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Formulation and evaluation of herbal anti-acne cream containing neem, tulsi and Aloe Vera

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Abstract
Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit commonly affecting adolescents and young adults. Conventional therapies such as antibiotics, retinoids, and hormonal treatments are effective but may cause adverse effects, antimicrobial resistance, and skin irritation. Herbal formulations have gained increasing attention as safer alternatives due to their antimicrobial, anti-inflammatory, and antioxidant properties. The present study aimed to formulate and evaluate a herbal anti-acne cream containing extracts of Azadirachta indica (Neem), Ocimum sanctum (Tulsi), and Aloe barbadensis (Aloe vera). The cream was prepared using an emulsification technique with beeswax and liquid paraffin as the base, borax as an emulsifying agent, and methyl paraben as a preservative. The formulation was evaluated for physicochemical parameters including pH, spreadability, viscosity, homogeneity, extrudability, washability, and stability. Antimicrobial activity against acne-causing microorganisms was also assessed. The prepared cream showed smooth texture, good spreadability, pH compatible with skin (6.1 ± 0.2), and good stability under various storage conditions. Antimicrobial testing demonstrated significant inhibition against acne-causing bacteria. The results suggest that the herbal anti-acne cream is a safe, stable, and effective formulation with potential application as a natural alternative for acne management.

Keywords: Herbal formulation, anti-acne cream, neem, tulsi, Aloe Vera, topical drug delivery

Introduction
Acne vulgaris is one of the most common dermatological disorders worldwide, particularly affecting adolescents and young adults. It is characterized by comedones, papules, pustules, nodules, and cystic lesions that primarily occur on the face, chest, shoulders, and back. The disease arises due to several factors including excessive sebum production, follicular hyperkeratinization, colonization by Cutibacterium acnes, and inflammatory responses.
Conventional anti-acne therapies include antibiotics, benzoyl peroxide, retinoids, and hormonal agents. Although these treatments can be effective, their long-term use may lead to side effects such as dryness, irritation, peeling, and antibiotic resistance. Consequently, there is growing interest in natural and herbal alternatives for acne management.
Herbal medicines have been used for centuries in traditional healthcare systems due to their therapeutic properties and minimal side effects. Many plant-derived compounds exhibit antimicrobial, anti-inflammatory, antioxidant, and wound-healing properties, making them suitable for dermatological applications.
Azadirachta indica (Neem) is well known for its antibacterial and anti-inflammatory properties and has been widely used in traditional medicine for skin disorders. Ocimum sanctum (Tulsi) possesses antimicrobial, antioxidant, and anti-inflammatory activities that help reduce acne-causing bacteria and oxidative stress. Aloe barbadensis (Aloe vera) is widely recognized for its soothing, moisturizing, and wound-healing effects.
The combination of these herbal ingredients in a topical formulation can provide synergistic benefits for acne treatment. Therefore, the present study focuses on the formulation and evaluation of a herbal anti-acne cream containing neem, tulsi, and aloe vera extracts.

Anatomy and Pathophysiology of Acne
The skin is the largest organ of the human body and consists of three major layers: epidermis, dermis, and hypodermis. Acne mainly affects the pilosebaceous unit, which includes the hair follicle, sebaceous gland, and associated duct.
Sebaceous glands produce sebum, a lipid-rich substance that lubricates the skin. During puberty, androgen hormones stimulate excessive sebum production. This excess sebum, combined with abnormal keratinization of follicular cells, leads to blockage of hair follicles and formation of comedones.
The blocked follicles create an anaerobic environment that promotes the growth of Cutibacterium acnes. These bacteria produce enzymes that break down sebum into free fatty acids, leading to inflammation and formation of acne lesions.
The inflammatory response involves the release of cytokines such as interleukin-1 (IL-1) and tumor necrosis factor-alpha (TNF-α), resulting in redness, swelling, and pain. Herbal formulations containing anti-inflammatory and antibacterial compounds can help reduce these symptoms and promote healing.

