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# Garlic as a Potential Nominee in Functional Food Industry

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## Abstract

Functional and nutraceuticals products provide a bigger prospect to one's health by permitting health costs and supporting economic growth in lower and middle developed countries. Because of this reason, mostly diversion of people is going towards functional food and these Phyto-based foods are turning out to be popular universal in the red to the number of statements from researchers for their therapeutic applications. Garlic is one of the ancient vegetables that is used worldwide in different aspects which includes seasoning, culinary purposes, flavoring, and medical purposes. The consumption of garlic word wide increases due to its convenience, tackiness, health benefits, and low side effects. Garlic has been utilized for thousands of years because of its rich active components, phytochemicals, and other Sulfur containing components. It has so much rich history to contribute to the food industry. It has been used as a food stabilizer to prevent the development of pathogens to the prevention of many diseases. The claimed vigor reimbursements of garlic are abundant, including, anticarcinogenic, antibiotic, anti-hypertensive, and cholesterol-lowering properties, the risk of cardiovascular disease lowering the effects of hypolipidemic, antithrombotic, anti-diabetic, antioxidant, antimicrobial, immunomodulatory, antimutagenic, and prebiotic activities. The present attempt of the chapter is to explore garlic history along with its active component's involvement in the prevention of diseases and threats.

**Keywords:** garlic, history, garlic as functional food, active components, prevention of diseases

## 1. Introduction

Healthy and nutraceutical food varieties are developing mainstream the whole around the world inferable from their wellbeing advancing points of view [1]. There are a few conventional plants, utilized as a remedial transporter for various physiological health problems. Analysis by way of food-based treatments, clarify the meaning of these Medicinal plants involving garlic, onion, dark cumin, green tea, ginger, nut and so on, nonetheless, a few hidden benefits from plant sources are yet to be investigated for scientists [2]. Pakistan being assorted in native rich land, has such kinds of therapeutic plants that are adding to wellbeing. Utilitarian food sources are huge in this milieu attributable to simple availability, low cost and associated wellbeing advancing viewpoints [3]. In the present situation, many plant-based foods, grains, nuts, and pulses and so forth are imperative since they

have helpful potential because of certain naturally dynamic synthetic substances known as phytochemicals. These are the organically significant compound atoms in plant food that are basically maintained different metabolic pathways, similar to free extremist rummaging, antimicrobial properties and giving assurance against sicknesses [4]. The variety in human eating pattern cannot be detected up to the mark as economic and natural components lead to broad variations in the dietary example of the worldwide populace. The unexpected expansion in clinical consideration expenses and human's craving for upkeep of one's wellbeing bring about more noteworthy consideration for nutritionists and general wellbeing researchers to clarify the eating routine wellbeing linkages [5]. Eating Habits and wellbeing relationships are associating as customer string is shifted and presently, they are more cognizant towards nourishing and practical properties of food. Be that as it may, various procedures are required, to investigate supplements thick sources, their likely usage, and applications, and particularly their method of activities [6]. In any case, vegetables are one of the significant food of human eating routine since antiquated occasions and stand firm on interesting foothold in all dietary direction frameworks. The American Dietician Association suggested day by day 4–5 portions of vegetables to meet the prerequisites of required nutrition. Vegetables are wealthy source of bioactive components like carotenoids, chlorophylls, anthocyanins and flavonoid [7]. All these bioactive compounds can focus on basic level successfully by managing protein energy, arrival of cytokines, and sign transduction. Among the practical food varieties, utilization of garlic is mounting step by step due to its wellbeing advancing expected other than fundamental nourishment [8]. The medicinal usage of different spices have been demonstrated tentatively as lifesaving substances, related with personal fitness, assertions attributable to their abundant phytochemicals profile. Beneficial outcomes of garlic are principally authorized to its sulfur containing compounds essentially allicin and S-allyl cysteine (SAC). Including organosulfur composites, thiosulfates, ajoenes and allicin (diallyl thiosulphate) are the most important bioactive parts in garlic for relieving different physical abnormalities [9]. Connections of essential significance have been established between nutritional parts and individual wellbeing security. There are confirmations that utilization of various vegetables is significant for human wellbeing as they are generally excellent for colon health due to enrichment of fiber, antioxidants, carotenoids, sulfur containing mixtures, nutrients, and minerals. Epidemiological examinations directed worldwide have uncovered that liberal utilization of vegetables particularly rich in nutraceuticals is related with an assurance of anticipation and decrease of wellbeing related persistent issues [10].

