

Original Research Article

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## Efficacy of Antimicrobial Activity of Aqueous Extract of Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) against Different Bacterial Species

Ravi Sikrodia\*, Daljeet Chhabra, S.D. Audarya and Rakesh Sharda

College of Veterinary Science & A.H., Mhow, NDVSU, Jabalpur, MP, India

\*Corresponding author

### ABSTRACT

#### Keywords

Antimicrobial activity, Garlic, Ginger, Medicinal plant

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Many medicinal plants are documented to have antimicrobial activity like neem, tulsi, ginger, garlic etc. Among which Garlic (*Allium sativum*) belonging to alliaceae family and Ginger (*Zingiber officinale*) belongs to Zingiberaceae family, apart from cooking also known for its medicinal values. Property of garlic and ginger like anti-tumor, in cardiovascular disorder, in liver damage, arthritis, cramps, sprain, constipation vomiting, hypertension already documented. Other than these properties also have the antimicrobial property. This study was conducted to see the antimicrobial activity of aqueous extract of garlic (*Allium sativum*) and ginger (*Zingiber officinale*) against *E. coli* and *Staphylococcus* bacterial species using agar diffusion assay with some commonly using antibiotics. The present study showed the potent antimicrobial activity against different concentration of ginger 100%, 50% and 25% the zone of inhibition was 20, 15 and 13 mm for *E. coli*, and 15, 12 and 10 mm for *Staphylococcus* respectively. While the there was no zone formation for 100%, 50% and 25% of garlic extract for the *E. coli* and *Staphylococcus*.

### Introduction

Antimicrobial resistance (AMR) is the ability of a microbe to resist the effects of medication previously used to treat them. The increased usage of antibiotics has induced microorganism to acquire resistance factor which have become a burning predicament.

Resistant microbes are increasingly difficult to treat, requiring alternative medication or higher doses both of which may be more expensive or more toxic. Even in the animal treatment abrupt use of antibiotics is one of the major cause of antimicrobial resistance. The WHO, concluded that inappropriate use

of antibiotics in animal husbandry is an underlying contributor to the emergence and spread of antibiotic resistant germs.

As a result there is an urgent need to find the alternative of antibacterial drugs for treating the disease especially from plant origin which are easily available and with less side effects (Khulbe and Sati 2009).

Many medicinal plants are documented to have antimicrobial activity like neem, tulsi, ginger, garlic etc. among which Garlic (*Allium sativum*) belonging to Alliaceae family. Apart from cooking Garlic also known for its medicinal values. It is most commonly used in

Asia also in India. In India it is used in various forms like garlic powder, garlic oil or whole garlic. Property of garlic like anti-tumor, in cardiovascular disorder, in liver damage already documented. It also shows effect on the blood pressure, blood sugar and cholesterol (Kamrul *et al.*, 2014).

Apart these the Garlic powder shows the power of killing the pathogens and antimicrobial activity. Ginger (*Zingiber officinale*) belongs to Zingiberaceae family, widely used as medicinal plant. Apart from its uses in arthritis, cramps, sprain, constipation vomiting, hypertension, fever also have the antimicrobial property. (Ali 2008)

With these information present work is aimed to evaluate the antimicrobial efficacy of aqueous extracts of Garlic and ginger against *E. coli* and *Staphylococcus* spp. organisms.

### **Materials and Methods**

Garlic and Ginger used in this study purchased from the local market of Mhow city for determining the antimicrobial activity against *E. coli* and *Staphylococcus aureus* were used. Both of the bacterial species were previously isolated from the food sample and preserved in the department of Veterinary Microbiology, College of Veterinary Science and A.H. Mhow.

### **Inoculum preparation**

Brain Heart infusion broth (Himedia Laboratories Ltd. India) was inoculated with freshly subcultured bacteria of both the species and incubated at 37°C for few hour to match the turbidity to that of 1 Macferland standard. Such prepared bacterial inoculums were used to spread onto Muller Hinton Agar, MHA (Himedia Laboratories Ltd. India) using sterile cotton swab for making lawn of bacterial culture.

### **Preparation of garlic extracts and ginger extract**

Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*) were purchased from local market of Mhow, 50g of peeled garlic and Ginger weighed and washed with sterile distil water by soaking for 15 minutes and then soaked in 95 % ethanol for 5 minutes. Then dried till the ethanol evaporates to make both sterile. Dried garlic and ginger were crushed in sterile pestle mortar with adding 1 ml dislilled water. Crushed garlic and ginger were filtered using Whatman filter paper no. 1 separately. Make the filtered extract 10 ml by adding the distil water. This 10 ml extract considered to be 100% and used for making the different concentration (100, 50, 25 percent) of aqueous extract disc for study.

### **Preparation of disc**

Himedia Sterile discs were used. The different concentration of garlic and ginger extracts were made by mixing the extract in distle water. In the experiment 100, 50 and 25 percent solution were prepared. The sterile disc were dipped in this solution for overnight and then removed and placed in the sterile petriplate for drying. These dried discs were used in the experiment. Other than these discs three antibiotic discs including gentamycin, ciprofloxacin and ampicillin plus sulbactam also used in the study.

### **Disc diffusion method**

The lawn of different bacterial culture is prepared on the Muller Hinton agar by using freshly subcultured broth. The staphylococcus spp. and *E. coli* bacteria were used in this study. The disc of different concentration of aqueous extract of ginger and garlic were placed on the plate. The different antibiotic discs were also placed on plate then plates were placed for incubation at 37°C for 24 hrs.

