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Antibacterial activity of cinnamon and clove oil against wound pathogens

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ABSTRACT

A wound is a complicated health issue, and it severely affects the injured area because of the growth of many pathogenic microorganisms. Cinnamon and clove oil exhibit antibacterial activity against wound pathogens like *Pseudomonas aeruginosa, Escherichia coli, and Klebsiella pneumoniae* were identified by the disc diffusion method. Cinnamon and clove oils are effective antibacterial agents because of their importance in reducing virulence and pathogenicity of drug-resistant bacteria in vivo. The increased frequency in clinically observed cases of antibiotic resistance has been attributed to many factors, such as the misuse and overuse of antibiotics. In some countries, antibiotics are sold over the counter without a prescription; hence, this study aimed to investigate the antimicrobial effect of clove and cinnamon on clinically isolated resistant strains of P. aeruginosa, E. coli, and K. pneumoniae.

Keywords: *antibacterial activity; cinnamon oil; clove oil; wound pathogens*

INTRODUCTION

Antibactericidal activity of spices may vary between strains, types, and nature like fresh, dried, or extracted form.[1] Cinnamon belongs to the family *Lauraceae* family and genus Cinnamomum. It is a traditional herbal medicine widely used in China, India, and Australia. It consists of about 250 species.[2] Cinnamon oil is extracted from *Cinnamomum zeylanicum* and *C. vervun* and is used to reduce inflammation, eliminate viruses, boost immunity,

facilitate pain relief, and improve metabolic function. The primary chemical constituents of cinnamon oil are cinnamaldehyde, cinnamyl acetate, eugenol, and eugenol acetate. Cinnamaldehyde possesses antifungal, antibacterial, and antimicrobial properties.[3] Cinnamyl acetate repels and prevents insect infestation and enhances circulation, thereby allowing the body to receive the required amount of oxygen, vitamins, and minerals to sustain health. A previous study by Khan et al. reports that eugenol exhibits antioxidant properties.[4] Cinnamon oil also is strongly cholesterolaemic, antioxidant, analgesic, antiulcer, and anticandidal. They also possess antiallergenic, anti-inflammatory, antiulcerogenic, antipyretic, antioxidant, and anestheticactivities.[5] The application of cinnamon oil is limited in food products because of its volatility and chemical instability in the presence of air, light, moisture, and higher temperatures.[6]

Clove oil is extracted from the flower buds of *Syzygium aromaticum*. It contains 84–95% phenols with primary components such as eugenol, eugenyl acetate, b-caryophyllene, etc.[7,8] Eugenol that possess antioxidant properties, and b-caryophyllene boosts immune system function and reduces inflammation.[9] The biological activities of clove oil include antibacterial, antifungal, insecticidal, and antioxidant properties, and are traditional savoring agents and antimicrobial additives in food.[1] One of the primary hurdles in antibiotic therapy is multidrug-resistant bacteria in hospitals and community- acquired infection. An infected wound is a localized defect or excavation of the skin or underlying soft tissue in which pathogenic organisms invade into viable tissue surrounding it. The infection of the wound triggers the body's immune response, causing inflammation, tissue damage, and retard the healing process. Several wound-causing bacteria were segregated by bioluminescence, pigment production, conjugation, antibiotic production, expression of virulence factors, biofilm formation, and many degradative enzymes in animals, fishes, and plants.[10–12]

MATERIALS AND METHOD

Essential oils were obtained from Himalaya Drug Co., Dehradun, India, and Aroma Sales Corporation, New Delhi, India. Mueller Hinton agar, peptone water, and Mac-Conkey agar was purchased from Hi-Media Laboratory, Mumbai, India, and Aroma Sales Corporation, New Delhi, India. Pseudomonas aeruginosa, Escherichia coli, and Klebsiella pneumoniae strains (patient wound swabs) were obtained from Apollo hospitals, Chennai, and were cultured and further isolated.

Determination of antibacterial activity

The antibacterial activity of cinnamon and clove oil was checked using the disc diffusion method. First, the microorganisms were isolated from diabetic patients' wounds using a differential medium like Mac-Conkey agar. Later the isolated organisms were inoculated into peptone water to enhance the growth of microorganisms and were subjected to antibiotic sensitivity testing using the lawn plate culture method. Antibacterial activity of cinnamon and clove oil was detected using the agar well diffusion method against the wound pathogens like *P. aeruginosa*, *K. pneumoniae*, and *E. coli*. In this study, Mueller Hinton agar was used to determine the zone of inhibition. Muller Hinton agar was prepared and allowed to sterilize for 45 minutes at 120 lbs, and was poured into disinfected plates and forest aside to solidify. Wells was created using a well-cutter. Later the test organisms were swabbed into it. The cinnamon and clove oils with different concentrations were loaded, and the plates were incubated at 37 °C for 24 hours. After the incubation time, the zone of inhibition was measured.

