Heterocyclic Letters
Vol. 14| No.1|169-174|Nov-Jan|2024
ISSN : (print) 2231–3087 / (online) 2230-9632
CODEN: HLEEAI
http://heteroletters.org

COMPARATIVE STUDY OF POTENTIAL ANTIMICROBIAL ACTIVITY OF ROOT AND LEAVES OF GINGER AGAINST SELECTED BACTERIA

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ABSTRACT: The main objective of present study was to evaluate comparative potential anti-microbial activity of aqueous extract, ethanol extract and n-hexane extract obtained from root and leaves of Ginger (*Zingiber officinale*) against selected bacteria *Pseudomonas aeruginosa* and *Salmonella typhi*. Different ginger extracts were prepared. 6 extracts of roots & leaves of Ginger were prepared with three solvents Aqueous, Ethanol & n-Hexane and antimicrobial activity checked by agar disc diffusion method. Generally, all extracts obtained by Ginger showed antibacterial activity against selected microorganisms. The study showed that Antibacterial activity exhibited among the six extract tested, aqueous extracts of ginger roots and n-hexane extract of ginger leaves exhibited antibacterial activity against one organism (*S.typhi*). And n-hexane extract of roots, Alcoholic extract of ginger leaves and roots exhibited antibacterial activity against both pathogens (*P.aeruginosa* and *S.typhi*). It is concluded that *Ginger root and leaves both* may be a potential source for the curing of various diseases caused to tested pathogens.

KEYWORDS: *Zingiber officinale*, Ginger extract, Antimicrobial, disc diffusion

INTRODUCTION

Spices used in foods are generally antimicrobial and antioxidant agents. Spices have been used in the traditional medicines from thousands of years. The scientific name of Ginger is *Zingiber officinale* which belongs to the Zingiberaceae family.

A number of medicinal properties can be shown by various parts of the *Ginger* tree. Almost all the parts of this plant: root, leaf, flowers etc. have been used for various ailments in the indigenous medicine of various countries [I]. Antimicrobial agents are very important for the control of pathogenic microbes, especially for the treatment of infections caused by resistant microbes Medicinal herbs with antimicrobial activities are considered a potent source of novel antimicrobial functions. *Zingiber officinale* is widely used as a vegetable, functional food and

medicinal plant that has rich nutritional composition with diverse pharmacological activities [II - IV]. In recent times, focus on plant research has increased all over the world and a large body of evidence has collected to show immense potential of medicinal plants used in various traditional systems [V]. Ginger is a natural antioxidant, antidiabetic, antiulcer, antiobessity, antibiotic, outstanding immune builder used in many countries from ancient times. Ginger not only adds flavour to food but also it provides nutritious values also. A few researchers have investigated the antimicrobial activity of *GINGER* (Lam) extracts against some pathogenic bacteria [VII - VIII]. In this present study focuses on the Antimicrobial action of Zinc nanoparticles prepared from Ginger extract. The present work also focuses on discovering new techniques for green synthesis of metal nanoparticles of ginger water extract.

Nanoparticles contain antimicrobial and antioxidant substance could be considered as new trend of antimicrobial therapeutic agents for prevention and reduction of deterioration of food and pathogenic microorganisms. Foodborne pathogens such as *S.typhi* which are widely distributed in nature. It's implicated in large numbers of foodborne outbreaks in many parts of the world, including the developed countries. Nano sized metals have been shown to have a good antimicrobial effect and they can be introduced as a solution for the resistance problem. Moreover Nano metals have diverse applications which can be explained by attaining a high surface area to volume ratio.

The main advantage of green methods was the presence of naturally occurring biomolecules, such as proteins, enzymes, tannins, phenols, sugars etc. that can be used safely as reducing agents to form stable Nano metals.

MATERIALS AND METHODS:-

COLLECTION OF PLANT MATERIAL

Fresh Ginger roots and leaves were obtained from campus of Siddhartha College, Jafrabad, Jalna (Maharashtra). The leaves and roots were identified and confirmed by the Botanist at the Botany Department of the present institution. All materials were washed with tap water to remove impurities. It were dried under shade for 1 week, all dried materials were ground in a mixer grinder separately, which were easily grinded into the powder form. Same processes repeated 4 to 5 times and it stored in an air tight container for further study.

