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Antimicrobial Activity of Bruguiera cylindrica against Oral Pathogenic Bacteria

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KEYWORDS
bruguiera cylindrica, mangrove, antibacterial activity, oral pathogens, dental caries.

Aim
The present study was commenced to investigate Bruguiera cylindrica for antimicrobial activity.
Materials and Methods
The samples of B.cylindrica were tested using the disc diffusion method. Zone of inhibition and MIC for 4 common oral pathogenic bacteria was checked.(S. Mutans, Klebsiella spp, S. Aureus/MRSA, P.Aeruginosa)
Results
The results of the present study demonstrate that B.cylindrica shows the highest zone of inhibition for Klebsiella spp followed by S. Mutans and S. Aureus and no antimicrobial effect against the bacteria P. Aeroginosa.
Conclusion
The current investigation gives proof of antibacterial activities present in B.cylindrica which can further be evaluated for use in the dental fraternity.

Introduction

Nature is always a tremendous source of relief for humans, supplying cures from its plants, animals, and other sources to cure any maladies. The plant kingdom contains a variety of plants that have medicinally valuable compounds that have yet to be discovered. With

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an increasing number of individuals seeking treatments and health approaches devoid of negative effects produced by synthetic medicines, medicinal plants are shifting from the fringe to the mainstream [1].

Many plant secondary metabolites, particularly those from mangroves, are employed frequently as antioxidants and antibacterial agents. Infections are frequently treated by using plants in the form of crude extracts. Hence it is essential to identify the phytochemical components in order to understand the antimicrobial properties of the plant [2].

The Rhizophoraceae family includes the evergreen mangrove tree known as Bruguiera cylindrica. It is a small to medium-sized tree that can reach a height of 15 meters. The trunk is supported by the roots, and the bark could be dark brown or gray with smooth contours. The opposite leaves have circular shapes and pointy ends. The axils of the leaves have tiny clusters of flowers [3]. Previous reports suggested using different parts of B.cylindrica indicated presence of insect repellant properties especially against mosquitoes [4].

Additionally, this plant's antibacterial effectiveness has been evaluated on eye infections and germs resistant to antibiotics. Additionally, it has demonstrated positive antibacterial activity against both bacterial types. Mangroves have also been discovered to possess potent antioxidant, antibacterial, and antifungal properties [5].

Studying the antibacterial activity of this plant's other sections is thus an intriguing topic that may lead to the development of treatments for illnesses that affect both humans and animals. Another issue that directly impacts humans is bacteria that cause dental caries and result in tooth structure damage. Therefore, learning how to employ bioactive substances from plants to prevent harmful bacteria will be helpful for replacing chemicals and antibiotics in dentistry.

Therefore, the purpose of this work is to conduct a preliminary screening of B.cylindrica bark, leaf and twig in order to ascertain their efficacy against pathogenic bacteria in the oral cavity. To the best of our knowledge, we are attempting the first study of the antibacterial activity of B.cylindrica because there hasn't been any information published on the interaction of mangrove extract with four oral pathogenic bacteria (S. Mutans, Klebsiella spp, S. Aureus/MRSA, P.Aeruginosa).

Materials and methods

Leaves and barks of Bruguiera cylindrica were collected. The collected leaves and bark were washed under tap running water and dried in an incubator at 40°C. Using an electric blender, dried leaves and bark were ground into fine homogeneous powders, which were then steeped in three different solvents (95% ethanol, methanol, and chloroform) at room temperature in the dark for three days.

Each sample was filtered through Whatman® No. 1 filter paper (Whatman International, England) and the filtered solutions were then evaporated to dryness using water evaporator at 40°C. The plant extracts were dissolved in dimethyl sulfoxide (DMSO). The antibacterial potentials of leaves and ethanol, methanol and chloroform extracts (10 mg/ml) were studied using the paper disc diffusion method of Kil et al. (2009). Three bacteria, commonly pathogenic in oral cavity were selected namely, S. mutans, Klebsiella spp. and MRSA. The obtained bacteria were grown in nutrient broth medium to yield a final concentration of 107 CFU/ml. Sterilized filter paper discs were soaked in each extract and placed on the Mueller Hinton medium plates after streaking the test bacteria using sterile swab cotton. The diameters of the produced inhibition zones were measured after 24 h incubation of the plates at 37°C.

