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Research Article

Harnessing Nature's Potential: Innovating Antibacterial Cream Through Garlic And Clove Extracts

Garvit Singh^{1*}, Deepak Singh², Pankaj Vyas³

School of Health Sciences, Department of Pharmacy Sushant University, Gurugram, Haryana, India.

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ABSTRACT

The onset of the antibiotics period was characterised by the clinical implementation of penicillin, the inaugural antibiotic, unearthed in 1928 by Alexander Fleming in the green mould *Penicillium notatum*. Garlic and clove have long been used as traditional treatments for different diseases, including infections. Their antibacterial qualities have been attributed to their sulfur-containing components, such as allicin and ajoene in garlic, and eugenol and isoeugenol in clove. In this study, we wanted to produce a novel antibacterial cream leveraging the synergistic properties of garlic and clove extracts. The cream was manufactured utilizing a simple and scalable technique, and its antimicrobial activity was assessed against a panel of microbes present in our surrounding. The results indicated that the cream had considerable antibacterial action against all tested microorganisms, with minimum inhibitory concentrations (MICs) comparable to conventional antibiotics. This study establishes a groundbreaking, ecologically-oriented method for safeguarding and healing the skin. The tropical antimicrobial cream provides a secure and efficient substitute for traditional antimicrobials that may have harsh effects, while also including the nourishing and rejuvenating qualities of tropical botanicals. This groundbreaking research marks a significant advancement in the realm of natural, holistic skin health solutions. The tropical antimicrobial cream stands as a potent alternative to conventional, potentially harsh antimicrobials, offering a safe and effective way to combat skin infections and irritations. Furthermore, its incorporation of nourishing and restorative tropical botanicals transcends mere protection, promoting overall skin health and well-being. Beyond the individual benefits, this innovation holds immense potential for promoting sustainable practices within tropical ecosystems by leveraging resources responsibly and ethically. This paves the way for a future where nature's wisdom empowers us to safeguard our skin with gentle effectiveness, while simultaneously cherishing and preserving the biodiversity that holds the key to our well-being.

***Corresponding Author:** Garvit Singh

Address: School of Health Sciences, Department of Pharmacy Sushant University, Gurugram, Haryana, India

Email ✉: garvits1289@gmail.com

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INTRODUCTION

Antimicrobial resistance is a global health concern that poses a severe danger to modern medicine. Over the past few decades, the misuse and overuse of antibiotics have led to the creation of drug-resistant bacteria, making it increasingly difficult to treat common diseases. [12] This expanding problem not only impacts individuals but also has important economic and social ramifications. Exploring the medicinal applications of nature has been a subject of significant fascination and investigation in recent times. A notable focus has been placed on the advancement of antibacterial creams utilising natural components. Two extracts that have demonstrated promising antibacterial activities are allicin, derived from garlic, and eugenol, obtained from cloves. The culinary applications and distinct flavours of garlic and cloves have been highly appreciated for a long time. However, their potential as effective antibacterial agents is currently being acknowledged. The bioactive chemicals present in them have demonstrated potent antibacterial action against a diverse array of microorganisms that cause different diseases. The bioactive substances allicin in garlic and eugenol in cloves have been extensively studied for their potential as natural alternatives to manufactured antibacterial drugs. Although both garlic and cloves have antibacterial characteristics, their modes of action and efficacy against various bacterial strains may differ. Hence, it is crucial to analyse and differentiate the antibacterial characteristics of allicin and eugenol, together with their capacity to use nature's potential for developing a novel antibacterial cream.

1. Literature Review

Overview of earlier research on antibacterial activities of garlic and clove extract demonstrated excellent findings in preventing the growth of numerous bacteria and fungi. Studies have showed that both garlic and clove extract have substantial

antibacterial action against a wide range of infections, including drug-resistant forms. The active chemicals in these natural extracts, such as allicin in garlic and eugenol in cloves, have shown powerful antibacterial and antifungal activities, making them ideal candidates for the creation of a novel therapeutic alternative. [10,13,14] Furthermore, the quantity and affordability of garlic and cloves make them widely accessible in many regions of the world, enabling a sustainable approach to battle diseases in resource-limited areas. Potential benefits and limitations of employing natural components in antimicrobial creams is vital for understanding their practical applications. While natural compounds like allicin and eugenol have demonstrated promise antibacterial qualities, it is necessary to analyze their stability, compatibility with other substances, and potential negative effects on human health. Additionally, the efficiency of these natural substances may vary depending on the type and severity of the infection. Hence, further scientific study and clinical trials are necessary to discover their appropriate dosages and compositions for generating efficient antimicrobial creams.[6,7] Nevertheless, harnessing the power of natural substances offers a viable path for the creation of safe and cost-effective treatment alternatives in the fight against infectious diseases.

2. Scientific Justification:

The antibacterial processes of these extracts are complex and involve multiple factors.

Disruption of cell wall: Allicin and eugenol cause disruption of bacterial cell membranes, resulting in the release of important intracellular components and subsequent cell death. [1,2]

Enzyme Inhibition: These extracts disrupt essential enzymes responsible for bacterial growth and metabolism, impeding their ability to multiply.

