors and nutritionists recommend eating raw garlic on an empty stomach to derive its umpteen health benefits. Though it may not be best for your breath, health incentives outweigh this effect. Ensure to have fresh raw garlic, as the allicin starts to degrade slowly when left peeled over a longer period. The recommended intake of raw garlic is about 2-5 grams or 1-2 cloves per day.

To Add Garlic To Diet: Garlic is an easy-to-add vegetable to your meal plan. It enhances the flavour and aroma of most savoury dishes, mainly soups, curries and sauces. The strong taste of garlic can add an extra zest to an otherwise bland dish. You can use garlic in several forms from whole cloves, chopped, salad dressing oil and smooth pastes to powders to add that extra taste and essence (Netmeds, 2023).

Cardiovascular: As of 2016, clinical research found that consuming garlic produces only a small reduction in blood pressure (4 mmHg), and there is no clear long-term effect on hypertension, ardiovascular morbidity or mortality. A 2016 meta-analysis indicated there was no effect of garlic consumption on blood levels of lipoprotein(a), a biomarker of atherosclerosis. Because garlic might reduce platelet aggregation, people taking anticoagulant medication are cautioned about consuming garlic.

Cancer: Two reviews found no effect of consuming garlic on colorectal cancer. A 2016 meta-analysis of case-control and cohort studies found a moderate inverse association between garlic intake and some cancers of the upper digestive tract.

Common cold: A 2014 review found insufficient evidence to determine the effects of garlic in preventing or treating the common cold. Other reviews concluded a similar absence of high-quality evidence for garlic having a significant effect on the common cold. Harvesting garlic, from *Tacuinum Sanitatis*, 15th century (Bibliothèque nationale de France)

Folk medicine: Garlic has been used for traditional medicine in diverse cultures such as in Korea, Egypt, Japan, China, Rome, and Greece. In his *Natural History*, Pliny gave a list of conditions in which garlic was considered beneficial (*N.H.* xx. 23). Galen, writing in the second century, eulogized garlic as the "rustic's theriac" (cure-all) (see F. Adams' *Paulus Aegineta*, p. 99). Alexander Neckam, a writer of the 12th century (see Wright's edition of his works, p. 473, 1863), discussed it as a palliative for the heat of the sun in field labor. In the 17th century, Thomas Sydenham valued it as an application in confluent smallpox, and William Cullen's *Materia Medica* of 1789 found some dropsies cured by it alone.

Other uses: The sticky juice within the bulb cloves is used as an adhesive in mending glass and porcelain. An environmentally benign garlic-derived polysulfide product is approved for use in the European Union (under Annex 1 of 91/414) and the UK as a nematicide and insecticide, including for use in the control of cabbage root fly and red mite in poultry.

In culture: Garlic is present in the folklore of many cultures. In Europe, many cultures have used garlic for protection or white magic, perhaps owing to its reputation in folk medicine. Central European folk beliefs considered garlic a powerful ward against demons, werewolves, and vampires. To ward off vampires, garlic could be worn, hung in windows, or rubbed on chimneys and keyholes. In the foundation myth of the ancient Korean kingdom of Gojoseon, eating nothing but 20 cloves of garlic and a bundle of Korean mugwort for 100 days let a bear be transformed into a woman. In celebration of Nowruz (Persian calendar New Year), garlic is one of the essential items in a *haft-sin* ('seven things beginning with "S"') table, a traditional New Year's display: the name for garlic in Persian is *seer*, which begins with *sin*, pronounced *seen* the Perso-Arabic letter corresponding to "S". In Islam, it is recommended not to eat raw garlic prior to going to the mosque. This is based on several hadith. Some Mahāyāna Buddhists and sects in China and Vietnam avoid eating onions, garlic, scallions, chives and leeks, which are known as *Wu hun.* Because of its strong odor, garlic is sometimes called the "stinking rose".
(Wikipedia, 2025).

Garlic contains compounds with potent medicinal properties: Throughout ancient history, people widely usedTrusted Source garlic for its health and medicinal properties. Scientists now know that most of garlic's health benefits are due to the formation of sulfur compounds when you chop, crush, or chew a garlic clove. Perhaps the most well-known compound is allicinTrusted Source. However, allicin is an unstable compound that is only briefly present in fresh garlic after you cut or crush it. Other compounds that may play a role in garlic's health benefits include diallyl disulfideTrusted Source and S-allyl cysteine. The sulfur compounds from garlic enter your body from the digestive tract. They then travel all over your body, exerting strong biological effects.

Garlic is highly nutritious but has very few calories: Calorie for calorie, garlic is incredibly nutritious. A single clove (about 3 grams) contains 4.5 caloriesTrusted Source, 0.2 grams of protein, and 1 gram of carbs. Garlic is a good source of several nutrients, such as: manganese, vitamin B6, vitamin C, selenium and fiber. Garlic also contains trace amounts of various other nutrients.

Garlic can help protect against illness, including the common cold: Research from 2016 suggests that aged garlic extract (AGE) can boost your immune system. The study found that people who took AGE supplements for 3 months during the cold and flu season experienced less severe symptoms and fewer days missed of school or work. Other research suggests that the compounds in garlic may have antiviral properties Trusted Source. In addition to boosting your immune system, it may help prevent viruses from entering host cells or from replicating within your cells.

