EDITORIAL

The Phytonutrients of Garlic have an effective efficacy against many forms of bacteria, including Salmonella and Escherichia coli

NAVEED SHUJA
Associate Professor Biochemistry
Lahore Medical & Dental College Lahore
Email: rananaveedshuja@gmail.com cell# +923334205687

INTRODUCTION

Throughout history, many different cultures have recognized the potential use of garlic for prevention and treatment of different diseases[1]. Recent studies support the effects of garlic and its extracts in a wide range of applications[2,3]. These studies raised the possibility of revival of garlic therapeutic values in different diseases. Different compounds in garlic are thought to reduce the risk of bacterial infections[11]. The use of garlic in treating infections is a long-standing tradition in many cultures[1,6]. However, it was not until recent years the exact reason why garlic has so much antibacterial, antifungal and antiviral properties were studied[4].

Allicin is the most prominent compound found in garlic and has excellent antimicrobial functions. It is the most active compound in garlic which gives it these properties[5]. Allicin is highly effective against MRS (Multidrug Resistance Strains) bacterias which makes it highly valuable for the medical community. Another component found in garlic called as Ajoene is also capable of treating fungal infections such as athlete's foot which many people suffer from worldwide[7]. Garlic extract can also be used for the treatment of influenza and herpes viruses and can deliver positive results.This compound can easily eradicate bacteria by resisting the production or blocking the enzymes that are directly responsible for several vital functions of the bacteria such as energy production and cell structure formation. Without the necessary energy, the bacterias will die off in no time[7,2]. Allicin can also actively inhibit the formation of biofilms which is one of the major defence mechanisms employed by bacterias and fungus. The formation of biofilms makes the treatment of these infections very difficult and garlic can be used to prevent the formation of biofilms[8,5].

The antibacterial activity of garlic is widely attributed to allicin. It is known that allicin has sulfhydryl modifying activity and is capable of inhibiting sulfhydryl enzymes. Cysteine and glutathione counteract the thiolation activity of allicin[9]. Garlic extract and allicin have been shown to exert bacteriostatic effects on some vancomycin-resistant enterococci. An inhibitory synergism was observed when used in combination with vancomycin. It is thought that allicin modifies the sulfhydryl groups on the enzymes of the TN1546 transposon, which encodes vancomycin resistance, enhancing susceptibility to vancomycin[10]. The antibacterial effect of different concentrations of garlic extract against human dental plaque microbiota has been shown in vitro study. The synergism between ciprofloxacin with garlic extract has been shown, but not between ampicillin and the garlic extracts. The cloves of garlic and rhizomes of ginger, extracted with 95% ethanol, suggested to have anti-bacterial activity against multi-drug clinical pathogens and can be used for prevention of drug resistant microbial diseases[9,16].

Mechanism of action of Allicin: Allicin (diallylthiosulfinate) is a defence molecule from garlic (*Allium sativum* L.) with a broad range of biological activities[11]. Allicin is produced upon tissue damage from the non-proteinogenic amino acid alliin (S-allylcysteinesulfoxide) in a reaction that is catalyzed by the enzyme alliinase. Current understanding of the allicin biosynthetic pathway will be presented in this review[12]. Being a thiosulfinate, allicin is a reactive sulfur species (RSS) and undergoes a redox-reaction with thiol groups in glutathione and proteins that is thought to be essential for its biological activity[13]. Allicin is physiologically active in microbial, plant and mammalian cells. In a dose-dependent manner allicin can inhibit the proliferation of both bacteria and fungi or kill cells outright, including antibiotic-resistant strains like methicillin-resistant Staphylococcus aureus (MRSA)[14]. Furthermore, in mammalian cell lines, including cancer cells, allicin induces cell-death and inhibits cell proliferation. In plants allicin inhibits seed germination and attenuates root-development. The majority of allicin's effects are believed to be mediated via redox-dependent mechanisms[15].

