

## Assessment of Antimicrobial Properties of *Zingiber officinale* Extract on *E. Coli* and *B. Subtilis*



### Microbiology

**KEYWORDS :** Antibacterial activity, *Zingiber officinale*, agar well diffusion, bacterial growth inhibition

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### ABSTRACT

*Spices are key ingredients of Indian food as it enhance flavour of the food. Apart from this, they have antimicrobial and preservative properties too. In this study, the antibacterial activity of n-hexane and water extracts of Zingiber officinale (ginger) was evaluated against Escherichia coli and Bacillus subtilis. Different concentrations of both the extracts were tested for studying dose dependent pattern of antibacterial activity of the ginger extract. Results indicated that Zingiber officinale has retained its antibacterial property in both the extraction system. n-hexane extract of ginger at high concentration was found to be most effective in controlling bacterial growth in the form of zone of inhibition, indicating its dose dependent nature.*

### INTRODUCTION

Since ancient times, ginger has been model source of medicines as it contains chemical agents with therapeutic properties. The general population is increasingly using herbal medicines in the form of dietary supplements for the treatment of many disorders. The spices are important part of human diet that not only enhance the flavor; and aroma of food, but also known for its preservative and medicinal value (Draughon, 2004).

Ginger has been used as a medicinal plant in Asia, India, Jamaica and Nigeria. In China, ginger has been used to aid digestion, treat stomach upset, diarrhea and nausea for more than 2000 years (Azu and Onyeagba, 2007). In Venezuela, ginger paste is applied to the abdomen for difficult menstruation. In Costa Rica, it is used to relieve throat inflammation and asthma with addition of honey. In Panama, it is used to relieve rheumatism. It is a valued remedy for treatment of coughs and bronchitis.

The mature ginger roots are fibrous and nearly dry. They can be used to prepare many food dishes. They are usually stewed in boiling water to make ginger tea with honey as sweetening agent. Plants are rich in a wide variety of secondary metabolites including such as terpenoids, alkaloids flavonoids, tannins etc. which have been found to be active antimicrobial in vitro conditions.

The characteristics flavour of ginger is because of mixture of gingerone, shogaols, gingerols, and volatile oils. The gingerols have analgesic, sedative and antibacterial properties (O' Hara et. al., 1998). Ginger has also been reported to be effective for the treatment of various abnormalities like inflammation, rheumatism, cold, heat cramps and diabetes (Afshari, 2007). The objective of the study was to evaluate the antimicrobial properties of ginger against two selected bacteria.

### MATERIALS AND METHOD

#### Collection and preparation of sample

The ginger roots were collected from vegetable market (Amreli, Gujarat). The roots were washed thoroughly with tap water and then with sterile distilled water. The roots were allowed to dry at room temperature for 10 day. The dried roots were grind using electric grinder. Approximately 100 gm powder was collected in sterile glass bottle and stored for extraction and future use (Pundir & Jain, 2010).

n-hexane extract was obtained by dissolving 20 g ginger powder in 100 ml n-hexane in 250 ml flask. The mixture was covered and kept in orbital shaker at 120 rpm for 24 hrs. The mixture was concentrated to 20 ml by keeping it in boiling water bath and filtered using Whitman no. 1. filter paper (Auta et. al. 2011). Water extract was prepared in the same way as above in 100 ml of sterile distilled water.

Different dilutions were prepared by serial dilutions to obtain 100%, 50%, 25% and 12.5% of ginger extracts concentration.

#### Inoculum preparation

A loopful of pure culture was transfer from agar slant and inoculated in 50 ml of nutrient broth. This overnight grown bacterial culture with specific OD of 0.5 at 620 nm was used as inoculum culture through out the study.

#### Assay of antibacterial activity

The antimicrobial activity of n-hexane and water extracts of ginger against *Escherichia coli* and *Bacillus subtilis* was evaluated by using agar well diffusion method (Parekh & Chanda, 2007). Nutrient agar plates were seeded with 50 µl of inoculum and spreaded with sterile spreader. Well of 6 mm size were prepared with the help of sterile cup borer into agar plates. The cups were filled with 100 µl of ginger extracts with positive control cup filled with acetic acid. A Negative control cup was filled with sterile distilled water. Plates were kept in refrigerator for pre diffusion of extracts to occur and incubated at 37 °C for 24 hrs. Next day, zone of bacterial growth was measured using a Hi media zone scale (Khan et. al. 1988)

### RESULT AND DISCUSSION

The results of antimicrobial properties of the extracts on the test organisms are shown in table no. 1 and 2. The results showed that ginger has antimicrobial active components present in n-hexane and water extracts with little difference in its activity. Table 1 represents the results of n-hexane extract of ginger on two test organisms. Results indicated that *E. coli* and *B. subtilis*, both were sensitive to different dose of n-hexane extracts. The variation in size of the zone of *E. coli* and *B. subtilis* with the same concentration of plant extract may be due to the variation in their sensitivity. Results showed that *E. coli* is more sensitive to n-hexane extract at high concentration which low concentration does not have any significant difference in antimicrobial properties in either of the plant extract.

**Table 1: Sensitivity patter of *E. coli* and *B. subtilis* against n-hexane extract of *Zingiber officinale***

Ginger extracts Conc (%)	Zone of growth inhibition diameter (mm)			
	Positive control (acetic acid)	Negative control (D/W)	<i>E. coli</i>	<i>B. subtilis</i>
100	22	0.0	11	13
50	22	0.0	9	10
25	21	0.0	5	7
12.5	21	0.0	2	3

Table 2 indicated the results of bacterial growth inhibition cause by water extract of ginger on both the bacterial strain. Here also almost similar type of antibacterial pattern has been observed, indicating water extract has also active antimicrobial components. As the concentration of plant extract was decreased, there was decrease in size of zone of bacterial growth inhibition. Smaller size of growth inhibition zone indicated the antimicrobial property of ginger is dose dependent. The results of the bacterial growth inhibition have shown that the water extracts were active at high concentration and inactive at very low concentrations.

The antimicrobial properties of ginger could be attributed to the chemical properties of ginger. The main components of ginger includes sesquiterpenoids and zingiberene while others are  $\beta$ -sesquiphellandrene, bisabolene and farnesene, which are monoterpenoid fractions (O' Hara et. al. 1998). Terpenoids are reactive compounds with immense medical applications (Parekh & Chanda, 2007). There was highest zone of inhibition in case of positive control which was almost uniform in all the plates tested, while there was no growth inhibition in negative control.

**Table 2: Sensitivity patter of E. coli and B. subtilis against water extract of Zingiber officinale**

Ginger extracts Conc (%)	Zone of growth inhibition diameter (mm)			
	Positive control (acetic acid)	Negative control (D/W)	E. coli	B. subtilis
100	22	0.0	8	12
50	21	0.0	7	10
25	22	0.0	2	6
12.5	20	0.0	0	2

**Conclusion**

In conclusion, this study has shown that ginger has antibacterial properties against both the tested organisms. Ginger poses medicinal properties and its antimicrobial property is dose dependent. In order to enhance antimicrobial properties of such medicinally important plant, other parameters also need to be investigated as its antimicrobial properties dependent on harvesting season, geographical source, and form of plant source used like fresh, dried or extracted etc. Further research is required to identify the bioactive molecules that actually responsible for the antimicrobial activity.

**Acknowledgement**

The authors are thankful to Director, Smt. U. B. Bhagat Science Mahila College, for providing necessary laboratory facilities to carry out this work.

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