The active compounds in garlic can reduce blood pressure: According to the World Health Organization Trusted Source, cardiovascular diseases like heart attack and stroke are responsible for more deaths than almost any other condition. High blood pressure, or hypertension, is one of the most important factors that may lead to these diseases. A 2020 review of studies Trusted Source found that garlic supplements reduce blood pressure in people with high blood pressure. Researchers linked this to a 16% to 40% lower risk of experiencing cardiovascular events. The analysis noted that garlic's effect was similar to that of some blood pressure medications, but with fewer side effects. A 2019 review Trusted Source notes th*at al*licin in garlic may limit the production of angiotensin II, a hormone that increases blood pressure. It may also relax your blood vessels, allowing blood to flow more easily.

Garlic improves cholesterol levels, which may lower the risk of heart disease: A 2018 research review Trusted Source suggests that garlic can lower total and LDL (bad) cholesterol. The authors recommend that people with high cholesterol eat more garlic, but caution that more research is needed to verify their findings. According to 2016 research, taking garlic supplements for more than 2 months could reduce your LDL by up to 10%. Researchers noted this effect in people with slightly raised cholesterol levels. But garlic does not seem to have the same effect on triglyceride levels, another risk factor for heart disease. Research also suggests that garlic does not have an effect on HDL (good) cholesterol.

Garlic contains antioxidants that may help prevent Alzheimer's disease and dementia: Oxidative damage from free radicals contributes to the aging process and related cognitive decline. Garlic contains antioxidants that support your body's protective mechanisms against oxidative damage. Some 2016 research suggests these antioxidants may significantly reduce oxidative stress and lower your risk of related diseases like Alzheimer's disease, the most common form of dementia. Animal studiesTrusted Source suggest th*at al*licin in garlic may also help protect against cognitive decline. Human research is needed before we can fully understand its potential. Some studies Trusted Source have found garlic supplements to benefit people with Alzheimer's disease directly.

Garlic may help you live longer: The potential effects of garlic on longevity are basically impossible to prove in humans. But given the beneficial effects on important risk factors like blood pressure, it makes sense that garlic could help you live longer. In a 2019 Chinese study Trusted Source, older adults who consumed garlic at least weekly lived longer than those who consumed garlic less than once a week. The fact that it can help defend against infectious diseases is also important. Such diseases are common causes of death, especially in older adults Trusted Source or people with weakened immune systems.

Garlic supplements may improve your athletic performance: Garlic was one of the earliest "performance-enhancing" substances. Ancient civilizations used garlic to reduce fatigue and improve the work capacity of laborers. While mouse studies Trusted Source have shown that garlic helps with exercise performance, there have been very few human studies. A recent 2023 study Trusted Source found that garlic didn't improve cyclists' performance in a 40-km time trial. However, it may have reduced exercise-related oxidative stress and muscle damage.

Eating garlic may help detoxify heavy metals in the body: At high doses, the sulfur compounds in garlic have been shown to protect against organ damage from heavy metal toxicity. Allicin in garlic can help reduce levels of lead in your blood and vital organs. A 2012 study involving employees at a car battery plant (who had excessive exposure to lead) found that garlic reduced lead levels in the blood by 19%Trusted Source. It also reduced many clinical signs of toxicity, including headaches and high blood pressure. Three doses of garlic each day even outperformed the drug D-penicillamine in reducing symptoms.

Garlic may improve bone health: A few recent studies have measured the effects of garlic on bone health, specifically in women after menopause. Results of a clinical trial Trusted Source published in 2017 showed that garlic can reduce oxidative stress that leads to osteoporosis. The participants took garlic tablets equal to about 2 grams of fresh garlic per day. Another 2018 study found that 12 weeks of garlic supplements (1 gram per day) helped reduce pain in women with knee osteoarthritis and obesity or overweight.

Garlic is easy to include in your diet and adds flavour: The last one isn't a health benefit but is still important. Garlic is very easy to include in your current diet. It complements most savory dishes, particularly soups and sauces. The strong taste of garlic can also add a punch to otherwise bland recipes. Garlic comes in several forms, from whole cloves and smooth pastes to powders and supplements like garlic extract and garlic oil. A common way to use garlic is to press a few cloves of fresh garlic with a garlic press, then mix it with extra virgin olive oil and a bit of salt. This works as a very simple and nutritious salad dressing (Healthline, 2025).

