

ORIGINAL ARTICLE

Estimation of some Bioactive substances and Antibacterial activity of *Zingiber officinale* (Ginger) Extract

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Abstract

The methanolic and aqueous extracts of ginger were employed in this investigation for antibacterial activity against both gram-negative (*Escherichia coli*) and gram-positive (*Staphylococcus aureus*). Agar disk diffusion was used to assess growth inhibition. The two extracts had clear antibacterial action against the microorganisms tested. In the growth of tested bacteria, the methanolic extract outperformed the aqueous extract. The maximum zone of inhibition of methanolic extract in the development of *S. aureus* (16 mm) and the lowest zone of inhibition in the growth of *E. coli* (13 mm). The impact of aqueous extract on the growth of two bacteria ranged between 10 mm in *E. coli* and 14 mm in *S. aureus*. Two extracts' antibacterial activity was compared to that of Gentamicin, a popular antibiotic (20 mm).

Keywords: Antibacterial activity, pathogenic bacteria, methanolic extract, Ginger

1 Introduction

Medical plants have been utilized for a long time and are widely used around the world; they comprise 80% of the terms, according to a World Health Organization assessment. The majority of the population relies on unusual remedies, including the usage of plant extracts or active substances [1]. Medical herbs can be in powder or liquid form, or a combination of both, and can be used fresh or boiled, as liniments, incisions, or ointments [2]. Because of microbial resistance to commonly used drugs, plants with antimicrobial characteristics have rekindled interest. This resistance might be related to the unrestricted use of informational medications or simply failing to follow the directions on an antibiotic prescription, such as failing to take all of the required medication in

the treatment of infectious infections [3]. It is critical to apply antibiotic choice to prevent the changing character of these infectious diseases dependent on the causal organism, which contributes to the increasing resistance to traditional antimicrobials [4]. The expensive expense of standard drugs, particularly in resource-constrained areas, has increased the use of plants as an option for treating infectious diseases. It is particularly essential in the treatment of infectious diseases with plants and extracts containing antibacterial phytochemicals. Antimicrobial activity testing of these extracts and products demonstrated that plants are a potential source of novel antibiotic prototypes [5]. The Zingiberaceae family includes ginger (*Zingiber officinale*). Gingerols were shown to be the primary active components in fresh ginger rhizome 6, with gingerol (5-hydroxy-1-(4-hydroxyl-3-

methoxy phenyl) decan-3-one being the most prevalent compound in the gingerol series. Rhizome powder contains 9% protein, 3-6% fatty oil, and 60-70% carbohydrates. 3-8% crude fiber, 8% ash, 9-12% water, and 2-3% volatile oil As in biosynthesis 3-5, the most predominant pungent component in dried ginger powder is shogaol, a dehydration product of gingerol [7]. The extraction of oleoresin with ethanol and acetone provides a 4-7.5% dry powder of aromatic chemicals such as zingerone, shogaol, and gingerol, papadol [8]. Ginger has been shown to be useful in the treatment of a wide range of human ailments such as cataracts, depression, heart disease, Reynard disease, kidney stones, fever, chronic fatigue, coughs, migraines, flu, athlete's foot, bursitis, cold, dizziness, erectile difficulties, struck amenorrhea, and infection with viruses [9]. Ginger has been shown in animal studies to be beneficial in the treatment of diabetes [10]. Ginger's active components have been shown in vitro to limit the proliferation of colon bacteria, which ferment undigested carbohydrates and create flatulence; ginger can assist to counteract this [11]. It prevents the growth of staphylococci, *E. coli*, streptococci, *proteus spp.*, and salmonella [12, 13].

The goal of this study was to look at *Zingiber officinale* roots' antibacterial properties towards various harmful microorganisms. This is in reaction to efforts to identify plant-based drugs and to confirm the scientific basis of some well-known practices in traditional medicine.

2 Materials and Methods

2.1 Bacterial isolates

At the pharmacy department's bacteriological laboratory, two clinical bacterial specimens of *Staphylococcus aureus* (a gram-positive) and *Escherichia coli* (a gram-negative) were both isolated and identified using conventional biochemical assays.

