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(REVIEW ARTICLE)

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Formulation and evaluation of herbal cream for the management of acne

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Abstract

Acne is a common skin condition that leads to inflammation, mainly affecting the sebaceous glands and hair Acne is a really common skin problem for teenagers and adults all over the world. It is mainly caused by too much oil, blocked hair follicles, bacteria like Cuti bacterium acnes (it used to be called Propionibacterium acnes) and inflammation. Common acne medications work very well, but they can cause dry skin, redness, and even antibiotic resistance. Because of this, more and more people are trying herbal remedies. We are looking at creating and testing an herbal cream for acne relief. It contains natural ingredients that fight bacteria, reduce inflammation in skin and protect the skin. To make the cream we combined extracts of aloe vera, neem, basil, amla, turmeric, sandalwood, cucumber, tomato, calendula and green tea with beeswax, liquid paraffin, borax and glycerin. We formulated the cream using a method of mixing liquids, and then examined things like its pH, how easy it is to spread, how thick it is, how it feels, how well it blends, how easy it is to wash off, and how stable it is. We also tested how well it kills acne bacteria. The results show that the cream feels smooth, has a skin pH close to your skin's natural pH, is not too greasy, spreads easily, and is good at killing bacteria, so it will be fine to use on your skin.

The herbal Ingredients work together – neem, turmeric and basil help fight bacteria, while aloe vera, amla and cucumber help soothe, moisturize and heal. The cream is gentle and feels good on the skin. But there are still some things that need to be figured out when it comes to selling herbal ingredients, such as how to make sure it's the same every time, how to keep it stable, and what regulations it falls under. Looking ahead, new technologies and testing can really help provide evidence that these products are safe and work well.

Keywords: Herbal cream; Anti-inflammatory; Antimicrobial; Natural formulation; Skin care.

1. Introduction

The skin is the largest organ of the human body, making up about 15% of an adult's total body weight. It plays an important role in protecting the body from physical, chemical, and biological factors. The skin also helps to prevent water loss, regulate body temperature, and is continuous with the mucous membranes that cover the body's surface.To maintain healthy, clear, and glowing skin, balanced nutrition is important. In addition to diet, hormonal changes, especially during puberty in both males and females, bring several changes in the body. Among these, acne vulgaris is the most common condition (Singh H.P. et al. 2015).

Acne is a common skin disorder that not only affects physical appearance but also causes social and psychological discomfort in patients. It occurs in both adults and teenagers. The main factors responsible for acne include excessive sebum secretion, abnormal shedding of skin cells, bacterial growth, and inflammation. The bacteria Propionibacterium acnes (P. acnes), an anaerobic organism, plays a key role in the development of acne by triggering inflammatory responses (Drano, B., et al. 2004).

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Acne mostly appears on areas of the skin that have many sebaceous glands, such as the face, upper chest, and back. Severe acne is usually inflammatory, but it can also occur in non-inflammatory forms. Acne is most common during adolescence and may continue into adulthood. In teenagers, it usually develops due to the rise in male hormones that increase during puberty in both boys and girl (Sandhya S. Vidhya Sravanthi et al. 2011).

