

**ANTIBACTERIAL ACTIVITIES OF RHIZOMES OF GINGER (ZINGIBER OFFICINALE) AGAINST STAPHYLOCOCCUS AUREUS AND ESCHERICHIA COLI.**

Zehra Ashraf<sup>1</sup>, Mirza Tasawer Baig<sup>2</sup>, Waseem Abbas.<sup>3</sup>

**Abstract:**

**Introduction:** Ever since the ancient times man has searched for numerous ways of curing and relieving many different diseases with the help of plants. Now a days, the curiosity and popularity concerning screening extract from plants to be used for medications. **Objective:** Ginger extracts were investigated for antimicrobial activity against *Staphylococcus aureus* and *Escherichia coli* by disc diffusion method. **Place of Study:** Study was conducted in the research lab of Jinnah University for Women, Karachi, Pakistan. **Duration of Study:** The duration of study is three months. **Method:** Rhizomes of *Zingiber officinale* Roscoe were extracted with water, ethanol, and hexane and cooking oil. All extracts of *Zingiber officinale* were subjected to antimicrobial testing against *Staphylococcus aureus* and *Escherichia coli* by disc diffusion method. **Result:** Four different extracts were used for investigate antimicrobial activities against *Staphylococcus aureus* and *Escherichia coli*. This result clearly shows that hexane ginger extract is more effective against gram +ve & gram -ve bacteria as compare to ethanol and cooking oil. But ginger water extract is not effective as it does not show any activity against *Staphylococcus aureus* and *Escherichia coli*. **Conclusion:** The result of the study shows that extracts of ginger reveals various antimicrobial activities. It can be used in antibacterial medication.

**Keywords:** Antimicrobial activity, Extracts, Ginger, Organisms

1. Lecturer, Department Of Pharmaceutics, Jinnah University for Women, Karachi.
2. Associate Professor, Pharmacy Practice, Ziauddin University, Karachi
3. Assistant Professor, Pharmacology Department, SMBBMU, Larkana

**Crossponding Author:** Zehra Ashraf, Lecturer, Lecturer, Department Of Pharmaceutics, Jinnah University for Women, Karachi.

Email; [dr.zehra.ashraf@gmail.com](mailto:dr.zehra.ashraf@gmail.com)

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**INTRODUCTION**

In many infections herbs and species are used as an important remedy. Through phytochemicals and secondary metabolites compound, these spices are obtained having a unique aroma and flavors.<sup>1</sup> As the resistances of pathogens from multi-drugs are increasing day by day, there have to be an alternative compounds for treatment of infectious diseases.<sup>2</sup> Anti-microbial agents with selective toxicity are especially useful as a therapeutic agent in treating infectious diseases and it may depend on the inhibition of bio-agents.<sup>3</sup> Literature review showed that the components of ginger (6-shogol and 6- gingerol) effectively used in gastrointestinal cancer.<sup>4</sup>

Ginger belongs to the family of *Zingiberaceae*; it is the rhizome of *Zingiber officinale*. It is used as a traditional herbal medicine for several conditions such as headache, cold, nausea, hypertension, migraine and arthritis.<sup>5</sup> The word “ginger” is derived from Greek “Zingiberis” & from Latin “Zingiberi”.<sup>6</sup> *Zingiber officinale* is also used as a flavoring agent for different beverages and foods.<sup>7</sup> Composition of *Zingiber officinale* is more than 400 compounds which include carbohydrates, lipids terpenes,  $\beta$ -bisabolene,  $\alpha$ -farnesene and  $\alpha$ -curcumene and phenolic compounds. Phenolic compound is

