Formulation and Evaluation of herbal soap for eczema

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Abstract:

Eczema is a chronic skin condition introduced by dryness, cracking, inflammation & itching. The present research is to develop herbal soap formulation by using traditionally medicinal plants in eczema such as chammomile, calendula flower extract, aloe vera & turmeric powder which shows anti-inflammatory, soothing, antimicrobial & moisturizing properties. chammomile with its calming effects, aloe vera for hydration & skin regeneration, turmeric provides antioxidant & anti-inflammatory benefits or calendula promotes wound healing & reduce skin irritation. The soap is developed by cold process method using a combination of herbal extracts & then evaluated for its physical and chemical properties; which promising results in alleviating symptoms associated with eczema. This soap found to be mild, non irritating & moisturizing which is suitable for eczema treatment. The results of this study suggest that the developed of herbal soap formulation can be effective & natural remedy for eczema.

Keyword: Calendula officinalis, Chammomile, Eczema, Anti-inflammatory, Anti-oxidant, Herbal soap.

❖ Introduction:

Human skin is most sensitive & largest organ in human body. Skin is also called a cutaneous membrane. this skin protected from barrier {Temperature, UV radiation, infection, disease}[1].

The skin, the body's largest organ, envelops the entire external surface. It comprises three distinct layers, each with unique an atomical structures and functions:

1) Epidermis
2) Dermis

3) Hypodermis[2].

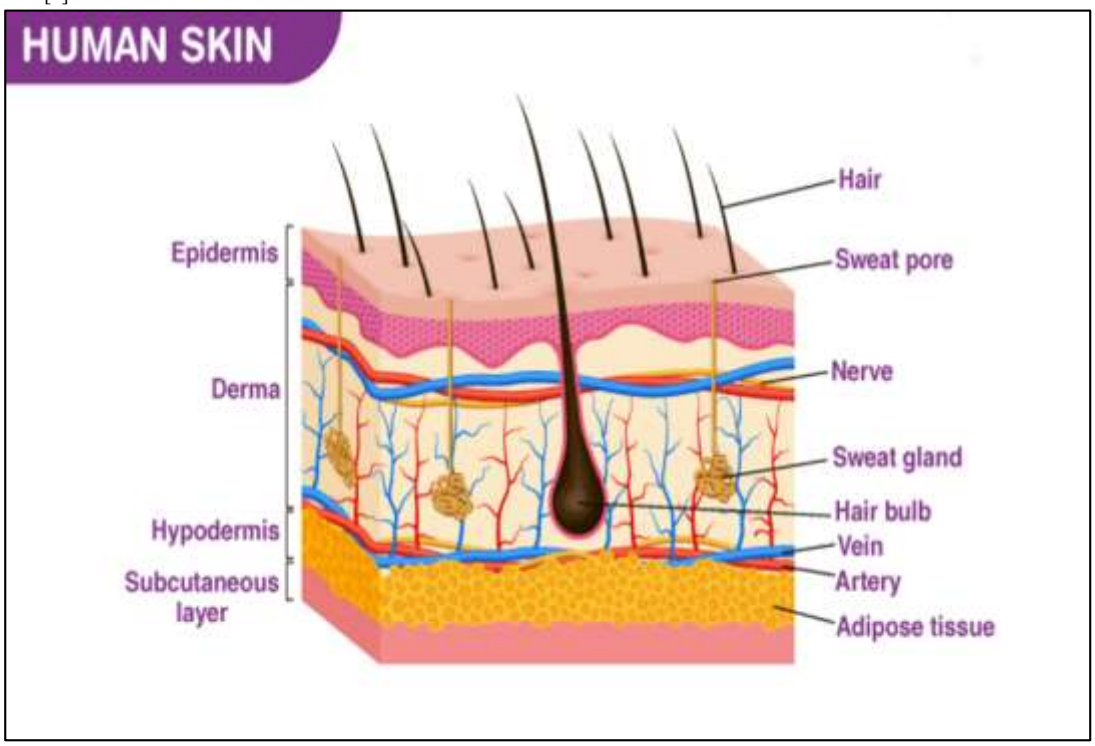


Fig 1: Human Skin Layers

1] Epidermis (Outermost Layer): The epidermis serves as the skin's outer shield, protecting against external factors like water loss, temperature, and pathogens.

It's composed of:

- Stratified squamous epithelial cells
- Keratinocytes (producing keratin)
- Melanocytes (producing pigment)

2] Dermis (Middle Layer): The dermis supports the epidermis, regulating body temperature and facilitating sensation.

It consists of:

- Connective tissue (collagen, elastin)
- Blood vessels
- Nerve endings
- Hair follicles
- Sweat and sebaceous glands

3] Hypodermis (Innermost Layer): The hypodermis, also known as subcutaneous tissue, anchors the skin to underlying muscles and bones.

It's primarily made up of:

- Adipose tissue (fat cells)
- Connective tissue
- Nerve endings

These three layers work together to maintain skin integrity, regulate body functions, and enable sensations like touch, pressure, and temperature [3].

