The Antibacterial Activity of *Zingiber officinale* Extract on Common Pathogenic Bacteria isolated from Patients with Otitis Media in Khartoum

Nesreen A. Sid Ahmed¹ and Musa A. Ali²

¹Al Neelain University, Khartoum, Sudan
²The National Ribat University, Khartoum, Sudan

Abstract

**Background:** *Zingiber officinale* has long been used as naturopathy due to their potential antimicrobial activity against different microbial pathogen. *Zingiber officinale* (ginger) is a major source of natural drug and its use as an alternative medicine for treatment of a mixture of diseases has been amplified in the last few decades. In comparison to the formulated drugs the herbs and spices have fewer side effects. They are also inexpensive, show better patient tolerance and are readily available for low socioeconomic inhabitants.

**Objective:** To assess the antibacterial activity of *Zingiber officinale* extract on common pathogenic bacteria isolated from patients with otitis media in Khartoum.

**Materials and methods:** Using the cup plate method the antibacterial activity of ethanolic extract of ginger was tested with different concentrations against the organisms: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Proteus spp.*

**Results:** The extract of *Zingiber officinale* showed a clear antibacterial activity against pathogenic bacteria associated with otitis media, and this activity was enhanced with increasing concentrations of *Zingiber officinale*. 100 % concentration of *Zingiber officinale* extract was found to give the best antibacterial activity against *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Proteus spp.*

**Conclusion:** The 100% concentration of ginger extract had the best antibacterial activity against pathogenic bacteria associated with otitis media in Khartoum.

**Key words:** Antibacterial activity, *Zingiber officinale*, Otitis media, Pathogenic bacteria

Introduction

In recent years, in view of their beneficial effects, the use of spices and herbs is increasing not only in developing countries but also in developed countries. The antimicrobial activity of spices is due to their specific phytochemicals or essential oils. The main factors that determine the...
antimicrobial activity are the type and composition of the spice, amount used, type of microorganism, composition of food, pH value, and temperature of the environment. Several reports had been published describing the antibacterial and antifungal properties of different herbs and spices. However, still there is little information as regard the exact mechanism of their antimicrobial action. Previously, medicinal plants have been a source of novel drug compounds. Plants derived products have made large contributions to human health and wellbeing. Green pharmacy may become the base for the development of medicines by providing a pharmacophore which could be used for the development of new drug with novel mechanisms of action. Many scientists across the globe have reported antimicrobial properties of several medicinal plants but still a very meager portion of this tremendous potential drug-repertoire has been scientifically screened.

A number of medicinal plants have been screened for antimicrobial activity in current years and efforts have been done to identify their active constituents. *Zingiber officinale* (ginger) is a member of the family Zingiberaceae; a small family with more than 45 genera, and 800 species. Ginger is truly a world domestic remedy. It is also used in India and the ancient Chinese where the fresh and dried roots were considered distinct medicinal products. Fresh ginger has been used for cold-induced diseases, nausea, asthma, cough, colic, heart palpitation, swelling, dyspepsia, loss of appetite, and rheumatism. In the nineteenth century ginger served as a popular remedy for cough and asthma when the juice of fresh ginger was mixed with a little juice of fresh garlic and honey. A paste of powdered dried ginger was applied to the skull temples to relieve headache. Fresh ginger was mixed with a little honey, tapped off with a pinch of burnt peacock feathers to alley nausea.

**Materials and methods**

The fresh ginger (*Zingiber officinale*) was obtained commercially. It was cleaned, peeled, sliced and dried at room temperature. After drying, the pieces of ginger were ground into fine powder. 10 grams of the powder of ginger was weighed and macerated in 250 ml of 100% ethyl alcohol. The containers were left at 25°C for 3 days (72 hrs). After that, the suspension was filtered and the filtrate (extract) was delivered into sterile, clean containers, labeled and stored at 4°C. Diverse 30 Gram positive and Gram negative clinical bacterial species were collected by ear swabs from patients presenting with otitis media. Swabs were cultivated on blood agar and Mac Conkey agar and incubated overnight at 37°C for 24 hr. Identification of bacterial species was performed using standard bacteriological conventional techniques based on the colonial morphology, Gram's stain, catalase test, mannitol fermentation test, oxidase test, citrate test, urease test, and indole test. The test organisms identified were *Staphylococcus aureus*, *Staphylococcus epidermis*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Proteus spp*. A loop-full colony from each bacterial isolate was inoculated on nutrient agar and incubated at 37°C for 24 hours. The bacterial suspension of each isolate was prepared with normal saline. The suspension turbidity was adjusted and compared with the Mc Farland standard to give a suspension containing 1.5 x 10^8 cfu/ml. A cotton swab was dipped into each bacterial suspension and streaked on Mueller Hinton agar plate, left for 10 minutes at room temperature to
The Mueller Hinton agar was cut into 4 wellss by a cork-borer. Four concentrations of the ginger extract solution (100%, 75%, 50%, 25%) were prepared in dimethy-sulfoxide solution. 50 µl of each ginger extract concentration was added into each well. All plates were incubated at 37°C overnight. Zone of inhibition of each concentration was measured. The diameter of the inhibition zone was measured by a measuring scale in millimeter (mm).