attached with the structure of *Zingiber officinale*.<sup>8</sup>

Characteristic flavors and odor are provided to ginger by phenolic compounds.<sup>9</sup> Structure of ginger is diverse; at least 2 hydroxyl groups are attached with aromatic ring structure. Phenols are divided into phenolic acid, tannins, lignin and others. Presence of hydroxyl group in ginger confirms the antioxidant activities.<sup>10</sup> It is particularly grows in African countries such as (Sierra, Leon, Nigeria) and China India Java. Medicinal properties of “*Zingiber officinale*” are anti-inflammatory, anti-microbial, anti-oxidant, anti-diabetic and Hypolipidemic larvicidal activities against filariasis vector and dengue, and anti-viral infection against rotavirus infection.<sup>11,12</sup> The main objective of the study to evaluate the antimicrobial activity of ginger extracts in different solutions against the *Staphylococcus aureus* and *Escherichia coli* many already marketed drugs lost the therapeutic effect against *Staphylococcus aureus* and *Escherichia coli* due to development of resistance.

**MATERIAL AND METHODS:**

**STUFF:**

Rhizomes of *Zingiber officinale* Roscoe were collected from Sabzi market at Saleem heights, Karachi, Pakistan. Ethanol, hexane was purchased from Irfan chemical store Hussainabad, and cooking olive oil of “Aliz”

brand. We choose nutritional Agar (500 g form 17.8 liters) and Broth (500 g form 38.4 liters) of company OXOID CLD, Basingstoke, Hampshire, England.

**ORGANISM’S COLLECTION:**

In this research test organism consisted of gram –ve (*E.coli*) and gram +ve (*S.aureus*) bacteria’s isolates collected from Dr.Essa laboratory and diagnostic Center, Department of Microbiology from January 2019 to March 2019.

**APPARATUS:**

Hot air drying oven (Model # DHG-90538), incubator (Model # JK-HIS-30HZ) size 30 liters, temperature range RT+5-65°C, were operated for the growth of bacterial cultures. The isolates were sterilized in Autoclave (Lab tech).

**MEDIA USED IN DISC DIFFUSION METHOD:**

In this study Nutrient agar was used.

**PREPARATION OF GINGER WATER EXTRACT:**

The 15 grams of fine powder of zingiber was weighed and soaked in 60ml of water for 48 hours. The solution was filtered with the aid of muslin clothes & then re filtered with 4mm what man’s filter paper.

**PREPARATION OF GINGER ETHANOL EXTRACT:**

The 15 grams of fine powder of zingiber was weighed and soaked in 60ml of ethanol for 48 hours. The solution was filtered with the aid of muslin clothes & then re filtered with 4mm what man’s filter paper.

**PREPARATION OF GINGER HEXANE EXTRACT:**

The 15 grams of fine powder of zingiber was weighed and soaked in 60ml of hexane for 48 hours. The solution was filtered with the aid of muslin clothes & then re filtered with 4mm whatman filter paper.

**PREPARATION OF GINGER EXTRACT WITH COOKING OIL:**

The 15 grams of fine powder of zingiber was weighed and soaked in 60ml of cooking oil for 48 hours. The solution was filtered with the aid of muslin clothes & then re filtered with 4mm what man’s filter paper.

**PREPARATION OF AGAR:**

The 2.8 grams of nutrient agar dissolve in dissolved in 100ml of distilled water. After preparation sterilized it at 121 °C in an autoclave for 15 minutes. Cool it and poured in petri dish. Allow to solidify at room temperature.

**ANTIMICROBIAL ACTIVITY:**

For antimicrobial activity disc diffusion method was used.

**ANTIMICROBIAL ASSAY:**

For preparation of disc what filter paper (6mm) was used.

Hot air oven is used for sterilized it.

Accurate 50µg were added on every disc separately.

For further analysis discs were enabled to absorb the solution

**METHOD FOR DISC DIFFUSION TEST**

**INOCULUM PREPARATION:**

For growth of clinical isolates Nutrient broth was used. For research work broth was inoculated with freshly sub cultured bacteria’s are used. After few hours matched the turbidity with 0.5 McFarland Standard.

