Systematic Review on Allium Sativum.L (Garlic)

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Abstract: **Garlic a well-known constitute in Indian spices it is also known as Allium Sativum Linn, it is very important for its medicinal properties specially its antioxidant properties, garlic and garlic extracts have been shown to protect the body from harm caused by free radicals. Since ancient times, garlic has been cultivated in India and consumed as a spice to enhance flavor in the Mediterranean and China. Garlic (Allium sativum) has been shown in numerous studies to have immunomodulatory inducing qualities, with multiple indications that it tends to have both stimulatory and inhibitory effects on lymphocytes. Studies have also shown that the therapeutic benefits of garlic are increased when the components that cause inflammatory cytokines are separated and removed. This plant is a member of the genus Allium, family Liliaceae, subfamily Allodia, order Asparagine's, and clade Angiosperms, Monocots. The volatile oils, sugars, carbohydrates, mucilage, albumen, and other components that increase activity are responsible for the therapeutic effects. Garlic has many qualities, including antiviral, antimicrobial, anti-cancer, cardiovascular, and immunomodulatory effects. The list is not exhaustive because it has many other applications. This review attempts to summarize some of the pharmacological effects and characteristics of Allium sativum.**

Keywords: **Allium sativum, Antioxidant. Anti-inflamantory**

INTRODUCTION

Garlic is a member of the Liliaceae genus, which includes more than 600 flowering plant species, many of which, like Allium cepa and Allium sativum, have been utilized as vegetables and spices. Allium sativum, commonly known as garlic, is believed to have originated in Central Asia, specifically in regions that include parts of modern-day Iran and Turkmenistan. It has a long history of cultivation, spreading to ancient civilizations in Egypt, Greece, and Rome. Garlic was used both as a food and for medicinal purposes, and over time it became widespread across Europe, Asia, and the Mediterranean. The plant belongs to the Amaryllidaceae family and has been cultivated for over 6,000 years. Today, garlic is grown in many parts of the world, with China being the largest producer. The antibacterial properties of garlic have demonstrated that thiosulphonates block enzymes, particularly thiol once, that can develop in microorganisms because of their ability to react with thiol groups rapidly. Garlic has been utilized to heal almost every ailment in traditional eastern medicine. (1) Garlic soup is used to treat pneumonia, garlic wicks to treat yeast infections, garlic fume to treat respiratory illnesses, and garlic juice to treat typhoid and meningitis. Due to its specificity, which may be produced from allicin components and effective even against some antibiotic-resistant pathogens, garlic must be used more frequently in typical clinical usage. (2). Members of this genus have several advantageous qualities, such as antiparasitic, antimicrobial, antiasthmatic, anticholesterolemic, antioxidant, cytotoxic, and insecticidal, with particular antifungal characteristics (inhibitory actions) against C. neoformans. While most people do not get this fungal disease, inhalation can expose them to C. neoformans. People with weakened immune systems, such as those with severe HIV/AIDS, are at a higher risk of contracting the disease (3). According to a US Food and Drug Administration survey of approximately 900 people, 17% of the population reported taking a supplement containing garlic in the 12 months prior, making it one of the most popular supplements. Whole garlic cloves contain two types of sulfur: glutamyl-S-alkyl cysteines and S-alkyl cysteine sulfoxides. Garlic's unique scent is released when odourless cysteine sulfoxides undergo a quick transformation into thiosulfanates when exposed to the enzyme allinase.

