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Health Benefits of Garlic- A Review

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ABSTRACT

Garlic has long been used in many ways by human beings in day today life. Researchers from various disciplines are now directing their efforts towards discovering the medicinal values of garlic on human health. various chemical constituents in garlic products, including sulphur and nonsulphur compounds, may contribute to the essential biological activities of garlic. The bioactive constituents in garlic are known to possess antimicrobial properties and prevent various diseases including cardiovascular disease, cancer, blood pressure, atherosclerosis and hyperlipidaemia.

Keywords: Active constituents, Garlic, Health promoting

I.INTRODUCTION

Garlic (*Allium sativum*) a member of the Liliaceae family is cultivated throughout the world. The genus Allium includes garlic, scallions, onions, chives, and leek [24]. The part of the pant used for cooking and medicinal uses is the garlic bulb which is formed from the teardrop shaped cloves enclosed in dry skin like papers. The use of garlic in therapeutic and medicinal purposes in both traditional and modern medicine make it an utmost important genus. It is consumed either as raw vegetable (fresh leaves or dried cloves), used as a spice in foods or after processing in the form of garlic oil, garlic extracts and garlic powder with variations in chemical composition and bioactive compounds [17]. Due to its strong and diverse effects, garlic is considered one of the best disease preventive foods [26]. The wide variety of effects may be due to the numerous compounds (organosulphur and others) contained in different concentrations, with potential beneficial properties on the human immune and cardiovascular systems [30].The aim of this article is to review the potential health benefits of garlic.

II. ACTIVE CONSTITUENTS IN GARLIC

Most of the reported medicinal effects of garlic are due to the sulphur containing compounds, high trace mineral content, and enzymes. One of the foremost biologically active compounds in garlic is allicin (diallyl thiosulfinate or diallyldisulfide). Alliin (S-allylcysteine sulfoxide), the most abundant sulphur compound is found in the concentration of 10 and 30 mg/g in fresh and dry garlic [19]. Common garlic food preparations like chopping, mincing and crushing disturbs S-allyl cysteine sulfoxide and expose it to the allinase enzymes, then convert it to diallyl thiosulfinate rapidly, that offer off garlic's characteristic aroma. The allinase enzyme

responsible for diallyl thiosulfanate conversion becomes inactivated below a pH of 3.5 or with heating [25]. As allicin being the major antioxidant and scavenging compound, recent studies shows that other compounds like polar compounds of phenolic and steroidal origin may play stronger roles and offer various pharmacological properties without odor and are also heat stable[16].

III.ROLE OF GARLIC IN HEALTH

1.1. Cardiovascular disease

Most common risk factors for cardiovascular disease include inflammation, high cholesterol, high homocysteine, high blood pressure, diabetes and dementia, including its most common form, Alzheimer's disease. Garlic is known to scavenge oxidants, increase superoxide dismutase, catalase, glutathione peroxidase, and glutathione levels, as well as inhibit lipid peroxidation and inflammatory prostaglandins. Garlic is also reported to reduce cholesterol synthesis by inhibiting 3-hydroxy-3-methylglutaryl-CoA. It inhibits LDL oxidation, platelet aggregation, arterial plaque formation, decrease homocysteine, lower blood pressure, and increase microcirculation, which is important in diabetes, where microvascular changes increase heart disease and dementia risks. Garlic is also known to prevent cognitive decline by protecting neurons from neurotoxicity and apoptosis, thereby preventing ischaemia or reperfusion related neuronal death and by improving learning and memory retention[3].

1.2. Reduces high blood pressure/hypertension

Garlic has been most popularized as a complementary therapy for blood pressure control [5]. A recent *in vitro* study has confirmed that, the vasoactive ability of garlic sulfur compounds whereby red blood cells convert garlic organic polysulfides into hydrogen sulfide, a known endogenous cardio protective vascular cell signaling molecule [2]. Using 2400 mg garlic tablet containing 31.2 mg allicin has reduced diastolic pressure by 16 mmHg after 5 h of administration [22].