**PREPARATION OF TEST PLATES OF INOCULUM:**

After modifying the inoculums suspension turbidity with 0.5 Macferland Standard and within 15 minutes immersed it on cotton swab. The excessive fluid was taken out by moving clockwise and anti clock wise and pressing the swab. Prepared inoculums were spread on nutrient agar by three different ways, rotation of plates at 60 °C for proper distribution. In contact with medium all disc were placed and little pressed. Finally incubated the plates and leave it for 24 hours.

**STATISTICAL ANALYSIS:**

The results were expressed in mean and standard deviation.

**RESULT:**

We assessed in vitro antimicrobial activity of the four extracts against the microorganism. When ginger ethanol extract was used antimicrobial activity is shown in Table 1 & 2. *Staphylococcus aureus* (gram +ve) show 15 mm zone of inhibition. While *Escherichia coli* (gram –ve) bacteria showed 10 mm zone of inhibition. Ginger hexane extract was used as a solvent antimicrobial activity shown in Table 1 indicate that *Staphylo coccus aureus* showed 16 mm zone of inhibition and *Escherichia coli* showed 12cmm zone of inhibition. Cooking oil was used as a solvent antimicrobial activity shown in Table 1 as *Staphylo coccus aureus* showed 10 mm zone of inhibition and *Escherichia coli* showed 6 mm zone of inhibition. Ginger water extract showed sensitivity to gram +ve and –ve bacteria.

This result clearly showed that hexane ginger extract is more effective against gram +ve& gram –ve bacteria as compare to ethanol and cooking oil. But ginger water extract was not effective as it did not show any activity against *Staphylococcus aureus* and *Escherichia coli*.

**TABLES**

*Table 1. Antimicrobial Activities of Ginger Extracts*

Test Organisms	Ginger ethanol Extract	Ginger hexane Extract	Ginger water Extract	Oil Extract
<i>Staphylococcus aureus</i>	+	+	-	+
<i>Escherichia coli</i>	+	+	-	+

Table 2 Zone of inhibition against *Staphylococcus aureus* and *Escherichia coli*.

Test Organisms	Zone of inhibition in mm $\pm$ Standard deviation			
	Ginger ethanol Extract	Ginger hexane Extract	Ginger water Extract	Oil Extract
<i>Staphylococcus aureus</i>	15 $\pm$ 0.05	16 $\pm$ 0.10	-	10 $\pm$ 0.05
<i>Escherichia coli</i>	8 $\pm$ 0.20	12 $\pm$ 0.10	-	6 $\pm$ 0.20

## DISCUSSION

Development of natural antimicrobial to control microbial diseases has increased due to the concern about health problems in the people. Plants and spices are abundantly used have natural antimicrobial agents in foods and have also been used for millions of years by many ancient civilizations to control common health problems. Plant based antimicrobial drug discovery has obtained utmost importance as the newly found drugs are presumed to be more effective versus multidrug resistant microbes.

In reference to previous reports ginger has antimicrobial activity agent *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *klebsiella spp.*, *Salmonella spp.* and *vibrio cholera*.<sup>13</sup> In one of other study the ethanol extract of ginger rhizomes has antimicrobial activity against all microbes except *Enterobacter spp.* & *klebsiella spp.*<sup>14</sup> In third research study, the different extract of ginger of ginger in methanol, ethanol and hexane show antimicrobial activity against *Staphylococcus aureus* & *Escherichia coli*.<sup>15</sup>

Tannins, saponins, phenolic compounds, essential oil and flavonoids give plants its antimicrobial potency. Interestingly enough crude extracts from these plants showed acceptable resistance strains as compared to the modern antibiotic therapy which was not as effective.<sup>16</sup>

Paper disc enquiry suggests a more practical approach towards the study of these likely antibacterial compounds.

## CONCLUSION

The result of the study shows that extracts of ginger reveals various antimicrobial activities. It can be used in antibacterial medication. Ginger water extract does not show antimicrobial activity against gram +ve and gram -ve bacteria.

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## Conflict of Interest

The Authors declare that they have no any conflict of interest

## Disclosure:

Not Applicable

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## Patient Consent

Not Applicable

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