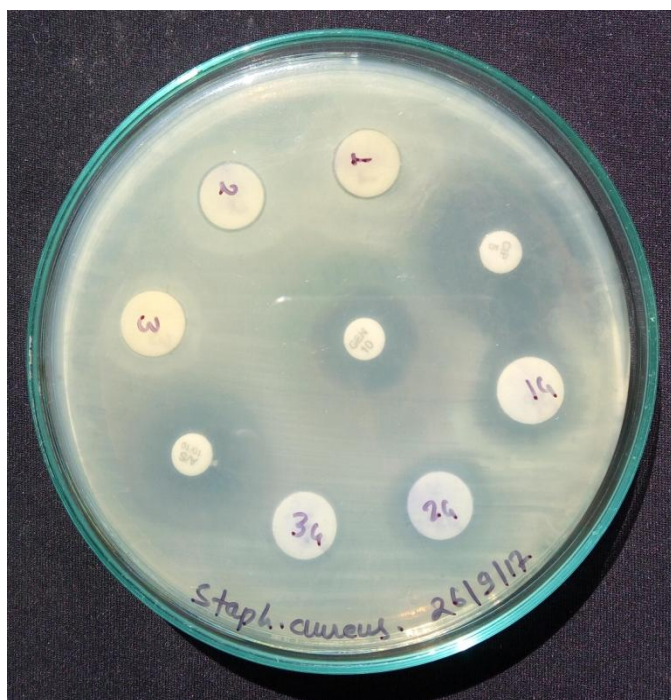
After incubation of 24 hrs the zone formed around the disc was observed and measured in millimeter.

### Results and Discussion

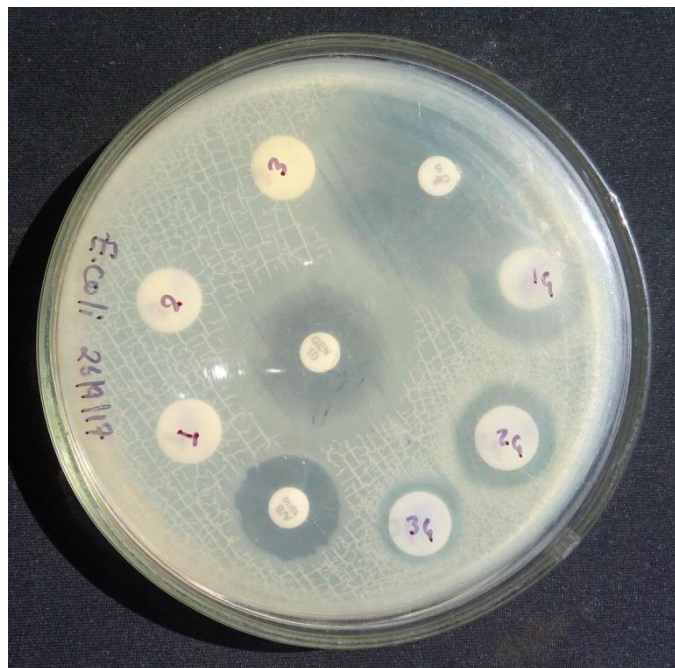
After the experiment it is noted that the efficacy of different extracts of Ginger is shown against the different bacteria, but the bacteria not showing any zone of sensitivity against garlic extracts. At different concentration of ginger 100%, 50% and 25% the zone of inhibition was 20, 15 and 13 mm for *E.coli*, and 15, 12 and 10 mm for *Staphylococcus* respectively. While there was no zone formation for 100%, 50% and 25% of garlic extract for the *E.coli* and *Staphylococcus* both which means the isolates were found resistant for the Garlic extract. Antimicrobial activity of crude Ginger at both room temperature and boiling temperature was studied previously by Pankaj *et al.*, (2012). However, they found that boiling temperature

treated ginger extract lost its antimicrobial activity against many bacteria. The bacteria also found sensitive for the different antibiotics used in the experiment. The zone of inhibition for Gentamycin (G), Ampicillin plus sulbactam (A+S) and ciprofloxacin (C) 20,16,30 mm in case of *E.coli*, and 17,22,20 in case of *Staphylococcus* respectively. In the experiment the *E.coli* showed better zone to ciprofloxacin as compared to other antibiotic and extracts of Ginger. The *Staphylococcus* showed better zone for the Ampicillin cum sulbactam than other antibiotic and extracts. Onyeagba *et al.*, 2014 also studied the effect of ginger and garlic against many bacteria which relates our study. The results of experiment clearly showed that as the concentration of ginger is decreased the diameter of the zone gradually decreases for both the bacteria used in the experiment. The result also indicates that the *E. coli* found more sensitive than the *staphylococcus* in case of different extracts of ginger (Fig. 1 and 2).

**Fig.1** Plate showing the clear zone of sensitivity against different antibiotic and different concentration of ginger and garlic for *Staphylococcus* spp.



**Fig.2** Plate showing the clear zone of sensitivity against different antibiotic and different concentration of ginger and garlic for *E. coli*



	Test organism	G	A+S	C	1G	2G	3G	1	2	3
1.	<i>E.coli</i>	20	16	30	20	15	13	0	0	0
2.	Staphylococcus spp.	17	22	20	15	12	10	0	0	0

- 1) G: Gentamycin
- 2) A+S: Ampicillin plus sulbactam
- 3) C: Ciprofloxacin
- 4) 1G, 2G, 3G: 100%, 50%, 25% Ginger concentration respectively
- 5) 1, 2, 3: 100%, 50%, 25% Garlic concentration respectively

Both of the bacteria used in the study are the major source of infection in animals and humans related with various diseases. Indiscriminate use of different antibacterial drugs and under and overdosing of these drugs making these common pathogens more resistant and also helpful for the development of superbugs.

As the result indicate the ginger is having better antibacterial efficacy than the Garlic and can be used for the treatment various infections caused by these organisms. Further studies are required for the investigation of main component of these herbal products responsible for antibacterial efficacy.

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