## 2. Garlic

In summary, Garlic (*A. sativum* L.) is one of the leading used potted plant, applied both for healing reasons and gastronomic enhancement as giving spice and palate to the ultimate product. It is assumed to be started from Central Asia around 6 000 a long time earlier and has been expanded on the way to West, South and East [11]. Be that as it may, whole garlic as well as its components/segments is applied since long time ago in Chinese medications certainly 3000 a long time while Egyptians reinforced garlic to pyramid troop to boost their insusceptibility in this manner render secure from different diseases and progress their great execution [12]. Garlic wellbeing advancing viewpoints have been exhibited and it is advised around the area as a nutritional supplement. It is additionally developed for its therapeutic esteem owing to an increment in its utilization equally in culinary and therapeutic. Recently, a wide-ranging offer of its cookery associated

Phytochemicals	Per 100 g	Reference
Energy	149 kcal	These nutrition values of garlic per 100 g is adapted from <a href="https://fdc.nal.usda.gov/ndb/foods">https://fdc.nal.usda.gov/ndb/foods</a>
Carbohydrates	33.06 g	
Sugars	1 g	
Dietary fiber	1.2 g	
Protein	6.34 g	
Fat	0.5 g	
Vitamins		
Thiamine	0.2 mg	
Riboflavin	0.11 mg	
Niacin	0.7 mg	
Pantothenic acid	0.59 mg	
Vitamin B <sub>6</sub>	1.2 mg	
Folate	3 µg	
Vitamin C	31.2 mg	
Minerals		
Calcium	181 mg	
Iron	1.7 mg	
magnesium	25 mg	
Manganese	1.67 mg	
Magnesium	153 mg	
Phosphorus	401 mg	
Potassium	17 mg	
Sodium	1.16 mg	
Zinc	14.2 mg	

**Table 1.**  
*Nutrition value of garlic per 100 g.*

and recuperative procedures arrive their availability in market (**Table 1**). In numerous nations, wellbeing opportunities of garlic and its unique items have been established [13].

### 3. Lifestyle ailments

Poor eating behaviors and changing daily routine regularly led to various physiological dangers which includes heart diseases with its impediments, immune dis-functions and development of tumor [14] It is projected that 30–40% of one-of-a-kind illnesses are curable with a full of life way of life and nutritional segments. Pathophysiological impediment scheme must encompass dietary and exercising strategies; specific embattled dietary factors could be a segment of this tactic Diet and wholesome ingredients have a sizeable influence on the immunity workable of the body and fight deficiency of nutrients, like vitamins, polyphenols that minimize the risk of a number of problems such as hyperglycemia and atherosclerosis [15] Plants wealthy in phytochemicals profile have the capacity to fight off free radicals in the body and deteriorates oxidative stress due to presence of free radicals. Among

these plants' essential components like phytochemicals, phytosterols, antioxidants and flavonoids have shown hypoglycemics and hypocholesterolemia potential. Functional ingredients and their active compounds have proven beneficial conceivable towards a range of organic threats such as antioxidant, anti-cancer, and immunomodulation [16]. Free radicals present in body has a reactive tendency in nature, injury to body organs. Oxidative stress in body is generated by increased level of free reactive oxygen species. Oxidative stress is an imbalance between the production of reactive oxygen species and antioxidant defense, resulting in tissue damage. Oxidative stress also leads to DNA damage, cardiovascular and neuropathy disorders, and cancers. It is advised to use natural merchandise presenting higher effectivity and safety, as replacer for drug therapy. Various herbal merchandise that may additionally be comprised of one or combination of special antioxidants have been investigated to shield against hepatic injury, having immune modulatory or antiviral residences [17].