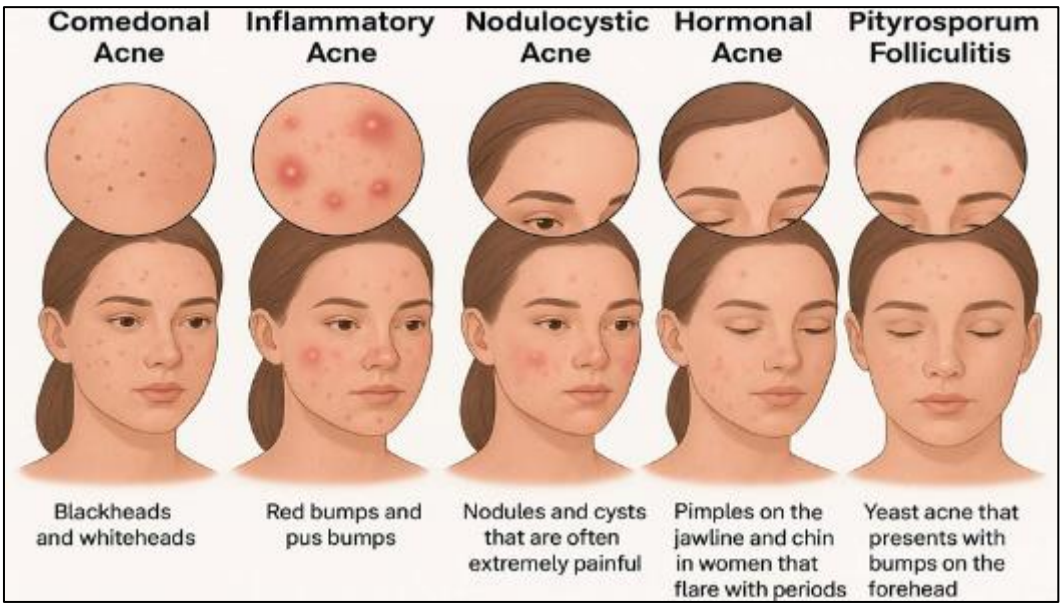

Figure 1 Types of acn**e**

1.1. Epidemiology

Acne is a common problem in peoples specially among young adults. Global reports show that about 85% of people experience acne between the ages of 12 and 25 years. Around 8% of adults between 23 and 34 years and about 3% of adults between 35 and 44 years are also affected. Acne, also called acne vulgaris. It is a long-lasting skin condition that occurs in the hair follicles and oil glands. It is usually seen during adolescence and often lasts for years. The condition is linked to the growth of Cuti bacterium acnes bacteria, which becomes active when certain hormones, such as dehydroepiandrosterone, increase in the blood during puberty (Kawada, Sakshi Dinkar et al. 2024).

1.2. Symptoms of acne on your skin include: - (A. Chaudhary et.al.2024)

- **Pustules (pimples):** These are bumps on the skin that are raised and contain pus.
- **Papules:** Small raised bumps that are discolored, usually red, purple, or darker than the normal skin color.
- **Blackheads:** Blocked pores that have a dark or black surface.
- **Whiteheads:** Blocked pores that have a white surface.
- **Nodules:** Large painful lumps that form deep under the skin.
- **Cysts:** Painful lumps that form under the skin and are filled with pus or fluid.

1.3. Factor responsible for acne

- **Propionibacterium acnes (P. acnes):** Acne lesions are predominantly colonized by the bacteria Propionibacterium acnes (P. acnes) and Staphylococcus epidermidis (S. epidermidis), and P. acnes is primarily responsible for triggering the inflammatory cascade that occurs with acne. **(**Sandhya S. Vidhya Sravanthi et al. 2011).
- **Use of cosmetics:** A majority of cosmetic and skin-care items are non-comedogenic, so they don't clog pores. There are several different available, but products that say they are "water-based" or "oil-free" are generally the best recommendation since they are less likely to cause of acne. (A. Chaudhary et.al.2024)
- **Psychological:** Even though stress-acne connections have been noted for quite some time, research has shown that there is likely a causal relationship where increased levels of stress appear to exacerbate acne. The National Institutes of Health (USA) also identifies stress as a potential trigger for acne flare-ups. A common study of adolescents in Singapore reported that as stress levels increased, severity of acne also intensified.