PREPARATION OF EXTRACTS

From each 30 gm. of the powdered sample of roots and leaves were separately extracted in 500ml conical flasks with 100 ml of deionised distilled water (aqueous extraction) while 100ml each of n-Hexane, and ethanol, (solvent extraction). The conical flasks were plugged with rubber corks, then shaken at 120 rpm for 30 min and allowed to stand at room temperature for 6 day. The extracts were separately filtered using Whatmann filter paper no. 1. The resulting filtrates were centrifuged. After centrifugation, supernatants were labelled as "Extract AQUL" and "Extract AQUR" for the aqueous extracts of leaves and roots respectively. They were similarly labelled for solvent extraction as "Extract NHX" and "Extract ETH" for n-Hexane and ethanol respectively. Totally six extract of Ginger were prepared with different solvent and different part. All extracts were properly labelled and kept at 4^{o}C until use.

ANTIMICROBIAL PROPERTIES OF GINGER EXTRACTS.

Agar diffusion assay (Disc diffusion method) was used in present study of antibacterial activity of ginger leaves and roots extracts on *P.aeruginosa* & *S.typhi*.

THE PATHOGENIC MICROORGANISM

Standard strains of two gram negative common pathogenic microorganism (*Pseudomonas aeruginosa* and *Salmonella typhi*) were obtained and used for the present study

MEDIA USED

Microbiological media used for bacteria (*Pseudomonas aeruginosa* & *Salmonella typhi) is* **Nutrient agar** (Hi-media) Composition **(gL-1)::** Sodium chloride, 5.0; Beef extract 10.0; Peptone 10.0 (pH 7.2).

ANTIBACTERIAL ACTIVITY BY DISC DIFFUSION METHOD

The method of testing used for the present study is the disc diffusion method [18]. Disc diffusion assay method is based on the inhibition of bacterial growth measured under standard conditions. The organism to be tested is grown to a specific turbidity in a standard liquid medium.

An inoculum from this culture is spread across the surface of a Nutrient Agar plate to give confluent growth. Assay carried out by taking concentration 100 microrgram per disk. Hi-media antibiotics disk: Standard antibiotic - Chloramphenicol (10 microgram/disk) moistened with DMSO were used as standard Sterile Disc size 6 mm.

The antibiotic in each disc diffuses outward from the disc, and the concentration of the antibiotic diminishes as the distance from the disc increases. After incubation at 35°C overnight, the diameter of the zone of growth inhibition is measured in mm and scored according to the size of the zone. The size of the zone of inhibition is directly proportional to the sensitivity of the organism to the respective roots and leaves extract and the standard antibiotic (chloramphenicol).

In this study, the zone of inhibition was observed for the aqueous, n-hexane and alcoholic extract of the ginger roots and leaves samples. Finally, the zones exhibited by the standard antibiotics (Chloramphenicol) were measured, and the results were recorded. With the help of a vernier caliper, the clear zone was measured. Care was taken not to measure the zone from the broken portion of the zone or the irregular lining of the zone. The clear zone which is completely transparent around the disc is the "zone of inhibition."

RESULT AND DISCUSSION :

Present study was carried out to examine the antibacterial effects of ginger extracts against different illness causing and water/food borne pathogens. For this study, the aqueous, n-Hexane and alcoholic extracts of ginger leaves and roots were tested on *P. aeruginosa* and *S. typhi* with disc diffusion method as in vitro.