Garlic has been used as both food and medicine in many cultures for thousands of years, dating as far back as the time that the Egyptian pyramids were built. Garlic is claimed to help prevent heart disease including atherosclerosis, high cholesterol, high blood pressure, and cancer. Animal studies, and some early investigational studies in humans, have suggested possible cardiovascular benefits of garlic. A Czech study found garlic supplementation reduced accumulation of cholesterol on vascular walls of animals. Another study had similar results, with garlic supplementation significantly reducing the placque in the aortas of cholesterol-fed rabbits. Another study showed that supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol. However, a NIH-funded randomized clinical trial found that consumption of garlic, in any form, did not reduce cholesterol levels in patients with moderately high baseline levels. In 2007 a BBC news story reported th*at allium sativum* may have beneficial properties, such as preventing and fighting the common cold. This assertion has the backing of long tradition. *Allium sativum* has been found to reduce platelet aggregation and hyperlipidemia. Garlic is also alleged to help regulate blood sugar levels. Regular and prolonged use of therapeutic amounts of aged garlic extracts lower blood homocysteine levels, and has shown to prevent some complications of diabetes mellitus. People taking insulin should not consume medicinal amounts of garlic without consulting a physician. In such applications, garlic must be fresh and uncooked, or the allicin will be lost. *Allium sativum* may also possess cancer-fighting properties due to the presence of allylic sulfur compounds such as diallyl disulfide (DADs), believed to be an anticarcinogen. In modern naturopathy, garlic is used as a treatment for intestinal worms and other intestinal parasites, both orally and as an anal suppository. Garlic cloves are used as a remedy for infections (especially chest problems), digestive disorders, and fungal infections such as thrush. Garlic has been reasonably successfully used in AIDS patients to treat cryptosporidium in an uncontrolled study in China. It has also been used by at least one AIDS patient to treat toxoplasmosis another protozoal disease. Garlic supplementation in rats along with a high protein diet has been shown to boost testosterone levels. To maximise health benefits from consuming cooked garlic, it has been suggested to allow crushed or chopped garlic to rest for 15 minutes before use to allow enzyme reactions to occur. However the primary compound of interest from this reaction, allicin, is generally deactivated during cooking due to its instability, and may be more beneficial consumed raw (Bionity, 2025). Garlic decreases the ability of blood platelets to form clots. Some animal studies suggest that garlic may improve insulin release in people with diabetes. But there is no evidence to support this effect in humans. Other studies show that garlic may improve the elasticity of the aorta. It may also keep atherosclerotic plaque from forming. There is some evidence that says garlic can slightly lower cholesterol levels. But recent research done by the National Center for Complementary and Integrative Health found that garlic had no effect on cholesterol. Some research shows that taking garlic by mouth can modestly reduce blood pressure. This effect was seen in people with high blood pressure. It was also seen in people with normal blood pressure. The evidence that it reduces high blood pressure is not strong (Plantvillage, 2025). There may be benefits that have not yet been proven through research. Some reports suggest that garlic may help prevent or treat cancer. Garlic contains allicin. This is a strong antibiotic. It's released when cloves are crushed or chewed. Garlic has been used as an antiseptic, antibacterial, and antifungal agent. It may help the body resist or destroy viruses and other microorganisms. It does this by boosting the immune system. Garlic is also claimed to fight infections. It may also build up strength. Garlic may also have laxative effects. Garlic may also help treat these issues: Chronic bronchitis, Chronic mucus in your nose and throat (catarrh), Recurrent colds and respiratory infections, Chronic earaches, Sore throat, Sinus problems, Flu, Yeast infections and Intestinal worms. Garlic is available fresh or dried in oral capsule form. The enteric-coated capsules are easiest for the body to absorb. It also comes as an extract and as odorless supplements. The quality of commercial forms of garlic varies a lot. Use garlic exactly as directed on the label (Plantvillage, 2025). Garlic is believed to boost the immunity of the body thus preventing common conditions like cold and flu. It helps regulate blood pressure in people with high blood pressure condition. It contains antioxidants that prevent cell damage and aging, thus lowering the risk of Alzheimer's disease and dementia. It also reduces the total cholesterol levels and bad cholesterol (LDL) levels in people with a high cholesterol condition. It can detoxify the body of heavy metals like lead, whose presence may cause toxicity and thus damage the body (Justgot, 2025). Garlic has been used since ancient times for its medicinal properties. Its bulbs are found in many traditional medicines. In India, a juice or paste prepared from garlic bulbs has traditionally been used to relieve coughs, fevers, and earaches, as well as improve skin conditions. In Ayurvedic and Siddha medicine, garlic juice has been used to alleviate sinus problems. Extracts from dried garlic bulbs have been used in Unani medicine to regulate menstruation and treat digestive problems and fevers. Hot water extracts from garlic bulbs mixed with honey were a folk remedy for whooping cough and intestinal worms. In Pakistan, a garlic extract is traditionally taken orally to settle the stomach, treat coughs and reduce fever. In Nepal, East Asia and the Middle East, it has been used to treat fevers, digestive and lung problems, and high blood pressure, among other illnesses. Some studies have shown that sulphur-containing compounds in garlic, like allicin, may have anti-bacterial, anti-fungal, anti-viral, and antioxidant properties. They may also provide pain relief, support immune function, and help lower blood glucose and blood pressure. Other research shows that garlic may help lower cholesterol, prevent blood clots, and alleviate swellings, sores, and acne, but more data from clinical trails is needed to support these claims (KEW, 2025).

Garlic has been used as both food and medicine in many cultures for thousands of years, dating as far back as the time that the Egyptian pyramids were built. Garlic is claimed to help prevent heart disease including atherosclerosis, high cholesterol, high blood pressure, and cancer. Animal studies, and some early investigational studies in humans, have suggested possible cardiovascular benefits of garlic. A Czech study found garlic supplementation reduced accumulation of cholesterol on vascular walls of animals. Another study had similar results, with garlic supplementation significantly reducing the placque in the aortas of

cholesterol-fed rabbits. Another study showed that supplementation with garlic extract inhibited vascular calcification in human patients with high blood cholesterol. However, a NIH-funded randomized clinical trial published in *Archives of Internal Medicine* in 2007 found that consumption of garlic, in any form, did not reduce cholesterol levels in patients with moderately high baseline levels. Despite decades of research suggesting that garlic can improve cholesterol profiles, a new NIH-funded trial found absolutely no effects of raw garlic or garlic supplements on LDL, HDL, or triglycerides... The findings underscore the hazards of meta-analyses made up of small, flawed studies and the value of rigorously studying popular herbal remedies. In 2007 a BBC news story reported th*at allium sativum* may have beneficial properties, such as preventing and fighting the common cold. This assertion has the backing of long tradition. Traditional British herbalism used garlic for hoarseness and coughs, both as a syrup and in a salve made of garlic and lard, which was rubbed on the chest and back. The Cherokee also used it as an expectorant for coughs and croup. *Allium sativum* has been found to reduce platelet aggregation and hyperlipidemia. Garlic is also alleged to help regulate blood sugar levels. Regular and prolonged use of therapeutic amounts of aged garlic extracts lower blood homocysteine levels, and has shown to prevent some complications of diabetes mellitus. People taking insulin should not consume medicinal amounts of garlic without consulting a physician. In such applications, garlic must be fresh and uncooked, or the allicin will be lost. *Allium sativum* may also possess cancer-fighting properties due to the presence of allylic sulfur compounds such as diallyl disulfide (DADs), believed to be an anticarcinogen. In 1858, Louis Pasteur observed garlic's antibacterial activity, and it was used as an antiseptic to prevent gangrene during World War I and World War II. More recently it has been found from a clinical trial that a mouthwash containing 2.5% fresh garlic shows good antimicrobial activity, although the majority of the participants reported an unpleasant taste and halitosis. In modern naturopathy, garlic is used as a treatment for intestinal worms and other intestinal parasites, both orally and as an anal suppository. Garlic cloves are used as a remedy for infections (especially chest problems), digestive disorders, and fungal infections such as thrush. Garlic supplementation in rats along with a high protein diet has been shown to boost testosterone levels (Wikidoc, 2025).

