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Invitro antibacterial activity of ginger root extracts against some pathogenic bacteria

[1]Pavitra T

[1]Assistant Professor, Department of Microbiology, Cauvery College of Allied Health Science, Cauvery Group of Educational Institutions, Mysuru- 570028.

Abstract: **Medicinal plants have considered as an alternative resource to antibiotics in the pathogenic bacterial treatment. In traditional medicine system, plant and their parts widely used as medicine among them Ginger (*Zingiber officinale*) plants used majorly. The present research work focused on antimicrobial activity of the hexane and methanol extract of ginger has tested against five pathogenic bacteria like *Escherichia coli, Proteus vulgaris, Klebsiella pneumoniae, Staphylococcus aureus*, and *Pseudomonas aeruginosa* by Kirby-Bayer agar diffusion method. In this analysis methanol ginger extract showed maximum zone of inhibition against *Escherichia coli* (23.65±0.52) and *Pseudomonas aeruginosa* (21.32±0.72) and minimum zone inhibition observed in *Proteus vulgaris* (15.63±0.63). The hexane ginger extract showed that maximum zone of inhibition against *Escherichia coli* (19.23±0.32) and minimum zone of inhibition against *Proteus vulgaris* (12.53±0.56). Present study, results confirmed that methanolic extract of ginger showed potential antibacterial activity against pathogenic bacteria over hexane extract, therefore methanolic extract perhaps used against these pathogenic bacterial treatments after proper validation.**

Keywords: **Ginger (*Zingiber officinale*), Methanol extract, Hexane extract, Zone of inhibition (ZOI), and Kirby-Bayer agar diffusion method.**

I. INTRODUCTION

Ginger (*Zingiber officinale*) has widely used as the herbal supplements in food as well as in general medication purposes since ancient times throughout the world [1, 2, 3]. Ginger (*Zingiber officinale*) belongs to the family Zingiberaceae, plants belong to this family exhibits aromatic and medicative properties and characterized by their stalky or non-tuberous rhizomes [4]. The United states Food and drug administration (FDA) listed ginger in GRAS (Generally recognised as safe) list [5]. The ginger rhizome studies reported to executes anti-oxidant, antibacterial, antiprotozoal, anti-fungal, anti-emetic, anti-rhinoviral, anti-inflammatory, anti-insecticidal activity *etc* [6]. Further, it is used to control various health issues like rheumatism, indigestion, dementia, arthritis, cramps, sprains, sore throats, muscular aches, pains, constipation, vomiting, hypertension, indigestion, dementia, fever and infectious diseases [7].

Ginger is used as stimulant and carminative in medical field and is used frequently for dyspepsia and colic control [8]. It has a property to stimulating the production of saliva commonly called sialagogue action. Ginger promotes the bile secretion from the gall bladder, decrease joint pain in case of arthritis, blood thinning and cholesterol lowering properties, and also use for the treatment of heart diseases and lungs diseases [8-10]. Generally, pathogenic bacteria infect and develops a disease condition when immune system is weak. Bacterial mediated food poisoning sometimes life threatening. To control or remove the activity of microbes generally use of several antimicrobial agents, some of them are weakened by microbial resistance [11]. There is diversified phytochemical such as saponin, flavonoids, alkaloids, cardiac glycoside, tannin, and terpenoids were present in ginger root extracts and very effective against large group of pathogenic fungi and bacteria [12]. In this study, tested the antibacterial activity of methanol and hexane extracts of ginger rhizome against selective human pathogenic bacteria by disc diffusion method (Kirby-Bauer method).

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II. MATERIALS AND METHODS

Ginger sample Collection and Solvent extraction:

The fresh ginger (*Z. officinale*) rhizomes used in this study were collected from the Chitradurga vegetable market, Chitradurga, Karnataka (India). The fresh roots were washed with distilled water make into small pieces, air dried and made into powder by using cryogenic tissue grinder. Later, 100 grams of the root powder was dissolved in 100 ml of methanol and hexane. Further solutions were allowed to stand for 3 days, after settling filtered through sterile muslin cloth followed by Whatman filter paper No.1. The filtrate obtained were placed in the hot air oven at 40 °C for 24 hrs to evaporate the solvent. Finally, precipitate was made into a concentration of 100mg/ml. Then diluted in ethanol and hexane solvent and made concentrations of 10µl and 15µl [12, 13].

Bacteria used in the study:

For determining antibacterial activity of ginger extract Five bacterial species were used they were *Escherichia coli*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*.

