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Antibacterial Efficacy of Medicinal Plant Extracts on Common Pathogens

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Abstract

This study delves into exploring the antimicrobial potential of extracts derived from four distinct plant species: Saba-banana (*Musa acuminata x balbisiana*), Mayana (*Coleus blumei*), Adgaw (*Premna odorata*), and Elepante-elepante (*Heliotropium indicum*) leaves. The preparation involved air-drying, grinding, and treating fresh samples of these specimens with 70% ethyl alcohol to obtain the extracts. To evaluate the inhibitory capacity against microorganisms, the paper disc diffusion method was employed. Each specimen yielded five samples, using 6mm paper discs and an incubation period spanning 16-20 hours. Subsequently, the agar plates were assessed post-incubation, measuring the zones of inhibition, serving as indicators of the plant's effectiveness as antimicrobial agents. The results unveiled substantial zones of inhibition, indicating the efficacy of these plant extracts as antimicrobial agents. This research sheds light on the potential of diverse plant extracts as sources of natural antimicrobial agents. These findings bear significant implications for healthcare, agriculture, and drug research, offering sustainable strategies to tackle microbial challenges.

Keywords: Saba-banana (*Musa acuminata x balbisiana*), Mayana (*Coleus Blumei*), Adgaw (*Premna Odorata*), and Elepante-elepante (*Heliotropium indicum*), Antimicrobial Analysis, Paper Disc Diffusion Method, Zone of Inhibition

Introduction

In a time where concerns about antibiotic resistance are growing and synthetic antimicrobial substances face constraints, there's a surge in exploring alternative reservoirs for antimicrobial compounds. Herbal plants, acknowledged across cultures for their healing properties, have been the focus of numerous studies probing their antimicrobial potential. For instance, [10] investigated essential oils from medicinal herbs like oregano, thyme, and basil, showcasing their remarkable ability to impede bacterial growth, highlighting their therapeutic value.

Moving to specific plants, bananas, cultivated widely, possess medicinal uses in various parts. Notably, their sap and parts like unripe peels and leaves find applications in treating conditions like dysentery, diarrhea, and more [8][4][2][6]. On the other hand, Mayana presents a myriad of health benefits, such as anti-inflammatory, analgesic, and wound-healing properties. Its traditional use for respiratory issues has been noted [1] [12]. Similarly, Adgaw and Heliotropium indicum exhibit significant antimicrobial potential against various pathogens [3] [13].

Bringing these plants together, a new research initiative aims to explore the antimicrobial capabilities of Saba banana, Mayana, Adgaw, and Elepante-elepante leaf extracts. This investigation seeks to assess their inhibitory effects on microorganism growth, contributing to our understanding of natural antimicrobial agents and their potential applications in addressing microbial-related health concerns.

Materials and Methods

Collection of Plant Material

Permits were obtained first from the Cantilan municipal government before collecting the samples. Fresh leaves of Saba-banana (*Musa acuminata x balbisiana*), Mayana (*Coleus Blumei*), Adgaw (*Premna Odorata*), and Elepante- elepante (*Heliotropium indicum*).

Preparation of Plant Extract

The plant materials underwent a process involving thorough washing and subsequent shade drying, followed by grinding into powder using a mechanical grinder. The plant components were meticulously cleansed and then air-dried in the shade before being ground into a fine powder with the use of a mechanical grinder. Subsequently, 100g samples of each section were immersed in 300 mL ethanol for 24 hours at ambient temperature. Afterward, the resulting extracts underwent filtration using Whitman filter paper (No.1) and were dried at temperatures below 45°C to eliminate ethanol, thereby obtaining a concentrated extract or establishing its concentration in mg/ml. This concentrated extract was stored at 2-4°C for future exploration regarding its potential antimicrobial properties.

Antimicrobial Screening

The study utilized *Escherichia coli and Staphylococcus aureus*, obtained from water samples through standard isolation methods, and confirmed their identity through morphological characteristics and conventional biochemical tests [(7)].

