



Detection of Antibacterial Activity of Clove Extract on *Pseudomonas Aeruginosa* Isolated from Patients Visiting Tertiary Care Hospital

Amruta Arathiya^[1] **Dr Deepashri Naik^[2] Shreya Anil Kadam^[3]

¹PG student Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi mumbai , Maharashtra

² Associate Professor Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi mumbai , Maharashtra

³Lecturer, Department of Microbiology, SMBT Dental College, MUHS, Nashik

^{1,2}Department of Microbiology, MGM Medical College , Navi mumbai , Maharashtra

Corresponding Author**

Dr Deepashri Naik

Associate Professor Department of Microbiology, MGM Medical College and Hospital, Kamothe, Navi mumbai , Maharashtra

(Received: 16 July 2025

Revised: 20 August 2025

Accepted: 02 September 2025)

KEYWORDS

Antibacterial Activity, *Pseudomonas Aeruginosa*

ABSTRACT:

Pseudomonas aeruginosa has become one of the major threats to public health as it causes serious infections like Hospital Acquired Infection and the condition becomes worse if it is caused by drug-resistant strain. To overcome this resistance natural products, have a great therapeutic property. Thus, this study was aimed to determine antibacterial activity of clove extract such as Infusion, Decoction and Clove oil against *Pseudomonas aeruginosa* isolated from clinical specimen of patients visiting tertiary care hospital. Total 250 number of *P. aeruginosa* were isolated from clinical samples such as Blood, Sputum, Urine, ET secretion, Pus, etc. Patients of age group from 18-80 were included in this study with 154 MDR isolates. Maximum number of *P. aeruginosa* isolates were found in ICU patients. Clove oil was susceptible to all 250 isolates of *P. aeruginosa* with mean zone of 23.59 ± 4.72 Standard deviation. These findings suggest the potential of clove oil as an adjuvant therapy along with antimicrobial agent against infection caused by *Pseudomonas aeruginosa*.

Introduction

Pseudomonas aeruginosa is an aerobic Gram-negative bacterium. It is an important cause of both community acquired and hospital acquired infections. Infections include otitis externa, ulcerative keratitis and soft tissue and skin infections, pneumonia, bloodstream infections, urinary tract infections, surgical site infections and skin infections associated with burns. Infections caused by *P. aeruginosa* are very common as well as they have also been associated with high morbidity and mortality rate when compared with other bacterial pathogens.^[1]

However, due to overuse of antibiotics multi-drug-resistant bacterial strains are developing day by day. The worldwide emergence of bacteria like *Pseudomonas*

aeruginosa has become a major therapeutic problem. Thus, as a result of the rapid global spread of emergence of resistant bacteria there is need to find new antibacterial agents. However, even new generations of antibiotics have low effectiveness.^[2]

Natural products provide unlimited opportunities for new drug. Therefore, search for new antibacterial compounds is an alternative way for solving this problem, so herbal products are increasingly turning the researcher's attention to develop better drugs against Multidrug Resistant Bacteria (MDR).^[2]

Cloves (*Syzygium aromaticum*) are belonging to the family Myrtaceae which are dried unopened floral buds of an evergreen tree.^[2] The high levels of eugenol



contained in clove essential oil gives strong biological and antimicrobial activity. This phenolic compound can denature proteins and reacts with cell membrane phospholipids changing their permeability.^[3] There are reports on biological activities of eugenol including anti-fungal, antibacterial, antioxidant and anti-inflammatory.^[4] Moreover, the hydrophobic nature of eugenol enables it to penetrate the lipopolysaccharide of the Gram-negative bacterial cell membrane which alters the cell structure and results in the release of intracellular constituents.^[5] Eugenol can be an alternative or adjuvant to antibiotics against many microbial pathogens, and can reduce the increasing resistance of microorganisms to antibiotics.^[6]

Therefore, this study was undertaken for detection of antibacterial activity of clove extract on

250 number of *Pseudomonas aeruginosa* isolated from clinical samples such as Urine, Blood,

Sputum, ET secretion, Gastric lavage and Pus.

Materials and Methods

Clove extract preparation^[7]

Preparation of infusion: The aqueous infusion was prepared by taking 10 g clove in 100 ml distilled water and left for 24 hours at room temperature with occasional shaking and filtered to obtain clear infusion.

Preparation of decoction: The aqueous decoction was prepared by boiling 10 g clove in 100 ml distilled water in a flask for 20 minutes. The flask was removed from heat and allowed to cool. The content of flask was filtered to obtain clear decoction.

Clove oil: It was purchased from a local market in Navi Mumbai.

Screening of antibacterial activity: Screening of antibacterial activity was performed by standard disc diffusion method. Sterilized discs of filter paper (6 mm diameter) were soaked in infusion, decoction and oil, separately for 1 minute and then used for screening. Mueller Hinton agar (MHA) was used as base medium inoculated with bacterial suspension matched with 0.5 McFarland nephelometer turbidity standard. Discs of infusion, decoction, oil and antibiotics were placed on the surface of inoculated plates and were incubated at 35-37°C for 24 hours.