Physiological Disorders

- Sprouting of bulbs in the field is noticed sometimes towards the start of maturity stage of bulbs particularly when there are winter rains or excessive soil moisture and nitrogen supply. This disorder is, however, not of permanent nature and varies from variety-to-variety. Early-planting also causes sprouting. Splitting is also noticed sometimes in some varieties, which is due to delayed harvesting or irrigation after long spell of drought. For past few years rubberification problem is noticed in Rajkot area and also Nilgiri hills of Tamil Nadu. It is increasing day-by-day. The actual cause for the disorder was since not identified. Rubberification was totally controlled by application of micronutrients i.e. zinc sulphate and ammonium molybdate. It was also controlled by neem cake insecticides and growth regulator like GA.
- The aerial bulbil formation is also quite common in garlic where lower temperature prevails for more periods or there is more temperature variation. It, however, does not affect much on yield or quality of bulbs .
- The rubberification and premature sprouting of bulbs are main physiological disorders in garlic. The reasons for these disorders are summarized as under for hill grown garlic in Tamil Nadu.
- Rubberification and premature sprouting of bulbs are noticed mostly in fields which are located in low-lying areas of watershed where there is heavy deposition of nutrients along with silt during heavy rains.
- These problems are severe in garlic fields which are more frequently irrigated than the normal requirements of garlic bulbs.
- With the application of higher levels of nitrogen, there is an increased level of pre-mature sprouting of bulbs which results in splitting and rubberification of bulbs. • Rubberification incidence also increases when higher level of nitrogen is applied in the form of urea.
- Due to increased levels of nitrogen, in addition to the increased production of rubberized, there is an increased level of thrips incidence in leaves during the later stage of crop. The thrips lacerate leaves and cause severe damage to the crop. Through lacerated wounds by thrips, there is a severe incidence of blast disease, caused by Botrytis allii, when crops is 70-90 days old, which further deteriorates the quality of garlic bulbs.
- Short duration type of garlic (Mettupalayam type) is more susceptible than long duration type (Singapore type).
- Premature sprouting of bulbs is more in the crop (April-August) when there is high moisture level in soil at maturity of crop due to heavy rains.
- Delayed harvest during rainy season has increased premature sprouting and splitting of bulbs.
- Wider spacing of cloves at the time of planting increases uptake of nitrogen and water by the individual plants which increases premature sprouting and rubberification of garlic bulbs **(TNAU, 2025).**

Garlic side effects: Keep in mind that garlic has some downsides, such as bad breath. Some people are also allergic to garlic. Garlic may also affect your blood clotting ability. If you have a bleeding disorder or are taking blood-thinning medications, talk with a doctor before increasing your garlic intake (Healthline, 2025).

CULTIVATION

Garlic is easy to cultivate and may grow year-round in mild climates. While sexual propagation of garlic is possible, nearly all of the garlic in cultivation is propagated asexually by planting individual cloves in the ground. In colder climates, cloves are best planted about six weeks before the soil freezes. The goal is to have the bulbs produce only roots and no shoots above the ground. Harvest is in late spring or early summer. Garlic plants can be grown closely together, leaving enough space for the bulbs to mature, and are easily grown in containers of sufficient depth. Garlic does well in loose, dry, well-drained soils in sunny locations, and is hardy throughout USDA climate zones 4–9. When selecting garlic for planting, it is important to pick large bulbs from which to separate cloves. Large cloves, along with proper spacing in the planting bed, will also increase bulb size. Garlic plants prefer to grow in a soil with a high organic material content, but are capable of growing in a wide range of soil

conditions and pH levels. There are different varieties of garlic, most notably split into the subspecies of hardneck garlic and softneck garlic. The latitude where the garlic is grown affects the choice of type, as garlic can be day-length sensitive. Hardneck garlic is generally grown in cooler climates and produces relatively large cloves, whereas softneck garlic is generally grown closer to the equator and produces small, tightly packed cloves. Garlic scapes are removed to focus all the garlic's energy into bulb growth. The scapes can be eaten raw or cooked (Wikipedia, 2025).

Production

The area, production and productivity of garlic has considerably increased from 0.42 lakh ha, 1.32 lakh tonnes and 3.18 t/ha during 1977 to 3.20 lakh ha, production 16.93 lakh tones and productivity 5.28 t/ha (66 % increase) in the year 2015-16 NHRDF. The above achievements are certainly because of the adoption of high-yielding and improved varieties and adoption of innovative technologies by farmers disseminated by the NHRDF, Govt. of India/State Govt., State Agricultural Universities and ICAR institutes (Mahajan *et al.,* 2017). In 2021, world production of garlic was 28 million tonnes, with China accounting for 73% of the total.(Wikipedia, 2025).