Results

The antimicrobial activity of different concentrations of ginger extract was performed by the well agar diffusion assay method. The isolates investigated were 12 species of each: *Staphylococcus aureus, Staphylococcus epidermis, Escherichia coli, Pseudomonas aeruginosa, and Proteus spp.* The different concentrations of ginger extract (100%, 75%, 50% and 25%) showed variable ranges (mean/standard deviation) of antibacterial activity. 50% concentration of ginger extract showed the highest antibacterial activity (mean value 16.17 ± 2.887) against *Staphylococcus aureus*. While 75% concentration of ginger extract showed the lowest antibacterial activity (mean value 8.80 ± 4.970) against *Proteus spp*. The 100% concentration of ginger extract seemed to have best antibacterial activity against *Staphylococcus aureus* (mean value 15.17 ± 1.946), followed by *Staphylococcus epidermidis* (mean value 15.25 ± 0.50), and then *Proteus spp* (mean value 12.88 ± 7.176). Ginger extract showed no antibacterial activity neither against *Pseudomonas aeruginosa* nor against *E. coli* (Table 1).

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<tr>
<th>Ginger extract Concentrations</th>
<th>Pathogens</th>
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<tr>
<td></td>
<td><em>S. aureus</em></td>
<td><em>S. epidermidis</em></td>
<td><em>P. aeruginosa</em></td>
<td><em>Proteus spp</em></td>
<td><em>E. coli</em></td>
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<td>100%</td>
<td>15.17 ± 1.946</td>
<td>15.25 ± 0.500</td>
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<td>12.88 ± 7.176</td>
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<tr>
<td>75%</td>
<td>14.75 ± 2.137</td>
<td>12.75 ± 0.500</td>
<td>0.00</td>
<td>8.80 ± 4.970</td>
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<tr>
<td>50%</td>
<td>16.17 ± 2.887</td>
<td>15.25 ± 1.708</td>
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<td>9.40 ± 5.595</td>
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<td>25%</td>
<td>15.50 ± 3.118</td>
<td>15.50 ± 6.403</td>
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Discussion

The present study was conducted to establish basic information on the *in vitro* antimicrobial activity of *Zingiber officinale* on pathogenic bacteria associated with otitis media. The agar well diffusion assay technique was preferred to determine this activity. All ginger extract concentrations were found to have variable antimicrobial activity against both Gram positive and Gram negative organisms. The widest inhibition zone was found with *Staphylococcus aureus* and *Staphylococcus epidermidis* followed by *Proteus spp*; while *Escherichia coli* and *Pseudomonas aeruginosa* were
found resistant to all concentrations of ginger extract. Generally, all concentrations of ginger extract were more effective against the Gram positive bacteria as compared to Gram negative bacteria. The higher resistance of Gram negative bacteria could be due to the complexity of the cell wall and cell membrane. Gram negative bacteria have an outer membrane composed of a phospholipid bilayer; and cell wall of Gram positive bacteria has a large amount of peptidoglycan and a small amount of lipids.

In Nigeria, Adeshina and his colleagues investigated *Pseudomonas aeruginosa, Staphylococcus aureus* and *Escherichia coli* against fresh ginger juice; and found no antimicrobial activity against these bacterial isolates\(^4\).

Also, Gull and his co-workers (2012) studied the antimicrobial activity of *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, and Staphylococcus epidermidis* against ginger extract; and reported that all tested bacterial strains showed poor susceptibility to the ginger aqueous extract\(^5\).

Another study performed by Kamrul Islam and his co-authors in Bangladesh (2014) to assess the antibacterial activity of *Zingiber officinale* against *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. They found a low zone of inhibition (8.0 ± 1.73mm) against *Escherichia coli*. Ginger extract also showed a low zone of inhibition (8.67 ± 2.52mm) against *Staphylococcus aureus*\(^6\).

Conclusion: The 100% concentration of ginger extract had the best antibacterial activity against pathogenic bacteria associated with otitis media in Khartoum.

**References**


**Sid Ahmed, et al., 2017: Vol 2 (12)**