- **Hormonal changes:** Puberty and menstrual cycles are physiologic hormonal changes that can result in acne. Factors, such as increases in the production of androgens (male hormones) like testosterone, DHT, and DHEAS during puberty, particularly enhance sebum (oil) production, and potentially other hormones like IGF-1, may also be involved. In women who are adults, other factors can play a role in acne during pregnancy, polycystic ovary syndrome (PCOS), or Cushing's syndrome. Post-menopausal, an individual can also develop acne due to decreases in estradiol (a hormone that may reduce the onset of acne). Squeezing pimples: Can worsen inflammation and cause scars. (U.S. Department of Health and Human Services et al., 2009)
- **Diet:** High glycemic load foods (like foods high in sugar or made with refined sugar) and cow's milk appear to worsen acne; however, there is no convincing evidence that chocolate or salty foods can cause acne. .(U.S. Department of Health and Human Services et al., 2009)
- **Genetics:** Acne is commonly inherited in families. If your parents or other relatives had acne, you are more likely to have acne earlier in life and have more spots or blocked pores. Excessive face washing: Over-cleansing can irritate the skin and worsen acne (Sandhya S. Vidhya Sravanthi et al. 2011).
- **Dirt: -** As noted previously, "blackheads" are oxidized oil, not dirt. In response to the misconception, sweat does not cause acne; It is not necessary to shower immediately following exercise due to the fear that sweat will clog your pores. On the contrary, constant exposure to a shower may irritate and dry up your skin.
- **Inflammation:** Generally, an inflamed skin is defined as erythematous, edematous, warm and tender. The skin reaction to inflammation occurs as a result of the body's immune response to foreign body. In the case of acne, the foreign bodies are typically bacteria or their irritating metabolites. The results of these processes lead to obstruction of the pilosebaceous units with resultant distention of the follicles and visible lesions (Kawada, Sakshi Dinkar et al. 2024).
- **Medications**: Certain drugs or medicines can trigger or worsen acne. Reason of acne some medicines give effects to body.

1.4. Treatment of acne

- Mild acne can be treatment by medicines applied on the skin, such as medicines clindamycin, erythromycin, azelaic acid, or salicylic acid etc.
- Moderate acne is manage using some topical antibiotics, and in some cases oral isotretinoin.
- Severe acne may require stronger options like hormonal therapy.

The pharmaceutical industry produces many types drug to acne treatments such as tablets, lotions, moisturizers, and creams. Creams are semisolid emulsions, either water-in-oil or oil-in-water, that are applied to the skin's surface. They stay longer at the application site and help protect skin, provides and treat skin many conditions like infections', irritation and acne (Telange.et.al.2022)

2. Cream

Figure 2 Types of Cream

Creams are semisolid emulsions preparation. It made of water and oil. They are mainly of two types: water-in-oil (W/O), where water droplets are dispersed in oil, and oil-in-water (O/W), where oil droplets are dispersed in water.

- **Oil-in-Water (O/W) Emulsion: -** In an oil-in-water emulsion, oil is present in the form of small droplets that are evenly spread throughout water. These creams have oil droplets dispersed in a continuous water phase. Example- Vanishing Cream, Foundation Cream.
- **Water-in-Oil (W/O) Emulsion: -** In a water-in-oil emulsion, water is present as tiny droplets that are spread in an oily medium. Here, oil forms the continuous phase, while water is dispersed within it. Example- Cold cream, Skin protection cream **(Sahu T. et al.)**

2.1. Ideal properties of Herbal Cream

- I It have Good Appearance.
- This creme spreads only to the skin.
- Not to be -irritant for the skin.
- They easily call the oil, sebum, dead skin cells.
- They form a blunt film that remains on the skin after application. I have to be choked, lubricate and protects the skin in addition to cleanliness.
- It doesn't have to be fat or stained.
- They do not modify membership and skin functions.

2.2. Benefits of topical drug delivery system

- Avoids first-pass metabolism (the liver breaking down the drug before it works).
- Can stop the drug quickly if needed.
- Can be used in more areas compared to nasal or mouth delivery.
- Delivers medicine directly to a specific area.
- Works well with drugs that have a short half-life, improving their effect.
- Improves patient compliance (Shelton)
- Allows self-medication safely.

2.3. Benefits Of Natural Anti Acne Cream

- Exhibits antibacterial activity against Acne-causing microorganisms.
- Reduces the occurrence of breakouts, whiteheads, and blackheads.
- Contributes to the diminution of acne scars.
- Minimizes the appearance of blemishes and hyperpigmented spots.
- Penetrates clogged pores to help prevent future breakouts.
- Provides soothing effects and alleviates skin irritation.