(4) It has been demonstrated that the majority of garlic's biological effects are caused by organosulfur compounds (OSCs), which are derived from allicin. The enzyme allinase converts alliin into allicin, which is then further broken down. Allinases are released when the plant is harmed and are a component of the defensive mechanism. OSCs produced from garlic have been demonstrated to target the majority of the cancer hallmarks identified by Hanahan and Weinberg, as well as to decrease the expression and activation of several cell-growth stimulatory proteins. OSCs are also thought to have an impact on the cellular redox systems; for example, reactive persulfide or sulfane sulfur progenitors are produced when cysteinyl S-conjugates are activated in OSCs through β-lyase reactions. Cysteine moieties on redox-sensitive proteins, such as those involved in cellular signaling, may then react with these. Garlic's S-allylcysteine has been demonstrated to inhibit the proliferation of human prostate cancer cells, and allicin can cause apoptosis in a variety of cancer cells both independently and caspase-dependently. It can also lessen the harmful effects of chemotherapy. It has been demonstrated that diallyl sulfides, such as diallyl disulfide (DADS) and diallyl trisulfide (DATS), which are produced when allicin breaks down, have anti-cancer properties by encouraging apoptosis and cell cycle arrest. The use of various pure OSCs or garlic extracts presents a challenge when comparing the various data on the biological effects of garlic. The rising interest in garlic for cancer prevention motivated us to study the molecular effects of a “kitchen/homemade” garlic extract (GE). Traditional remedies are by no means preferred over established clinical therapies when it comes to treating cancer; however, dietary changes made by the patient, such as adding different biological extracts, can be helpful and may result in better therapeutic outcomes as well as improved prevention of cancer recurrence. Here, we show how a homemade GE has significant effects on several signaling cascades, inhibits the growth of cancer cells both in vitro and in vivo, enhances the effectiveness of well-known antitumor medications in vitro, and helps to slow the growth of cancer in a pre-clinical mouse model of breast cancer. It is of the oldest medicines in the world and has been used for its curative and preventative qualities as well as for flavoring. Many cultures utilize garlic and garlic supplements because of its health benefits. 4. It is also a medical plant that has been used as a drug to lower blood pressure, lower serum triglycerides and cholesterol, and limit platelet formation 5. Garlic's medicinal qualities are mostly due to its bioactive ingredients. 6.According to data, at least 15.7 million tons of garlic were produced globally in 2007. With a combined 60% of the production area and 69% of the global yield, China and India are the biggest producers of garlic 8. The "garlic flavor," however, must be measured before the right amounts of garlic can be added during industrial-scale food preparation because different batches of garlic range greatly in terms of flavor intensity.7. (5)

Fig.no.01. ALLIUM SATIVUM

BOTANY OF GARLIC

The garlic plant consists of delicious, meaty cloves covered in a thin layer of white or pink. Moreover, its leaves, stem, and head-mounted flowers are edible. It may be cultivated year-round and is very simple to grow. According to Figure 1, the leaves are flattened, long, and narrow. Tropical and temperate areas are used to grow it. The garlic plant thrives in soil that drains properly, and it needs cool, moist conditions when growing and a relatively dry period as it ages. Cloves from the bulbs are used to propagate it, and when the top turns yellow or brown, it is ready to be harvested. It should ideally be kept in a room with

good ventilation. The literature describes several botanical types of garlic, including A. sativum var. sativum L., which flowers infrequently or never; A. sativum var. ophioscorodon (Link) Doll, which flowers frequently and is known as "serpent garlic"; and A. sativum var. pekinense (Prokh.) Makino, which flowers infrequently but has wider leaves than A. sativum var. sativum.

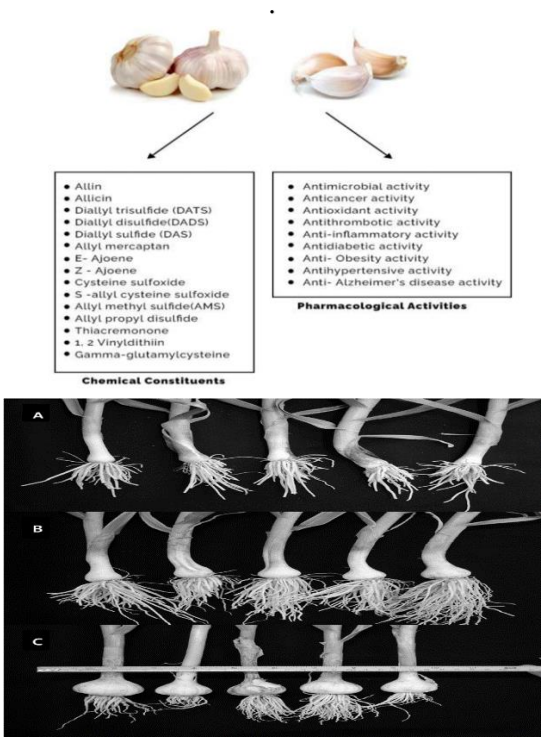

FIG NO: 2 Growth stages from bulb differentiation to bulging in garlic (Allium sativum L.)