2.2 Extracts preparation

The ginger roots utilized in this investigation were acquired from Baghdad's local marketplaces. The ginger root was cleaned, peeled, split, and crushed into tiny bits. Separately, ten grams of ginger were soaked in 250 ml of D.W. water and 250 ml of methanol for two weeks in flasks at room temperature The raw extracts were filtered using filter paper and stored until needed.

2.3 Antibacterial activity assay

Agar disc diffusion was used to test antibacterial activity [14]. Nutrient agar plates were infected with

tested bacteria culture and disseminated with a sterile loop spreader. Sterile paper disks (5 mm in diameter) were impregnated with various crude extract concentrations and dried at room temperature. A disk in the center of an agar plate treated with gentamicin (20mg/2ml) served as a comparison control. After 24 hours in an incubator set at 37°C, the size of the growth zone inhibition was measured (mm).

2.4 The determination of certain vitamins in ginger aqueous and alcoholic extracts

Using commercial materials and 25ug/ml, an HPLC (High Performance Liquid Chromatography) was utilized to estimate the vitamin A and vitamin B content of ginger, while a colorimetric approach was employed to provide vitamin C.

Table 1: Retentions time and the active compound area

Subjects	Retention time	Area	Concentration
Vitamin A	2.47	57438	25ug/ml
Vitamin B	4.92	184397	25ug/ml

3 Results

The results of our investigation revealed that the tested bacteria were sensitive to the two ginger extracts in various ways. Table.2 demonstrated that *E. coli* (as G-ve) was more resistant to methalonic extract than *S. aureus* (as G+ve) bacteria. The inhibition zone of *E. coli* was (13 mm) and (16 mm) for *S. aureus* in response to methalonic extract compared to gentamicin as a comparator antibiotic, with a zone of growth inhibition equal to (20 mm) in Figure1 and 2. The zone of inhibition of growth of the studied bacteria against equeous extract of ginger was (14 mm) for *S. aureus* and (10 mm) for *E. coli*, with Gentamicin as a comparator antibiotic at (20 mm) as in (Table.3, Figures.3 and 4). According to the two tables, the methalonic extract of ginger was more efficient than the equeous extract in the development of the two tested bacteria, and *E. coli* was less susceptible to the two extracts than *S. aureus*.

Table 2: Antibacterial activity of Ginger methalonic extract against investigated microorganisms as assessed in (mm).

Tested Bacteria	Zone of growth inhibition (mm)	
	Methalonic extract of ginger	(20)ug gentamicin
<i>Staphylococcus aureus</i>	16	20
<i>Escherichia Coil</i>	13	20

Table 3: Antibacterial efficacy of ginger aqueous extract against micro-organisms as assessed in (mm).

Tested Bacteria	Zone of growth inhibition (mm)	
	Methalonic extract of ginger	(20)ug gentamicin
Staphylococcus aureus	14	20
Escherichia Coil	10	20

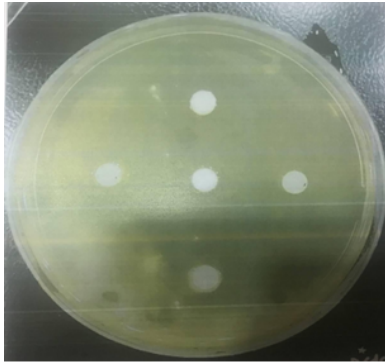


Figure 1: Zones of suppression of growth of *S. aureus* by ginger alcoholic extract

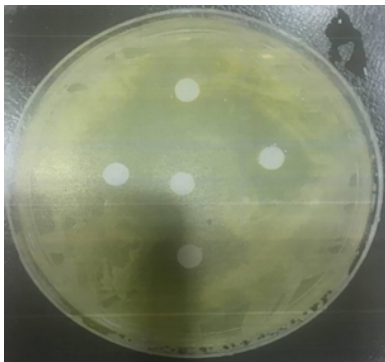


Figure 2: Zones of suppression of *E. Coli* development by ginger alcoholic extract