#### **4. Garlic in immune nutrition**

Diet is an important part of human health. Foods' rich in phytochemicals are usually related to the normal functioning of the immune system. The term "immune nutrition" refers to the intake of certain nutrients that play an important role in balancing the body's immune system. Internal and external factors, but diet plays a vital role in the regulation and normal operation of the immune system [18]. The immune system is an extremely complex device that prevents infections and diseases by controlling malignant cells and foreign cells. For centuries, humans have been looking for substances that enhance immunity. In almost many cultures, garlic and garlic supplements are used as immunity-enhancing substances in addition to claimed beneficial effects. Immunonutrition is usually based on diet, which can strengthen the immune system, maintain homeostasis, and help fight foreign and malignant cells. Several compounds and classes have been identified, which play an important role in the normal function of the immune system [19]. The use of garlic mentioned in the literature can be traced back centuries. Many civilizations rely on its ability to cure various diseases, and even the Egyptians provided food for their teams to strengthen them. Garlic has many modes of action; on the one hand, it acts as an immunostimulant, on the other hand, it may have the function of immuno-suppressive agents [20].

The immunostimulant results of garlic and its components/arrangements consist of growth withinside the general white blood cell (WBC) rely on and superior bone-marrow cellularity [21]. The OSC in garlic scavenge oxidizing retailers inhibiting the oxidation of fatty acids, thereby stopping the formation of pro-inflammatory messengers, through interplay with sulfur-containing enzymes. Consumption of garlic ended in inspired synthesis of NO and, in turn, IFN-alpha in humans, which might be useful in viral or proliferative diseases [22].

The ability of bioactive compound of garlic which is allicin has an ability to prevent immune mediated, concanavalin A (ConA) damage to liver by protecting effect on T-cells and inhabitation of NF-kappa B activation along with protecting effect against adhesion molecule [23]. In different vitro studies it has been proved that adhesion of TNF-alpha-mediated components to extracellular cell and endothelial cells [24]. On human vascular endothelial cells, inhabitanacy of molecule-1 TNF-alpha facilitated intracellular and vascular cell connection molecule-1 is negotiated by allicin [25] It also mediates the inhabitation of SDF-1 alpha (CXCL12) T cell migration by activating fibronectin which further helped by down-regulation of T-cell polarization, its adhesion to fibronectin and rearrangement of cortical actin [26].



Allicin may be used as a therapeutic agent to cure chronic inflammatory disorder. Cell mediated T- Helper-1 immune response is activated by cytokines involved in inflammatory bowel disease. This cell mediated T- helper-1 cells and cytokines involved in this disease can be inhibited by regulating interleukin-10 production [27]. Inflammation associated with IBD can be controlled by garlic extract. The other two main components of garlic such as Diallyl sulphide (DAS) and diallyl disulphide (DDAS) has an inhibitory effect against Methicillin-resistant *Staphylococcus aureus* (MRRSA) infection [28]. Garlic extract has ability to protect body against different types of fungi, viruses, and pathological bacteria. In vitro effect of whole extract and identification of novel immunomodulating drugs and other therapeutic alternatives for the treatment of leishmaniasis is linked to specific 10 to 14KDa fraction [29]. Generally, elements of garlic such as allicin, DAS, DDAS results in development of cellular immune parameters.