2.4. Drawbacks of topical drug delivery system

- There is a possibility of skin irritation or contact dermatitis due to the drug or its excipients.
- Certain medications exhibit poor absorption through the skin.
- The risk of allergic reactions remains a potential limitation.
- Topical delivery is applicable only for drugs effective at very low plasma concentrations.
- Enzymatic activity within the epidermis may lead to drug degradation.
- Drugs with larger particle sizes encounter difficulty in permeating the skin barrier. **(Shelton)**

2.5. Why Should Consider Herbal cream:

- Few or no negative side effects. Whenever a patient takes a pharmaceutical cream, it often creates one or more side effects with the patient can suffer from. The things are that sometimes the drug company may not even understand the patients experience of negative side effects.
- Most herbal cream utilize the body's own natural healing process to treat the condition. The ingredients are familiar to the body as they are tears with to optimize the body's own healing mechanism.
- It is cost- effective. Often a generic pharmaceutical drug can cost several hundred dollars.
- Herbal cream can help the body defend against the disease. Continuing to treat with a natural medicine can increase immunity and overall state of health. These benefits are often not readily apparent until

other forms of treatment have been treated or may take a longer time to realize. **(Pandey, Sonika ,et al. 2014).**

2.6. Objectives:

- To formulate an herbal anti-acne cream and conduct a complete evaluation of its physicochemical, pharmacological, safety, cosmetic properties, and anti-acne potential.
- To assess the effectiveness of the herbal cream in comparison to the safety of the standard marketed cream formulations.
- To assess the prepared cream for the physicochemical parameters of pH, spread ability, consistency, viscosity, stability, safety, and spread ability.
- To formulate herbal cream and comparison between chemical and herbal cream.

3. Herbal Ingredients Used in Cream

3.1. Aloe vera (Mane V.B. et al. 2020)

Scientific Name: Aloe barbadense

Family: Liliaceae

Biological Source: Dried Juice of the leaves of Aloe barbadense

Chemical Constituents: Aloin, Barbaloin, Eroding, Siphoning, Vitamins (A, C, E, B12), Amino acids, Polysaccharides.

Uses:

- Antibacterial Activity
- Anti-inflammatory Property
- Antiacne Properties
- Aloe vera can also be used to moisturize and soften skin.
- Aloe vera has the ability to reduce facial pigmentation and dark patches

3.2. Neem Extract (Joshi S.S et al. 2024)

Scientific Name: Azadirachta indica.

Family: Meliaceae

Biological Source: Leaves of Azadirachta indica.

Chemical Constituents: Azadirachtin, Nimbin, Nimbolide, Quercetin, Salannin**.**

Uses:

- Antibacterial Activity
- Antifungal Activity
- Anti-inflammatory Property
- Antiacne Properties
- Purifies skin,

3.3. Tulasi (Holy Basil) (Giridhar, Pooja et al. 2021)

Scientific Name: Ocimum sanctum Linn.

Family: Lamiaceae

Biological Source: Leaves and aerial parts of Holy Basil.

Chemical Constituents: Eugenol, Ursolic acid, Rosmarinic acid, Flavonoids, Linalool.

Uses:

- Antimicrobial Activity
- Anti-oxidant Property
- Anti-inflammatory Property
- Reduces pimples and skin irritation.

3.4. Amla (Indian Gooseberry) (Tazeen R. et. al. 2024)

Scientific Name: Emblica officinalis.

Family: Phyllanthaceae

Biological Source: Fresh and dried fruits of Indian Gooseberry

Chemical Constituents: Ascorbic acid (Vitamin C), Gallic acid, Ellagic acid, Emblicanin A & B, Tannins.

Uses:

- Antioxidant Property
- Improves skin texture
- Reduces hyperpigmentation
- Prevents acne scars.

3.5. Green Tea Extract

Scientific Name: Camellia sinensis.

Family: Theaceae

Biological Source: Young leaves and buds of green tea.

Chemical Constituents: Catechins (Epigallocatechin gallate – EGCG), Caffeine, Theanine, Polyphenols, Flavonoids.

Uses:

- Antioxidant Property,
- Anti-inflammatory Property
- Sebum regulation,
- Reduces acne lesions.

3.6. Cucumber Extract (Tazeen R. et. al. 2024)

Scientific Name: Cucumis sativus Linn**.**

Family: Cucurbitaceae

Biological Source: Fresh fruit of Cucumber.

Chemical Constituents: Cucurbitacin's, Flavonoids, Tannins, Vitamin C, Silica, Lignans.

Uses:

- Cooling and soothing effect.
- Reduces skin irritation,
- Keep Hydrates skin,
- Lightens dark spots**.**

3.7. Tomato Extract

Scientific Name: Solanum lycopersicum Linn.