Garlic production – 2021	
Country	**Millions of tonnes**
China	20.5
India	3.2
South Korea	0.8
Bangladesh	0.5
Egypt	0.3
Spain	0.3
World	**28.2**

Consumption pattern of garlic in India: NHRDF, Nashik has done on extensive sample survey covering 12 states with sample of about 6975 rural (52 districts) and 5330 urban (53 districts) families and noted highest per capita consumption of garlic in Gujarat 5.28 g/person/day followed by Punjab 4.85 g/person/day, Himachal Pradesh 4.78 g/person/day, Haryana 4.63 g/person/day and lowest consumption noted in Tamil Nadu 2.75 g/person/day, Uttar Pradesh 3.17 g/person/day, Delhi 3.22 g/person/day and Rajasthan 3.61 g/person/day, as against the national average of 3.88 g/person/day (Mahajan *et al.,* 2017).

Adverse effects and toxicology: The scent of garlic is known to linger upon the human body and cause bad breath (halitosis) and body odor. This is caused by allyl methyl sulfide (AMS). AMS is a volatile liquid which is absorbed into the blood during the metabolism of garlic-derived sulfur compounds; from the blood it travels to the lungs (and from there to the mouth, causing garlic breath) and skin, where it is exuded through skin pores. Since digestion takes several hours, and release of AMS several hours more, the effect of eating garlic may be present for a long time. Washing the skin with soap is only a partial and imperfect solution to the smell. Studies have shown sipping milk at the same time as consuming garlic can significantly neutralize bad breath. Mixing garlic with milk in the mouth before swallowing reduced the odor better than drinking milk afterward. Plain water, mushrooms, and basil may also reduce the odor; the mix of fat and water found in milk, however, was the most effective. Garlic breath is allegedly alleviated by eating fresh parsley. Abundant sulfur compounds in garlic are also responsible for turning garlic green or blue during pickling and cooking. Under these conditions (*i.e.*, acidity, heat) the sulfur-containing compound alliin reacts with common amino acids to make pyrroles, clusters of carbon-nitrogen rings. These rings can be linked together into polypyrrole molecules. Ring structures absorb particular wavelengths of light and thus appear colored. The two-pyrrole molecule looks red, the three-pyrrole molecule looks blue, and the four-pyrrole molecule looks green (like chlorophyll, a tetrapyrrole). Like chlorophyll, the pyrrole pigments are safe to eat. Upon cutting, similar to a color change in onion caused by reactions of amino acids with sulfur compounds, garlic can turn green. The green, dry "folds" in the center of the garlic clove are especially pungent. The sulfur compound allicin, produced by crushing or chewing fresh garlic, produces other sulfur compounds: ajoene, allyl polysulfides, and vinyldithiins. Aged garlic lacks allicin, but may have some activity due to the presence of S-allylcysteine. Some people suffer from allergies to garlic and other species of *Allium*. Symptoms can include irritable bowel, diarrhea, mouth and throat ulcerations, nausea, breathing difficulties, and, in rare cases, anaphylaxis. Garlic-sensitive people show positive tests to diallyl disulfide, allylpropyldisulfide, allylmercaptan, and allicin, all of which are present in garlic. People who suffer from garlic allergies are often sensitive to many other plants, including onions, chives, leeks, shallots, garden lilies, ginger, and bananas (Wikipedia, 2025).

Several reports of serious burns resulting from garlic being applied topically for various purposes, including naturopathic uses and acne treatment, indicate care must be taken for these uses, usually testing a small area of skin using a low concentration of garlic. On the basis of numerous reports of such burns, including burns to children, topical use of raw garlic, as well as insertion of raw garlic into body cavities, is discouraged. In particular, topical application of raw garlic to young children is not advisable. The side effects of long-term garlic supplementation are largely unknown. Possible side effects include gastrointestinal discomfort, sweating, dizziness, allergic reactions, bleeding, and menstrual irregularities. Some breastfeeding mothers have found, after consuming garlic, that their babies can be slow to feed, and have noted a garlic odor coming from them. If higher-than-recommended doses of garlic are taken with anticoagulant medications, this can lead to a higher risk of bleeding. Garlic may interact with warfarin, saquinavir, antihypertensives, calcium channel blockers, the quinolone family of antibiotics such

as ciprofloxacin, and hypoglycemic drugs, as well as other medications. The American Veterinary Medical Association considers garlic to be toxic to pets (Wikipedia, 2025).

Storage: Domestically, garlic is stored warm [above 18°C (64°F)] and dry to keep it dormant (to inhibit sprouting). It is traditionally hung; softneck varieties are often braided in strands called plaits or *grappes*. Peeled cloves may be stored in wine or vinegar in the refrigerator. Commercially, garlic is stored at 0°C (32°F), in a dry, low-humidity environment. Garlic will keep longer if the tops remain attached. Garlic is often kept in oil to produce flavored oil; however, the practice requires measures to be taken to prevent the garlic from spoiling which may include rancidity and growth of *Clostridium botulinum*. Acidification with a mild solution of vinegar minimizes bacterial growth. Refrigeration does not assure the safety of garlic kept in oil, requiring use within one month to avoid bacterial spoilage. Garlic is also dried at low temperatures, to preserve the enzymatic activity and sold and kept as garlic granules, and can be rehydrated to reactivate it. Stored garlic can be affected by *Penicillium* decay known as "blue mold" (or "green mold" in some locales), especially in high humidity. Infection may first appear as soft or water-soaked spots, followed by white patches (of mycelium) which turn blue or green with sporulation. As sporulation and germination are delayed at low temperature, and at −4 °C are inhibited entirely, in refrigerated cloves one may only see the white mycelium during early stages. *Penicillium hirsutum* and *Penicillium allii* are two of the predominant species identified in blue mold (Wikipedia, 2025). Domestically, garlic is stored warm (above 18°C) and dry, to keep it dormant (so that it does not sprout). It is traditionally hung; softneck varieties are often braided in strands called "plaits", or in short plaits called "grappes". Commercially, garlic is stored at 0°C, also dry (Bionity, 2025) (Fig. 2).