It is determined that garlic extract element S-allyl-Cysteine (SAC) has capability to prevent nitric oxide assembly with the help of repression of murine macrophage, cell line fueled by IF, settlement of protein demonstration and repression of iNOS mRNA [30]. Garlic also stimulates the proliferation of lymphocytes and phagocytosis of macrophages. It also induces infiltration of macrophages and lymphocytes in transplanted tumors and initiates splenic hypertrophy [31]. It increases the efficacy of killer cells and lymphokine activated killer cell, increases the production and synthesis of cytokines. All these improved functionalities in the body leads to strong immune response [32]. Garlic and aged garlic extract initiate the Th-1 cellular immune response due to repetition of cytokines [33]. Destruction of immunity due to chemotherapy and electromagnetic contamination is protected by garlic. Aged black garlic can act as an immune modifier due to its ability to maintain the balance of immune function and it is highly effective when it is included in a diet [34].

Inflammation is triggered by stimulation of neutrophils to act of reactive oxygen species and respiratory burst to get rid of the infected deadly pathogen. This is essential component of our body defensive system [35]. Garlic appears to be very helpful in preventing the free radicals' generations from rat neutrophils. This could be effective in inflammation associated pathological condition [30].

Garlic having immunomodulatory ability have been relevant to the clinical applications. Garlic and its extract have capability to enhance innate or specific cell immunity along with improvement in host resistance to toxic pathogenic invaders [36]. Innate killer units movement of advanced cancer patients has been enhanced by directing aged black garlic extract [37]. Inclusion of garlic and aged black garlic in diets especially designed for patients suffering from cancer have great impact as an immune nutrition. Garlic possible health advantages have been adopted by eras old used as a resistant supporter against pathogens.

## 5. Effect of garlic on cardiovascular diseases

In recent history cardiovascular diseases have been a major non-communicable disease. Garlic active main component allicin has helpful effect on cardiovascular system [38]. With the support of pharmacokinetics exploration, it has been noticed that sort of allicin is aquaphobic that makes it effortless for allicin to easily carry all through cell layer without any harm to the phospholipid bilayer, leading to metabolized by cell. These metabolites have health benefits and are important to cardiovascular system [39]. It has protecting effect to heart by inducing vasodilation and inhibiting different pathological conditions to CVD, which includes angiotensin, platelet aggregation, hyperlipidemia, hyperglycemia, and cardiac

hypertrophy. High cholesterol, high level of homocysteine hypertension and inflammation are the major cause for cardiovascular diseases [40]. Progression of disease with age linked to high risk of dementia and Alzheimer's. oxidative damage is most highlighted cause for cardiovascular problems. Garlic and aged black garlic due to its high profile of antioxidants may be beneficial for protection from heart related problems [41]. A study was performed which proves that allicin has a major antioxidant property that protect heart cells from oxidative stress that leads to cell injury or cell death [42].

Antioxidant estate of allicin was assessed by using 1-diphenyl-2-picrylhydrazyl (DPPH) assay and cell destruction H9C2 Cardio myoblasts induced by hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) [43]. It is demonstrated that allicin has shielding impact compared to oxidative damage by reducing intracellular oxidative species creation. It has also defensive influence in opposition to free radical induced myocardial cell death in ischemic condition [44].

## **6. Effect of garlic on blood glucose levels**

Exploring garlic effect on hyperglycemic is still under studied by researchers. Not so many studies have been done by scientist to prove this claim. Presence of bioactive compounds in garlic such as allicin, alliin, diallyl disulfide, diallyl trisulfide, diallyl sulfide, S-allyl cysteine, ajoene and allyl mercaptan is mainly attributed to prevent high glucose level in blood [45]. Insulin resistance can be controlled by garlic extract [46]. It has been proved that aged black garlic extract has beneficial effect on decreasing homocysteine level, lower blood pressure and increase micro-circulation that is fundamental for controlling hyperglycemia [47]. Some of studies has showed in favor of hypoglycemic effect of garlic. A study was conducted that proves metformin treatment with garlic has quicker lower of blood glucose level in patients as compared to patients treated with only metformin [48]. Another study was conducted in which patients with type 2 diabetes showed significant improvement in HDL cholesterol along with decrease concentration of LDL cholesterol when they were treated with garlic [47].

