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Full Length Research Paper

Allium sativum - A Global Natural Herb with Medical Properties

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ABSTRACT

Traditionally, garlic (*Allium sativum*) is known to be a significant immune booster. Garlic has been used as medicine in many cultures for thousands of years, dating as far back as the time that the Egyptian pyramids. Physicians prescribed the herb during the middle-ages to cure deafness and the American Indians used garlic as a remedy for ear aches, scurvy, flatulence. Garlic is not only beneficial as medicinal plant, but it can be used as repellent to some plant pests and diseases. Its chemical compounds and medicinal properties will be discussed in this review.

Key words: Garlic, *Allium cepa*, immunomodulatory, Cardiovascular disease, flatulence

1. INTRODUCTION

Garlic has been used throughout history for both culinary and medicinal purposes (Coppi *et al.*, 2006; Banerjee and Maulik 2002). Garlic has been used as a traditional remedy and possesses various therapeutic functions. Aged garlic extract has been shown to be more potent compared to raw garlic in many of the therapeutic properties of garlic (Gardner *et al.*, 2007). Garlic (*Allium sativum* L.) is one of the oldest cultivated plants used for food and medicine its uses have been well documented. (Block, 1985). As an antiseptic, its use has long been recognized. It is said to prevent anthrax in cattle and juice and milk of garlic are still used as a vermifuge (Lanzotti *et al.* 2012). The domestic Alliums (onion, garlic, chives and leek), contain high concentrations of organic sulphur compounds especially in the vegetative tissue of the swollen leaf bases and leaves (Block, 1992).

1.1 Scientific name: *Allium sativum* L.

1.2 Common name

Allium sativum, commonly known as garlic, is a species in the onion genus, *Allium*. Its close relatives include the onion, shallot, leek, chive and rakkyo.

1.3 Plant Description

A. sativum is a perennial herb with a tall, erect flowering stem that grows up to 3 feet and is cultivated asexually.

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1.4. Distribution

Garlic is native to central Asia and has long been a staple in the Mediterranean region, as well as a frequent seasoning in Asia, Africa, and Europe. It was known to ancient Egyptians, and has been used for both culinary and medicinal purposes.

2. NUTRITIONAL VALUE

Garlic is hot and dry, relieves pain caused by the colds, and acts like an antidote for bites. A paste made from it is applied on blisters of the skin. It also precipitates menstruation and helps to expel the afterbirth. Garlic is very good for cold temperaments, for those who are phlegmatic, and for those who have palsy, but it dries up semen.

3. MEDICINAL USE

The bulbs of the plant have been used in many parts of the world as a stimulant, antiseptic, anthelminthic, antihypertensive, carminative, diaphoretic, expectorant, diuretic, antisorbutic, aphrodisiac and antiasthmatic and for the relief of rheumatic pains (Mikail 1995). Transgenic rice cultivars containing (*A. sativum* leaf lecithin based) ASAL protein have a compound in it that helps the blood flow more freely and reduce the incidence of clots. A daily dose of 1 mL/kg body weight of garlic extract for six months can result in significant reduction in oxidant (free radical) stress in the blood of patients with atherosclerosis and cholesterol circulating in the bloodstream. Garlic's ability to prevent these oxidation reactions may explain some of its beneficial effects in atherosclerotic cardiovascular diseases (Karuppiah and Rajaram 2012).

It has hypoglycemic/antidiabetic activity, anticancer activity and has cardioprotective effects. It helps in relieving high blood pressure, antispermatogenic activity, antimicrobial/antifungal activity, radioprotective effect, antipyretic and analgesic activities. Besides this it also helps in constipation, burn case, peptic ulcer and Respiratory infection. In has been employed for cure of atherosclerosis and as a treatment for local intestinal diseases.

3.1 Immunomodulatory effects of black garlic

Black garlic is created from ordinary fresh garlic by the process of ageing, by providing temperature 65-80ºC, and humidity 70-80% controlled room for a month without any additional treatment and additives. The heat extract of black garlic were rich in S-allyl-L-cysteine (SAC) and enforced anti-tumor activity. The fresh white garlic changed its color from white to brown and eventually became black a month later, caused by Maillard and Browning reaction. This black garlic has a soft fruity taste with a non-irritating odor. Aged garlic extract (AGE) possesses superior immunomodulatory effects than raw garlic; these effects are attributed to the transformed organosulfur compounds. Chandrashekar and Venkatesh (2009) have shown recently that AGE also contains some immunodulatory proteins which have been identified as the major garlic proteins or agglutinins. Together, their results suggest that immunomodulatory proteins and fructans contribute to the therapeutic potential of AGE, in addition to the crucial transformed organosulfur compounds. Garlic contains a mixture of **fructooligosaccharides** and **fructopolysaccharides** ranging in

molecular mass from <1000 Da to 6800 Da corresponding to degree of polymerization (DP) as high as 38 (Losso and Nakai, 1997).