- **The Skin: A Multifunctional Organ:**

The skin performs several vital functions essential for maintaining overall health and well-being.

1. Barrier Function: Protects against external factors like water loss, temperature, pathogens, and physical damage.

2. **Immunological Defence**: Houses immune cells (Langerhans cells) that detect and fight infections.

3. Regulation of Homeostasis: Maintains body temperature, fluid balance, and electrolyte levels.

4. Endocrine Function: Produces hormones like melanin (pigmentation) and vitamin D.

5. Exocrine Function: Secretes sweat and sebum to regulate body temperature and hydration.

6. Sensory Function: Contains nerve endings that detect touch, pressure, temperature, pain, and vibrations.

7. Diagnostic Indicator: Reflects overall health through changes in colour, texture, and appearance.

8. **Cell Division**: Continuously regenerates cells to replace damaged or dead skin.

9. Shedding: Regularly sheds dead skin cells to maintain skin integrity[4].

- **The Complex Interplay of Skin Health**

The skin's delicate balance is influenced by a combination of genetic, immunological, and environmental factors. In recent years, the prevalence of skin allergies has surged due to various external factors compromising the skin's natural barrier.

- **Genetic Factors:**

- Inherited traits (e.g., atopy, eczema)
- Mutations affecting skin structure and function[5].

- **Immunological Factors:**

- Overactive or impaired immune responses
- Allergies and sensitivities[6].

- **Environmental Factors:**

- Harsh soaps and cleansers
- Climate change and pollution
- Exposure to irritants (e.g., chemicals, fragrances)
- Poor diet and lifestyle choices
- Increased use of antibiotics and antimicrobials[7].

The combination of genetic, immunological, and environmental factors can lead to skin inflammation, cracking, redness, and itching and this all characteristic introduced the disease of **Atopic Dermatitis (AD), also known as Eczema**[8].

- **Atopic Dermatitis/Eczema:**

Atopic Dermatitis, is characterized by:

> Familial Hypersensitivity: Genetic predisposition to overreact to environmental triggers.

> Skin and Mucosa Affected: Inflammation and irritation affect skin and mucous membranes.

- **Key Immunological Features:**

1. **Increased IGE Production**: Elevated levels of immunoglobulin E, an antibody involved in allergic responses[9].

2.**Altered Pharmacological Reactivity**: Abnormal sensitivity to substances, leading to exaggerated immune responses.

- **Environmental Triggers:**

- Allergens (pollen, dust mites)
- Climate changes (Environmental Factors)
- Irritants (soaps, fragrances, chemicals)[10].
- Stress
- Family History
- Asthma[11].

- **Immunological Imbalance:**

- Overactive Th2 immune response
- Imbalanced cytokine production
- Impaired skin barrier function[12].

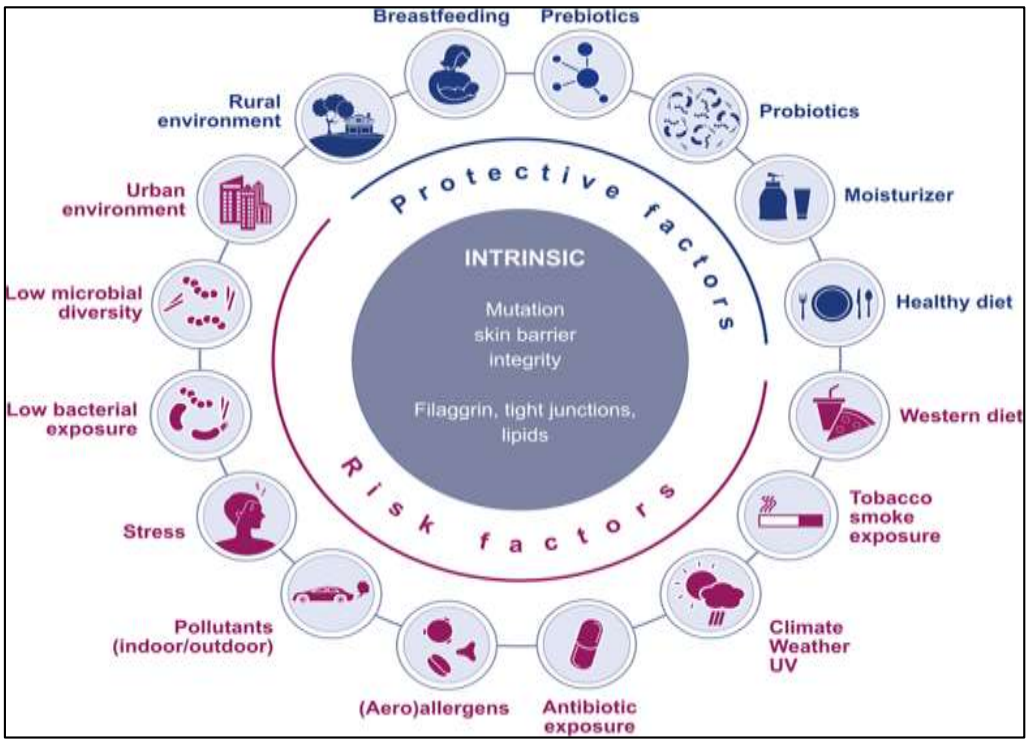


Fig 2: Protective & Risk Factors of Atopic Dermatitis

- **Symptoms of Atopic Dermatitis:**

-Inflammation (redness, swelling)

- Prickly (like tiny pins)

- Rough (uneven texture)

- Itchy (intensely irritating)[13].