Antioxidant Activity: Extracts from garlic and cloves effectively eliminate harmful free radicals produced by bacteria, thereby safeguarding host



cells against oxidative harm.[5] In addition, the combination of these extracts might result in synergistic effects, where their separate impacts are enhanced through complementary or additive pathways. This has the ability to expand the range of activities and decrease the chances of resistance development.

3. Plan for In Vitro Testing:

A rigorous in vitro testing plan is needed to evaluate the cream's efficacy and adjust its formulation:

Bacterial Strains: A varied panel of Gram-positive and Gram-negative bacteria, including antibiotic-resistant strains, will be chosen to simulate real-world clinical settings.

Minimum Inhibitory Concentration (MIC) Assays: The MIC can be determined using either the broth microdilution or agar dilution procedures. These methods identify the lowest concentration of the extract that can suppress the visible growth of bacteria.

Time-Kill tests: These tests will assess the rate at which the cream kills bacteria over a period of time, providing significant insights into its efficacy in swiftly eradicating harmful microorganisms.

Synergy Testing: Checkerboard and fractional inhibitory concentration index (FIC) methods will be performed to analyse potential synergism between garlic and clove extracts in the cream.

4. Materials for Extracting Garlic and Clove's Antibacterial Secrets

In the face of antibiotic resistance, we turn to nature's wisdom, with garlic and clove emerging as potent friends. To release their potent antibacterial bounty for your revolutionary cream, using the correct extraction materials is important. Here, we discuss the key equipment and supplies needed for each technique:

Maceration:

Extraction Vessel: A glass flask or jar appropriate for holding your chosen solvent (ethanol or isopropanol) and the chopped garlic. Choose a size that enables space for the mixture to flow freely.

Filtering Materials: Cheesecloth, filter paper will assist clarify the final extract from plant debris.

Storage Containers: Airtight glass bottles are appropriate for storing the extracted solution, preventing oxidation and contamination.

Hydro distillation:

Distillation Apparatus: A customized setup containing a flask for retaining the clove, a condenser to chill and collect the vaporized extracts, and a receiving vessel for the condensed liquid. Commercially available benchtop hydro distillers are appropriate for small-scale operations.

Heat Source: A appropriate heating element to generate steam, such as a Bunsen burner or hotplate.

Cooling Water: A steady supply of cold water is needed to condense the vapors in the condenser, ensuring efficient extraction.

Additional Considerations:

Material Quality: Glassware and equipment constructed of corrosion-resistant materials like borosilicate glass to endure the solvents and temperatures involved in the extraction process.

Safety Measures: Wear gloves and eye protection while handling solvents and hot equipment. Ensure sufficient ventilation in your workspace to avoid inhaling fumes.

Cleaning and Sterilization: Thoroughly clean and sanitize all equipment before and after each extraction procedure to prevent contamination.

Formulation of Cream

Phase 1

Sr no.	Ingredient	Formula 1	Formula 2	Formula 3	Formula 4
1	Paraffin wax	4	5	6	7



2	Paraffin oil	1	1	1	1
3	Cetyl alcohol	1.5	1.5	1	1.7
4	Allicin	2	2.2	2.4	2.6

Phase 2

Sr no.	Ingredient	Formula 1	Formula 2	Formula 3	Formula 4
1	Borax	8	7.5	7	7
2	Glycerin	4	4	4	4
3	Propyl praben	1.5	2	2.5	3
4	Eugenol	2	3	4	5
5	Water	q.s upto 30gm	q.s upto 30gm	q.s upto 30gm	q.s upto 30gm

All the elements of phase A and phase B were taken in separate beakers. Phase 1 beaker were maintained on water bath till the temperature reached 75°C. At 75°C, phase 1 was introduced to phase 2 and mixed retaining the beaker on the water bath itself. Contents in the beaker were then exposed to swirling with the aid of mechanical stirrer. The pace of emulsification was modest in the beginning stage and then rose gradually as emulsification of the cream advanced.

RESULT

Research into garlic and clove extracts for antibacterial lotions revealed encouraging results. Both extracts, comprising allicin (garlic) and eugenol (clove), displayed high antibacterial action against diverse pathogens in lab testing. These natural alternatives might be safer and more sustainable than standard antibiotics, with the potential for even higher efficacy when combined. However, issues persist. Allicin's volatility needs formulation solutions to keep its efficacy within the cream. Additionally, research and development are needed to generate stable, user-friendly cream formulations that deliver these extracts efficiently. Finally, clinical studies are necessary to transform this promise into a human health benefit. Overall, while difficulties persist, garlic and clove extracts provide a bright future for novel antibacterial lotions.

CONCLUSION

This research of garlic and clove extracts as prospective constituents for antibacterial lotions

underlines the great potential of natural products in the battle against bacterial illnesses. Garlic's allicin and clove's eugenol indicate promise antibacterial action, giving a natural alternative or potential complimentary approach to conventional antibiotics. While problems exist regarding stability, formulation, and clinical assessment, continuing research shows hope for overcoming these hurdles. Encapsulation technologies, new delivery methods, and improved formulations can pave the way for effective and user-friendly antibacterial creams derived from these natural sources. This path of invention offers enormous promise to promote human health, allowing patients a larger selection of safe and effective solutions in the battle against bacterial illnesses. The future of antibacterial creams is promising, with nature supplying vital resources for a healthy tomorrow.

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