

Evaluation of Garlic Extract's (*Allium sativum*) Effect on Common Pathogenic Gram-Positive and Gram-Negative Bacteria Isolated from Children with Septicemia Hospitalized at Imam Khomeini Hospital

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Abstract: Garlic is from major herbal. Performed studies on various bacteria have shown bactericidal potency of garlic. In this study, inhibitory effects of garlic extract on common bacteria have tested. Minimal Inhibitory Concentration (MIC) was $156 \mu\text{g mL}^{-1}$ for six of eight *Staphylococcus aureus* and it was $132 \mu\text{g mL}^{-1}$ for other two. MIC varies from 78 to 624 for Enterobacteriaceae. Inhibitory effect of garlic extract for *Pseudomonas aeruginosa* was lower in comparison with other gram-negative bacteria. This study shows that garlic extract has antimicrobial effect against tested bacteria including Gram-positive Cocci and Gram-negative bacilli.

Key words: Garlic, extract, minimal inhibitory concentration, gram positive bacteria, gram negative bacteria

INTRODUCTION

Garlic (*Allium Sativum* L.) is from Bulbous plant that is important for its nutritional aspect (Velisek *et al.*, 1997). It is believed that its genetic origin was central Asia and it has been spread to west, east and south (Ettoch *et al.*, 2001). Therapeutically applications of garlic have known from many ages ago (Ghazanfari *et al.*, 2002). This plant is broadly used for antibiotic effects and its effects against Diabetes, atherosclerosis and cancer (Ghazanfari *et al.*, 2002; Augusti, 1996; Chiba *et al.*, 1998). This green reduces blood plasma cholesterol, Blood pressure and inhibits platelet mass formation (Mayeux *et al.*, 1998). Various products have been produced from garlic and are available in the international markets (Velisek *et al.*, 1997). Iran has a long-term hoary precedent in garlic cultivation and consumption. Under cultivation, lands are estimated as 10 thousand hectare. Six therapeutic products extracted from garlic are available in Iran market.

Compositions in garlic are been divided into 2 major groups: Sulfurated and unsulfurated. Therapeutic properties of garlic are due to sulfurated composite Allicin (Hansel and Taler, 1998). Garlic have no Allicin, however there is a composite (Alliin) that convert into Allicin, Pyrovate and Amonium at hashing and due to an enzymatic reaction by Aliinase enzyme. Garlic has mineral substances like Zinc, Calcium, Manganese, Copper,

Selenium and Germanium. It is envisaged that Selenium and Germanium strengthen body immune system. Then it might be useful in AIDS treatment if be consumed in the pharmaceutical form (Bianchini *et al.*, 2001). Performed studies have showed that different bacteria belonging to *Staphylococcus*, *Streptococcus*, *Vibrio*, *Klebsiella pneumonia*, *Proteus Volgaris*, *Bacillus Sabtilis* and *Salmonella Entertidis* are sensitive to Allicin (Sander, 1995; Jonkers *et al.*, 1999). This study's aim is evaluation of garlic's effects on common pathogenic bacteria.

MATERIALS AND METHODS

We weeded out the impurities from the garlic then milled it and make it powder. With extracted the powder with 150 mL Methanol (80%) in Soxhlet method for half hour. In next stage obtained extract were been compacted in $35-40^{\circ}\text{C}$ inasmuch as drying. Definite amount of extract were been dissolved in definite volume of physiology serum and its weight to volume proportion quantity was calculated. Then serial dilution of it was prepared in the Tryptic Soy Broth (TSB) and its weight in volume was calculated. Tested bacteria including *Escherichia coli*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Staphylococcus Epidermidis* were added. All test tubes were been incubated for 48 h in $35\pm 2^{\circ}\text{C}$. The last dilution of test

tubes that have no growth was been considered minimal inhibitory concentration. All tubes were been cultured in the solid Medias like Blood Gellouse and Mc Conki and were been incubated for 48 h at $35\pm 2^{\circ}\text{C}$ (14, 15).