- Dry, cracked, or scaly skin

- Intense itching

- Skin thickening

- Bumpy (small raised patches)

- Rashes (visible, inflamed areas)[14].

These symptoms can appear anywhere on the body, but commonly affect:

- Face

- Hands

- Feet

- Elbows

- Knees

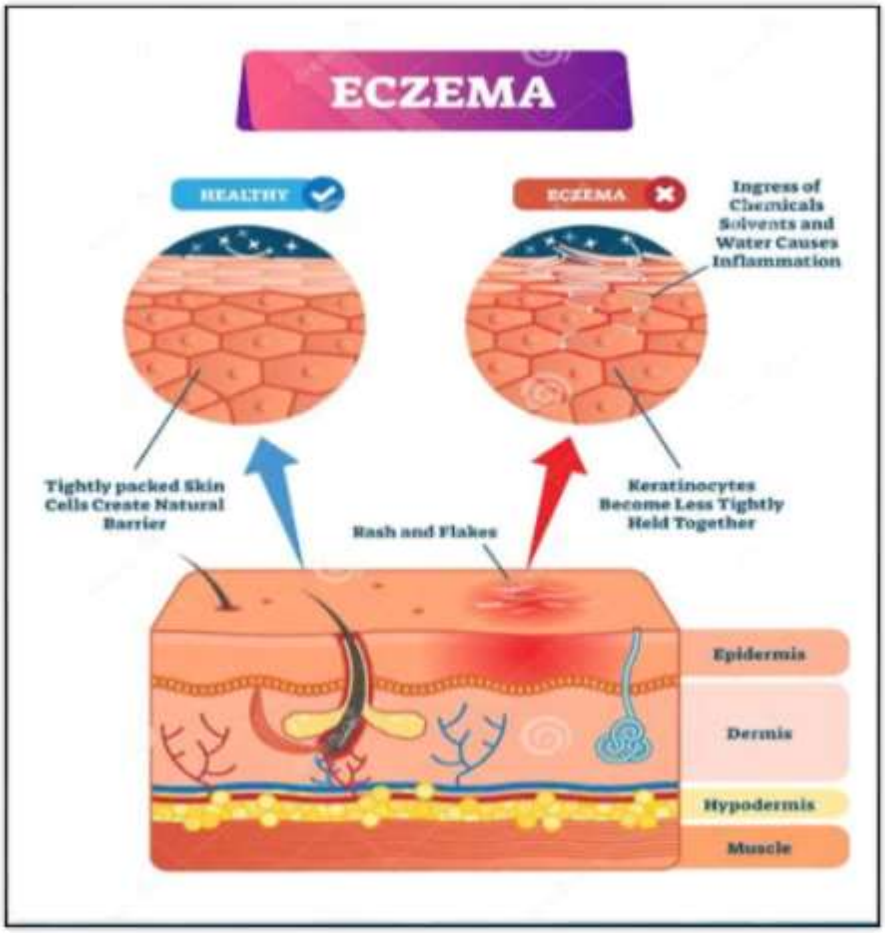


Fig 3: Normal Skin Vs Disease Affected Skin

- **Managing Atopic Dermatitis:**

  - Topical corticosteroids and immunomodulators.
  - Oral antihistamines and antibiotics (if necessary).
  - Phototherapy (UV light)[15].
  - Lifestyle modifications (diet, stress management).
  - Moisturizers and emollients.

  Early diagnosis and effective management can alleviate symptoms, prevent complications, and improve quality of life for individuals with Atopic Dermatitis[16].

➢ Herbal Soap:

Soap is essential for cleaning our bodies and removing dirt and odours. Herbal soaps, made from natural ingredients like seeds, fruit peels, and flowers, offer additional benefits. They can kill bacteria, slow down aging, and protect the skin from damage. Plus, these soaps are free from artificial colours and fragrances, making them a more natural choice for cleansing[17].

Herbal soap is a great choice because it cleanses the skin without removing its natural oils. This means it effectively gets rid of dirt, oil, and impurities while helping to maintain your skin's natural pH balance. As a result, it prevents excessive dryness, keeping your skin healthy and hydrated[18].