The antibacterial activity assessment of four medicinal plant extracts employed the agar well diffusion method. Pure cultures of these bacteria were maintained on nutrient agar at 4°C. Sterile Muller-Hinton agar plates received 0.1 mL of a freshly prepared test inoculum (106 CFU/mL). Wells, 6 mm in diameter, were subsequently created with a sterile cork bore. Subsequently, 50 microliters of various plant extracts were carefully introduced into the wells using a micropipette. The plates were chilled at 4°C to allow the extract to permeate the medium. Subsequently, they were incubated for 24 hours at 37°C with sealed lids. Assessments were conducted for the inhibition zone by gauging the diameter of the restrained area against the bacterial pathogens under examination. To ensure accuracy and dependability, each trial was replicated thrice. [(9).]

Results and Discussion

Table 1: Zones of Inhibition (in millimeter) of *Musa acuminata x balbisiana, Coleus blumei, Premna odorata, Heliotropium indicum*

Medicinal Plants	Average zone of Inhibition in mm	
	S. aureus (Gram positive)	*Escherichia coli (Gram negative)*
Musa acuminata x balbisiana	27	17
Coleus blumei	26	17
Premna odorata	21	16
Heliotropium indicum	24	18

Legend: <10mm-inactive, 10-13mm- partially active, 14-19mm- active, > 19mm- very active

The antibacterial activity of various plant extracts against Escherichia coli and Staphylococcus aureus was assessed using the average zone of inhibition (mm) to gauge their growth-impeding effectiveness. The classification scale categorized the results as follows: less than 10 mm as inactive, 10-13 mm as partially active, 14-19 mm as active, and greater than 19 mm as very active.

Musa acuminata x balbisiana (Saba banana) and *Coleus blumei* (Mayana) extracts exhibited robust antibacterial activity. The extract of Saba banana exhibited robust efficacy against S. aureus and moderate efficacy against E. coli, whereas Mayana demonstrated partial efficacy against E. coli. and potent efficacy against S. aureus. Similarly, *Heliotropium indicum* (Elepante-elepante) demonstrated active antibacterial

properties against both bacteria. Conversely, *Premna odorata* (Adgaw) exhibited moderate activity against these strains.

For instance, the Saba banana leaf extract exhibited active inhibition against microorganisms, consistent with previous studies that identified antimicrobial compounds in Saba banana flesh and peel, showcasing potential against bacteria, fungi, and viruses [(11)]. Mayana, containing phytoconstituents like alkaloids, saponins, and quercetin, demonstrated active inhibition against microorganisms. Its richness in rosmarinic acid has strong anti-inflammatory and antioxidant properties, promising in regulating immune responses [(5)]. The Adgaw leaf extract displayed partial activity against microorganisms, indicating potential for natural antimicrobial agent development, supported by prior research highlighting its significant antimicrobial activity against various pathogens [(3)].

Additionally, the Elepante-elepante plant extract showed active inhibition against microorganisms, in line with research demonstrating its concentration-dependent antibacterial effects against different bacteria [(14)]. To condense, Saba banana and Mayana extracts exhibited potent antibacterial activity against S. *aureus*, while *Heliotropium* indicum exhibited significant efficacy against both E. coli and S. aureus. Adgaw displayed moderate activity against these bacteria, indicating potential for further investigation in antimicrobial research using medicinal plants.

Conclusion

Assessing different plant extracts for their antibacterial effects on Escherichia coli and Staphylococcus aureus unveiled varying levels of effectiveness. *Musa acuminata x balbisiana* (Saba banana) and *Coleus blumei* (Mayana) extracts demonstrated robust antibacterial potential, with Saba banana particularly effective against *S. aureus* and Mayana exhibiting strong activity against both bacteria. *Heliotropium indicum* (Elepante-elepante) also displayed notable activity against both *S. aureus* and *E. coli*. In contrast, *Premna odorata* (Adgaw) exhibited moderate activity against these strains. These findings underscore the promising antimicrobial properties present in these plant extracts, especially in Saba banana and Mayana, which showcased significant inhibition of bacterial growth. The active constituents within these plants, such as rosmarinic acid in Mayana, offer the potential for developing natural antimicrobial agents. The results align with prior research indicating the antimicrobial potential of these plants, validating their traditional uses in various cultures. Saba banana, Mayana, Elepante-elepante, and Adgaw emerge as valuable candidates for further exploration in medicinal plant-based antimicrobial research. Understanding and harnessing the potency of these natural sources could lead to the development of effective and sustainable antibacterial treatments, offering potential solutions for combating bacterial infections and contributing to the field of natural medicine.

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