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Bioactive components of garlic and their physiological role in health maintenance: A review

*S.G. Santhosha, Prakash Jamuna, S.N. Prabhavathi**

Department of Food Science and Nutrition, University of Mysore, Manasagangothri, Mysore-570 006, India

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ABSTRACT

In recent years, natural plant products are gaining popularity in preventing various diseases. Garlic is one of the most extensively researched product for investigating its beneficial effects. Potential health benefits of allium vegetables, in particular garlic (*Allium sativum*) has its origin in antiquity. It has acquired a reputation as a formidable prophylactic and therapeutic medicinal agent in the folklore of many cultures, over the centuries. The bioactive components of garlic are mainly responsible for the healing properties. The major physiological role of garlic are its antimicrobial, anticancer, antioxidant, immune boosting, antidiabetic, hepatoprotective, antifibrinolytic and anti-platelet aggregatory activity and its potential role in preventing cardiovascular diseases. The acclaimed health benefits of chemical constituents of garlic in treating various disorders have been investigated both in animals as well as in humans. This article reviews the current knowledge regarding the physiological role of garlic in various disease states.

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*Corresponding author. Tel.: +91 890 400 9327.
E-mail address: pprabhavathisn@gmail.com (S.N. Prabhavathi).

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1. Introduction

Human beings for several centuries are dependent on medicinal plants to cure various diseases and developments in the area of nutrition during the last few decades have revealed their therapeutic benefits (Ramaa, Shirode, Mundada, & Kadam, 2006; Dattner, 2003; Fong, 2002). With rapid urbanization change in life style and dietary habits have been linked to the pathogenesis such as cardiovascular complications, cancer and immune dysfunction. Habitual use of functional foods such as garlic could help to protect from such maladies (Amira & Okubadejo, 2007; Shamseer, Charrois, & Vohra, 2006; Tapsell et al., 2006). Potential health benefits of vegetables belonging to the allium species, particularly garlic have been used from ancient times to treat various disorders, but still extensive research is required to establish the claimed benefits (Galeone et al., 2006). Garlic is one of the ancient medicinal plants which originated from Central Asia over 6000 years ago. Garlic based remedies have been in India since 5000 years ago and the utilization of garlic in Chinese medicine had started 3000 years ago (Rivlin, 2001).

The physiological effects of garlic are mainly due to the presence of volatile sulfur compounds like thiosulfates which give pungent aroma (Agarwal, 1996). Because of its beneficial effects garlic is recommended as a dietary supplement today (Raman, Dewitt, & Nair, 2007; Kik, Kahane, & Gebhardt, 2001). Several scientific research and clinical trials have been conducted during the last decade to determine the effects of garlic consumption. Several studies report the functional activity of garlic which includes, free radical scavenging, immune stimulating, and cardiovascular disease, anticancer and anti-infectious properties (Herman-Antosiewicz, Powolny, & Singh, 2007; Singh et al., 2007; Borek, 2006; Khanum, Anilakumar, & Viswanathan, 2004; Colic & Savic, 2000; Harris, Cottrell, Plummer, & Lloyd, 2001). This paper attempts to review the current knowledge regarding bioactive components of garlic and their physiological role in disease prevention.

1.1. *Classification and chemistry*

Garlic belongs to the family *Liliaceae*. It comprises higher concentration of sulfur compounds which yield characteristic flavour and taste and are also responsible for beneficial effects. Garlic contains approximately 65% water, 28% carbohydrate (fructans), 2.3% organosulfur compounds, 2% proteins (allinase), 1.2% free amino acid (arginine) and 1.5% fiber. The active substance allicin (diallyl thiosulfate) is responsible for the typical pungent smell and for its therapeutic properties (Macpherson et al., 2005; Li, 2000; Song & Milner, 2001). Major sulfur containing compounds present in garlic are gamma-glutamyl-*s*-allyl-cysteine and S-allyl-L-cysteins sulfoxides (alliin). These also act as precursors of several other compounds (Matsuura, 1997).

1.1.1. *Thiosulfinates*

Disruption of garlic bulb results in the formation of thiosulfinates such as allicin, by the action of enzymes (Lawson & Hughes, 1992). Other thiosulfinates present in garlic are allyl methyl-methyl allyl- and *trans*-1 propenyl-thiosulfinate which are unstable in nature (Lawson, Wood, & Hughes, 1991).

1.1.2. *Organosulfur volatiles*

Diallyl disulfide (DADS), diallyl sulfide (DAS), diallyl trisulfide (DTS) and sulfur dioxide are formed by the decomposition of allicin. The major volatiles that are identified from disrupted garlic and garlic essential oil are, DAS, DADS, DATS, methyl allyl disulfide, methyl allyl trisulfide vinyldithiins and ajoenes. The major sulfide compounds of garlic oil are DAS (5%), allyl methyl (37%), dimethyl (6%), mono-to-hexasulfides and a small amount of allyl 1- propenyl and methyl 1-propenyl di-tri- and tetra sulfides (Amagase, 2006; Canizares et al., 2004b).

1.1.3. *Vinyldithiins*

These are the thermal degradation products of allicin. It is formed by type of mechanism involving diels-alder

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