- **Herbal soap offers several benefits:**

- Natural Ingredients: Made from natural components, they help maintain healthy skin without harmful chemicals.
- Antibacterial: It helps kill bacteria, keeping your skin clean and healthy.
- Protected Skin Barriers: Herbal soap supports the skin's natural defences, keeping it protected from damage[19].
- Maintain Skin Health: It nourishes the skin, promoting overall health.
- Enhance Skin Fairness: Many herbal soaps can brighten your skin tone naturally.
- Improved Skin Texture: Regular use can lead to smoother and softer skin.
- Reduced Appearance of Wrinkles: It can help minimize fine lines, promoting a youthful look[20].
- Lesser side effects
- Better safety and efficacy
- Easily available
- Potent therapeutic effect.
- Cost friendly.
- Greater variety.
- No animal testing required
- Better compatibility with all skin types[21].
- Herbal soap is made from fatty acids combined with alkali salts sourced from plants or vegetables. It often includes natural fragrances and organic ingredients, making it a gentle and effective option for cleansing the skin.

❖ Literature Review:

1] Namo Jeremiah Akuaden, I. Y. Chindo, Joel Ogboji; (2019).

The formulation of antifungal herbal soap using the bark and seed extracts of Azadirachta indica (neem) and Ziziphus mauritiana (ber) aims to create a natural alternative to conventional soaps, promoting healthy skin. Unlike commercial soaps, which often contain artificial colors, flavors, and fluoride, herbal soaps are made from plant-based ingredients known for their medicinal properties. In this study, the focus is on developing a soap with antifungal properties, which could be beneficial for treating various skin issues, including fungal infections. Azadirachta indica, commonly known for its antimicrobial and antifungal effects, and Ziziphus mauritiana, with its soothing and healing qualities, make an effective combination for such a formulation. These herbs have been traditionally used in treating skin problems due to their high medicinal value. the physicochemical evaluation of the herbal soap involves testing its properties, such as pH level, texture, solubility, and stability. the antifungal evaluation tests its effectiveness against common skin fungi, ensuring that the soap not only cleanses but also provides therapeutic benefits. this formulation provides a natural and eco-friendly alternative for maintaining healthy skin without relying on synthetic chemicals[22].

2] Komal Sharma (2022).

The present work involves the preparation of a medicinal soap using marigold petals extract, known for its effectiveness in treating skin issues such as irritation, burns, wounds, and rashes. Marigold contains powerful antioxidants and anti-inflammatory compounds that help treat infections, reduce swelling, improve blood circulation, ease muscle spasms, and slow down the aging process by combating free radical damage. in this study, marigold petal extract was incorporated into the formulation of herbal marigold soap, aiming to provide a natural remedy for various skin problems. the results suggest that the herbal marigold soap is safe and beneficial for human skin, offering therapeutic properties that can help alleviate skin conditions and promote healthier skin overall. this natural soap provides an alternative to chemical-laden products, harnessing the healing power of marigold for skin care[23].

3] Omkar Bhujbal, Dnyaneshwar Bhosle, Piyush Jangam & Yogesh Bafana (2023).

The current study aims to develop an antibacterial polyherbal bath soap using extracts from several herbal plants, including Curcuma longa (turmeric), Citrus limon (lemon), Olea europaea (olive), Crocus sativa (saffron), and Cocos nucifera (coconut). These plants are known for their antibacterial, anti-inflammatory, and other therapeutic properties. the soap was tested for various physicochemical parameters such as pH and foam retention time, which are important for ensuring the soap's effectiveness and user experience. the goal of this research is to create a natural soap that can effectively combat bacteria while providing benefits like improved skin health and hygiene. by combining these plant extracts, the polyherbal soap not only provides antibacterial, protection but also takes advantage of the healing properties of these plants, offering a safe & natural alternative to synthetic antibacterial products[24].

4] Neha Ugale, Madhuri Darade & Sneha Kedar (2023).

The aim of the present study is to formulate an antibacterial polyherbal bath soap using extracts from Azadirachta indica (neem), Ocimum tenuiflorum (holy basil), Curcuma longa (turmeric), and Allium sativum (garlic). these plants are easily available and are known for their effectiveness on the skin, making them a cost-effective option for manufacturers. additionally, these plants have fewer or no side effects, making them safer for use in personal care products. neem leaves, in particular, are well-known for their wide range of health benefits, including anti-inflammatory, antihyperglycemic, antiulcer, antimalarial, antifungal, antibacterial, and antimutagenic properties. by combining these plants, the formulated soap aims to provide antibacterial protection & promote skin health, offering a natural alternative to commercial soaps with added therapeutic benefits[25].

5] Siddhartha Das, Sejal Agarwal, Rajat Das & Muskan Kumari (2024).
The objective of this study is to create herbal soap using the cold process method with ingredients such as lemon, Aloe Vera, Tulsi (holy basil), Neem, and Ritha. the soap was made with varying concentrations of these ingredients, and its effectiveness was assessed by measuring properties like pH, moisture content, foaming height, foam retention duration, and total fatty matter, compared to a standard formulation. herbal soaps, also known as natural soaps, are made from plant-based ingredients and botanical extracts. these soaps offer several advantages for the skin, such as natural aromas, antioxidant properties, and nourishing and moisturizing benefits. because herbal soaps are made from natural ingredients, they are gentle on the skin and provide purifying beautifying effects. one of the main benefits of using herbal cosmetics is their purity, which helps to nourish the skin with essential nutrients and minerals, without causing harmful side effects. herbal soaps are an excellent choice for maintaining healthy and radiant skin while being environmentally friendly[26].