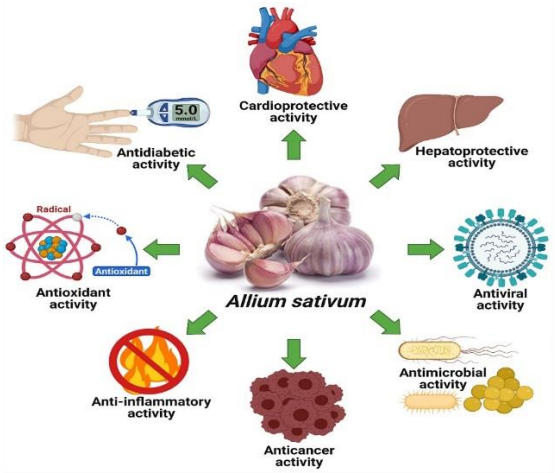

Table 1. Comparing properties of Allicin and Alliin, which are the main components of garlic

ANTI-OXIDANT PROPERTIES

Allyl methyl tetrasulfide, osulfide, allyl (methylthio)methyl trisulfide, and 4-mexidative stress brought on by free radicals and reactive oxygen species (ROS) are all prevented by antioxidants. Poor cellular function can result from oxidative stress, which can be caused by the production of ROS and the detoxification of elevated ROS levels in equilibrium. ROS-induced oxidative stress can lead to a number of chronic illnesses, including osteoporosis, coronary heart disease, and cancer. Biomolecules are susceptible to damage by free radical reactions, particularly the polyunsaturated fatty acids found in cell membranes. Among the substances that are classified as free radicals are hydrogen peroxide (H2O2), singlet oxygen, hypochloric acid (HOCl), peroxynitrite (ONOO−), nitric oxide, superoxide anion (O2 •−), perhydroxyl radicals (HO2 •), and hydroxyl radicals (•OH). Starting with the absorption of O2, ROS are created by activating NADPH oxidase, which in turn generates superoxide anion radicals. SOD then converts O2 into H2O2. Antioxidants donate their own electrons to free radicals without turning into free radicals themselves, thus breaking the sequence of free radical reactions. Antioxidants are categorized as either enzymatic or non-enzymatic based on their action. Enzymatic antioxidants are those that use many enzymes, including GPx, CAT, and SOD, to catalyze the neutralization of free radicals and ROS, whereas non-enzymatic antioxidants can be found in natural foods like fruits, onions, and other plants. Flavonoids, alkaloids, carotenoids, and phenolic groups are among the chemicals with antioxidant action found in these natural sources. Numerous test methods, including the DPPH free radical scavenging assay, the oxygen radical absorbance capacity (ORAC) assay, the trolox equivalent antioxidant capacity (TEAC) assay, the ferric reducing antioxidant power (FRAP) assay, the cupric reducing antioxidant capacity (CUPRAC) assay, the reducing power assay, and others, can be used to measure antioxidant activity.A. fistulosum, A. ursinum, A. schoenoprasum, A. flavum, A. cepa, A. scorodoprasum, A. sativum, A. cepa, and A. vineale are among the species of Allium that can also yield antioxidant chemicals. Any portion of the plant, including the roots, bulbs, leaves, flowers, and bark, can yield these chemicals. The chemicals found in the leaves of Allium species will be examined in this study for their antioxidant properties. Using the

DPPH and FRAP experiment, the antioxidant activity of the species A. sativum was tested.