CONCLUSION

Garlic and shallots are safe and rich sources of biologically active compounds with low toxicity. Further studies are needed to confirm the safety and quality of the plants to be used by clinicians as therapeutic agents.Our aim in preparing this paper was to show the traditional usage and previously confirmed pharmacological effects of garlic along with shallots as two of the most well-known medicinal plants in Iran and to illustrate their potential to be used as novel sources for development of new drugs based on the most recent associated studies. As it is shown in this study, garlic has a wide range of pharmacological effects including antibacterial and antimicrobial, among these biologically active compounds, allicin, allyl methyl sulfide, DTS, and ajoene have been shown to be the main responsible compounds for the antifungal, antibacterial, antiprotozoal, and antiviral effects of garlic, respectively. It is evident from this study that A. sativum may exert toxicity

only at high doses and that there have been few reports of intoxications following the ingestion of garlic.

REVERENCES

1. Singh TU, Kumar D, Tandan SK, Mishra SK. Inhibitory effect of essential oils of Allium sativum and Piper longum on spontaneous muscular activity of liver fluke, Fasciolagigantica. *ExpParasitol.* 2009;123:302–308.
2. Eja ME, AsikongBE, Abriba C, Arikpo GE, Anwan EE, Enyi-Idoh KH. A comparative assessinent of the antimicrobial effects of Garlic (Allium sativum) and Antibiotics on diarrheagenic organisms. *Southeast Asian J Trop Med Public Health.* 2007;38:2. [
3. *PDR for Herbal Medicines.* Medical Economics Company, Inc: Montvale; 2000.
4. Mikaili P, Mehdioghli R. *Garlic Pharmacology.* National Library and Archives Organisation of Iran; 2010. ISBN: 9789647780704.
5. EL-mahmood MA. Efficacy of crude extracts of garlic (Allium sativum Linn) against nosocomial Escherichia coli, Staphylococcus aureus, Streptococcus pneumoniea and Pseudomonas aeruginosa. *J Med Plants Res.* 2009;3:179–185.
6. McRae MP. A review of studies of garlic (Allium sativum) on serum lipids and blood pressure before and after 1994: does the amount of allicin released from garlic powder tablets play a role. *J Chiropr Med.* 2005;4:82–90.
7. Tariq HA, Kandil O, Elkadi A, Carter J. Garlic revisited: therapeutic for the major diseases of our times. *J Natl Med Assoc.* 1988;80:439–445.
8. Lanzotti V, Barile E, Antignani V, Bonanomi G, Scala F. Antifungal saponins from bulbs of garlic, Allium sativum L. var. Voghiera. *Phytochemistry.* 2012;78:126–34.
9. Azimi H, Fallah-Tafti M, Karimi-Darmiyan M, Abdollahi M. A comprehensive review of vaginitis phytotherapy. *Pak J Biol Sci.* 2011;14:960–966.
10. Ankri S, Mirelman D. Antimicrobial properties of allicin from garlic. *Microbes Infect.* 1999;2:125–129.
11. Meriga B, Mopuri R, MuraliKrishna T. Insecticidal, antimicrobial and antioxidant activities of bulb extracts of Allium sativum. *Asian Pac J Trop Med.* 2012;5:391–395.
12. Pundir RK, Jain P, sharma CH. Antimicrobial activity of ethanolic extracts of syzygiumaromaticum and Allium sativum against food associated bacteria and fungi. *Ethnobotan Leaflets.* 2010;14:344–360.
13. Liu S, Sun Y, Li W, Yu H, Li X, Liu Z, et al. The antibacterial mode of action of allitridi for its potential use as a therapeutic agent against Helicobacter pylori infection. *FEMS MicrobiolLett.* 2010;303:183–189.
14. Benkeblia N. Antimicrobial activityof essential oil extracts of various onions (Allium cepa) and garlic (Allium sativum) *Lebensm.-Wiss. u.-Technol.* 2004;37:263–268.
15. Palaksha MN, Ahmed M, Das S. Antibacterial activity of garlic extract on streptomycin-resistant Staphylococcusaureus and Escherichia coli solely and in synergism with streptomycin. *J Nat SciBiol Med.* 2010;1:12–5.
16. Lai PK, Roy J. Antimicrobial and chemopreventive properties of herbs and spices. *Curr Med Chem.* 2004;11:1451–1460.