❖ Aim and Objectives

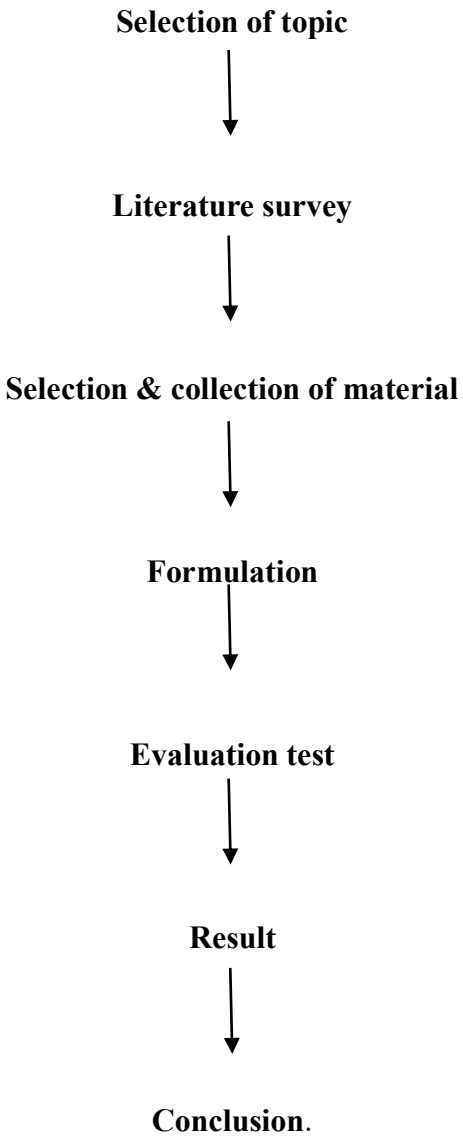
Aim:

To develop a herbal soap formulation, which provides an effective & gentle treatment for eczema & improve skin health.

Objectives:

- Promoting overall skin health which gives safe & sensitive skin.
- Relieving itching, cracking & redness which reduce symptoms of eczema.
- To shows antibacterial, antifungal & anti-inflammatory effects which may works against eczema disease.
- Provide moisturizing & hydrating property.
- Use of herbal ingredients shows non irritating & any side effect.

❖ Plan Of Work


Selection of topic
Literature survey
Selection & collection of material
Formulation
Evaluation test
Result
Conclusion.

❖ Active Pharmaceutical Ingredients & Excipients Profile

➢ Active Pharmaceutical Ingredients:

1] Calendula officinalis:

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Order:** Asrerales
- **Family:** Calenduleae
- **Genus:** Calendula
- **Scientific name:** Calendula Officinalis[27].

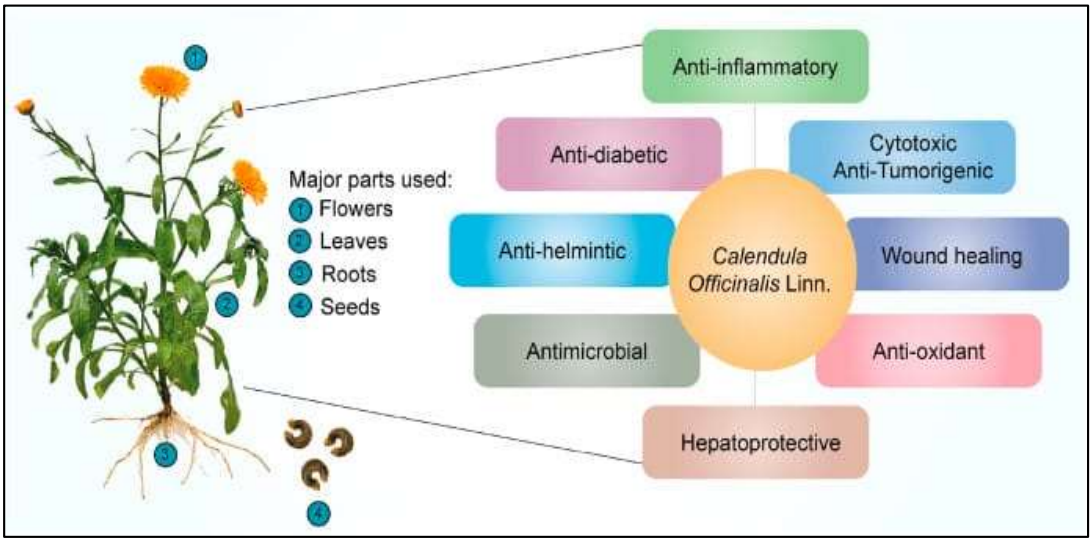
Fig 4: Calendula Officinalis Flower

Calendula officinalis, commonly known as marigold, is often used in homeopathic medicine for its anti-inflammatory properties. recent studies have highlighted its antibacterial, antifungal, and antiviral activities[28]. these findings suggest that Calendula may play a significant role in protecting against oxidative stress[29]. is a perennial herb with daisy-like flowers. this plant is notable for its behaviour of turning its flowers toward the sun, which is a characteristic feature of many sunflowers. It's vibrant blooms and sunny disposition make it a popular choice in gardens[30].

