

Short Communication

Antibacterial Effect of Garlic (*Allium sativum*) on *Salmonella* serovars: An *in vitro* Study

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Abstract

Garlic (*Allium sativum*) has an important dietary and medicinal role for centuries. In India, garlic has been used to prevent wound infection and food spoilage. The present study evaluated the efficacy of aqueous extract of garlic for its antibacterial activity *in vitro*. The extract showed concentration dependent antibacterial activity against *Salmonella* spp.

Keywords: Garlic, infection, food spoilage, antibacterial activities

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INTRODUCTION

Garlic has been used from the time when ancient times in India and China for a valuable effect on the heart and circulation, cardiovascular disease (Kris- Etherton *et al.*, 2002), and regular use of garlic may help to prevent cancer, to treat malaria, and to raise immunity. Garlic has also proposed to treat asthma, candidiasis, colds, diabetes, and antibacterial effect against food borne pathogens like *Salmonella*, *Shigella* and *Staphylococcus aureus* (Teferi and Hahn, 2002).

Therapeutic use of garlic has been recognized as a potential medicinal value for thousands of years to different microorganisms. For example; antifungal, antiviral, antibacterial antihelminthic, antiseptic and anti-inflammatory properties of garlic are well documented. Moreover, garlic extracts exhibited activity against both gram negative (*E. coli*, *Salmonella* sp. And *Citrobacter enterobacter*, *Pseudomonas kilabsella*) and gram positive (*S.aureus*, *S. pneumonia* Group A streptococcus and *Bacillus anthrax*) all of which are cause of morbidity worldwide. This study will focus on protective effects of

garlic against *Salmonella* spp.

There is extensive literature on the antibacterial effects of fresh garlic juice, aqueous and alcoholic extracts, lyophilized powders, steam distilled oil and other commercial preparations of garlic. Fenwick and Hanely (1985) understood a thorough review of the antibacterial effects of garlic and other allium vegetables up to mid-1984; more recently, the antibacterial effects of garlic have been studied by Reuter *et al.* (1996). The present study tested an aqueous extract of dried garlic *in vitro* for its antibacterial activity against *salmonella* spp.

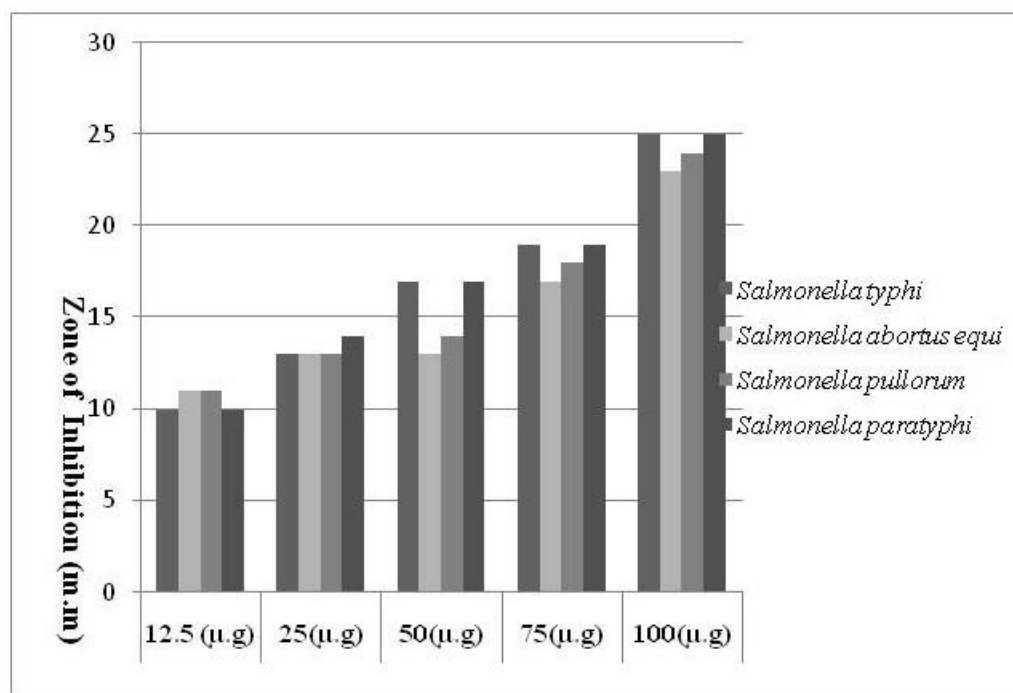
MATERIALS AND METHODS

Microorganisms

Salmonella.typhi, *Salmonella abortus equi*, *Salmonella pullorum* and *Salmonella paratyphi* were obtained from