1.3. Obesity

Obesity is related to low grade chronic inflammation characterized by abnormal cytokine production, increased acute phase reactants, and different mediators in response to excess nutrients in metabolic cells [11]. 1,2-vinyldithiin derived from garlic reduces the secretion of IL-6 and MCP-1, -2 in human preadipocytes treated with macrophage factors. Both molecules are associated with inflammation and the metabolic complications of obesity [12].

1.4. Anti cancer effects

Diallyl sulfide (DAS), diallyl disulfide (DADS) and diallyl trisulfide (DATS) derived from garlic have been shown to possess anticancer activities [13]. Generation of ROS (reactive oxygen species) and subsequent activation of the ROS-dependent caspase pathway in U937 leukemia cells mediates the cytotoxicity caused by DATS [8]. a A potent compound, S-allylcysteine (SAC) has been recently identified in garlic possessing in vitro chemo-preventive activity. It may also be a promising candidate for prostate cancer treatment [20]. Allicin (diallyl thiosulfinate), the best-known biologically active component in freshly crushed garlic extract, is effective on cell proliferation of colon cancer cells [1].

1.5. Immunomodulatory effects

Compared to raw garlic, aged garlic extract has been reported to have excellent immunomodulatory properties [7]. This effect of garlic is attributed to the transformed organosulfur compounds [6]. Aged garlic fructans have recently been shown to possess immunomodulatory activities in vitro [7]. A study demonstrated that immune-mediated liver damage in mice can be prevented by allicin, probably because of its immunomodulatory effects on T cells and adhesion molecules and inhibition of NF-kappaB activation[4]. Another observation indicated that allicin exerts an inhibitory immunomodulatory effect on intestinal epithelial cells and it may have the potential to attenuate intestinal inflammation[15].

1.6. Antibacterial activity

Garlic extract inhibits the growth of Gram positive and Gram negative bacteria, such as *Staphylococcus, Streptococcus, Micrococcus*, *Enterobacter*, *Escherichia*, *Klebsiella*, *Lactobacillus*, *Pseudomonas*, *Shigella*, *Salmonella*, *Proteus*, and *Helicobacter pylori* [31]. Allicin is considered to be the most potent antibacterial agent in garlic. It is produced by the enzymatic activity of allinase on alliin. But is unstable, and breaks down within 16 h at 23°C [10]. However, the use of a water based extract of allicin stabilizes the allicin molecule due to the hydrogen bonding of water to the reactive oxygen atom in allicin. There may also be water soluble components present in crushed garlic that destabilize the molecule [18].

1.7. Antiviral activity

Garlic is also known to be active against viruses, herpes simplex, HIV and influenza. The order of compounds found in garlic for virucidal activity are, ajoene > allicin > allyl methyl thiosulfanate > methyl allyl thiosulfanate [9].

1.8. Antifungal activity

The bioactive compound that plays a major role as topical antifungal agent derived from garlic is Ajoene [14]. Garlic has been reported to inhibit growth of fungal diseases as equally as the drug ketoconazole, when tested on the fungi *Malassezia furfur*, *Candida albicans*, *Aspergillus*, *Cryptococcus* and other *Candida* species [29].

1.9. Osteoporosis

Garlic conjointly possess phytoestrogenic effects to counter boneloss. A study on rats examined the effects of garlic extracts on the intestinal movement of calcium as well as garlic's possible role in maintaining the bone mineral content associated bone tensile strength in an ovariectomized rat model of osteoporosis. The results suggested that, oil extract of garlic promotes intestinal transference of calcium by balancing the activities of both intestinal alkaline phosphatase and Ca(2+) activated ATPase. Also, the garlic oil supplementation restored the low bone mineral content and low bone tensile strength within the rats. Moreover, the supplementation was able to partially restore the bilateral ovariectomy induced decrease in the serum estrogen titer. Interestingly, the serum parathyroid hormone level, was found unaltered in these rats. The garlic oil supplemented partial recovery in serum estrogen titer in bilaterally ovariectomized rat was found to be persistently related to increased calcium transference and better preservation of bone mineral content [23]. It may then be beneficial to use garlic as a treatment strategy in post-menopausal women with osteoporotic tendency or for premature menopausal women who have sustained low estrogen levels.