Powder

Tea

Blended Confit

Paste

Paste

Oil Capsules

Fig. 2. Products

Potential adverse effects: Common adverse effects of consuming garlic, garlic oil, and garlic supplements are breath and body odor, abdominal pain, nausea, vomiting, and other symptoms of gastrointestinal disorders. Garlic oil consumption may have anticoagulant effects in some people, causing bleeding, and may interfere with prescription drugs (Wikipedia,2025a).

Garlic-flavored oil: Garlic-flavored oil is produced and used for cooking and seasoning purposes, and is sometimes used as an ingredient in seasoning mixtures. This differs from essential garlic oil, and typically involves the use of chopped, macerated or crushed garlic placed in various vegetable oils to flavor the oil Wikipedia. 2025a.

Wit and Wisdom: Rub raw garlic on an insect bite to relieve the sting or itch. Find out more uses for raw garlic. Old-time gardeners swear that garlic “learns” because it adapts to your growing conditions and improves each year (Boeckmann, 2025).

Habitat: Rocky valleys, riverbeds, stream beds, and ravines in temperate and tropical regions all over the world (KEW, 2025).

Properties : When crushed, *Allium sativum* yields allicin, a powerful antibiotic and anti-fungal compound (phytoncide). However due to poor bioavailability it is of limited use for oral consumption. It also contains alliin, ajoene, enzymes, vitamin B, minerals, and flavonoids. The phytochemicals responsible for the sharp flavor of garlic are produced when the plant's cells are damaged. When a cell is broken by chopping, chewing, or crushing, enzymes stored in cell vacuoles trigger the breakdown of several sulfur-containing compounds stored in the cell fluids. The resultant compounds are responsible for the sharp or hot taste and strong smell of garlic. Some of the compounds are unstable and continue to evolve over time. Among the members of the onion family, garlic has by far the highest concentrations of initial reaction products, making garlic much more potent than onions, shallots, or leeks. Although people have come to enjoy the taste of garlic, these compounds are believed to have evolved as a defensive mechanism, deterring animals like birds, insects, and worms from eating the plant. A large number of sulfur compounds contribute to the smell and taste of garlic. Diallyl disulfide is believed to be an important odour component. Allicin has been found to be the compound most responsible for the spiciness of raw garlic. This chemical opens thermoTRP (transient receptor potential) channels that are responsible for the burning sense of heat in foods. The process of cooking garlic removes allicin, thus mellowing its spiciness. When eaten in quantity, garlic may be strongly evident in the diner's sweat and breath the following day. This is because garlic's strong smelling sulfur compounds are metabolized forming allyl methyl sulfide. *Allyl methyl sulfide* (AMS) cannot be digested and is passed into the blood. It is carried to the lungs and the skin where it is excreted. Since digestion takes several hours, and release of AMS several hours more, the effect of eating garlic may be present for a long time. This well-known phenomenon of "garlic breath" is alleged to be alleviated by eating fresh parsley. The herb is, therefore, included in many garlic recipes, such as Pistou, Persillade and the garlic butter spread used in garlic bread. However, since the odour results mainly from digestive processes placing compounds such as AMS in the blood, and AMS is then released through the lungs over the course of many hours, eating parsley provides only a temporary masking. One way of accelerating the release of AMS from the body is the use of a sauna. Due to its strong odor, garlic is sometimes called the "stinking rose". Because garlic passes into the bloodstream, it is believed by some to act as a mosquito repellent. However there is no evidence to suggest that garlic is actually effective for this purpose (Bionity, 2025).

Cautions

Known adverse effects of garlic include halitosis (non-bacterial), indigestion, nausea, emesis and diarrhea. Garlic may interact with warfarin, antiplatelets, saquinavir, antihypertensives, Calcium channel blockers, hypoglycemic drugs, as well as other medications. Consult a health professional before taking a garlic supplement or consuming excessive amounts of garlic. Garlic can thin the blood similar to the effect of aspirin. Cases of botulism have been caused by consuming garlic-in-oil preparations. It is important to add acid when creating these mixtures and to keep them refrigerated to retard bacterial growth. Whilst culinary quantities are considered safe for consumption, very high quantities of garlic and garlic supplements have been linked with a increased risk of bleeding, particularly during pregnancy and after surgery and child birth. Some breastfeeding mothers have found their babies slow to feed and have noted a garlic odour coming from their baby when they have consumed garlic. The safety of garlic supplements had not been determined for children. The side effects of long-term garlic supplementation, if any exist, are largely unknown and no FDA-approved study has been performed. However, garlic has been consumed for several thousand years without any adverse long-term effects, suggesting that modest quantities of garlic pose, at worst, minimal risks to normal individuals. Possible side effects include gastrointestinal discomfort, sweating, dizziness, allergic reactions, bleeding, and menstrual irregularities. Some degree of liver toxicity has been demonstrated in rats, particularly in large quantities. There have been several reports of serious burns resulting from garlic being applied topically for various purposes, including naturopathic uses and acne treatment. On the basis of numerous reports of such burns, including burns to children, topical use of raw garlic, as well as insertion of raw garlic into body cavities is discouraged. In particular, topical application of raw garlic to young children is not advisable. Garlic and onions are toxic to cats and dogs (Bionity, 2025).