4. ANTIHARBIVORY AND ANTIMICROBIAL ACTIVITY

Garlic exhibits antiharbivory and antimicrobial activity. cysteine sulphoxides, in combination with the enzyme **alliinase**, are thought to be responsible for chemical protection from herbivory (Keusgen, 2002). High levels of cysteine sulphoxides have also been shown to have antibacterial and antifungal properties which are probably beneficial during extreme environmental conditions. The role of saponins in plants is not completely elucidated but there is strong evidence that they act as defense compounds against fungal pathogens' attack (Morrissey and Osbourn, 1999) and show anti-cancer, anti-inflammatory, ion channel blocking, immune stimulating, antifungal, antithrombotic and hypocholesterolemic property (Harmatha, 2000). High concentrations of two eugenol diglycosides were found for the first time in Allium spp by Lanzotti (2012) which had antimicrobial activity towards two fungal species, the air-borne pathogen *Botrytis cinerea* and the antagonistic fungus *Trichoderma harzianum* (Lanzotti 2012).

5. BIOSYNTHESIS

The path of synthesis of alkyl cysteine sulphoxides, or flavour precursors, in the Alliums is still speculative. There are two proposed routes for alliin biosynthesis, one is from serine and allyl thiol while the other is from glutathione and an allyl source via c-glutamyl peptides.

6. GARLIC TISSUE CULTURE

Both garlic and onion tissue cultures were able to synthesize **alliin** following incubation with **allylthiol,** and **cysteine** conjugates such as **allyl cysteine**. The ability of the tissue cultures to form **alliin** from intermediates was compatible with the proposed routes of synthesis of alliin (Hughes *et al.*, 2004).

7. GARLIC TISSUE CULTURE

Garlic contains water (62–68%), carbohydrate (26–30%), protein (1.5–2.1%), amino acids (1–1.5%), organosulfur compounds (1.1–3.5%), and fiber (1.5%), all based on fresh weight (Koch and Lawson, 1996). Carbohydrates are the most abundant class of compounds present in garlic bulbs and account for about 77% of the dry weight. The majority of the carbohydrate material in garlic cloves, as well as in other Allium species, consists of water-soluble fructose polymers called fructans or fructosans (Koch and Lawson, 1996). It has been established that approximately 65% of the dry weight of garlic consists of fructans; hence, fructans constitute 84% of the carbohydrate content of garlic (Lawson and Wang, 1995).

Members of the genus Allium, such as Chinese chive (*Allium tuberosum*), garlic (*Allium sativum*) and bulb onion (*A. cepa* L.), contain high levels of the reduced organosulfur compounds alk(en)yl cysteine sulfoxides (ACSOs), which confer characteristic flavors (Randle and Lancaster, 2002). The sulphur is primarily as alkylcysteine sulphoxides and c-glutamyl peptides which together make up over 70% of the total sulphur in garlic (**Lawson**, 1996). Allicin is an organosulfur compound obtained from garlic, a species in the family Alliaceae. It was

first isolated and studied in the laboratory by Chester J. Cavallito and John Hays Bailey in 1944. This colorless liquid has a distinctively pungent smell. This compound exhibits antibacterial and Allicin is garlic's defense mechanism against attacks by pests**.** The thiosulphinates play a very important role in flavor and aroma of fresh garlic. Several authors have suggested (Keusgen *et al.*, 2012) that the content of the four major cysteine sulphoxides (**alliin, isoalliin, methiin and propiin**) underlies the different tastes of common onion, garlic, leek., and human health benefits (Griffiths *et al.*, 2002).

8. EVOLUTIONARY SIGNIFICANCE

Methiin is the dominant cysteine sulphoxide in all evolutionary lines of Allium and additionally occurs in the **Brassicaceae** (Keusgen, 1999). Methiin can be also found in some fungi (Kreuzberg and Keusgen, 2004). Therefore, the content of **methiin** can only complement taxonomic interpretations based on the presence of additional sulphur containing compounds (e.g., glucosinolates for **Brassicaceae**, and other cysteine sulphoxides for **Allium**).

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