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A Research on Formulation and Evaluation of Herbal Bael Soap for Eczema

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Abstract: *Eczema is a common chronic skin disorder marked by inflammation, itching, and redness, often requiring long-term treatment. The present study aims to formulate and evaluate an herbal soap using Bael (Aegle marmelos) leaves extract, traditionally known for its anti-inflammatory, antimicrobial, and skin-soothing properties, as a natural treatment option for eczema. The soap was prepared using the cold process method with natural oils and additives to enhance its therapeutic efficacy and skin compatibility. The formulated soap was evaluated for key physicochemical parameters such as pH, hardness, foamability, cleansing ability, and skin irritation potential. Microbiological studies were conducted to assess antimicrobial activity against skin pathogens commonly associated with eczema. Preliminary findings indicate that the herbal Bael soap meets standard quality criteria, is well-tolerated on the skin, and exhibits notable antimicrobial and soothing effects. These results suggest that Bael leaf-based herbal soap could offer a promising alternative or complementary approach to conventional eczema treatments.*

Keywords: Aegle marmelos, Herbal soap, Eczema, Cold process method, Natural formulation, Anti-inflammatory

I. INTRODUCTION

The skin is the largest organ in the body, covering its entire external surface. The skin has 3 distinct layers-the epidermis, dermis, and hypodermis, which have different anatomical structures and functions.1) The skin's structure comprises an intricate network that serves as the body's initial barrier against pathogens, ultraviolet (UV) light, chemicals, and mechanical injury. This organ also regulates temperature and the amount of water released into the environment.2) Skin is very important for all healthcare professionals to have basic information about the structure and function of human skin. Skin is also called a cutaneous membrane.3)

Layers of skin:

1) Epidermis
2) Dermis
3) Hypodermis

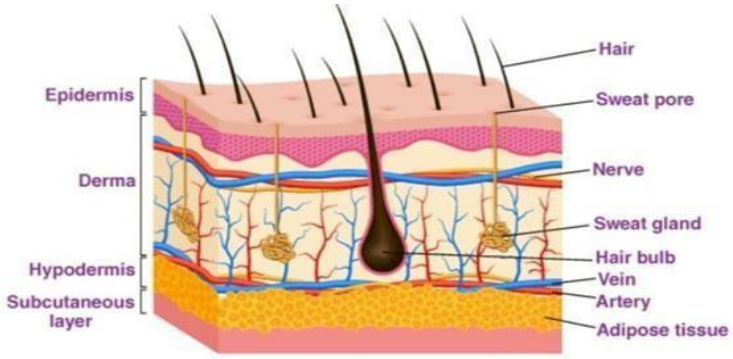

Figure.No.1-Human skin layers

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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 :

1) Stratified squamous epithelial cells
2) Keratinocytes (producing keratin)
3) Melanocytes (producing pigment)

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

1) Connective tissue (collagen, elastin)
2) Blood vessels
3) Hair follicles
4) Sweat and sebaceous glands

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

It's primarily made up of:

1) Adipose tissue (fat cells)
2) Connective tissue

These three layers work together to maintain skin integrity, regulate body functions, and enable sensations like touch, pressure, and temperature 4).

Functions of skin : The skin perform a multitude of function listed below:

1. It makes a protective layer to stop injury, germs, chemicals, and bad stuff from getting in.
2. It excretes sodium chloride and metabolites like urea.
3. It also helps in maintaining water and electrolyte balance.
4. It help in synthesis of vitamin D from ergosterol of skin by the action of UV rays of sunlight.
5. It secretes sweat and sebum which keep the skin soft..5)

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.

The most common skin diseases are Eczema, Acne, Rashes, Psoriasis, Allergy, dry skin, urticaria, etc The herbal remedies used for special skin problems are given in Special skin problem and Herbal Remedies. 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 Eczema6)

Eczema (also called atopic dermatitis)

1) Eczema is a recurrent inflammatory skin disease characterized by:
2) pruritic lesions and dryness of the skin.
3) skin barrier dysfunction.