Statistical analysis

The present data were represented as Mean ± SD, while one way analysis of variance (ANOVA), using SPSS software of 13 version, was considered for analyzing the significance level of calculated values ($P<0.05$)[10]

Results

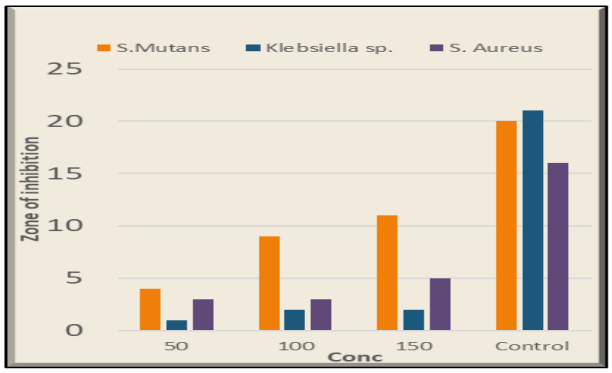

Figure 1: The results of the present study demonstrate that B.cylindrica shows the highest zone of inhibition for Klebsiella spp followed by S. Mutans and S. Aureus and no antimicrobial effect against the bacteria P. Aeroginosa.

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µg/ml	S.mutans	St.Er	Klebsiella sp.	St.Er	P.aeroginosa	St.Er	S.aureus	St.Er
0	0	0	0	0	0	0	0	0
50	4	1.2	1	0.4	0	0	3	0.6
100	9	2.4	2	0.2	0	0	3	1.4
150	11	2.5	2	0.5	0	0	5	1.2

Table 1: The following is the zone of inhibition for various concentrations of the extract with various pathogenic bacteria.

µg/ml	S. mutans	St.Er	Klebsiella sp.	St.Er	S.aureus	St.Er
0	0	0	0	0	0	0
100	76.4	2.6	98	2.4	83.47	3.1
150	92.34	3.4	98.64	3.1	79.62	2.5
200	88.61	2.8	94.28	2.5	76.4	2.1

Table 2: The following table demonstrates the maximum Inhibitory Concentration for the oral pathogenic bacteria.

Discussion

The current study's findings clearly demonstrated that extracts from B. cylindrica exhibited antibacterial efficacy against tested pathogenic strains, including antibiotic-resistant ones. The efficiency of the active chemicals found in plant extracts demonstrated growth inhibition, which is seen as clear areas surrounding the disc. [11]

Gram positive bacteria are thought to be weaker because they have merely an exterior peptidoglycan layer, which is not an effective impermeable barrier, whereas gram negative bacteria have an outer phospholipid membrane carrying the structural lipopolysaccharide component. The inclusion of a peptidoglycan and a phospholipid bilayer renders these bacteria's cell membranes impervious to medicinal components. In the face of this barrier, the phytochemical contents were efficient in suppressing the growth of these pathogenic strains [6,13].

This antibacterial action could be attributed to active components found in plant extracts. This antibacterial activity could be attributed to active chemicals found in this plant such as anthroquinone, terpenoids, flavonoids, saponin, phenolics, and alkaloids. Some of these phytochemical substances have already been shown to possess antibacterial activities [7,8].

Based on the findings, it is feasible to conclude that B. cylindrica possessed antibacterial action against pathogenic oral bacteria[9]. Furthermore, the quantitative assessment of its phytochemical elements is critical for future research.

Conclusion

The results of the present in vitro antibacterial assay and MIC/MBC test revealed that the methanolic extracts of various parts of B. cylindrica were effective against pathogenic oral bacteria of both gram-negative and gram-positive strains.

The present study provides evidence of antimicrobial properties that correspond to the phytochemical study which showed the active ingredients in B. cylindrica. This species could probably provide alternative bioactive agents to mitigate the problems of dental caries prevailing majorly in dentistry.

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