Traditionally, Calendula officinalis has been used to treat various conditions, including eczema and abdominal cramps. its anti-inflammatory properties make it effective in soothing skin irritations and reducing discomfort[31]. they are effective in reducing dermatitis, and helping to heal radiation damage; shows wound healing property[32].

The primary chemical compounds found in Calendula officinalis include steroids, terpenoids, triterpenic alcohols (both free and esterified), phenolic acids, and flavonoids[33]. it is well known that the inflammatory response and skin damage caused by UV light are largely driven by an excess of reactive oxygen species and free radicals, as well as a weakened antioxidant system[34].

Fig 5: Properties of Calendula Officinalis



2] Chamomile:

- **Kingdom:** Plantae
- **Division:** Magnollophyta
- **Class:** Magnoliopsida
- **Order:** Asterales
- **Family:** Asteraceae
- **Genus:** Matricaria
- **Scientific name:** Matricaria Chamomilla.

Fig 6: Chammomile Flower

German chamomile (Matricaria recutita), a member of the daisy family, has been used for centuries for various ailments, especially skin conditions. It also demonstrates antimicrobial activity in laboratory studies[35]. The anti-inflammatory, wound-healing, and antimicrobial effects of German chamomile are mainly due to its essential oil, which contains compounds like sesquiterpene alcohol, bisabol, chamazulene, and flavonoids[36].

It features flower heads with white, tongue-shaped inner petals and yellow tubular outer petals, typical of the Asteraceae family. Both the total extract of chamomile flowers and the flavonoid fraction have proven very effective in reducing inflammation. Chamomile flower is commonly used externally to treat skin inflammation and irritation, as well as bacterial skin infections, nappy rash, cradle cap, eczema[37].

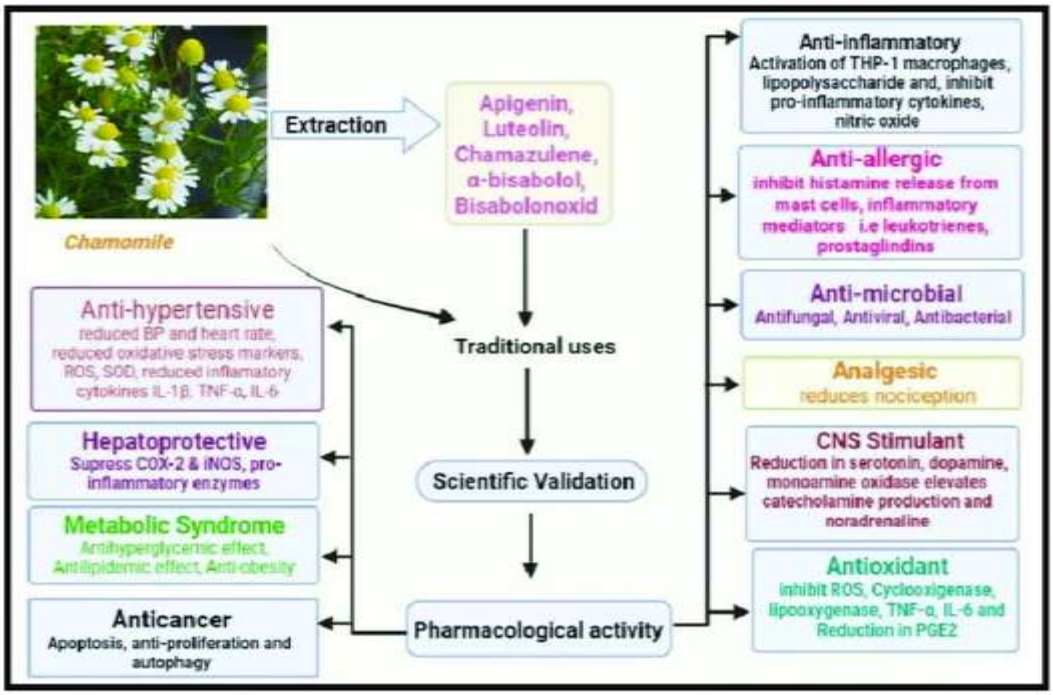


Fig 7: Properties of Chamomile Flower

3] Aloe Vera Plant

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Asparagales
- **Family:** Asphodelaceae/ Liliaceae.
- **Genus:** Aloe

Fig: 8 Aloe Vera

- **Scientific name:** Aloe Barbadensis miller

Aloe vera thrives in hot, dry climates and has been valued for centuries for its health and beauty benefits. The gel from its leaves is widely used in cosmetics and skincare products due to its effectiveness in treating sunburns, burns, and various skin conditions. Aloe vera contains amino acids, lipids, sterols & vitamins, it may improve skin & prevent wrinkles, it accelerates wound healing, it has antioxidant & antibacterial properties[38].