## **7. Anti-carcinogenic effect of garlic**

Garlic has countless ability to prevent cancer growth. Anticarcinogenic outcome of garlic has been characterized by diverse mechanisms including upsurge level of glutathione, collective enzymes actions such as S-transferase, catalase, and glutathione, hunting ability to minimize radicals, restoration mechanism of DNA, safety of chromosomal impairment and settlement of cytochrome p450E1 [49]. Different studies have been proceed including anti-proliferative ability of garlic active compounds to stop the tumor growth in vitro and in vivo [50]. Protein extracted from garlic bulb has significant effect against tumor size. Different studies revealed that individual mammary endothelial and colon cancer cell propagation has been constrained by active compound of garlic allicin [51]. Breast tumor risk is increased by linoleic acid. Garlic has negative effect against linoleic acid by increasing the effect of eicosatetraenoic acid, which is a breast cancer suppressor [52]. Probability of hormone receptive cancer is repressed by Sulfur compounds of garlic such as allyl-sulfides because of its aquaphobic environment and estrogen receptors with cysteine residue in hormone binding [53]. Different studies have been done which proves garlic and organic allyl Sulfur elements has capability to prevent cancer process. Risk of chemical induced tumors in animal model can be reduced by using

water soluble component S-allyl-Cysteine which is present in garlic. Proliferation of neoplasms can be reduced by treating with oil soluble compounds such as diallyl disulphide [54].

## **8. Cholesterol lowering potential**

All over the globe mortality and morbidity rate is increasing due to prominent cause of cardiovascular diseases. Atherosclerosis development is associated with mainly low-density lipoproteins (LDLs). Toxic Radicals initiate and increases the lipids peroxidation that further leads to increase in concentration of free radicals that disturb normal physiology of body including atherosclerosis. To colonize effect of cardiovascular disorders cholesterol controlling therapy is major vital to this [39]. Nearly All of the time patients having high-level percentage of cholesterol with other disorder is treated with drug which has side impact along with prerequisite of time. People are diverting their intentions to the natural sources to cure diseases. Garlic has been being used in natural medicine to cure lipid profile [55]. Different supplements have been invented that presents remarkable positive effect on regulating cholesterol, LDL cholesterol, and high-density lipoprotein (HDL) cholesterol and contributed to inhibit progression of disease [56].

Garlic and garlic supplements along with specific preparations have benefits to lowering cholesterol levels, blood pressure with decreasing platelets aggregation and inhibition LDL oxidation [57]. Garlic oil and extracts have also been used to lower the cholesterol level due to presence of bioactive component. A study was done to check the efficacy of garlic against cholesterol which showed decline in total cholesterol level as compared to garlic preparations such as oil [58]. Effect of garlic on lipid profile showed significant decrease of triglycerides level. Aqueous extract of garlic has sufficiency of decreasing cholesterol synthesis up to 75% without any cellular toxicity mediated by 4- $\alpha$ -methyl oxidase. It is effective against reducing coronary calcium progression [59].

In isoproterenol induced myocardial ischemia activity of lecithin acyl transferase was substantially improved along with control of 3-hydroxy-3-methylglutaryl-CoA reductase enzyme by garlic element S-allyl cysteine sulfoxide [60]. According to scientists observations, cholesterol synthesis can be controlled up to 40–60% by SAC, S-propyl cysteine and S-ethyl cysteine [61]. Garlic has capability to increase sulfhydryl oxidation that apparently hinder production of 3-hydroxy 3-methyl glutaryl-CoA reductase enzyme activity [62]. Yet there is not any significant mechanism to evaluate the process of reducing atherosclerosis disease progression. Further establishment should be managed to develop the relation among other garlic preparations, their antioxidant status and blood lipid profile.