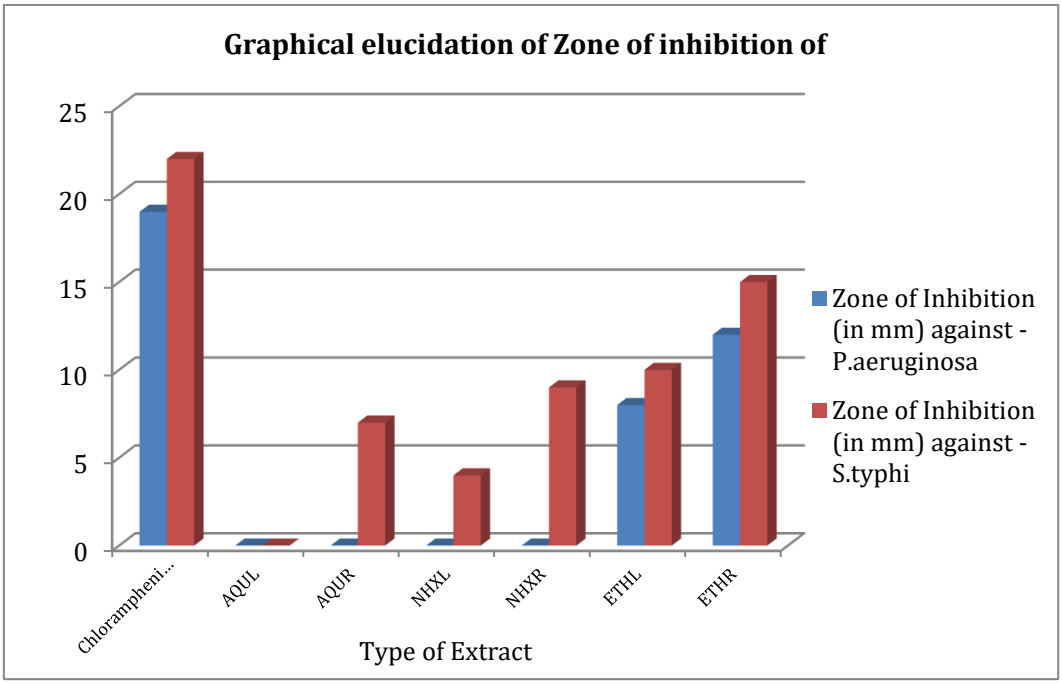
Ginger leaves and roots extract was prepared in three solvents namely water, n-hexane and ethanol. No activity was found in aqueous extract of ginger leaves against both pathogens. Whereas aqueous extract of ginger roots along with n-hexane extract of ginger leaves were not exihibited any activity against *P.aeruginosa*. Among the six extract tested, aqueous extracts of ginger roots and n-hexane extract of ginger leaves exhibited antibacterial activity against one organism (*S.typhi*). And n-hexane extract of roots, Alcoholic extract of ginger leaves and roots exhibited antibacterial activity against both pathogens (*P.aeruginosa* and *S.typhi*).

Comparatively the alcoholic extracts gave a better response than the aqueous and n-hexane extracts. The results of the antibacterial activity assays are represented in Table 1.

Table No. 1 Comparison of antibacterial activity of different ginger extracts

Type of extract / std used	Zone of Inhibition (in mm)	
	P.aeruginosa	*S.typhi*
Chloramphenicol	19	22
AQUL	--	--
AQUR	--	7
NHXL	--	4
NHXR	--	9
ETHL	8	10
ETHR	12	15

P.aeruginosa – *Psedomonas aeruginosa*, *S.typhi* – *Salmonella typhi*, AQUL- Aqueous extract of ginger leaves, AQUR- Aqueous extract of ginger roots, NHXL- n-Hexane extract of ginger leaves, NHXR- n-Hexane extract of ginger roots, ETHL- Ethanol extract of ginger leaves, ETHR- Ethanol extract of ginger roots.



As shown in above Table No. 1 and Graphical elucidation, Antibacterial activity exhibited by the standard antibiotics (Chloramphenicol) was found to be 19 mm zone of inhibition against *P.aeruginosa* and 22 mm zone of inhibition against *S.typhi*.

The study reveals that the selected ginger roots extract in ethanol has more antibacterial property against *S.typhi* (15 mm) than *P.aeruginosa* (12 mm). And the next being the ginger leaves extract in ethanol which exihibited 8 mm and 10 mm zone of inhibition against the *P.aeruginosa* and *S.typhi* respectively. Whereas n-hexane ginger roots extract was at the best in exhibiting the antibacterial activity with 9 mm zone of inhibition against *S.typhi* only. However, n-hexane leaf extract and aqueous root extract exihibited 4mm and 7 mm of zone of inhibition against *S.typhi* respectively.

This clearly emphasizes that the ethanol extracts of ginger roots and leaves exhibited better antibacterial activity and the killing rate of the bacterial strains is higher relatively.

CONCLUSION

The result of this research has demonstrated that *Z. Officinale* could become promising natural antimicrobial agents with potential application in therapeutic drugs for controlling the pathogenic bacteria. Inhibition of Gram-negative pathogenic microorganisms by this plant extract depicts that it can serve as a source of antibiotics, which justified the traditional use of this plant for therapeutic purposes.

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Received on September 30, 2023.