Environmental Triggers:

1) Allergens (pollen, dust mites)
2) Climate changes (Environmental Factors)
3) Irritants (soaps, fragrances, chemicals)7).
4) Stress
5) Family History

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6) Asthma

Immunological Imbalance:
1) Overactive Th2 immune response
2) Imbalanced cytokine production
3) Impaired skin barrier function

Common Symptoms of Atopic Dermatitis:
• Inflammation (redness, swelling)
• Intense Itching (Pruritus)
• Dry Skin (Xerosis)
• Prickly (like tiny pins)9)

Herbal Soap :
Herbal soap is a type of soap made using natural ingredients derived from various herbs and plants. Herbs such as bael, neem, alove are commonly used in making herbal soap. Herbal soap is known for its soothing, rejuvenating, and healing properties, making it a popular choice for people with sensitive or dry skin. Currently, a significant number of cosmetic products are adulterated, and numerous other beauty preparations available in the market are of inferior quality, posing potential risks of side effects such as skin rashes, allergic reactions, and even the development of skin diseases.10)
Herbal soaps often contain antimicrobial and anti-inflammatory properties, thanks to ingredients like tea tree oil, neem, and turmeric. These properties can help combat acne, eczema, and other skin conditions while promoting overall skin health.11)

II. REVIEW OF LITERATURE:

Sharma .P. and Yadav .R., et al. (2022)
This aim of this study is to explores the formulation of a natural soap using neem, tulsi, and bael leaf extracts for their synergistic antibacterial properties. The formulation process involved cold saponification using coconut and castor oils as base oils. The herbal extracts showed significant activity against Staphylococcus aureus and E. coli, suggesting their utility in personal hygiene products. The soap was also evaluated for pH, foamability, and user acceptability.
Verma .M. and Singh .A, et al. (2022)
The aim of the study is to develop and evaluate a herbal soap formulation incorporating Aegle marmelos (bael) leaf extract along with neem and tulsi as co-actives. The formulation was evaluated for physicochemical parameters and dermatological safety. The bael extract demonstrated strong antioxidant activity, contributing to skin protection and rejuvenation. The combined extract soap showed promising results in reducing skin irritation and inflammation.
Selvamani M Surya Prakash R, et al. (2022)
The aim of the study is to formulate and evaluate polyherbal soap using coconut oil, beeswax, NaOH (lye), glycerine, neem, aloe vera, turmeric, tulsi, sandalwood powder, orange peel powder, multani mitti, reetha, honey, and vitamin E capsule. The herbal formulation was prepared and then evaluated for various physical parameters such as pH, foam height, foam retention time, moisture content, and alcohol-insoluble matter. The findings revealed that these herbal plant extracts possess antibacterial, anti-inflammatory, and antifungal activities.
Mahesh.D. Shinde, et al. (2023)
The aim of this project is dedicated to formulating a herbal soap by harnessing the extracts from Azadirachta indica (Neem) and Ocimum tenuiflorum (Tulsi) powders. With an increasing recognition of Ayurvedic cosmetics, renowned for their natural composition and minimal side effects, this formulation seeks to integrate botanical ingredients deeply rooted in traditional medicine practices. Nem, celebrated for its medicinal properties, assumes a crucial role, distinguished for its anti-inflammatory, antihyperglycemic, antimalarial, and antibacterial attributes.
Nikita Prakash Gaikawad, et al. (2024)

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This study aim to focused on formulating an herbal soap using neem and bael fruit extracts, renowned for their antimicrobial and skin-soothing properties. The preparation involved extracting active compounds from neem leaves and bael fruit pulp, followed by their incorporation into a soap base. The formulated herbal soap underwent comprehensive physicochemical evaluation, including pH determination, microbial analysis, and stability testing. Results revealed that the neem and bael fruit herbal soap exhibited favorable characteristics, including appropriate pH levels, antimicrobial activity against common skin pathogens, and stability under varying storage conditions.

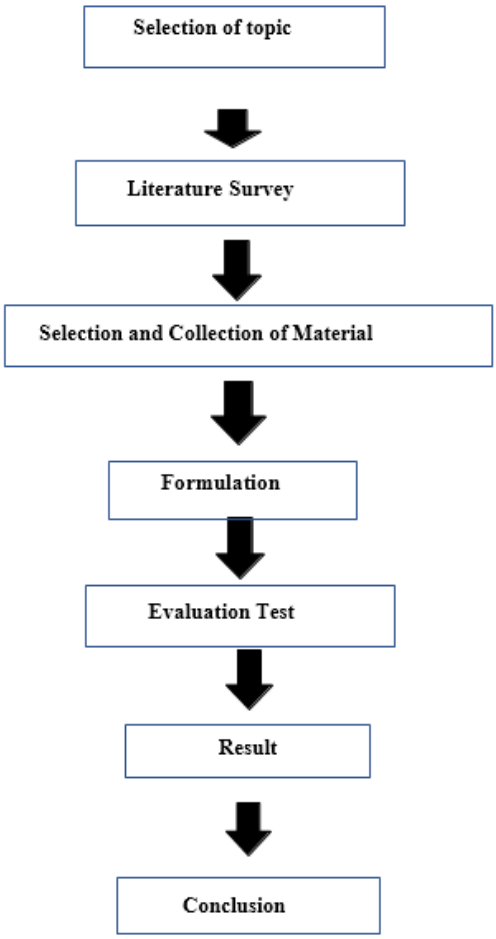
AIM AND OBJECTIVE:

• Aim : Formulation and Evaluation of Herbal Bael Soap For Eczema.