## **9. Atherosclerosis and hyperlipidemia**

The pathogenesis of atherosclerosis also includes defectiveness of microvascular perfusion, which further leads to impaired wound healing. Nitric Oxide (NO) is a crucial modulator for endothelial regeneration, vasorelaxation and leucocytic chemotaxis inhibition. The poor microvascular perfusion is due to impaired release of NO because of reduced local endothelial NO synthase (eNOS) induced by atherosclerosis linked endothelial damage. Aged garlic extract (AGE) has been shown positive therapeutic effects in wound healing through NO dependent pathways, enhancing vascular elasticity and endothelial function. In a cohort of 93 patients with confirmed atherosclerosis, 2400 mg daily AGE for a year showed a



significant improvement in peripheral tissue perfusion and increase microcirculation, thus, facilitated wound healing [63]. Cardiovascular disease (CVD) leads to serious secondary manifestations such as Coronary atherosclerosis, a subsequent of hyperlipidemia, which can be further modifies if started with calcium disposition, known as calcification atherosclerotic lesions. Coronary artery calcification (CAC) is a well validated prognostic marker for the risk of ischemic heart diseases. Randomized Clinical Trial (RCT) showed a significant decrease in CAC progression with the introduction of AGE. It was also noted during experiments that AGE has had a major advantageous impact on inflammation by decreasing Interlukin-6 in patients with atherosclerosis [64, 65]. It is also evident that the high organosulfur properties of black garlic has an antioxidant effect to reduce atherosclerosis [61].

**Bacterial Infections:** The antibacterial activity attributed to allicin component makes garlic effective against numerous antibiotic-resistant, gram positive and gram-negative bacteria such as *Shigella*, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Streptococcus* mutants, *S. faecalis*, *S. pyogenes*, *Salmonella enterica*, *Klebsiella aerogenes*, *Vibrio*, *Mycobacteria*, *Proteus vulgaris*, and *Enterococcus faecalis*. The garlic extracts such as aqueous, methanolic, and ethanolic have been reported for inhibitory effects against *E. coli* and *Sal. Typhi* strains and other pathogenic bacteria cause diarrheal infections in humans. Garlic also showed effectiveness in preventing the toxins produced by bacteria, and towards methicillin-resistant *S. aureus* (MRSA) infections. Allicin chemical interaction with thioredoxin reductase, RNA polymerase, and alcohol dehydrogenase makes it as an effective component in antibacterial activity. Allicin can act as a biocide in killing all eukaryotic cells by influencing cysteine proteinase metabolism [66]. Encouraging findings have been attained by the use of allicin as an anti-microbial macrophage enhancer in handling drug susceptible or drug resistance *Mycobacterium tuberculosis* infection [67]. The characteristic of forming a biofilm helps resist bacteria against certain antibiotics drugs, which has become a global concern in treatment of bacterial infection. Hydrophobic compounds such as allicin found to be as an acting agent in inhibition of bacterial biofilm formation. Other hydrophobic garlic components such as vinyl dithiins, ajoenes and diallyl polysulfides showed similar biofilm formation suppressing effects help prevent drug resistance and enhance the efficacy of existing antibiotics [68]. For example, the anti-biofilm activity of fresh garlic extract (FGE) showed 35–59% less biofilm formation in Shiga toxin producing *Escherichia coli* (STEC) samples when studied in vitro [69]. Garlic was also being used as an effective antibacterial agent for the prevention of gas gangrene during World War II [70].

## 10. Fungal and parasitic infections

Garlic is an excellent antifungal agent against *Candida*, *Torulosis*, *Trichophyton*, *Cryptococcus*, *Aspergillus*, *Trichopteran*, and *Rhodotorula* species. It is evident that the components present in garlic extracts namely aqueous, ethanolic, methanolic, and petroleum ether act as antifungal agents against different human pathogenic fungal species such as *Trichophyton verrucosum*, *T. mentagrophytes*, *T. rubrum*, *Botrytis cinerea*, *Candida* species, *Epidermophyton floccose*, *Aspergillus niger*, *A. flavus*, *Rhizopus stolonifera*, *Microspore gypsum*, *M. audouinii*, *Alternaria alternate*, *Neofabraea alba*, and *Penicillium expansum*. The mechanism involves the irreversible ultrastructural changes that eventually leads to fungal cells death. Saponin components present in garlic showed effective antifungal properties against *Botrytis cinerea* and *Trichoderma harzianum* [71]. It has been observed that the garlic could inhibit the fungal growth as equally as the antifungal drugs