A sativum leaves have a very high antioxidant activity, according to certain research, with an IC50 of 7.21 ± 0.39 mg/mL in the DPPH assay and 7.99 mol/g in the FRAP experiment. Four flavonol compounds were successfully isolated from A. sativum leaves by Kim et al. in 2005. These include kaempferol 3-O-β-D-glucopyranoside (astragalin), isorhamnetin 3-O-β-D-glucopyranoside, quercetin 3-O-β-D-glucopyranoside (isoquercitrin), and quercetin 3-O-β-D-xylopyranoside (reynoutrin). Using the ferric thiocyanate method, hydroxyl radical-scavenging activity, and the DPPH method, the antioxidant activity of the four compounds was evaluated. Using the phosphomolybdenum reduction experiment, Singh and Kumar also demonstrated that A. sativum leaves exhibited antioxidant activity. The technique is based on formatting a green phosphate complex subsequence in the methanol extract to reduce Mo (IV) to Mo (V) or Mo (V). According to El Hadidy et al., the leaf extract of A. fistulosum contained three main components. They are rutin, myricetin, and quercetin. Molecules 2021, 26, 7175 20 of 27 additional compounds, or 38.75%, contain myricetin, the most prevalent of the three chemicals in the Giza 6 and photon variants. According to the proportion of antioxidants, the antioxidant activity test conducted using the DPPH method revealed that the activity dropped after three months of storage. Using the DPPH radical scavenging experiment, the ethanol extract of A. ursinum leaves demonstrated 77% antioxidant activity with an EC50 value of 322 g/mL. The extract's phenolic component content had an impact on the activity. Additionally, studies on the antioxidant activity of A. schoenoprasum leaves were conducted using the DPPH bleaching test and TEAC. An EC50 value of 6.72 ± 0.44 g/mg indicated weak antioxidant activity in the DPPH results, but 132.8 ± 23 g Trolox eq./g was the value obtained from the TEAC method, which measures total oxidant scavenging activity. (07 To 17)

ANTI-INFLAMATORY

Ulcerative colitis and other chronic, multifactorial inflammatory illnesses of the colonic mucosa are known as inflammatory bowel diseases (IBDs), and they are typified by an imbalanced and heightened immune response to outside stimuli. The biological benefits of garlic and its bioactive components have been documented to include immunomodulatory, antioxidant, and anti-inflammatory properties. Using isolated LPS-treated mouse colon specimens, we used an ex vivo experimental model of ulcerative colitis to assess the preventive benefits of a hydroalcoholic (GHE) and a water (GWE) extract from a Sicilian garlic cultivar called Nubia red garlic. Both extracts may inhibit the expression of nuclear factor-kB (NF-kB), cyclooxygenase (COX)-2, tumor necrosis factor (TNF)-α, and interleukin (IL)-6 genes in the mouse colon caused by LPS. The extracts also raised the 5-hydroxyindoleacetic acid/serotonin ratio and inhibited prostaglandin (PG)E2 and 8-iso-PGF2α after using LPS. Specifically, the anti-inflammatory profile of GHE was superior. Both extracts may have anti-inflammatory and antioxidant properties that are at least largely attributed to their polyphenolic makeup, specifically with regard to catechin. In conclusion, our findings demonstrated that GHE and GWE had protective effects in the colon, indicating their possible application in the herbaceous plant garlic (Allium sativum L.), a member of the Amarillidaceae family and a spice and traditional medicine used worldwide. The therapeutic properties of garlic were also linked to its organosulfur compounds, such as S-allyl-cysteine (SAC), E/Z-ajoene, diallyl thiosulfonate (allicin), diallyl sulfide (DAS), diallyl disulfide (DADS), and diallyl trisulfide (DATS). Specifically, allicin was identified as one of the most significant bioactive components exhibiting antioxidant properties. Ulcerative colitis and other chronic, multifactorial inflammatory illnesses of the colonic mucosa are known as inflammatory bowel diseases (IBDs), and they are typified by an imbalanced and heightened immune response to outside stimuli. Here, it was discovered that anti-inflammatory and antioxidant herbal extracts might counteract the symptoms of IBD by lowering a number of oxidative and pro-inflammatory indicators, including cytokines, prostaglandins, and reactive oxygen/nitrogen (ROS/RNS) species. Interestingly, there has been evidence that garlic can prevent ulcerative colitis. Furthermore, in the rats' small intestine, garlic oil inhibited the infiltration of neutrophils caused by

endotoxins. Furthermore, Balaha and associates (2016) shown that garlic oil (GO) could prevent ulcerative colitis in rats that was brought on by dextran sulfate sodium. It was proposed that the immunomodulatory, anti-inflammatory, and antioxidant properties of GO were responsible for this impact. More recently, GO was shown to reduce cellular damage and inflammation in a rat model of acetic acid-induced colitis. In light of these results, we conducted this investigation to assess the possible preventive benefits of garlic hydroalcoholic extract (GHE) and water extract (GWE) on isolated mouse colon specimens treated ex vivo with E. coli lipopolysaccharide (LPS) is an ulcerative colitis experimental model. Specifically, our study concentrated on water and hydroalcoholic extracts from a Sicilian garlic species called Nubia red garlic, which is distinguished by the bright red hue of its bulbil tubers. Known as a protected designation of origin product (DOP), this kind is valued globally. As far as we are aware, we have documented the first possible positive benefits of Nubia red garlic on colon inflammation (18 to 29).