3.10.Drug toxicities

Various organosulfur compounds present in garlic has been hypothesized to forestall glutathione depletion, a compound necessary for liver detoxification. Patients experiencing increases in reactive oxygen species induced stress on liver function may be protected by garlic ingestion [27]. A study on Escherichia coli cultures reported that S-allylcysteine, diallyl sulfide and diallyl disulfide from aged garlic extract do not interfere with the antibiotic activity of gentamycin but may mitigate gentamycin induced nephrotoxicity [21]. Aged garlic has also been shown to reverse oxidant effects of nicotine toxicity in rat studies [28].

II. CONCLUSION

Garlic is one of the foremost utilized seasonings for cookery. Additionay used in traditional medicine with protective and curative purposes, it has been used to treat cardiovascular diseases, including atherosclerosis, hypertension, and hyperlipidemias, as well as uses in Alzheimer's, and cancer. Today, with the ever growing resistant organisms, taking of garlic extract remains a powerful antimicrobial agent. Clearly additional studies are required to refine the employment and improvement of the effectuality of this important medicinal plant.

REFERENCES

[1] W. Bar-Chen, T. Golan, I. Peri, Z. Ludmer, and B. Schwartz, Allicin purified from fresh garlic cloves induces apoptosis in colon cancer cells via Nrf2, *Nutrition and Cancer*, *62*, 2010, 947-957.

[2] G. A. Benavides, G. L. Squadrito, R. W. Mills, H. D. Patel, T. S. Isbell, R. P. Patel, V. M. Darleyusmar, J. E. Doeller, and D. W. Kraus, Hydrogen sulfide mediates the vasoactivity of garlic, *PNAS*, *104*, 2007, 17977-17982.

[3] C. Borek, Garlic reduces dementia and heart disease risk. *Journal of Nutrition*, *136(3)*, 2006 810S-812S.

[4] R. Bruck, H. Aeed, E. Brazovsky, T. Noor, and R. Hershkoviz, Allicin, the active component of garlic, prevents immune mediated, concanavalin A-induced hepatic injury in mice. *Liver International, 25*, 2005, 613-621.

[5] M. Capraz, M. Dilek, and T. Akpolat, Garlic hypertension and patient education. *International Journal of Cardiology, 3*, 2006, 15-19.

[6] P. M. Chandrashekar, K. V. Prashanth, and Y. P. Venkatesh, Isolation, structural elucidation and immunomodulatory activity of fructans from aged garlic extract. *Phytochemistry*, *72*, 2011, 255-264.

[7] P. M. Chandrashekar, and Y. P. Venkatesh, Fructans from aged garlic extract produce a delayed immunoadjuvant response to ovalbumin antigen in BALB/c mice. *Immunopharmacology and Immunotoxicology*, *34*, 2012, 174-180.

[8] Y. H. Choi, and H. S. Park, Apoptosis induction of U937 human leukemia cells by diallyl trisulfide induces through generation of reactive oxygen species. *Journal of Biomedical Science*, *19*, 2012, 50.

[9] G. Gebreselema, and G. Mebrahtu, Medicinal values of garlic. A review. *International journal of Medicine and Medical sciences*, *5(9)*, 2013, 401-108.

[10] G. Hahn, *The science and therapeutic application of Allium sativum L. and related species* (In: Koch HP, Lawson LD, ed. Garlic: 2nd edn. Baltimore Williams and Wilkins, 1996, 1-24).

[11] G. S. Hotamisligil, Inflammation and metabolic disorders. *Nature, 444*, 2006, 860–867.

[12] M. F. Keophiphath, I. Priem, Jacquemond-Collet, Clement, and D. Lacasa, 1,2-vinyldithiin from garlic inhibits differentiation and inflammation of human preadipocytes. *Journal of Nutrition, 139(11), 2009*, 2055–2060.

[13] K. C. Lai, C. L. Kuo, H. C. Ho, J. S. Yang, C. Y. Ma, and H. F. Lu et. al, Diallyl sulfide, diallyl disulfide and diallyl trisulfide affect drug resistant gene expression in colo 205 human colon cancer cells in vitro and in vivo. *Phytomedicine, 19*, 2012, 625-630.

[14] E. Ledezma, and R. Apitz-Castro, Ajoene the main active component of garlic (*Allium sativum*): a new antifungal agent. *Revista Iberoameriacana Micologia, 23*, 2006, 75-80.