• Objectives:

1. To formulate a herbal soap using Bael leaf extract as the main active ingredient.
2. To relieve common eczema symptoms such as itching, redness, dryness, and irritation.
3. To evaluate the antibacterial, antifungal, and anti-inflammatory properties of the soap.
4. To provide natural moisturizing and soothing effects for sensitive skin.
5. To ensure the soap is gentle, non-irritating, and safe for daily use.

PLAN OF WORK:



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III. PLANT AND EXCIPIENT PROFILE

1) Aegle Marmelos : (Bael)

Figure No .2- Leaves of Aegle Marmelos

- Kingdom:- Plantae
- Division:- Magnoliophyta
- Class:- Magnoliophyta
- Order:- Sapindales
- Family:-Rutaceae
- Genus:- Aegle
- Species:- A.marmelos
- Part Used:- Leaves
- Common Name:-Bael Patra, Bael

2) Aloe Vera:-

Figure No.3- Aloe vera

- Kingdom:- Plantae
- Division:- Tracheophyta
- Class:- Liliopsida
- Order:- Asparagales
- Family:- Asphodelaceae
- Genus:- Aloe
- Species:- A. Vera
- Common Name:-Barbados Aloe

3) Turmeric:

Figure No.4- Turmeric

- Kingdom :- Plantae
- Division :-Magnoliophyta
- Class :- Liliopside
- Order :-Zingiberaales
- Family :- Zingiberaceae
- Genus :- Curcuma
- Species :- C. Longa
- Common Name :- Curcuma Longa

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4) Neem:

Figure No.5-Neem

- Kingdom :- Plantae
- Division :- Magnoliophyta
- Class :- Magnoliopsida
- Order :- Sapindales
- Family :- Meliaceae
- Genus :- Azadirachsta
- Species :- Azadirachta indica
- Common Name :- Indian lilac

5) Tulsi:

Figure No.6- Tulsi

- Kingdom :- Plantae
- Division :- Magnoliophyta
- Class :- Mangoliopsida
- Order :- Lamiales
- Family :- Lamiaceae
- Genus :- Ocimum
- Species :- Ocimum tenuiflorum
- Common Name:- Holy basin

6) Rose water

Figure No.7- Rose water

- Biological Source:- sepals and petals of Rosa species particularly Rosa damascena (Damask rose).
- Parts:- Petals and Sepals
- Uses:- Soothes skin irritation,Reduces skin redness.
- Properties:- Antibacterial, Anti-Inflammatory
- Chemical Constituents:- Phenethyl alcohol, Geraniol, Beta-Citronellol 12).

IV. MATERIAL AND METHODOLOGY:

1. Collection of Plant Material: Bael leaves , Neem leaves, Tulsi leaves, aloe vera and roots of turmeric were collected from fully grown plants. The collected plant material were meticulously sun dried and ground into a fine powder and stored in airtight bottles for further study. Homemade Powder of bael leaves which directly used for preparation.

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Table n : Formulation table of Soap

Sr .no	Ingredient	F1	F2	F3	Category
1	Aegle Marmelos Powder	10 gm	10 gm	10 gm	Anti Inflammatory
2	Neem Powder	3 gm	2 gm	3 gm	Anti Bacterial
3	Tulsi Powder	2 gm	3 gm	3 gm	Anti Microbial
4	Aloe Vera	1 ml	2ml	2.5 ml	Smoothing, Moisturizing
5	Turmeric Powder	1 gm	2 gm	1.5 gm	Anti Bactrial,Wound healing
6	Bees Wax	25 gm	25 gm	25 gm	Soap base
7	Rose water	5 ml	5 ml	5 ml	Fragnance
8	Coconut Oil	2 ml	2 ml	2 ml	Moisturizing Agent
9	Sodium Lauryl Sulfate	12 gm	15 gm	10 gm	Foaming agent

Methodology:

Preparation of Extract:

Bael leaves were first washed, sliced, and sun-dried until constant weight was achieved. The dried material was then ground into a fine powder using a mechanical grinder and sieved through a 60- mesh screen.

For extraction, a solvent system of propylene glycol and water (80:20 v/v) was prepared. A sample of 10g bael leaves powder was accurately weighed and placed into a 100 mL amber glass flask. The prepared solvent was added in a solid-to-solvent ratio of 1:20 (w/v), yielding 100 mL of solvent for 10 g of bael powder.