RESULTS

In this study inhibitory effects of garlic extract on common bacteria that produce infections including: Staphylococcus aureus, Staphylococcus Epidermidis, Escherichia coli, Klebsiella Pneumonia, Proteus Mirabilis and Pseudomonas Aeruginosa were tested. All microbes have been isolated from clinical samples (children with septicemia hospitalized at Imam Khomeini hospital). From 8 staphylococcus, among 6 types MIC was $156\ \mu\text{g mL}^{-1}$ while in 2 other types MIC was $312\ \mu\text{g mL}^{-1}$. MIC was lower in Staphylococcus Epidermidis than Staphylococcus aureus. Among 8 type of Staphylococcus Epidermidis MIC varied between 19.5 and $78\ \mu\text{g mL}^{-1}$ (Table1). Among Enterobacteriaceae including Escherichia coli, Klebsiella Pneumonia and Proteus Mirabilis MIC varied between 78 and $624\ \mu\text{g mL}^{-1}$. Inhibitory effect of garlic extract against Pseudomonas Aeruginosa was lower in comparison with other Gram-negative bacteria. Among 8 studied Pseudomonas Aeruginosa in one type MIC was $20\ \mu\text{g mL}^{-1}$ while in other seven types MIC was $80\ \mu\text{g mL}^{-1}$ (Table 2). This study show that garlic extract has antimicrobial effect against tested bacteria either Gram-positive and Gram-

Table 1: Minimal Inhibitory Concentrations (MIC) of garlic extract for Staphylococcus aureus and Staphylococcus Epidermidis

Species	Tested types numbers	Dilution	MIC ($\mu\text{g mL}^{-1}$)
Staphylococcus aureus	8	$\frac{1}{3200} - \frac{1}{6400}$	156-312
Staphylococcus Epidermidis	8	$\frac{1}{3200} - \frac{1}{12800}$	19.5-78

Table 2: Minimal Inhibitory Concentration (MIC) of extract for gram negative bacteria

Species	Tested types numbers	Dilution	MIC ($\mu\text{g mL}^{-1}$)
Escherichia coli	8	$\frac{1}{3200} - \frac{1}{12800}$	78-156
Klebsiella pneumonia	8	$\frac{1}{3200} - \frac{1}{6400}$	156-312
Proteus mirabilis	5	$\frac{1}{1600} - \frac{1}{6400}$	156-624
Pseudomonas aeruginosa	8	$\frac{1}{12} - \frac{1}{50}$	20-88

negative bacteria, with this fact that among Gram-negative bacteria MIC for Pseudomonas Aeruginosa was 1000 times lower in comparison with other tested Gram-negative Bacilli. This result show high resistance of these bacteria versus antimicrobial agents.

DISCUSSION

Garlic (*Allium sativum*), onion (*Allium cepa*) and scallion (*Allium hirtifolium*) belong to Iris family. Numerous studies have performed for antimicrobial effects of these plants. For example in a study by Didry *et al.* (1987) antimicrobial effects of garlic extract was higher in comparison with other compositions and combined with antibiotics had synergistic effect. In another study by Dankert *et al.* (1997) antimicrobial effects of mentioned plants against 5 Gram-negative bacteria, three Gram-positive bacteria and two species of yeast were evaluated. In their studies garlic extract inhibited growth of all studied microorganisms while extract of onion and scallion were not effective so much (Didry *et al.*, 1987). In a study by Naganawa and Iwata (1996) Sulfuric compositions extracted from garlic had antimicrobial effects against Bacillus Subtilis, Mycobacterium smegmatis, Strophomyces griseus, Staphylococcus aureus, Lactobacillus plantarum, Escherichia coli, Klebsiella pneumonia, Stenothromonas multofilum and yeasts (Dankert *et al.*, 1997). Yin *et al.* (1999) have evaluated anti fungal effects of Allium family. Extracts of all seven types of Allium had inhibitory effect on three Aspergillus's species (Naganawa and Iwata, 1996). This study show that garlic extract has antimicrobial effect against tested bacteria either Gram-positive and Gram-negative bacteria, with this fact that among Gram-negative bacteria MIC for Pseudomonas Aeruginosa was 1000 times lower in comparison with other tested Gram-negative Bacilli. It seems that more surveys are necessary in the context of comparison between antimicrobial strength of different types of Allium.

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