Family: Solanaceae

Biological Source: Ripe Fruits of Tomato**.**

Chemical Constituents: Lycopene, Beta-carotene, Vitamin C, Flavonoids, Phenolic acids**.**

Uses:

- Antioxidant Property
- Reduces sebum secretion
- Brightens skin,
- Prevents acne scars.

3.8. Calendula Extract (Tazeen R. et. al. 2024)

Scientific Name: Calendula officinalis Linn.

Family: Asteraceae

Biological Source: Dried flower of calendula plant.

Chemical Constituents: Flavonoids, Triterpenoids, Carotenoids, Saponins, Essential oils**.**

Uses:

- Anti-inflammatory Property
- Antimicrobial Activity
- Wound Healing Property.

3.9. Turmeric Extract (A.Chaudhary et.al.2024)

Scientific Name: - Curcuma longa.

Family: Zingiberaceae

Biological Source: Rhizomes**.**

Chemical Constituents: Curcumin, Demethoxycurcumin,Turmerone, Zingiberene.

Uses:

- Antibacterial Activity
- Anti-inflammatory Property
- Antioxidant Property
- Reduces acne scars and pigmentation.

3.10. Sandalwood Extract: -

Scientific Name: - Santalum album

Biological Source: -Sandalwood oil is obtained from the wood of Santalum album.

family: -Santalaceae.

Chemical Constituents: - α-santalol , β-santalol ,santalyl acetate.

Uses: -

- Antimicrobial activity,
- Effective against acne-causing bacteria
- Anti-inflammatory agent, reducing redness.
- Provides antioxidant protection, preventing oxidative stress on skin.

3.11. Bee Wax

Beeswax produces from a gland in the abdomen of honeybees. It is excreted to manufacture the hive itself. The female worker bees have 8 glands in their stomach and produced the wax when it is time required to build the honeycomb. The wax that is secreted hardens it hits the air and forms a wax scale (A. Chaudhary et.al.2024).

chemical Constituents: - Hydrocarbons, Free fatty acids, aromatic substances, minerals, and vitamins.

Use: -

- Anti-inflammatory property
- Antibacterial Activity
- Wound-healing properties.
- Making it suitable for herbal anti-acne formulations.
- Enhances cream texture.

3.12. Chemical use in herbal cream formulation: -

- **Methyl Parabean: -**Microbial growth prevention, product stability improvement, broad-spectrum activity, and low-concentration safety. It is use in formulations of herbal cream for the purpose increase Self life of herbal cream. It inhibits the growth of microorganisms. It increases the safety of herbal cream.

- **Glycerine: -** Herbal anti-acne creams often use glycerin as a humectant and skin protectant to provide deep hydration without clogging pores. This hydration helps to combat the drying effects of certain anti-acne ingredients while soothing and protecting the skin barrier.

- **Borax: -**Borax can be used in cosmetics for its antimicrobial effects. It helps to exfoliate dead skin cells while acting to control the proliferation of harmful bacteria on the skin. Due to its ability to stabilize emulsions, the addition of borax to cold creams provides stability of the image of oil and water. **(S. Khadabadi)**

- **Liquid Paraffin: -**Liquid paraffin, also referred to as mineral oil or paraffinum liquidum, is an odorless, clear, colorless oil from refined petroleum. It is widely used in cosmetics and medicines. This type of paraffin is distinct from paraffin or kerosene, which are both fuels. Liquid paraffin has an oily and smooth feel to it. Due to its low price and wide availability, it is often used as a base ingredient for many products made from petroleum. **(Dhakane A.E et al. 2023).**

3.13. Collection of plants material

Turmeric, aloe vera, cucumber, and neem (Azadirachta indica) were gathered from a local garden. No matter what kind of raw material is being collected or where it is gathered from, it is clear that the best collection happens when the plant has the highest amount of active ingredients. When collecting natural products on a larger scale, it is important to consider the environmental conditions that help in getting the best quality. Also, it is necessary to use skilled workers during the collection process. The fruits are picked based on which part of the fruit is needed. They are collected either when they are ripe, half-ripe, or fully grown. Rhizomes are taken when they have stored enough food and contain the most chemical components. Collecting plants is an old practice, with records showing that a Chinese botanist collected roses more than 5000 years ago. These plants often ended up in botanical gardens or the gardens of rich collectors. They can also offer biological materials for researchers. These samples are used as references in herbaria around the world. Usually, plant samples in herbaria come with a sheet that includes details about the plant and the information about how and where it was collected. **(Chamidash, A , Agnesia et. al. 2024)**