BOTANICAL CLASSIFICATION ALLIUM SATIVUM

Kingdom	Plantae
Subkingdom	Tracheobionte
Superdivision	Spermatophyta
Division	Magnoliophyte
Class	Equisetopsida
Subclass	Magnoliidae
Superorder	Lilianae
Order	Asparagales
Family	Amaryllidaceae
Genus	Allium

THE CHEMISTRY OF GARLIC

Higher levels of sulfur compounds, which give garlic its distinct odor and taste and are also responsible for its health benefits, are found in garlic. The basic ingredients of fresh garlic are listed in Table 1. Calcium, phosphorous, potassium, salt, magnesium, aluminum, copper, manganese, chromium, molybdene, selenium, germanium, and iodide are among the essential minerals and trace elements found in relatively high concentrations in garlic cloves. The concentrations of the other trace elements that were examined are displayed in Table 2. Along with them, the following 17 amino acids and around 33 sulfur compounds have been found and isolated: alanine, arginine, aspartic acid, asparagine, histidine, leucine, methionine, phenylalanine, praline, serine, threonine, tryptophan, and valine. Allium plants have a special group of constituents called S Alk(en)yl–cysteine sulfoxides (ACSOs), which give them their distinctive smell and flavors 16. Some of these sulfoxides are S-Methyl-L-cysteine sulfoxide (Methiin), S-Allyl-L-cysteine sulfoxide (Alliin), S-propyl-L-cysteine sulfoxides (propiin), S-propenyl-L-cysteine sulfoxide (Isoalliin), S-Ethyl-L-cysteine sulfoxide (Ethiin), and S-n-Butyl-L-cysteine sulfoxide (Butiin) 2.

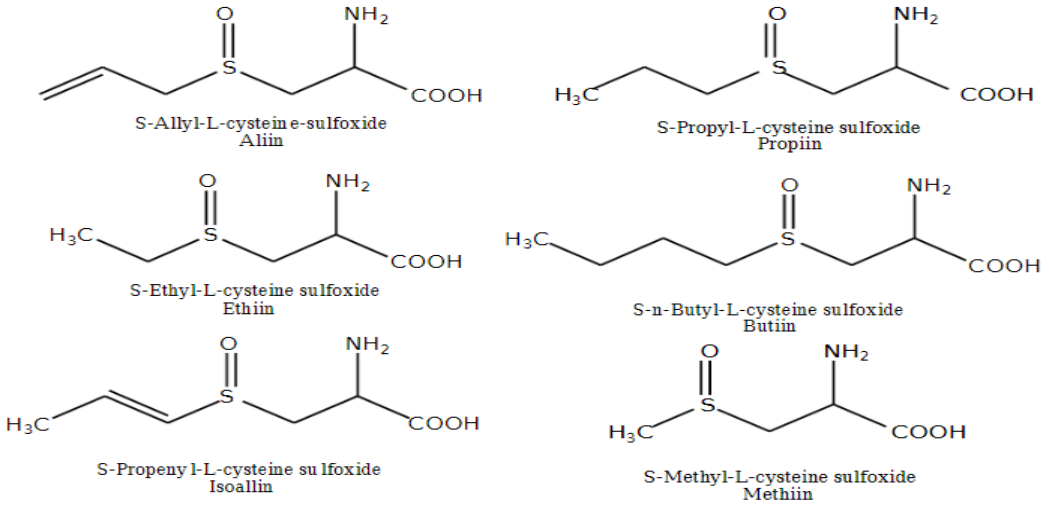

Figure 1: Examples of sulfoxides that are present in allium vegetable. 2

Crushed garlic contains eight known dialk (en) ylthiosulfinates, with allyl-2-propenethiosulfinate (allicin) being the most prevalent (50–90% mol). Among them are allylmethane-TS (3–20% mol), trans-1-propenyl-2-propene-TS (5–18% mol), methyl-2-propene-TS (1.5–8% mol), allyltrans-1-

propene-TS (1.5–2% mol), methylmethane-TS (1–2% mol), trans-1-propenylmethane-TS (1–2% mol), and methyl-trans-1-propene-TS (0.5% mol) 18.