Harvesting

Harvesting: Garlic grows about 60 cm tall. The duration of subsequent growth and development phases strongly depends on the prevailing conditions. The total growing period varies depending on the area, where harvesting takes place 3–4 months after planting (in the tropics) to about 9 months (for winter garlic in temperate regions). Harvesting is done once the leaves start turning yellow and begin to dry up. Once ready, the farmer pulls the bulbs out of the soil using their hands. They are then tied in bunches for drying and later stored in a dry place with good ventilation to inhibit growth or decay (Plantvillage, 2025). Harvest from fall plantings will range from late June to August. If you planted in the spring, calculate your approximate harvest date based on the “days to maturity” of the garlic variety you planted. In general, the clue is to look for yellowing foliage, but this isn’t the case for all garlic varieties. Harvest when the tops begin to yellow and fall over, but before they are completely dry. Before digging up your whole crop, it’s a good idea to sample one bulb. Lift a bulb to see if the crop is ready. We often dig up a bulb before the tops are completely yellow (in late June or early July), as some garlic types will be ready earlier. The garlic head will be divided into plump cloves, and the skin covering the outside of the bulbs will be thick, dry, and papery. If pulled too early, the bulb wrapping will be thin and easily disintegrate. If left in the ground too long, the bulbs sometimes split apart. The skin may also split, which exposes the bulbs to disease and will affect their longevity in storage. To harvest, carefully dig (don’t pull or yank stems by hand) up the bulbs using a garden fork. Avoid damaging the roots, especially the root plate (where they attach to the bulb). Lift the plants and carefully brush off surplus soil, but do not remove any foliage or roots before putting them to dry thoroughly (Boeckmann, 2025).

How to Store Garlic: Let garlic cure in an airy, shady, dry spot for about 2 weeks. Hang them upside down on a string in bunches of 4 to 6, or leave them to try on a homemade rack made from chicken wire stretched over posts. Make sure all sides get good air circulation. After a few weeks, the garlic should be totally dry and ready to store. The bulbs are cured and ready to store when the wrappers are dry and papery, and the roots are dry. The root crown should be hard, and the cloves can be cracked apart easily. Once the garlic bulbs are dry, you can store them. Brush off (do not wash) dirt, remove only the dirtiest wrappers, trim roots to ¼ inch, and cut tops to 1 to 2 inches. Bulbs should be stored in a cool (13°C), dark, dry place, and can be kept in the same way for several months. Don't store in your basement if it's humid. Do not store garlic in the refrigerator, either, as it will be too cold and too humid. The flavor will increase as the bulbs are dried. Properly stored, garlic should last until the next crop is harvested the following summer. If you plan on planting garlic again next season, save some of your largest, best-formed bulbs to plant again in the fall (Boeckmann, 2025).

Thrust areas: Although reasonable progress has been made so far in the garlic research, still many important problem have to be tackled. 1. Development of bigger clove garlic varieties, which can be grown under short winter season for export.2. Development of early maturing varieties. 3. Standardization of improved package of practices particularly for new varieties. 4. Development of high TSS varieties suitable for processing. 5. Resistance breeding against biotic and abiotic factors. 6. Mechanization and cropping system in garlic cultivation. 7. Development of garlic varieties for *kharif* season. 8. Post-harvest technology is to be strengthened with special thrust on storage and value added product development. 9. Rapid multiplication technology for virus free plantlets *in vitro* and hardening protocol for same (Mahajan *et al.,* 2017).

Pests/Diseases: Garlic has very few problems with pests in the garden (in fact, it's a natural pest repellent), and very few problems with the diseases that plague other veggies. Keep an eye out for the same pests that bother onions (Boeckmann, 2025).

Garlic Pests and Diseases			
Pest/Disease	**Type**	**Symptoms**	**Control/Prevention**
Onion maggots	Insect	Limp, yellow, or stunted plants; larvae feed on roots/bulbs/stems and may spread bacteria	Use row covers; harvest on a timely basis; monitor adults with yellow sticky traps; weed, especially wild onions; destroy crop residue; rotate crops
Onion thrips	Insect	Leaves, especially in folds near base, have white patches or silver streaks; brown leaf tips; bulbs distorted or stunted; curling or scarring	Remove plant debris; choose resistant varieties; add native plants to invite beneficial insects; use row covers; use straw mulch; monitor adults with yellow or white sticky traps; use sprinklers or other overhead watering
White rot	Fungus	Leaves yellow, wilt, and die, starting with oldest; white, cottony growth at stem base or on the bulb, later with black, poppy seed–like particles; roots rot	Destroy infected plants; choose disease-free cloves/sets; destroy crop residue; disinfect tools; solarize soil; rotating crops on 5-year or longer cycle may help
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Side effects, toxicity, and interactions: Garlic has a strong taste and odor. Raw garlic can cause stomach upset in some people. Odorless garlic supplements get rid of the strong taste and odor. They may also reduce stomach upset. Some people are allergic to garlic. When taken in large amounts, garlic may cause side effects. These include causing stomach ulcers and anemia. Garlic can interact with certain medicines. Using supplements of garlic that contain allicin for a long time may decrease how well saquinavir (a medicine used to treat HIV) works. If you're taking this medicine, talk with your healthcare provider before using garlic. Be careful when taking blood thinner medicines, because garlic may increase the risk of bleeding (Plantvillage, 2025).

