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The Role Of Neem And Clove Oil In Acne Management: A Study On The Development Of An Anti-Acne Cream

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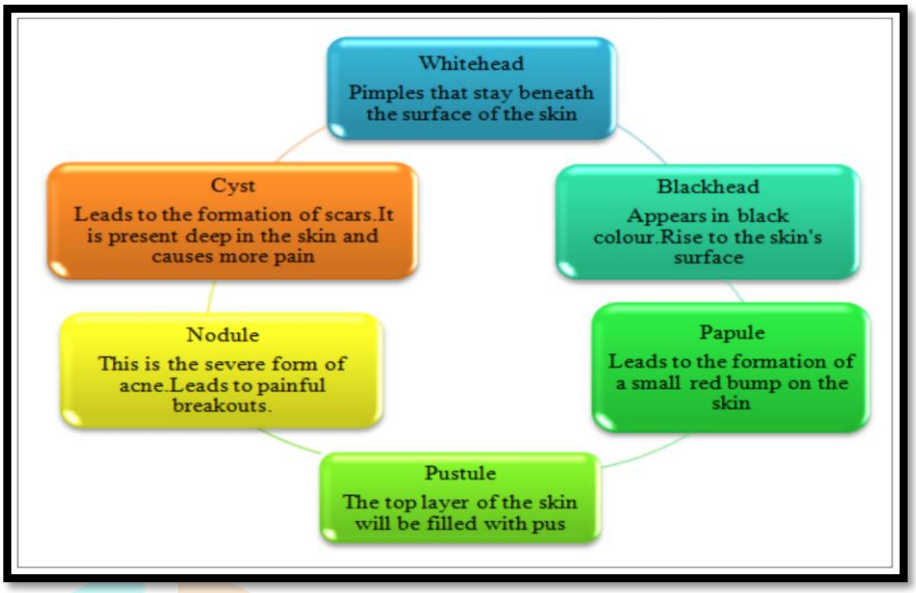
Abstract: Acne vulgaris is a common dermatological condition that significantly impacts adolescents and young adults, often leading to permanent scarring and psychological distress. Traditional treatments, including antibiotics, face challenges due to rising antibiotic resistance. This study explores the formulation of an anti-acne cream using **Neem** and **Clove Oil**, known for their antimicrobial, anti-inflammatory, and skin-healing properties. Aloe Vera and Tulsi are also incorporated for their moisturizing and radiance-enhancing effects. Neem helps reduce inflammation, skin irritation, and bacterial growth, while Clove oil targets acne-causing bacteria and soothes inflammation. Aloe Vera provides hydration and wound healing, and Tulsi improves skin radiance. This herbal cream offers a natural, effective alternative to synthetic acne treatments, addressing acne's physical symptoms and its psychosocial impact. Given the global prevalence of acne and the increasing concern over antibiotic resistance, this study highlights the potential of using natural bioactive compounds in acne management. The cream formulation aims to provide a holistic approach to acne care, promoting skin health while minimizing the risk of side effects commonly associated with conventional treatments.

Keywords: Acne vulgaris, Neem oil, Clove oil, Aloe Vera, Tulsi, Anti-acne cream, Natural skincare, Acne management, Herbal formulation, Antibiotic resistance.

Introduction: -

Acne vulgaris is one of the most prevalent chronic skin disorders, primarily affecting areas rich in sebaceous glands such as the face, back, and chest. It is commonly associated with adolescence, but also affects adults of both genders. The condition arises from several factors, including excess sebum production, follicular hyperkeratinization, bacterial colonization, particularly by *Propionibacterium acnes* (*P. acnes*), and inflammation. *P. acnes* contributes to acne pathogenesis by activating the complement system and breaking down sebaceous triglycerides into pro-inflammatory fatty acids, which attract neutrophils and intensify the inflammatory response.

Though not life-threatening, acne can cause significant psychological distress, particularly due to its visibility and potential to leave permanent scars. Traditionally, acne has been treated using topical and systemic antibiotics; however, the widespread use of these agents has led to increasing antibiotic resistance.



This growing concern has prompted interest in alternative therapies, especially herbal formulations, which are often preferred due to their minimal side effects and natural origin.