such as ketoconazole. There is an evidence of an effective antiparasitic activity of garlic against parasites such as *Schistosoma mansoni*, *Hymenolepis diminuta*, *H. microstoma*, and *Taenia taeniaeformis*, *Fasciola hepatica*, *Plasmodium falciparum* and *Trypanosoma brucei*, and *Echinostoma caproni*. The mechanism of action involves helping create antioxidants which eventually leads to reduced number of parasite eggs and low birth rate of new worms. Garlic is also helpful in treating human intestinal parasitic infection caused by *Entamoeba histolytica* and *Giardia lamblia* (chronic giardiasis) [72]. Garlic also possesses anthelmintic characteristics helpful in discarding injurious parasites in the intestine [73]. Sulphureous components of garlic make it an effective eliminating agent for intestinal tapeworms. Viral Infections: Garlic is found to be an effective herb against numerous viral infections and diseases. The antiviral components in garlic against influenza B, Human Immunodeficiency Virus (HIV), vesicular stomatitis virus, herpes simplex virus (types 1 and 2) has been demonstrated. The Ajoene component present in garlic prevents Human Immunodeficiency Virus (HIV) induced destruction of CD<sup>+</sup> cells and boost cellular immunity, induces apoptosis of infected cells in Human cytomegalovirus (HCMV), inhibits adhesive interactions and fusion of leukocytes in HIV infected platelet aggregation and fusion assays, inhibits HIV cell attachment, and occludes HIV-induced CD4 T-cells destruction. Allicin, allyl methyl thiosulfate, and methyl allyl thiosulfate inhibit numerous virus particles entry via disruption of viral envelope and cell membrane. The lectins present in garlic help inhibit HIV-1 replication and also inhibit the early and the late infectious cycle in severe acute respiratory syndrome (SARS-CoV) [74]. The antiviral potential of garlic against a number of viruses like influenza B, HIV (type 1), vesicular stomatitis virus, herpes simplex virus (types 1 and 2), coxsackievirus species, and gamma retrovirus was earlier demonstrated. The recent data has revealed that chymotrypsin-like protease (3CLpro) is a common main protease in both type 1 and type 2 SARS-CoV. The inhibition of 3CLpro in SARS-CoV was most possibly considered by seven alliin derived organosulfur compounds (OSCs). Detailed analysis revealed that alliin has the highest antiviral potency in preventing COVID-19. There is a possibility of SARS-CoV-2 elimination with the lowest side effects and toxicity by using garlic based bioactive components alone or in combination.

## 11. Conclusion

Garlic is one of the most vital herbaceous herbal that have been discovered next to a variety of lifetime associated ailments. Its richness in phytochemicals helps body go through abnormalities. Garlic includes magnesium, calcium, selenium, vitamin B<sub>1</sub> and vitamin B<sub>6</sub> tryptophan and protein. These components provide harmonious effect against various physiological disorders to increase preventive measure effects. More research should be designed to clarify claim of diseases. It has been identified that sulfur containing compounds in garlic has major role to prevent diseases and to insure pharmacological effect. Globally, it is consumed in different forms such as powder, extract, oil, and capsules. It should be added more frequently in diet due to its unique phytochemical's moieties. Garlic has wide application such as anti-inflammatory, antidiabetic, anticarcinogenic, antihyperlipidemic, antifungal, antiviral, and antiatherosclerosis.

## Conflict of interest

The authors proclaim not any contradiction.

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