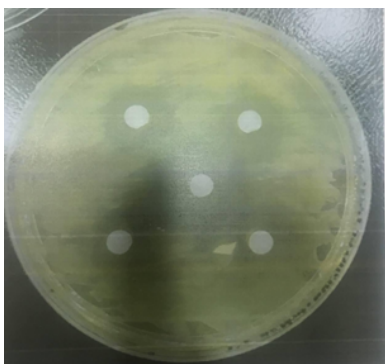


Figure 3: Zones of suppression of *E. Coli* growth by ginger aqueous extract

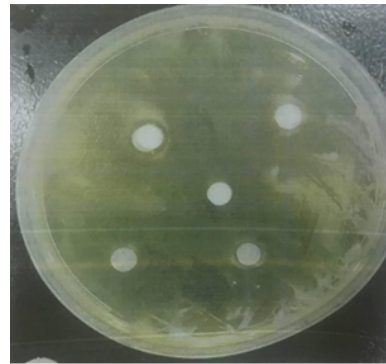


Figure 4: Zones of suppression of growth of *S. aureus* by ginger aqueous extract

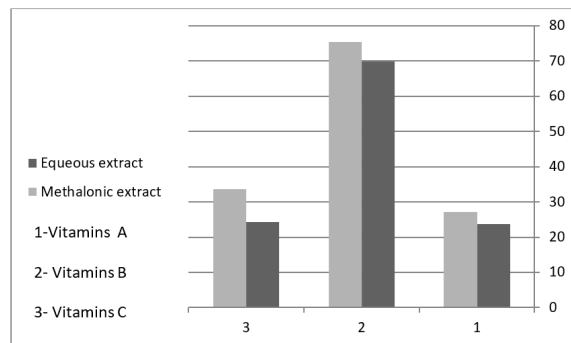


Figure 5: Vitamin concentrations in root ginger(aqueous and alcoholic) extracts

Figure.5 shows that the alcoholic extract of ginger provided the greatest amounts of vitamins A,B, and E (27.13,75.44,33.65) ug/g sequentially. The aqueous extract produced the lowest amounts of (23.63,69.88,24,32) ug/g.

4 Discussion

Our results revealed that various species of bacteria were sensitive to ginger extract in distinct ways. The sensitivity of bacterial species to phenolic chemicals is being investigated in gram-negative bacteria. As demonstrated by [15], gram-negative bacteria were also revealed to be more resistant than gram-positive bacteria. These discrepancies in inhibition may be due to changes in the content and surface structure of these bacterial types [16].

In addition to the cell wall and cell membrane, gram-negative bacteria have an outer membrane consisting of phospholipid bilayers, which may operate as a protective barrier against these phenolic chemicals [17]. Furthermore, G-ve bacteria have a high lipid content and a low peptidoglycan content due to the presence of an outer membrane, whereas G+ve

bacteria have a high peptidoglycan content and a low lipid content [18]. The majority of phenols are metal chelators that adhere to the active site of metabolic enzymes, lowering enzyme activity and hence delaying bacterial metabolism and reproduction. [19]. Because Gram-negative bacteria have an additional outer barrier on their cell walls, phenol penetration may be inhibited, resulting in a less severe impact on the cell. Gram-positive bacteria, on the other hand, lack an outer membrane and are thus more susceptible to phenols. Both aqueous and methanolic extracts of ginger were effective against the bacterium isolates tested. These observations corroborate previous studies by [20]. Given the significant sensitivity of the isolates to ginger extract shown in this investigation, it is clear that both forms of ginger extract can serve as antimicrobial chemotherapeutics that are beneficial in the treatment of certain illnesses. Future research should focus on understanding the many mechanisms of action of the phytochemical active components contained in ginger.

Conflict of Interest: None

Ethical consideration: from ethical committee in the Conflict of Interest: None

Ethical consideration: from ethical committee in the Medical Institute Tech., Mansour Middle Tech. University, Baghdad, Iraq

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