Fig. 1.1 Stages of acne

Acne can be classified into two types: **acne vulgaris** and **acne rosacea**. Acne vulgaris is characterized by both non-inflammatory lesions (blackheads and whiteheads) and inflammatory lesions (papules, pustules, nodules, and cysts), resulting from changes in the pilosebaceous units. In contrast, acne rosacea is a chronic skin condition resembling adult acne, typically affecting the central face, particularly the nose, and presenting symptoms such as redness, pimples, and visible blood vessels. It may also lead to eye-related issues such as conjunctivitis.

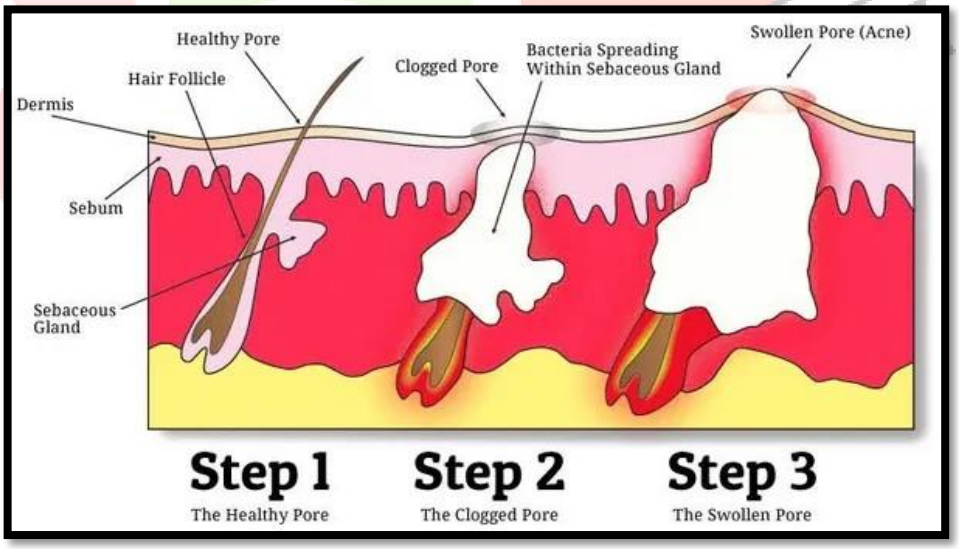
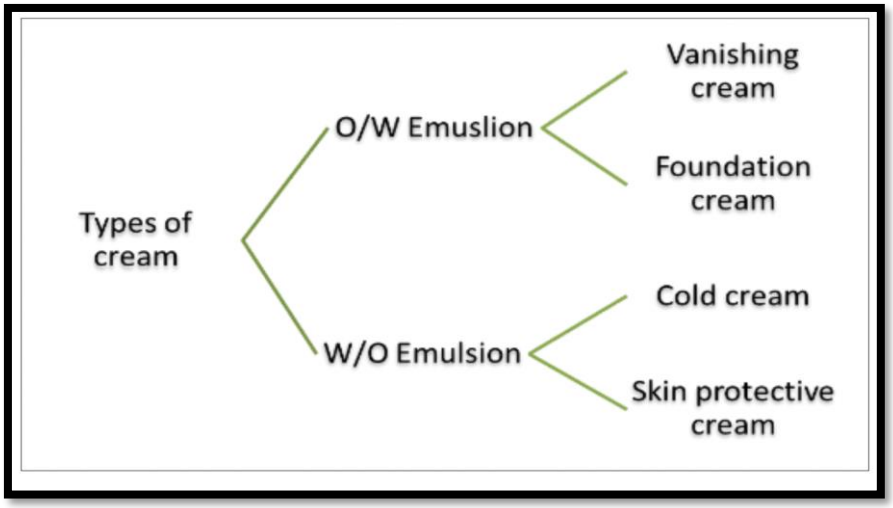


Fig. 1.2 Types of acne

Treatment of acne: -

Several intrinsic and extrinsic factors contribute to acne, including hormonal changes, genetics, stress, diet, use of cosmetics, medications, and improper skincare habits. Based on severity, treatment options range from over-the-counter agents like benzoyl peroxide for mild cases to topical retinoids, antibiotics, and hormonal therapy for moderate to severe cases.

Topical creams are widely used in acne management due to their ease of application and local action. These creams are semisolid emulsions, typically categorized either as Oil-in-water (O/W) or Water-in-Oil (W/O) formulations. O/W creams are lightweight and suitable for oily skin, while W/O creams provide deeper moisturization. Such topical formulations are effective for delivering herbal and synthetic agents directly to



the affected skin, offering benefits like soothing, healing, and protection from environmental factors.

