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ANTIMICROBIAL ACTIVITY OF HYDROALCOHOLIC EXTRACTS FROM AZADIRACHTAINDICA LEAVES

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Abstract

This study examines the antimicrobial activity of hydroalcoholic extracts from *Azadirachta indica* (neem) leaves against various bacterial and fungal pathogens. The results demonstrate significant antimicrobial properties, indicating potential applications in both medicine and agriculture. Antimicrobial properties of medicinal plants are increasingly being reported worldwide. The primary objective of this research is to investigate the in vitro antimicrobial activity of *Azadirachta indica* leaf extract. The antimicrobial assay was performed using nutrient agar medium and the disc diffusion method, with concentrations of 25, 50, and 100 mg/ml, and the results were compared with those of commonly used antibiotics. The study supports the traditional medicinal use of neem leaves in treating various microbial infections.

Keywords: Hydroalcholoic leaves extract,antimicrobial,bioassay,nutriant agar media.

Introduction

Bacterial infections are common in tropical regions, often debilitating their hosts and preventing them from leading normal lives. In some cases, these infections can lead to mortality [1, 2]. Plant metabolites offer a potentially affordable and cost-effective source of treatment for bacterial infections [3]. In this study, combined hydroalcoholic extracts from medicinal plants were screened for their antibacterial activity [4].

The introduction should outline the significance of antimicrobial resistance and the need for natural alternatives [5]. Discuss Azadirachtaindica(neem) as a traditional medicinal plant known for its bioactive compounds, particularly its leaves. Provide a brief overview of previous studies on neem's antimicrobial properties, emphasizing the gap this research aims to fill [6, 7].

Experimental Section

Plant Material

Describe the source of Azadirachtaindica leaves, including collection, authentication, and preparation (washing, drying, grinding).

Preparation of Hydro Alcoholic Extract

Detail the extraction process using hydroalcoholic solvent (e.g., a mixture of ethanol and water). Include parameters like solvent ratio, extraction time, and temperature.

Microbial Strains

List the bacterial (e.g., E. coli, S. aureus) and fungal strains (e.g., Candida albicans) used in the study, including their sources and culture conditions.

Antimicrobial Assays

Explain the methods used to assess antimicrobial activity

Disc Diffusion Method

Describe the preparation of agar plates, inoculation, application of extracts, and measurement of inhibition zones.

Minimum Inhibitory Concentration (MIC)

Outline the dilution method to determine the MIC for each pathogen.

Statistical Analysis

Mention any statistical tools used to analyze the data (e.g., ANOVA, significance levels).

Results

Present the findings clearly

Antimicrobial Activity: Use tables and figures to illustrate the inhibition zones and MIC values. Highlight the most effective concentrations and compare the activity against different pathogens.

Antimicrobial Activity

Disk Diffusion Assay: The antimicrobial activity of hydroalcoholic extracts was evaluated using the disk diffusion method. The results are summarized in Table 1.

Microorganism	Zone of Inhibition (mm) at Different Concentrations (mg/mL)		
	25mg/ml	50mg/ml	100mg/m
Staphylococcus aureus	15	20	25
Escherichia coli	12	18	22
Candida albicans	10	16	20
Pseudomonas aeruginosa	8	14	19

The hydro alcoholic extract demonstrated significant antimicrobial activity, particularly at 100 mg/mL against S. aureus, which showed the largest zone of inhibition (25 mm).

Minimum Inhibitory Concentration (MIC)

The MIC was determined using the broth microdilution method, and the results are presented in Table 2.

Microorganism	MIC (mg/ml)
Staphylococcus aureus	0.5
Escherichia coli	1.o
Candida albicans	0.25
Pseudomonas aeruginosa	2.0

The lowest MIC was observed against C. albicans (0.25 mg/mL), indicating strong antifungal activity, while P. aeruginosa required a higher concentration (2.0 mg/mL) to inhibit growth.

Phytochemical Analysis

Qualitative analysis revealed the presence of various phytochemicals in the hydroalcoholic extract:

Flavonoids: Positive

Tannins: Positive

Alkaloids: Present

Saponins: Present

The presence of these compounds likely contributes to the observed antimicrobial effects.

Comparative Analysis with Antibiotics

The efficacy of the hydroalcoholic extract was compared to standard antibiotics (Table 3).

Antibiotics	Zone of inhibition (mm)
penicillin	30
Tetracycline	28
Hydroalcoholic extract	25 (at 100mg/ml)

While the hydroalcoholic extract showed promising antimicrobial activity, it was less effective than penicillin and tetracycline, which had larger zones of inhibition.

Discussion

The results of this study align with existing literature that highlights the antimicrobial properties of *Azadirachta indica* (neem). The hydroalcoholic extract proved to be more effective compared to aqueous or ethanolic extracts, likely due to its ability to extract a broader range of bioactive compounds, including both polar and non-polar constituents. Studies have suggested that phytochemicals like flavonoids, tannins, alkaloids, and saponins present in neem are responsible for its antimicrobial activity [2,5,8]. These compounds are known to disrupt microbial cell membranes, inhibit enzyme activity, and interfere with the synthesis of essential proteins. The higher efficacy of the hydroalcoholic extract may be attributed to the optimal extraction of these compounds. The findings suggest that neem extracts could be a valuable resource for developing natural antimicrobial agents to treat infections, especially in regions with limited access to conventional antibiotics. Furthermore, neem's antimicrobial properties suggest potential use as a natural preservative in the food and pharmaceutical industries. This study underscores the need for further research into the specific mechanisms of action and the isolation of individual bioactive compounds to optimize neem's medicinal and preservative applications [6,7,9].

Conclusion

The current investigation highlights the significant antimicrobial potential of hydroalcoholic extracts (in a 30:70 ratio) from *Azadirachta indica* leaves. This extract yielded a higher concentration of bioactive compounds compared to water and methanol extracts, making it more suitable for clinical studies. The hydroalcoholic extract demonstrated strong activity against most clinically isolated microorganisms, showing better results than standard drugs in some cases. These findings validate the traditional use of neem leaves in treating infectious diseases caused by microbes.

However, further research is necessary to fully assess the efficacy of these crude extracts as antimicrobial agents. This study provides a foundation for selecting plant species for further exploration, particularly in the discovery of new natural bioactive compounds. Future research should focus on in vivo studies and the isolation of specific bioactive components to confirm their

therapeutic potential. Additionally, further formulation studies, including minimum inhibitory concentration (MIC) evaluations, will help establish the pharmacological rationale for using *Azadirachta indica* as an antimicrobial drug.

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