RESULTS AND DISCUSSION

The antibacterial activity of cinnamon and clove oil is shown in Figure 1. *P. aeruginosa* showed a higher zone of inhibition followed by *E. coli* and *K. pneumoniae* for both cinnamon and clove oil at all

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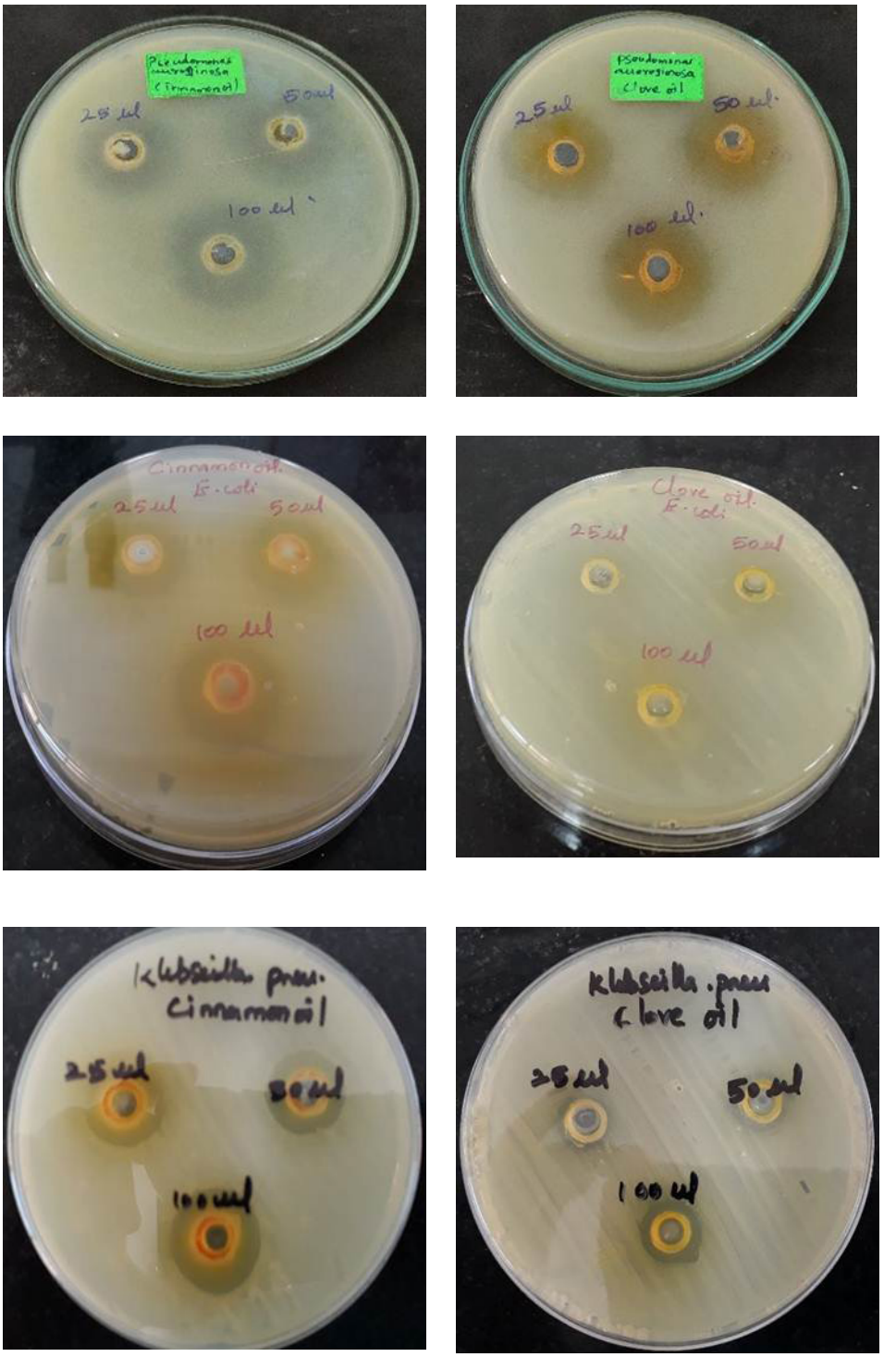

FIGURE 1. Antibacterial activity of cinnamon and clove oils.