Aloe vera has several beneficial effects on eczema:

Soothing and calming: Aloe vera's anti-inflammatory and cooling properties help reduce redness, itching, and irritation associated with eczema.

Moisturizing: Aloe vera's hydrating properties lock in moisture, reducing dryness and flakiness.

Antibacterial and antifungal: Aloe vera prevents infection and promotes wound healing. and inflammation.

Skin regeneration: Aloe vera promoting skin renewal and repair.

Relieving itching: Aloe vera's anti-itch properties reduce scratching, preventing further skin damage[39].

4] Turmeric Powder

- **Kingdom:** Plantae
- **Division:** Magnoliophyta
- **Class:** Liliopsida
- **Order:** Zingiberales
- **Family:** Zingiberaceae
- **Genus:** Curcuma
- **Scientific name:** Curcuma longa

Fig 9: Turmeric Powder

Turmeric has long been used in traditional medicine across various cultures, largely due to curcumin, its active compound. curcumin has powerful antibacterial, antifungal, and anti-tumour properties. In dermatology, turmeric is known for its impressive wound healing abilities. The dried powder of the turmeric contains 3-5 % of curcumin which provides highly anti-oxidative, anti-inflammatory & anti-carcinogenic properties, hence the use of turmeric in cosmetics & skin care products helps to slow naturally the appearance of ageing, protect the skin against UV-radiation & acts as a natural healing agent for such skin condition as eczema, dry skin. The antimicrobial activity may help to protect soaps from microbial contamination[40].

Anti-inflammatory: Curcumin reduces inflammation, alleviating symptoms like redness, swelling, and itching.

Antioxidant: Turmeric protects skin from oxidative stress, promoting skin health.

Antibacterial and antifungal: Turmeric prevents infections, common in eczema-prone skin.

Immune system regulation: Curcumin modulates immune responses, reducing inflammation.

Skin barrier repair: Turmeric enhances collagen synthesis, improving skin elasticity.Reduced itching: Turmeric's anti-pruritic properties alleviate itching[41].

❖ Materials:

Sr. No	Ingredients	(F1)	(F2)	(F3)	Category
1	Calendula Powder	3 gm	5 gm	4 gm	Anti-inflammatory
2	Chamomile Powder	10 gm	10 gm	10 gm	Anti-oxidant
3	Aloe Vera	1 ml	2 ml	2.5 ml	Soothing, Moisturizing
4	Turmeric Powder	1 gm	2 gm	1.5 gm	Antibacterial, wound Healing
5	Beeswax	25 gm	25 gm	25 gm	Soap base
6	Rose water	5 ml	5 ml	5 ml	Fragnance
7	Coconut oil	2 ml	2 ml	2 ml	Moisturizing agent
8	Sodium Lauryl Sulfate	12 gm	15 gm	10 gm	Foaming agent

Table 1: Ingredients used for soap formulation

Sr. No.	Equipment & Apparatus
1]	Measuring Cylinder
2]	Spatula
3]	Double Boiler
4]	Heat Source
5]	pH meter / pH strips
6]	Beaker
7]	Blender
8]	Soap Molds
9]	Cutting Tools
10]	Test tubes

Table 2: Equipment & Apparatus

❖ Methodology

Collection, Identification & Processing of Plant extract:

Petals of Calendula Officinalis flower, aloe vera leaves and roots of turmeric were collected from fully grown plants. Then it were dried using a hot air oven ground into a fine powder and stored in airtight bottles for further study. Readymade Powder of chammomile flower was collected from nearby Market which directly used for preparation

Fig 10: Material used in soap formulation

Steps of Preparation process of Soap:

- Weigh out calendula officinalis, chammomile powder extract, aloe vera & turmeric powder accurately.
- By using double boiler method, melt the beeswax & add coconut oil over low flame until it become liquid.
- Gradually, add the calendula officinalis, chammomile powder extract in melted beeswax stirring well be.
- Then add aloe vera gel & turmeric powder stirring continuously to ensure they are fully incorporated.
- Once the powder are well mixed, then add sodium lauryl sulfate to mixture it works as a foaming agent & create lather in the soap.
- Stir the mixture well to combine all the ingredients thoroughly.
- Remove the mixture from heat & allow it to cool slightly.
- As the mixture cools, add a few drops of rose water for fragnance.
- Pour the semi-solid soap mixture into soap molds or any suitable container.
- Allow the soap to cool & solidify completely before removing it from the molds.
- Once the soap is solidify, then remove from the soap molds.
- Place the prepared soap in well ventilated area to cure & haden further.
- Allow the soap bars to cure for at least 4-5 weeks before using for better result obtained[42].