Fig. 1.3 Types of creams

Cosmetological importance of Aloe Vera, Tulsi, Neem, Clove Oil & Tea Tree Oil

Aloe vera, Tulsi (Ocimum sanctum), and Neem (Azadirachta indica) are botanicals considerably used in cosmetology due to their multifunctional benefits for skin and hair health. Their phytochemical ingredients and natural conditioning make them important constituents in both traditional and ultramodern ornamental phrasings.

1. Aloe vera

Aloe vera is a rich source of vitamins (A, C, E, B12), enzymes, minerals (zinc, selenium, calcium), sugars, lignin, saponins, salicylic acids, and amino acids. It contains polysaccharides like acemannan and glucomannan, which are responsible for its moisturizing and mending properties. Its benefits in cosmetology include: -

- **Skin hydration:** Aloe vera enhances the water content of the skin due to its mucopolysaccharide content.
- **Anti-aging:** - Aloe vera stimulates fibroblast activation, enhancing collagen and elastin fiber synthesis, thereby improving skin elasticity and reducing the appearance of wrinkles.
- **Crack mending: -** It accelerates re-epithelialization in injuries and becks via stimulation of keratinocyte and fibroblast proliferation.
- **Anti-inflammatory: -** Composites like C-glucosyl chromone reduce inflammation by inhibiting cyclooxygenase pathways.
- **Antimicrobial: -** Aloe vera shows bacteriostatic and fungistatic activity, which helps in the treatment of acne and dandruff.

Fig. 1.4 Aloe Vera

2. Tulsi (Ocimum sanctum)

Tulsi is known for its adaptogenic, antibacterial, antifungal, and antioxidant properties. It contains essential oils like eugenol, methyl eugenol, and caryophyllene, along with flavonoids, tannins, and phenolic compounds.

- **Antioxidant: -** Its flavonoid and phenolic content help in scavenging reactive oxygen species, guarding skin from oxidative damage.
- **Anti-acne: -** The antibacterial parcels, especially against Propionibacterium acnes, are attributed to its essential oil ingredients.
- **Skin lightening: -** It helps in reducing saturation and dark spots due to its melanin-inhibitory properties.
- **Anti-inflammatory:** -It modulates seditious pathways through repression of cytokines like TNF-nascence and IL-6.
- **Hair care: -** Tulsi oil painting stimulates blood circulation in the crown, helps with hair loss, and acts against dandruff.

Fig. 1.5 Basil Leaves (Tulsi)

3. Neem (Azadirachta indica)

Neem contains bioactive ingredients like nimbin, nimbidin, azadirachtin, nimbolide, and quercetin. It's honoured for its strong antibacterial, antifungal, antiviral, and keratolytic properties.

- **Acne treatment: -** Neem inhibits acne-causing bacteria and reduces sebum production due to azadirachtin and nimbolide.
- **Antifungal: -** Effective against various dermatophytes and provocations, also useful in phrasings for dandruff and athlete's foot.
- **Skin soothing: -** Reduces inflammation, greenishness, and itching in sensitive skin conditions, like eczema and psoriasis.
- **Skin revivification: -** Neem oil painting promotes collagen production and improves skin pliability and crack mending.

- **Anti-aging: -** Antioxidants in neem help prevent unseasonable aging caused by free radical damage.

Fig. 1.6 Neem

4. Tea Tree Oil

Tea tree oil is extracted from the leaves of Melaleuca alternifolia and is well-known for its antimicrobial and anti-inflammatory properties. It is widely used in cosmeceuticals for acne-prone and oily skin types.

- **Antibacterial: -** Tea tree oil contains terpinen-4-ol, a compound that effectively kills acne-causing bacteria like Propionibacterium acnes and Staphylococcus aureus.
- **Anti-inflammatory: -** Reduces redness, swelling, and pain around acne lesions by modulating inflammatory responses.
- **Sebum regulation: -** Helps in controlling excess oil production, thereby preventing clogged pores.
- **Wound healing: -** Promotes healing of acne lesions without causing skin dryness or irritation.

Fig 1.7 Tea Tree Oil

5. Clove Oil

Clove oil is obtained from the flower buds of Syzygium aromaticum. It is rich in eugenol, which imparts strong antimicrobial and analgesic properties.