Materials and Methods
1. Materials
The following ingredients were used in the preparation of the herbal anti-acne cream:

Ingredient	Role in Formulation
Neem extract	Antibacterial, anti-inflammatory
Aloe vera gel	Moisturizer and healing agent
Tulsi extract	Antibacterial and antioxidant

Beeswax	Thickening agent and stabilizer
Liquid paraffin	Emollient
Borax	Emulsifying agent
Methyl paraben	Preservative
Rose water	Fragrance and soothing agent
Ethanol	Solvent
Distilled water	Vehicle

2. Extraction of Plant Materials

Aloe Vera Gel Extraction

Fresh aloe vera leaves were washed and the outer rind was removed. The inner gel was collected using a sterile spoon and blended to obtain a smooth gel. The gel was filtered and stored in an airtight container at 4°C.

Neem Leaf Extraction

Neem leaves were shade-dried and powdered. The powder was soaked in ethanol for 24–48 hours and filtered. The solvent was evaporated to obtain crude neem extract.

Tulsi Leaf Extraction

Tulsi leaves were dried and powdered. The powder was soaked in ethanol for 24 hours and filtered. The solvent was evaporated to obtain the concentrated extract.

3. Formulation of Herbal Anti-Acne Cream

The cream was prepared by the emulsification method.

Oil Phase

Beeswax and liquid paraffin were heated at 75°C until melted.

Aqueous Phase

Borax and methyl paraben were dissolved in distilled water and heated to the same temperature.

The aqueous phase was slowly added to the oil phase with continuous stirring to form an emulsion. Aloe vera gel, neem extract, and tulsi extract were then incorporated into the mixture. Finally, rose water was added for fragrance and the cream was allowed to cool to room temperature.

Evaluation of the Cream

The prepared cream was evaluated using the following parameters:

1. Physical Appearance

The formulation was visually inspected for color, texture, and homogeneity.

2. pH Determination

The pH of the cream was measured using a digital pH meter.

3. Spreadability

Spreadability was determined by measuring the time required for two glass slides to separate when the cream was placed between them under a specific weight.

4. Viscosity

Viscosity was measured using a Brookfield viscometer.

5. Extrudability

The ease with which the cream could be extruded from a collapsible tube was evaluated.

6. Stability Studies

Stability testing was carried out at different temperatures including room temperature, refrigeration (4°C), and accelerated conditions (40°C).

7. Antimicrobial Activity

Antimicrobial activity was evaluated using the agar well diffusion method against acne-causing microorganisms.

Results

Parameter	Result
Appearance	Smooth greenish-white cream
Odor	Pleasant
Homogeneity	Uniform
pH	6.1 ± 0.2
Spreadability	7.2 ± 0.3 g·cm/sec
Viscosity	12,500 ± 300 cps
Emulsion type	Oil-in-water
Washability	Easily washable
Extrudability	Good

The antimicrobial test showed significant inhibition of Cutibacterium acnes and Staphylococcus aureus.

Discussion

The herbal anti-acne cream formulated in this study demonstrated satisfactory physicochemical and biological properties. The pH of the formulation was within the normal physiological range of the skin, indicating its compatibility and safety for topical application.

The spreadability and viscosity values indicated good consistency and ease of application. The oil-in-water emulsion type contributed to the non-greasy texture of the cream, which is desirable for acne-prone skin.

Neem and tulsi extracts contributed significant antibacterial activity against acne-causing microorganisms, while aloe vera provided soothing and healing effects. The synergistic action of these herbal ingredients enhanced the overall effectiveness of the formulation.

The stability studies indicated that the formulation remained stable under different storage conditions, suggesting good shelf life.

Conclusion

The present study successfully formulated and evaluated a herbal anti-acne cream containing neem, tulsi, and aloe vera extracts. The cream showed good physicochemical properties, stability, and antimicrobial activity against acne-causing bacteria.

The results indicate that herbal formulations can provide an effective and safe alternative to conventional synthetic anti-acne products. Further clinical studies may be conducted to confirm the long-term efficacy and therapeutic benefits of the formulation.

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