Table 1. Antibacterial activity of different concentrations of AGE by agar well method

| S.No | Salmonella species | Different Concentration (μ .g) | | | | |
|------|--------------------------------|--------------------------------------|----|----|----|-----|
| | | 12.5 | 25 | 50 | 75 | 100 |
| | | Minimum Inhibitory zone (m.m) | | | | |
| 1 | <i>Salmonella typhi</i> | 10 | 13 | 17 | 19 | 25 |
| 2 | <i>Salmonella abortus equi</i> | 11 | 13 | 14 | 17 | 23 |
| 3 | <i>Salmonella pullorum</i> | 11 | 13 | 14 | 18 | 24 |
| 4 | <i>Salmonella paratyphi</i> | 10 | 14 | 17 | 19 | 25 |

**Figure 1.** Antibacterial effect of aqueous garlic extract (AGE) against salmonella species

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Preparation of Aqueous Garlic Extract (AGE)

Fresh garlic (*Allium Sativum*) bulbs were purchased from a retail food store (Bareilly, U.P, India). Then, the garlic bulbs were peeled, weighed (100 g), and cleaned garlic were taken and surface sterilized using ethanol. The ethanol was allowed to evaporate in a sterile laminar flow chamber, and the garlic was homogenized aseptically using a sterile mortar and pestle. The homogenized mixture was filtered through sterile cheesecloth and 25mm disposable syringe filter. This extract was considered as the 100% concentration of the extract. The concentrations, 75%, 50%, 25% and 10% were made by diluting the concentrated extract with appropriate volumes of sterile distilled water. After filtration the substance was freeze dried and stored at -20°C until use.

Preparation of Aqueous extract disc

Disc having different concentration (75%, 50%, 25% and 12.5%) of aqueous garlic extract was prepared using Whatman filter paper and it was allowed to dry for 30 minutes.

Determination of Antibacterial activity

The cultures were enriched in sterile nutrient broth for 6-8 hours at 37°C . Using sterile cotton swabs, the cultures were aseptically swabbed on the surface of sterile nutrient agar plates, the different concentration of garlic extract discs were aseptically placed over the seeded agar plates sufficiently separated from each other to avoid overlapping of inhibition zones. The plates were incubated at 37°C for 24 hours and the diameter of the inhibition zones was measured in mm.

RESULT AND DISCUSSION

Drugs derived from plants are effective, easily available, and less expensive and rarely have side effects. The practitioners of traditional and indigenous medicine rely mainly on medicinal plants and herbs for preparation of therapeutic substance. Initial screening for the potential antibacterial and antifungal compounds from plants may be performed by using the crude extracts. The two most commonly used methods to determine antimicrobial susceptibility are the dilution assay and the disc or agar well diffusion assay.

Modern antimicrobial garlic research started with the classic studies of Cavallito and Bailey (1994). In the present investigation different concentrations of the aqueous garlic extracts (AGE) was tested for their inhibitory activity on various *salmonella* serovars.

Arora and Kaur (1999) observed a significant bactericidal effect of garlic extract against *Staphylococcus epidermidis* and *Salmonella typhi*. Even bacteria resistant to antibiotic agents were sensitive to extracts of garlic (Indu 2006). The antibacterial activity of garlic is widely attributed to allicin. Allicin interferes with RNA production and lipid synthesis. If RNA cannot be produced, or produced in less amount then protein synthesis will be severely affected. It would be stopped at every stage due to the absence of messenger RNA, ribosomal RNA and transfer RNA. If amino acids and proteins cannot be produced then growth and development of the organism will not occur as they are essential for all parts of cell structure. Also, as lipid

synthesis is affected, other parts of the cell are interfered with. The main effect being the phospholipid bilayer of the cell wall cannot form correctly in both Gram positive and Gram negative bacteria. All these things contribute to the bacteria cannot grow in the presence of allicin or AGE.

Antibiotics were used for therapy, but many of the pathogenic bacteria are resistant. Natural products of higher plants may offer a new source of antibacterial agents and from this result it is clear that the medicinal value of AGE is comparable to the present day antibiotics.

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