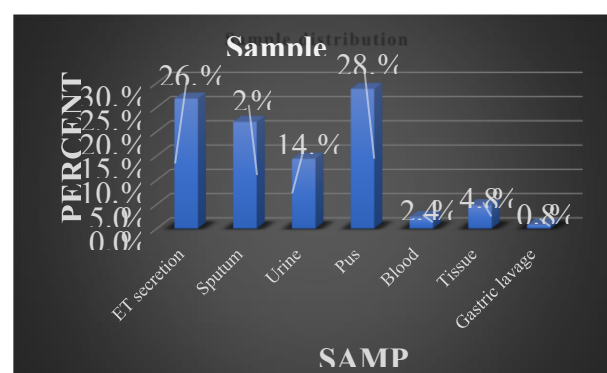
^[7,8] After incubation inhibition zone diameters were measured to the nearest millimeter (mm).^[7]

Statistical analysis: Mean diameter of zone of inhibition and standard deviations were calculated.^[7]

Results

Table:1 Sample distribution of *P. aeruginosa* isolates

Sample	No. of isolates	Percentage
ET secretion	67	26.8%
Sputum	55	22%
Urine	36	14.4%
Pus	72	28.8%
Blood	06	2.4%
Tissue	12	4.8%
Gastric lavage	02	0.8%



Graph 1: Maximum number of *P. aeruginosa* isolates was found in Pus (28.8%)

Table:2 Antimicrobial Susceptibility Testing of *P. aeruginosa* for 1st Line antibiotics

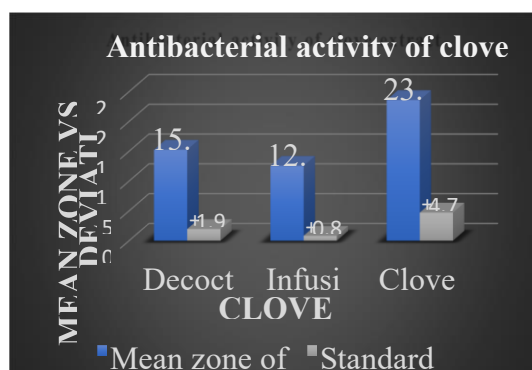
Antibiotics	Total no. of Susceptible isolates	Susceptible Percentage
Amoxyclav (AMC)	06	2.4%
Tobramycin (TOB)	173	69.2%
Cefazolin (CZ)	09	3.6%
Gentamicin (GEN)	163	65.2%



Table 5: Antibacterial activities of infusion, decoction and oil of clove on isolates of *P.*

aeruginosa [n=250]

Clove Extract	Mean zone of Inhibition	Standard Deviation
Decoction	15.26	±1.96
Infusion	12.57	±0.83
Clove oil	23.59	±4.72



Graph 5: Maximum no of *P. aeruginosa* isolates was susceptible to Clove oil

Discussion

Therapy is now increasingly challenging due to the growing prevalence of multidrug-resistant bacteria, especially in hospitals. Alternative methods of treating MDR bacteria include the use of natural substances, which have been investigated and advocated as spread control measures.^[2] There are reports on biological activities of eugenol including anti-fungal, antibacterial, antioxidant and anti-inflammatory.^[4] The high levels of eugenol contained in clove essential oil gives strong biological activity and antimicrobial activity.^[3]

In this study, clove extract was prepared such as Decoction, Infusion and Clove oil from which highest susceptibility were observed for Clove oil with mean 23.59 and standard deviation of ±4.72 and least susceptibility was observed for Infusion with mean 12.57 and standard deviation of ± 0.83. Similar records were found in the study by Saeed S et. al where Clove oil exhibited maximum antibacterial activity with mean

zone of 18.86 and ± 1.46 of Standard deviation whereas Infusion showed minimum antibacterial activity with mean zone of 10.43

and ± 1.76 of Standard deviation.^[7]

Conclusion

- Total 250 non-repetitive isolates of *Pseudomonas aeruginosa* were obtained from the clinical samples such as Urine, Blood, ET secretion, Gastric lavage, Pus, Sputum and Tissue from the patients visiting tertiary care hospital.
- During this study it was observed that out of 250 isolates 61.6% were multi-drug resistant (MDR).
- Maximum inhibitory activity was shown by clove oil (100%) in all 250 isolates.
- As there is an increase in prevalence of MDR *P. aeruginosa*, there is need to find an alternative treatment regimen.
- Hence, Clove can be used as an adjuvant for the treatment of infections caused by *Pseudomonas aeruginosa*.

References

1. Driscoll JA, Brody SL, Kollef MH. The epidemiology, pathogenesis and treatment of *Pseudomonas aeruginosa* infections. *Drugs*. 2007 Feb;67:351-68.
2. Abdullah BH, Hatem SF, Jumaa W. A comparative study of the antibacterial activity of clove and rosemary essential oils on multidrug resistant bacteria. *Pharmaceutical and Biosciences Journal*. 2015 Feb 27:18-22.
3. Kumar U, Kumar B, Bhandari A, Kumar Y. Phytochemical investigation and comparison of antimicrobial screening of clove and cardamom. *Int J Pharm Sci Res*. 2010;1(12):138-47.
4. Chatterjee D, Bhattacharjee P. Comparative evaluation of the antioxidant efficacy of encapsulated and un-encapsulated eugenol-rich clove extracts in soybean oil: Shelf-life and frying stability of soybean oil. *Journal of Food Engineering*. 2013 Aug 1;117(4):545-50.



5. Devi KP, Nisha SA, Sakthivel R, Pandian SK. Eugenol (an essential oil of clove) acts as an antibacterial agent against *Salmonella typhi* by disrupting the cellular membrane. *Journal of ethnopharmacology*. 2010 Jul 6;130(1):107-15.
6. Kowalewska A, Majewska-Smolarek K. Eugenol-based polymeric materials—antibacterial activity and applications. *Antibiotics*. 2023 Oct 27;12(11):1570.
7. Saeed S, Tariq P. In vitro antibacterial activity of clove against gram negative bacteria. *Pak. J. Bot.* 2008 Oct 1;40(5):2157-60.
8. Chakotiya AS, Narula A, Sharma RK. Efficacy of methanol extract of *Zingiber officinale* rhizome against acute pneumonia caused by *Pseudomonas aeruginosa*. *Journal of Lung Health and Diseases*. 2018 Feb 5;2(1).