- **Antimicrobial: -** Eugenol helps in inhibiting acne-causing bacteria and reduces the risk of infection.
- **Anti-inflammatory:** - Soothes inflamed acne and calms irritated skin.
- **Antioxidant: -** Neutralizes free radicals and prevents oxidative stress-induced skin damage.
- **Mild exfoliation: -** Promotes cell turnover and decreases the chances of post-acne marks and pigmentation.

Fig. 1.8 Clove Oil

Together, these botanicals are frequently incorporated in herbal ornamental products for synergistic goods, including anti-aging, saturation reduction, skin hydration, acne control, and overall skin health improvement. Their natural origin, combined with wide-ranging pharmacological conduct, supports their growing use in organic and Ayurvedic skin and hair care lines.

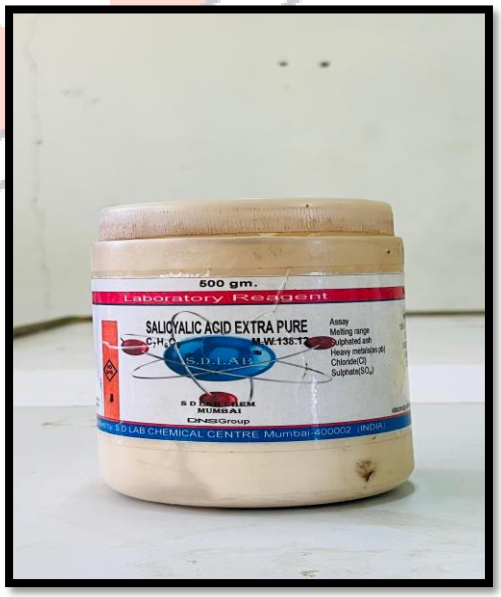
Materials & Methods: -

Collection of plant material

Aloe Vera, Neem, and Tulsi leaves were collected from the local botanical garden, Krishnarao Bhegade Institute of Pharmaceutical Education and Research, Talegaon Dabhade, Pune.

Table No. 1: Role of ingredients:

Serial No.	Ingredients	Roles	Figures
	Neem	Promote wound healing, relieve skin dryness, itching, and redness. Antibacterial and anti-inflammatory to fight acne-causing microbes.	 Fig. 2.1 Neem
	Clove oil	An antiseptic that reduces acne bacteria and swelling.	 Fig. 2.2 Clove Oil

	Tulsi	Antibacterial, adds glow, and detoxifies the face.	 Fig. 2.3 Tulsi
	Sodium Chloride	Cleanses skin and helps control excess oil by drying out active acne.	 Fig. 2.4 Sodium Chloride
	Salicylic Acid	Chemical exfoliant that removes dead skin cells and prevents clogged pores.	 Fig. 2.5 Salicylic Acid

	Kojic Acid	Inhibits melanin production to fade acne scars and pigmentation.	 Fig. 2.6 Kojic Acid
	Aloe Vera + Vitamin C Gel	Heals skin, boosts collagen, and reduces inflammation and marks.	 Fig. 2.7 Aloe Vera + Vitamin C Gel
	Papaya Gel	Contains enzymes that exfoliate, brighten, and reduce acne marks.	 Fig. 2.8 Papaya Gel

	Methyl Paraben	Preservative	 Fig. 2.9 Methyl Paraben
	Borax	Stabilizes cream texture and provides mild antiseptic action.	 Fig. 2.10 Borax
	Potato Starch	Soothes skin, absorbs oil, and provides a mattifying effect.	 Fig. 2.11 Potato Starch

	Beeswax	Forms a protective barrier while locking in moisture and preventing dryness.	 Fig. 2.12 Beeswax
	Tea Tree Oil	Penetrates pores to cleanse bacteria and reduce redness/swelling.	 Fig. 2.13 Tea Tree Oil
	Olive Oil	Moisturizes skin and prevents irritation from active ingredients.	 Fig. 2.14 Olive Oil

Fig. 2.15 Ingredients used in the formulation

Table No. 2 Formulation Table: -

Sr. No.	Ingredients	F1	F2	F3	F4	Role of Ingredients
1	Neem Extract (gm)	2	3	2	3	Antibacterial, Anti-acne
2	Clove Oil (ml)	1	1	1	1	Antiseptic, Anti-inflammatory
3	Tea Tree Oil (ml)	2	1	1	2	Antibacterial, prevents acne
4	Sodium Chloride (gm)	0.5	0.5	0.3	0.5	Exfoliant, Astringent
5	Salicylic Acid (gm)	1	0.5	1	0.5	Exfoliates dead skin, unclogs pores
6	Kojic Acid (gm)	1	1	2	1	Skin whitening reduces pigmentation
7	Aloe Vera + Vitamin C Gel (gm)	6	5	5	4	Hydrates, soothes, brightens, and protects against aging
8	Potato Starch (gm)	20	22	20	21	Binder, Absorbs oil