(F1)

(F2) **(F3)**

Fig 11: Images Of Prepared Soap

Fig 12: Label of Prepared Soap

❖ Evaluation Parameters

1] Colour and Shape: The colour and shape of the product were evaluated by eye.

2] Odor: The fragrance of the formulation was tested by applying a small amount to the hand and noting the scent of the perfume[43].

3] pH: The pH of the prepared soap was measured by placing a pH strip on the freshly made soap. Additionally, 1 gram of the soap was dissolved in 10 ml of water, and a digital pH meter was used for a more precise measurement.

Fig 13: pH Test

4] Foam Height: A sample of 0.5 grams of soap was mixed with 25 ml of distilled water and then transferred to a 100 ml measuring cylinder. The volume was adjusted to 50 ml with additional water. After giving the mixture 25 strokes, it was allowed to settle. The height of the foam above the liquid was then measured[44].

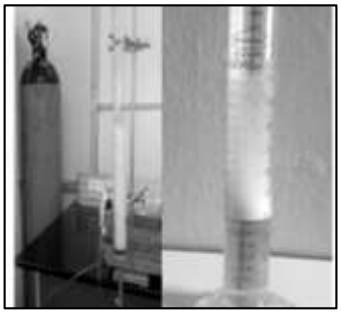


Fig 14: Foam Height

5] Foam Stability: the same amount of soap and distilled water was mixed as in the formability test. After mixing, the solution was allowed to sit undisturbed for 30 minutes. After this time, the height of the foam was measured from above the water level to assess how stable the foam was[45].

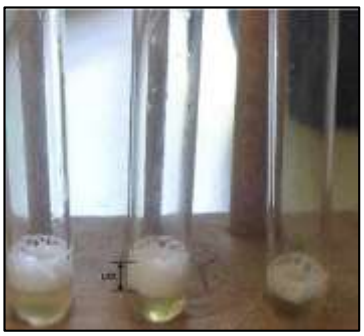


Fig 15: Foam Stability

6] Irritation Test: the soap is applied to the skin for 10 minutes. If there's no irritation afterward, the soap is considered non-irritating.

Fig 16: Irritation Test

7]Foam Retention: 25 ml solution of 1% soap is prepared and poured into a 100 ml measuring cylinder. the cylinder is then shaken 10 times for 4-5 minutes. after shaking, the volume of foam is measured every minute to see how much foam remains over time[46].

Fig 17: Foam Retention Test

8] Moisture Content: 5 gm of the soap sample are weighed and placed in a pre-weighed porcelain dish. This dish is then heated at 105°C for 2 hours in a hot air oven. after heating, the weight of the dish with the sample is recorded. the moisture content is calculated using the formula:

Moisture content = (weight loss / initial weight) × 100.

9] Total Fatty Matter (TFM): To determine the total fatty matter take 5 gm of the soap sample and dissolve it in 150 ml of distilled water. Then, add 20 ml of 15% sulfuric acid (H_2SO_4) to the solution. add 7 grams of beeswax to help solidify the mixture. Heat the solution again to allow a cake to form. the cake has formed, remove, dry and then weigh it to find the total fatty matter content[47].

10] Foam-forming Ability: Take 1 gm of the soap sample and dissolve it in 50 ml of water in a 100 ml graduated measuring cylinder. Shake the cylinder vigorously for 2-3 minutes, then the foam Settle about 10 minutes. after settling, measure the height of the foam. Repeat this process three times and record the results. Finally, calculate the average foam height from the three trials[48].

Fig 18: Foam-forming Test

❖ Result:

Table 3: Result of formulation of Soap

Sr. No.	Parameters	F1	F2	F3
1]	Colour	Brown	Brown	Dark Brown
2]	Shape	Round shape	Heart shape	Oval shape
3]	Odour	Aromatic	Aromatic	Aromatic
4]	pH	7.5	7.2	7.6
5]	Foam Height	2.3	2.5	2.0
6]	Foam Stability	15	13.2	14.5
7]	Irritation Test	No irritation	No irritation	No irritation
8]	Foam Retention	3 min 18 sec	3 min	2 min 42 sec
9]	Moisture Content	3.5	1.5	2.7
10]	Total Fatty Matter	36.5 %	37.7 %	35 %
11]	Foam Forming Ability	2.5	2	2.2

❖ Conclusion:

The soap formuation by using cold process, from natural ingredients such as Calendula Officinalis, Chammomile, Aloe vera, & Turmeric for Eczema provides a natural & Soothing option for individuals with sensitive skin all ingredients have anti-inflammatory, antibacterial & moisturizing properties. The main purpose of this soap formulation is to reduce symptoms of eczema disease such as redness, cracking, itching & inflammation of skin. The prepared formulation when tested for different test then F2 gave best result than F1 & F3, it does not gave any kind of irritation to the skin. F2 was suitable for every skin type. F2 also standardized by evaluating various physico chemical properties, such as pH, appearance and Odour each of this gave well satisfactory result. Herbal medicine are a rich source of active ingredients it can be safe & cost effective skin infection treatment ranging from rashes, redness & itching, also helpful in skin glowing.

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