Screening of antibacterial activity:

The antibacterial assay of Ginger extracts was performed by disc diffusion method as described by Kirby-Bauer [14], all

the experiments were performed under sterile conditions. In this method each test pathogenic bacterial inoculum was separately swabbed on MHA medium surface evenly (0.5 Mac Farland). After that sterile empty discs (6 mm diameter), were loaded with 10 and 15 µl methanol and hexane extracts for one minute and placed over the Mueller Hinton agar plates already seeded with bacterial culture and incubated at 37^{o}C for 24 hrs. Commercially available Ciprofloxacin discs (10 µg) were used as control. The antibacterial assay was performed in triplicate with each bacterial strain and diameter of inhibition zones was measured in millimetres [15].

Results and Discussion

The antimicrobial activity of the ginger root extract was tested against the five bacterial isolates, varied results were observed in different concentration on different bacterial species. In this study, the effects of ginger root extract and Ciprofloxacin were studied against the bacteria, the maximum zone of inhibition showed in 15µl of methanol ginger root extract, hexane extract showed maximum ZOI 15µl and 10 µg of Ciprofloxacin.

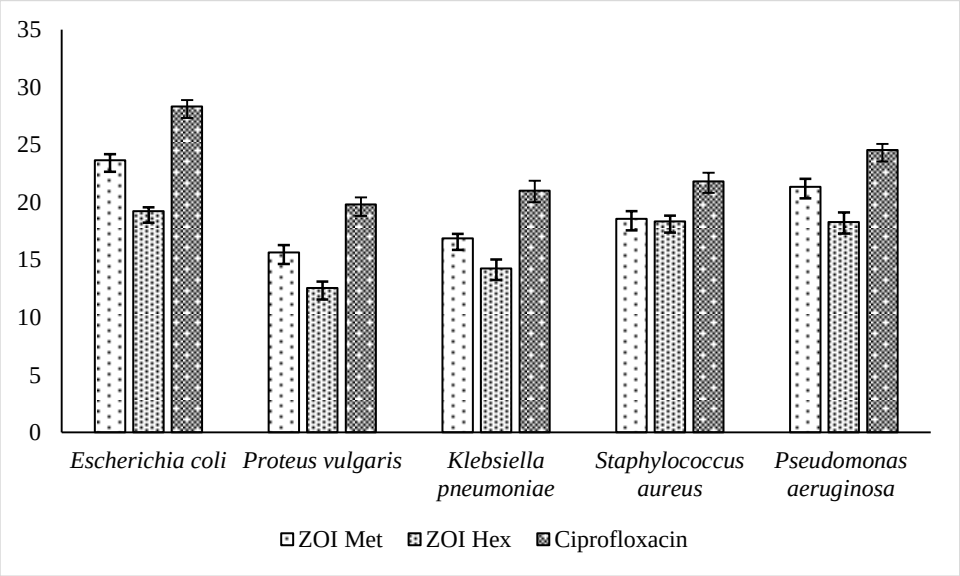

Fig. 1: Antibacterial activity of ginger root extract against pathogenic bacteria at 10 µl concentration.

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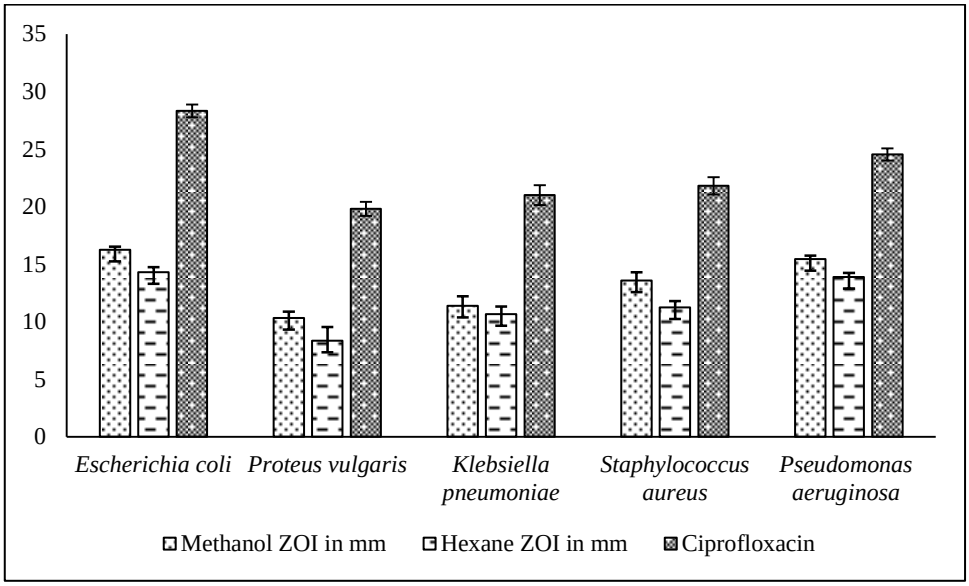