BENEFICIAL EFFECTS OF GARLIC

- Antioxidant: Garlic has demonstrated antioxidant qualities, according to several studies. The antioxidant activity of S-Allyl cysteine (SACS) was thus demonstrated. Rats with alloxan diabetes were also treated with these substances. According to reports, alliin also possesses antioxidative properties. An additional investigation into the antioxidant qualities of garlic compounds—alliin, allyl cysteine, allyl disulfide, and allicin—represented the four major chemical classes. The results showed that the compounds displayed a variety of antioxidant activity patterns as protective agents against damage from free radicals.

- Anticancer: Later research has revealed other benefits of garlic, such as the inhibition of dimethylhydrazine-induced colon cancer by diallyl sulfide, a garlic taste. Garlic may also be a useful treatment for bladder cancer. Since garlic contains organosulfur compounds, several studies have shown that garlic has chemo preventive properties. Furthermore, it has been discovered that in a number of animal models, certain organosulfur compounds obtained from garlic, such as S-allyl cysteine, slow the growth of chemically produced and transplantable cancers.
- Antimicrobial: Garlic is considered a natural antibiotic that works against a variety of microorganisms. Pure allicin has been shown to have antibacterial activity against a variety of gram-positive and gram-negative bacteria, including multidrug-resistant enterotoxicogenic stains of Escherichia coli, antifungal activity, especially against Candida albicans, antiparasitic activity, including some major human intestinal protozoan parasites like Entamoeba histolytica and Giardia lambia, and antiviral activity. In mixed culture studies of Lactobacillus acidophilus and Escherichia coli, garlic inhibited the growth of E. coli, but had no effect on the competition's outcome.
- Antidiabetic: Additionally, S-allyl cysteine SAC may be considered an effective therapeutic agent for the treatment of diabetes mellitus. Garlic alcoholic extract decreased serum glucose, triglycerides, cholesterol, urea, uric acid, AST, and ALT, while increasing serum insulin levels in treated diabetic rats compared with control diabetic rats. Garlic has been shown to improve glycemic control in addition to antihyperlipidemic activity when combined with standard antidiabetic remedies.
- Anti-inflammatory: Inflammation linked to IBD (inflammatory bowel disease) may be reduced by using garlic extract, which inhibits Th1 (cell-mediated T-helper 1) and inflammatory cytokines while increasing the production of IL-10. Four sulfur-containing anti-inflammatory compounds from garlic were recently discovered, and their chemical structures were also determined to be Z- and E-ajoene and oxidized sulfonyl derivatives of ajoene 40. Additional evidence suggested that garlic therapy considerably reduced liver damage and inflammation brought on by E. papillate infections. (41to 54)

CONCLUSION

Garlic's many health benefits have been demonstrated by a number of studies. These studies primarily attribute its medicinal properties to organosulfur compounds, which are created when S-allyl-L-cysteine undergoes enzymatic, chemical, and thermal transformations during bulb crushing, drying, or processing. There are several techniques that have been developed for quantifying allicin and thiosulfinates in general. Spectrophotometry, HPLC processes, and gas chromatography comprise the majority of these techniques. The comparison of various techniques will enable us to choose the simplest and most practical approach for assessing the quality of garlic while it is being stored. A vital ingredient in ready-to-eat snack meals, garlic is an aromatic herbaceous plant that raises the product's flavor, therapeutic value, and shelf life. Furthermore, garlic is a good source of organosulfur and flavonoid chemicals that can be used to treat a variety of illnesses and could be a helpful way to avoid COVID-19. Garlic extracts are a nutritious way to add nutrients to snacks. Due to its abundance of phytocompounds and many bioactive qualities, such as antimicrobial, anti-inflammatory, anti-hypertensive, anticarcinogenic, antifungal, antiviral, and antioxidant, garlic is used for a variety of medicinal purposes. The claims that garlic can be

used to cure and prevent a variety of illnesses need to be supported by more clinical research and standard trials.

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