9	Basil Leaves Extract (gm)	2	2	1	2	Anti-inflammatory, Antibacterial
10	Methyl Paraben (gm)	0.02	0.03	0.02	0.03	Preservative, Antimicrobial
11	Borax (gm)	0.5	0.3	0.5	0.3	Emulsifier, Mild antiseptic
12	Beeswax (gm)	5	4	5	4	Thickener, Skin protectant
13	Olive Oil (ml)	4	3	4	3	Moisturizer softens skin
14	Papaya Gel (gm)	3	2	3	2	Lightens skin, Rich in enzymes and vitamins

Procedure: -

Phase 1: Oil Phase

1. **Take a clean beaker**, and add:
- **Beeswax**
- **Olive oil**
- **Clove oil**
- **Tea tree oil**
- **Methyl paraben (oil-soluble preservative)**

2. **Heat gently to 65–70°C** using a water bath to melt and mix the waxes and oils completely. Stir continuously.

Phase 2: Aqueous Phase

1. In a separate beaker, add:
- **Distilled water**
- **Borax** (acts as an emulsifier and helps in saponification of beeswax)
- **Sodium chloride** (mild astringent and helps control oiliness)
- **Potato starch** (thickener)
- **Salicylic acid** (dissolve using a small quantity of alcohol if needed)

2. Heat to the same temperature as the oil phase (65–70°C) with gentle stirring.

Phase 3: Active & Herbal Additives

1. Once both phases reach similar temperatures, **slowly add the aqueous phase to the oil phase** with continuous stirring to form an emulsion.
2. As the mixture begins to cool:
- Add **Neem powder**
- **Papaya gel**
- **Basil leaves extract**
- **Kojic acid**
- **Aloe Vera gel** + **Vitamin C gel** (add at a lower temperature, below 40°C to avoid degradation)
- Add **Fragrance** if desired

Final Steps

1. Keep stirring the cream as it cools to room temperature to maintain uniform emulsification.
2. **Check the pH** and adjust if needed (using citric acid or sodium hydroxide solution).
3. **Transfer the cream** to a suitable, sterilized container.
4. **Label the product** with name, ingredients, batch number, Mfg./Exp. Date.

Fig. 2.16 Final product of Anti-acne cream

Table No. 3 Evaluation Parameters: -

Parameter	**Method**	**Observation (Ideal/Expected)**
Colour	Visual inspection	Light green / Off-white (due to neem, aloe, papaya)
Odour	Sensory evaluation	Pleasant, herbal scent with mild essential oil note
Appearance	Visual inspection	Smooth, uniform cream without lumps or separation
Texture	Touch	Soft, creamy, non-greasy
Spreadability	Glass slide method	5–7 cm in 1 minute (good spreading ability)
pH	pH meter (1% w/v cream)	5.0 – 6.5 (ideal for skin application)
Washability	Rinse with water	Easily washable with plain water
Sensitivity	Human patch test	No redness, itching, or irritation (Non-irritant)

Results: _

Four formulations (F1–F4) of the herbal anti-acne cream were successfully prepared using ingredients like Neem, Clove oil, Tea tree oil, Aloe Vera + Vitamin C gel, and Papaya gel.

All formulations showed:

1. Smooth texture
2. Good spreadability
3. Stable pH (5.9–6.2)
4. No signs of irritation during patch testing

Among all, Formulation F2 demonstrated the best spreadability and aesthetic appeal.

Discussion: -

The herbal actives, such as Neem, Tea Tree Oil, and Clove Oil, provide antibacterial and anti-inflammatory effects that help combat acne-causing bacteria. The presence of Aloe vera and Vitamin C gel supported *skin hydration, healing, and reduction of post-acne marks.

Other ingredients like Beeswax, Olive Oil, and Papaya Gel contributed to moisturization, exfoliation, and skin brightening. The inclusion of Methyl Paraben and Borax ensured product stability and preservation.

Conclusion: -

Among all formulations, F2 emerged as the most effective and stable, making it suitable for further development as an anti-acne herbal cream.

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