Fig. 2: Antibacterial activity of ginger root extract against pathogenic bacteria at 15 µl concentration.

The10 µl of methanol ginger extract showed minimum zone of inhibition as *Proteus vulgaris* (10.32±0.56), *K. pneumoniae* (11.36±0.86), and *Staphylococcus aureus* (13.58±0.72). Meantime, *Escherichia coli* (16.23±0.28) and *Pseudomonas aeruginosa* (15.43±0.31) bacterial growth inhibited maximum. Then 10 µl of hexane extract of ginger root showed zone of inhibition in *Proteus vulgaris* (8.35±1.2), *K. pneumoniae* (10.65±0.68), and *Staphylococcus aureus* (11.23±0.56). Meantime, *Escherichia coli* (14.29±0.45) and *Pseudomonas aeruginosa* (13.87±0.37) showed maximum zone of inhibition (Fig. 1). Increased concentration of extract of 15 µl of methanol ginger extract showed minimum zone of inhibition as *Proteus vulgaris* (15.63±0.63), *K. pneumoniae* (16.84±0.41), and *Staphylococcus aureus* (18.55±0.68). Meantime, *Escherichia coli* (23.65±0.52) and *Pseudomonas aeruginosa* (21.32±0.72) bacterial growth inhibited maximum. Then 15 µl of hexane extract of ginger root showed minimum zone of inhibition in *Proteus vulgaris* (12.53±0.56) and *K. pneumoniae* (14.23±0.78). Meantime, *Escherichia coli* (19.23±0.32), *Staphylococcus aureus* (18.34±0.49), and *Pseudomonas aeruginosa* (18.28±0.82) showed maximum zone of inhibition (Fig. 2). A positive control Ciprofloxacin showed average 23 mm zone of inhibition against tested bacterial isolates.

Earlier studies reported the antimicrobial activity of ginger [6, 12, 13], in this study we are also focused on the effect of ginger root extracts against selective pathogenic bacteria. The active secondary components of ginger root inhibit the growth of bacteria [15], however some times due to variation in abiotic and biotic factors ginger extracts not exhibits the antimicrobial activity [16, 17]. In this study, both methanol and hexane extract of ginger root showed the active inhibition against tested bacteria, possible due to the secondary compounds released in the solvents. Previously, several reports confirmed that ginger root extracts inhibit the *P. aeruginosa*, *E. coli*, *S. aureus*, *K. pneumoniae*, *E. faecalis*, *E. cloacae* and *Enterobacter aerogenes* [18, 19, 20, 21]. Ginger extract not only effective against bacterial colonies but also effective towards the biofilm formation microorganisms like *P. aeruginosa*, *E. coli*, *S. aureus*, *K. pneumoniae*, *B. cereus*, *A. baumannii*, *C. albicans*, and *C. krusei* [13, 20, 22]. Further, ginger rhizome extracts also exhibited inhibitory activity against different fungi like *C. albicans A. niger*, C. *albicans*, *C. Krusei*, *Aspergillus* spp., *Penicillum* spp., *Fusarium* spp., *Trichoderma harzanium*, *Beauveria bassiana*, *Mucor mucedo*, *Saccharomyces cerevisiae* [1, 11, 12, 23].

III. CONCLUSION

Present study emphasizes to enhance the current understanding of various solvent extraction of ginger rhizome. The methanol extract showed maximum inhibitory activity by forming a maximum zone of inhibition at higher concentration (15µl) and recorded minimal activity by form of minimum zone of inhibition at lesser concentration (10 µl). Further, hexane extract also exhibited same inhibitory pattern with less activity was observed. The maximum zone of inhibition observed at 10 µg concentration of ciprofloxacin used, however methanol or hexane extract of ginger not recorded equal activity as ciprofloxacin exhibited. The present study results once again confirms the effectiveness of ginger rhizome extracts against selective pathogenic bacteria.

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