3.14. Formulation of Anti-acne Herbal cream

- Measurement: Weigh all components using weighing balance.
- Oil phase: Mix Bee wax, Jojoba butter, Sandalwood oil and other fatty acids in a beaker and this mixture to heat 70-75 ° C, and ensures that all materials melt completely and the same.
- Aqueous phase: In another clean cup, glycerine, glycol and the weight of the correct amount of distilled water suggests. And other herbal ingredients Heat this beaker at 70-75 ° C to match the temperature in the oil phase.
- Emulsification: When both steps are at the same temperature, add hot water phase to the oil phase using a homogenizer or sterile, and ideally move between 800 and 1500 rpm. For a maximum of 10 to 15 minutes to create emulsion, you homogenize if necessary. See time because too much symmetry can break the emulsion.
- Cooling and addition of active: After emulsion, cool it and pipes and cool it. When it reaches about 40 ° C or less, you can add herbal extract (always pre-de reduction), with the preservative, antioxidant and alternative aroma. Stir slowly until the emulsion is cooled at room temperature, about 23–25 ° C, when it should be smooth and well mixed.
- Packaging: Insert sterile creams in bottles with labels. Let the cream settle for at least 24 hours before evaluating this.

3.15. Evaluation Parameters

- **Physical evaluation: -** The formulated herbal cream was tested by checking its basic physical properties such as color, odour, and appearance. **(Tazeen R. et. al. 2024)**
- **pH Determination: -** The pH of the prepared herbal cream was evaluated using a calibrated digital pH meter. A 100 mL dispersion of the cream was prepared in distilled water and allowed to stand for 2 hours to achieve equilibrium. The pH of the resulting solution was measured in triplicate, and the mean value was recorded as the final pH of the formulation. **(Praveen Ruhel et. al. 2018).**
- **Spreadability:** The spreadability of the formulated cream was evaluated by placing a small quantity of the sample between two glass slides. A definite weight was then placed on the slides for a fixed period of time to compress the cream to a uniform thickness. The time taken to separate the two slides was recorded, which indicated the spreadability of the cream **(Tazeen R. et. al. 2024)**
- **Sensitivity: -**The prepared cream was applied to the skin of the hand and then exposed to sunlight for 4–5 minutes. (Saha **P. Das, and Saha A.)**
- **Washability**: A small amount of cream was applied to the hand and then washed off with tap water.
- **Homogeneity: -**The formulated cream was homogeneous in nature.
- **Antimicrobial test: -** Nutrient agar was prepared and then inoculated with both E. coli and Lactobacillus. Once the agar had solidified, the plate was divided into four equal sections. Using a sterile borer, four wells were created—one in each section—and each well was filled with an antibiotic solution. The plate was then incubated at 37°C for 24 hours. After incubation, the zones of inhibition around the wells were observed and measured.
- **Viscosity: -** The measurements of the prepared gel's viscosity have been carried out with a Brookfield viscometer. The measures were carried out in a 100 RPM's speed to 25 ºc using a Brookfield viscometer.
- **Greasiness: -** This test is mostly used to determination of cream is greasy or oily.
- **Consistency:** The formulated herbal cream examined by rubbing cream on hand manually. The Cream having smooth consistency.
- **Determination of type of smear: -**The thickness of the cream on the volunteer's skin surface was assessed as a measure of how much grease remained on the skin after the testing commenced. There was less oil on the skin. **(Yadav A. et al. 2023).**