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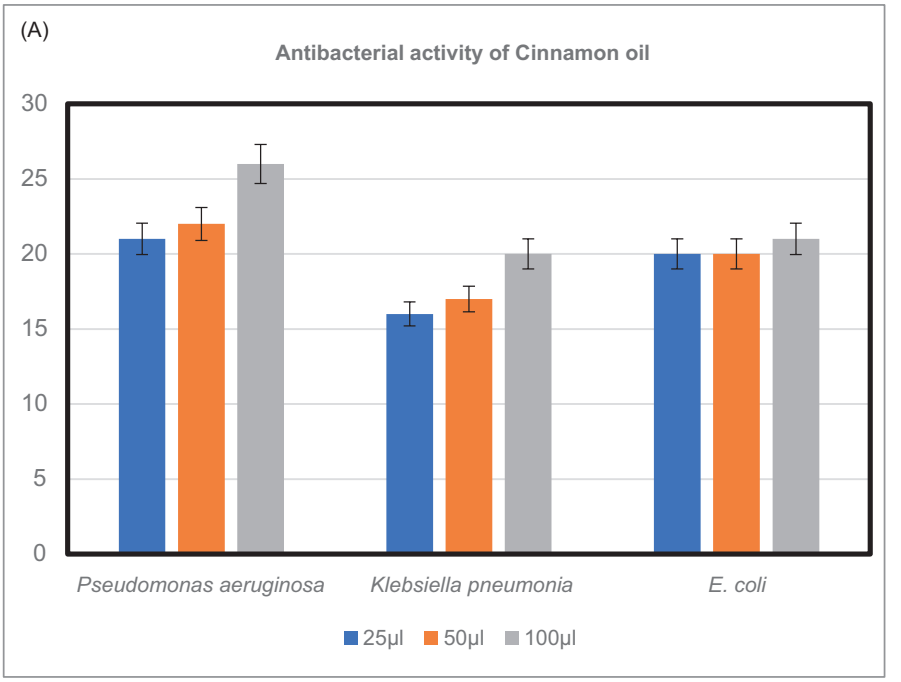

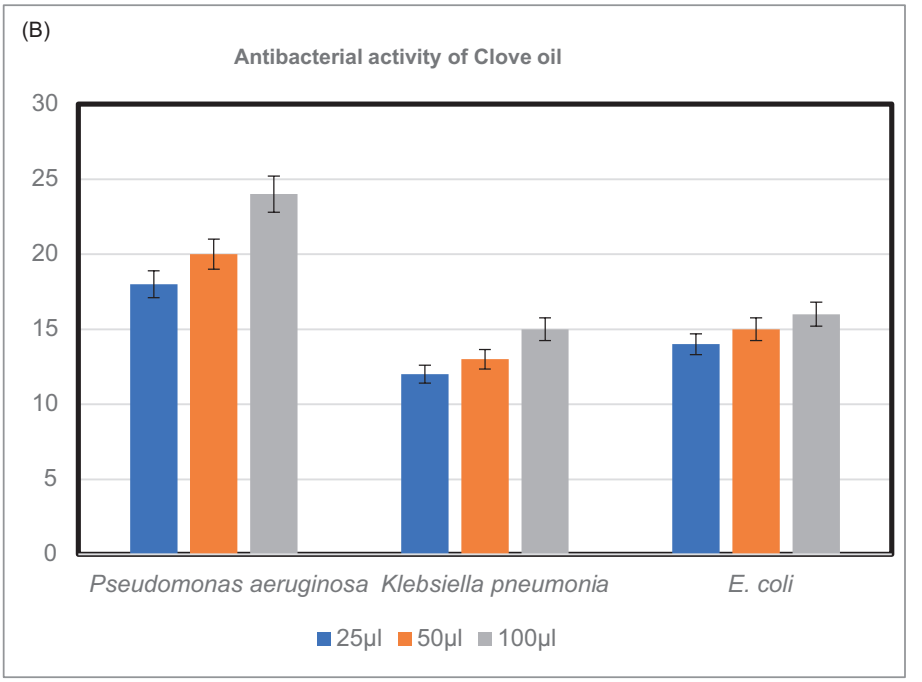

FIGURE 2. Histogram of antibacterial activity of cinnamon oil (A) and clove oil (B).

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minimum and maximum concentrations. Cinnamon oil showed higher antibacterial activity because of cinnamaldehyde, benzoic acid, benzaldehyde, and cinnamic acid (Figure 2). This outcome agreed with the study of Gupta et al.[9] Previous research shows that herbal oils were used in various biomedical applications like antimicrobial activity against different diseases and preparation of nanoparticles. [13-19.]

CONCLUSION

In this present study, the antibacterial activity of cinnamon and clove oils was tested against wound pathogens. The results revealed that cinnamon oil is more effective in killing wound pathogens than clove oil. The wound pathogen *P. aeruginosa* showed a higher zone of inhibition, indirectly indicating its use to treat nosocomial infections that seem to be a primary threat in hospital areas. The antibacterial efficacy of cinnamon and clove oil demonstrated in this study proved its use in many food and sanitizing products as antibacterial agents. Future research on this work can prove its biomedical application.

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