

Antimicrobial Activity of Garlic Extract Against *Shigella*

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Abstract

Some beliefs suggest that garlic is an excellent natural antimicrobial drug that can be considered as an alternative form of treatment or prophylaxis in gastrointestinal infections. The purpose of this study is to determine quantitative antimicrobial activity of garlic against *Shigella* by detecting the MIC. Garlic extracts were obtained and dilution susceptibility assay was used to determine the antibacterial properties of these extracts. All tested isolates of *Shigella* were susceptible to garlic extracts, and no one showed resistance to garlic extracts. These and many other research works propose garlic as a strategy for a low-cost intervention with few side effects and complete lack of resistance for prophylaxis and remedy of shigellosis in populations at high risk, particularly where antibiotic resistance and the risk of reinfection are high.

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Keywords • Garlic • shigella • antibacterial activity

Introduction

Garlic is believed to possess antimicrobial properties that can control a variety of infecting organisms.^{1,2,3,4,5} Louis Pasteur was the first to describe the antibacterial properties of garlic juice.^{1,6,7} Several studies recommend garlic as an alternative form of treatment or prophylaxis in cases of infections especially gastrointestinal infections.^{8,9}

Shigella spp. is a frequent cause of gastroenteritis, particularly in the developing countries.¹⁰ In this study, we evaluated antimicrobial effects of garlic against *Shigella* by detecting the minimum inhibitory concentration.

In this study a total of 100 *Shigella* isolates were obtained from stool specimens and the antibacterial activity of garlic extracts was investigated against these 100 clinical isolates of *Shigella* from patients presenting with diarrheal infections. The tested *Shigella* strains comprised *Shigella flexneri* (n = 68), *Shigella sonnei* (n = 27), *Shigella boydii* (n = 5).

For this study garlic extract was prepared in two ways, a modified method of percolation and by means of refluxing device (*suxhlet*).

Distilled-water and methanol both were used as solvent in these extraction methods^{11,12}

a) Agar dilution assay was used primarily to test the susceptibility of the 100 clinical isolates of *Shigella* to the garlic extracts at different concentration^{8,13}

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Table 1: Percent of sensitive *Shigella* to different kind of garlic extract with different concentration (agar dilution)

Garlic extract Strength	Alcoholic: not heated (percolated)	Alcoholic; heated (suxhlet)	Aqueous; not heated (percolated)	Aqueous; heated (suxhlet)
2%	17%	8%	0%	0%
3%	39%	20%	2%	0%
4%	76%	32%	10%	2%
5%	100%	54%	23%	8%
6%	100%	77%	48%	14%
7%	100%	100%	73%	25%
8%	100%	100%	100%	51%
9%	100%	100%	100%	77%
10%	100%	100%	100%	100%

b) The broth dilution test was used to determine the minimum inhibitory concentration (MIC) of garlic extracts^{9,11,14,15}

Results of *Shigella* growth on agar plates with different concentration of garlic extracts (Agar dilution) are shown in Table 1. The 100 *Shigella* isolates were all susceptible to garlic extract. Subcultures from the surface of plates produced no growth after 48 hours, suggesting that the mode of action of garlic extract against *Shigella* is bactericidal.

This study clearly showed that the methanol extracts had a greater growth inhibitory effect on *Shigella* isolates than the aqueous extracts and also percolated extracts had greater growth inhibitory effect on *Shigella* isolates than the suxhlet extracts.

As a part of this study we determined quantitative antimicrobial activity of garlic extracts against *Shigella*. We tested extracts of garlic (*Allium sativum*) tested with tube dilution method in which, active extracts of garlic were standardized for its concentration and tested for its antimicrobial activity on *Shigella*.^{9,15} The MICs ranged from 250 to 1000 µg/ml of active garlic extract and minimum bactericidal concentrations (MBCs) ranged from 250 to 1000 µg/ml of active garlic extracts.

It is noteworthy that garlic extracts inhibited even the growth of bacteria that were resistant to commonly used antibiotics.

Shigellosis is endemic in developing countries where sanitation is poor. Any means for prophylaxis or treatment is therefore valuable and garlic could be a safe means for such purposes. This study has provides evidence for effective anti-*Shigella* activity of garlic that with safety and other property. The role of garlic in warding off infection may be particularly valuable in light of the growing bacterial resistance to antibiotics.^{12,16}

The active ingredient in garlic is called *allicin*, volatile oil- containing sulphur that is responsible for its pungent odour.^{11,17,18} Allicin is generated by

action of the enzyme alliinase on alliin. Allicin normally protects the plant from soil parasites and fungi when garlic cloves are crushed.^{11,18,19} Antimicrobial activity of garlic is known to be due to allicin.¹⁴ Antimicrobial activity of garlic could be explained by blocking mechanism by which allicin blocks certain groups of enzymes as cysteine proteases and alcohol dehydrogenases.^{13,19,20} These groups of enzymes are found in a wide variety of infectious organisms such as bacteria, fungi and viruses and this provides a scientific basis for broad-spectrum antimicrobial activity of garlic.^{19,20} It is unlikely that bacteria would develop resistance to allicin because this would require modifying the very enzymes that make their survival and activity possible¹⁹

Some other researches have demonstrated that moderate concentration of garlic extract also have prominent growth inhibitory effect on *H. pylori*, *E. Coli* 0124, *E. Coli* 0111, *Salmonella typhimurium*, *Salmonella Havana*, *Salmonella para typhi* even those that are resistant to commonly used antibiotics.^{8,9,14,15} These and many other researches propose allicin, the primary antimicrobial component in garlic as an alternative form of par enteral treatment in cases that fail to respond to conventional antibiotic regimens.

Although garlic is not a substitute for antibiotic usage in all gastrointestinal infections, it can be considered useful for some bacterial infections and the combination of garlic with antibiotics may lead to partial or total synergism.¹⁶ We recommend garlic in its fresh state as bulb or fresh juice, but not all people enjoy its pungent odor and fiery taste.

Further clinical evaluation of garlic is necessary to explore the possibility of using garlic as a strategy for a low-cost intervention with few side effects for prophylaxis and remedy of shigellosis in populations at high risk for shigellosis, particularly where antibiotic resistance and the risk of reinfection are high.

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