3.16. Representative findings from recent studies

- Polyherbal creams with additions of Tulsi, Aloe vera and extracts, typically have acceptable physical and chemical properties and some in-vitro antimicrobial effect, while a few small clinical or pilot studies have shown that they resulted in lesion reduction. **(Madewad, V. et al. 2023).**
- Topical gels with Aloe vera, onion (Allium cepa) and eucalyptus extracts have shown potential in-vitro and early clinical results in formulation studies **(Ansong, J. A., et al. 2023).**
- Creams that contain essential oils—such as clove oil—showed antimicrobial efficacy in vitro and good antimicrobial activity when evaluated as a formulation, but care should be taken to monitor for irritation **(Miser, K. S., et al. 2020).**
- Several recent narrative reviews and meta-analyses concluded that many herbal therapies result in a reduced count of lesions and tolerability, but due to a limited number of high-quality randomized controlled trials, and the lack of consistency of extracts, caution is warranted when interpreting results **(Ansong, J. A., et al. 2023).**

3.17. Challenges in commercializing and developing:

- **Batch-to-batch variation and standardization: -** Variation in plant material based on cultivar, harvest, extraction method, and more, and a lack of standardized markers that determine effect, potency, etc. will compromise reproducibility and regulatory acceptance **(Leti M, et al.2025).**
- **Stability and compatibility with preservatives: -** Botanical extracts can destabilize emulsions or react with excipients or preservatives that compromise their stability and impact product shelf life and safety **(JCDR** (2023))
- **Risk for skin irritation and skin sensitization: -** Essential and some concentrated extracts can act as irritants or allergens, and adequate dermal safety tests must be performed.
- **Gaps in high-quality clinical evidence: -** Some studies are too small, too short, not blinded or not conducted using standardized endpoints to allow for meta-analytic conclusions about the consistency of effects in humans **(Ansong, J. A., et al. 2023).**
- **Regulatory classification: -** Herbal creams may be marketed as cosmetics, cosmeceuticals or medicines depending on the type of claims being made, and each jurisdiction may classify products differently; often the claims vs required clinical data requirement is confusing to navigate **(JCDR 2023)**
- **Quality of raw materials & contamination: -** There is a risk of contamination with harmful microbes, pesticide residue or heavy metals in dietary supplements made from a plant extract which require useful QC procedures to be put in place regardless of regulatory classification **(Rasheed A. et. al 2012)**

3.18. Future Directions and recommendations

- **Uniform extracts and chemical standards: -** Utilizing uniform, high-grade extracts and measuring levels of key active chemicals will produce more reliable results and comply with government quality benchmarks **(Leti M, et al.2025).**
- **Novel Drug Delivery system:–** Today's delivery systems such as liposomes, nano-emulsions or solid lipid nanoparticles, will enable the compounds to penetrate greater depths into the skin, minimize any irritation and improve stability of fragile natural compounds. Current studies in this area are promising **(El-Shiekh, R. A., et al. 2025).**
- **Strong clinical trials:-** Well-planned trials with sufficient sample sizes, proper control groups and standardized outcome measures (such as acne spot counts, acne improvement and quality of life) should be conducted to validate past claims **(Madewad, V. et al. 2023).**
- **Combination treatments: -** Delivering various natural products with varied mechanisms of action, which target acne through different ways (bactericidal, anti-inflammatory and oil controlling mechanisms) may be additively or synergistically effective since there are likely multiple causes of acne.
- **Safety monitoring: -** Development of mechanisms for monitoring side effects and patch test data would allow identification of any risks of allergy to skin and could also help ensure the product is safe to useful for the long-term.
- **Green extraction methods:-** The use of eco-friendly extraction methods that are safe and effective such as supercritical CO_2 or pressurized water extraction methods will help protect the environment while ensuring quality control of the product and supply.**(Madewad, V. et al. 2023).**

4. Conclusion

The development and evaluation of plant-based cream for the management of acne showed that natural agents like Aloe vera, Neem, Tulsi, Turmeric and Green tea are likely to possess antibacterial, anti-inflammatory and antioxidant activity. Plant-based agents are theorized to work synergistically together to reduce the presence of acne as well as the formation of acne scars, while improving skin texture and with minimal side effects. Additionally, the plant-based agents will likely have a cost-effective alternative to synthetic formulations. The primary challenge will continue to be the standardization, stability and clinical validation of products. continued studies as well as assistance by more advanced delivery mechanisms will lead to greater therapeutic and commercial efficacy for plant-based anti-acne formulations.

Compliance with ethical standards

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No conflict of interest to be disclosed.

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