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How to Cook With Garlic: There is probably no end to the uses and potential uses of garlic in the culinary arts. It can be part of dishes that are sautéed, baked, roasted, and braised, and it is added to soups, sauces, marinades, spice rubs, and stir-frys. Garlic is also minced and used as a flavoring in sausages, meatballs, and other ground meat preparations. The entire head of garlic can be roasted whole and the tender cloves used as a spread or added to a soup or sauce. Before adding garlic to a recipe, the papery skin

needs to be removed. There are several tricks to accomplish this task, the simplest being to gently press down on the clove with the flat side of a large knife; the skin should easily peel off. Once you have the bare clove, you will need to slice, chop, mince, grate, press, or crush the garlic. For some techniques, you can use a knife but others require a special tool. It is important to note that the more you handle your garlic, the more the compound called allicin, a pungent chemical, is released. Therefore, if you grate your garlic using the small holes on a box grater, or puree it in a food processor, your garlic will be much more pungent than if it were sliced. If you want to mince garlic without a knife, pressing the cloves with the tines of a fork will produce better results than a grater or food processor. When cooking garlic, it is important you watch carefully because it can burn quickly—especially when it is chopped small (Alfaro, 2023).

What Does It Taste Like?: When eaten raw, garlic has a powerful, pungent flavor. For that reason, it's customary to cook it in some way before serving it, which mellows the flavor considerably. Roasting garlic changes the flavor and texture significantly, resulting in creamy cloves with a nutty, mild taste. As garlic is one of the most popular ingredients in cooking, there are endless recipes including garlic. But if you would like the garlic to be the star of the dish, choose a recipe with garlic in the title. We may all be familiar with garlic bread and garlic knots, a simple pasta with garlic, and a garlic aioli (mayonnaise), but there are plenty of other dishes from around the world that highlight garlic, from compound butter to cold soups to braised chicken dishes (Alfaro, 2023).

Buy Garlic: Garlic is readily available at the supermarket in the produce section along with the onions and potatoes. It is sold individually as full heads (and sometimes as multiple heads in netted pouches). Make sure to choose heads that are firm—you don't want any soft cloves. Also reject garlic that shows signs of mold (powdery, dark patches) and heads that have sprouted as this means they are older and not as fresh. Garlic is also sold in jars with olive oil, either as whole, peeled cloves or minced cloves. You will also find it in different forms, such as freeze-dried and garlic powder. Keep in mind that anything other than fresh garlic will taste different, and some products may have added ingredients. It is easy to grow garlic in either the garden or in containers. To plant in the garden, simply place the individual cloves in the soil in either the spring or fall (depending on where you live). For containers, you need to plant in the fall and harvest in the summer while keeping the soil amply watered (Alfaro, 2023).

Storage: Whole heads of garlic should be kept unpeeled, placed in an open container (like a garlic keeper, a miniature ceramic pot with holes for air circulation), and kept away from other foods in a cool, dry place. When stored this way, garlic will keep for up to three months. The jars of garlic in oil should be placed in the refrigerator and will last around three months (Alfaro, 2023). Domestically, garlic is stored warm (above 18°C) and dry, to keep it dormant (so that it does not sprout). It is traditionally hung; softneck varieties are often braided in strands called "plaits", or in short plaits called "grappes". Commercially, garlic is stored at 0°C, also dry (Wikidoc, 2025).

Precaution & Side Effects Of Garlic (Admin, 2021).

Not everything in the world has positive effects, Garlic also has adverse effects on some conditions. Read out the precaution and side effects that you may experience when you are using garlic. When taken by mouth: Garlic is safer to use by mouth by most people. It can be used for 3 years without any problem.

- **When applied to the skin**: Garlic products in the form of gel, mouthwash, and cream are safer to apply on the skin. Well, applying raw garlic is not safe for the skin. It might cause skin damage like burns or skin irritation.
- Spicy flavour- Garlic has a peculiar, spicy flavour. This fact, on occasions, can generate gastric, digestive, oral or oesophagal discomfort. Mostly in people with a sensitive stomach. It is also a food that causes gastric burning. So, try to keep the garlic dose within the limit.
- **Interaction with medications**: Garlic use in large quantities can change the effects of certain drugs, either boosting or decreasing their effectiveness.
- **Halitosis**: Garlic is one of the foods that promote halitosis or bad breath. It's tough to disguise the scent of garlic on our breath when we eat food with a strong garlic flavour. Even more so, given that it is a cuisine that can be easily replicated.
- **Breast milk**: Some components of garlic can transfer into breast milk, giving it an unpleasant odour and flavour. As a result, the infant may reject milk given directly by the mother.
- **Pregnant women**: It is not safe to use garlic capsules or supplements. The medical amount of garlic is not recommended for pregnant and breastfeeding women. There is no reliable information about the dose of garlic for pregnant women, so it is good to avoid it.
- **Children:** The dose of garlic for children is lesser than for adults. It is important to mind the dose, especially for children and babies.
- **Bleeding Disorders**: The fresh garlic and garlic supplement might increase the risk of bleeding. It is not recommended to overdose or not recommended without consultation with healthcare professionals. If you have bleeding problems, talk to your professional first.
- **Surgery**: As garlic has the capacity to increase bleeding and change blood pressure. It is not good for you to consume garlic when you are going to surgery.
- **Medication**: If you are on medication related to heart, sugar, blood pressure, then you need to talk to a healthcare professional first. Garlic is a strong herb and works on many body functions.

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