[15] A. Lang, M. Lahav, E. Sakhnini, I. Barshack, H. H. Fidder, B. Avidan, et al, Allicin inhibits spontaneous and TNF-alpha induced secretion of proinflammatory cytokines and chemokines from intestinal epithelial cells. *Clinical Nutrition, 23*, 2004, 1199-1208.

[16] V. Lanzotti, The analysis of onion and garlic. *Journal of Chromatography A, 12(1)*, 2006, 3-22.

[17] V. Lanzotti, F. Scala, and G. Bonanomi, Compounds from Allium species with cytotoxic and antimicrobial activity. *Phytochemistry Reviews, 13*, 2014, 769-791.

[18] L. D. Lawson, and Z. Y. J. Wang, Changes in the organosulphur compounds released from garlic during aging in water, dilute ethanol or dilute acetic acid. *Journal of Toxicology, 14*, 1996, 214.

[19] L. D. Lawson, *Garlic: a review of its medicinal effects and indicated active compounds* (In: Lawson LS, Bauer R, ed. Phytomedicines of Europe: Chemistry and Biological Activity, ACS Symposium Series 691, Am. Chem. Soc. Washington, 1998, 176-209).

[20] Z. Liu, M. Li, K. Chen, J. Yang, R. Chen, T. Wang, et al, S-allylcysteine induces cell cycle arrest and apoptosis in androgen independent human prostate cancer cells. *Molecular Medicine Reports, 5*, 2102, 439-443.

[21] P. D. Maldonado, M. E. Chánez-Cárdenas, and J. Pedraza-Chaverri, Aged garlic extract,garlic powder extract, S-allylcysteine, diallyl sulfide and diallyl disulfide do notinterfere with the antibiotic activity of gentamicin. *Phytothetrapy Research, 19(3)*, 2005, 252-4.

[22] F. G. McMahon, and R. Vargas, Can garlic lower blood pressure? A pilot study, *Pharmacotherapy, 13*, 1993, 406-407.

[23] M. Mukherjee, A. S. Das, D. Das, S. Mukherjee, S. Mitra, and C. Mitra, Role of oil extract of garlic (Allium sativum Linn.) on intestinal transference of calcium and its possible correlation with preservation of skeletal health in an ovariectomized rat model of osteoporosis. *Phytotherapy Research, 20(5)*, 2006, 408-15.

[24] M. Murray, The Encyclopedia of Healing Foods. Atria Books 2005, 201.

[25] J. Pedrazza-Chaverri, E. Tapia, O. N. Medina-Campos, M. Granados, and M. Franco, Garlic prevents hypertension induced by chronic inhibition of nitric oxide synthesis. *Life Sciences, 62,* 2006, 71-77.

[26] R. Rivlin, Historical perspective on the use of garlic. *Journal of Nutrition, 131,* 2001, 951S–4S.

[27] B. Sabayan, F. Foroughinia, and A. Chohedry, A postulated role of garlic organosulfur compounds in prevention of valproic acid hepatotoxicity. *Medical Hypotheses, 68(3),* 2007, 512-4.

[28] G. Sener, A. O. Sehirli, Y. Ipci, S. Cetinel, E. Cikler, and N. Gedik, Chronic nicotine toxicity is prevented by aqueous garlic extract. *Plant Foods for Human Nutrition, 60(2),* 2005, 77-86.

[29] M. Shams-Ghahfarokhi, M. R. Shokoohamiri, N. Amirrajab, B. Moghadasi, A. Ghajari, F. Zeini, G. Sadeghi, and M. Razzaghi-Abyaneh, In vitro antifungal activities of *Allium cepa*, *Allium sativum* and ketoconazole against some pathogenic yeasts and dermatophytes. *Fitoterapia, 77(4),* 2006, 321-323.

[30] G. P. Sivam, Protection against Helicobacter pylori and other bacterial infections by garlic. *Journal of Nutrition, 131(3), 2001,* 1106s–1108s.

[31] S. M. Tsao, and M. C. Yin, In vitro antimicrobial activity of four diallyl sulphides occurring naturally in garlic and Chinese leek oil. *Journal of Medical Microbiology, 50,* 2001, 646-649.

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