The mixture was subjected to maceration at ambient temperature (25 ± 2°C) for 24hrs with continuous stirring on a magnetic stirrer. After extraction, the solution was filtered through Whatman No. 1 filter paper to remove solid residues. The filtrate was then collected, and if concentration was required, the solvent was partially removed using a rotary evaporator under reduced pressure at 45°C. The final extract was stored in amber vials at 4°C until further analysis.

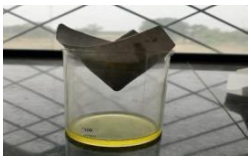

Figure No.8- Extraction of bael leaves

Steps of Preparation process of Soap:

• Weigh out Bael, Neem, Tulsi 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 Bael, Neem, Tulsi 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 13).

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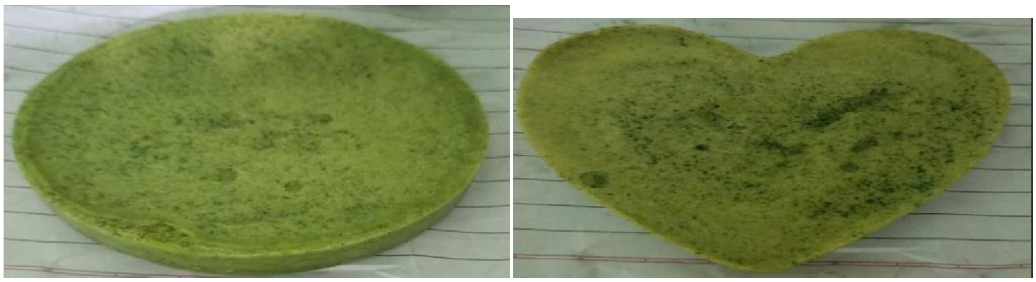

(Image-1) (Image-2)

(Image-3)

Figure No. 12: Images of prepared soap

EVALUATION TEST:

1] The optimize based formulation F3-because it is more effective for skin disease than other formulation. 2] Physaical Evaluation

a) Colour: The colour of formulation was checked manually and observed.

b) Shape: Evaluation of organoleptic properties, such as shape and clarity, was carried out by sensory and visual examination.

c) Odour: The Smell of Formulation was checked by applying preparation on hand and feel the fragrance 14).

d) Texture: Smooth

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.

Figure No.9: 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.15)

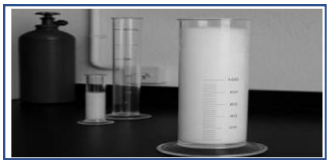

Figure No. 10: Foam Height

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.16)

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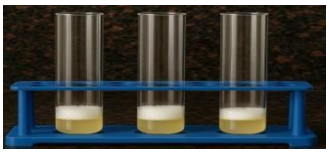

Figure No.11: Foam stabilitys

6] Skin irritation test : For the determination of irritancy test, Use the soap sample on clean skin to observe for signs of irritation, such as redness, burning, or itching and 24 hours, the situation was monitored.

Figure No.12: Irritation Test

7] Foam Retention : In the 100 ml of measuring cylinder transfer the Prepared the 25 ml of the 1% soap solution . Then the cylinder was shaken 10 times. The volume of foam retention was recorded.17)

Figure No.13 : 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] Foam forming ability: The Cylinder Shake Method was utilised to determine the Foaming ability. First, in a 100 ml measuring cylinder, we put 50 ml of a 1% sample solution and shaken vigorously 10 times. After shaking for 1 minute, we measured the height of the foam that had formed and recorded the total volume of foam.18)

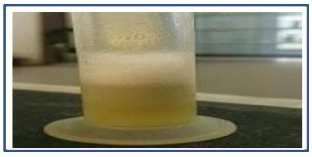

Figure No.14 : Foam-forming Test

RESULT :

Sr. no	Parameter	F1	F2	F3
1]	Colour	Greenish Yellow	Greenish Yellow	Greenish Yellow
2]	Shape	Round	Heart	Rectangular
3]	Odour	Aromatic	Aromatic	Aromatic
4]	pH	7.4	7	7
5]	Foam Height	2.3	2.5	2.0
6]	Foam Stability	14	15	14
7]	Irritation Test	No irritation	No irritation	No irritation
8]	Foam Retension	2 min 18 sec	3 min	2. min 40 sec
9]	Moisture Content	2.4	3.5	1.7
10]	Foam Frming Ability	2.1	2.5	2

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V. CONCLUSION

The study successfully formulated a herbal soap containing Aegle marmelos (Bael) leaf extract, demonstrating significant potential in managing eczema-related skin issues. The soap exhibited desirable physicochemical characteristics, good antimicrobial activity, and was well-tolerated on human skin, with no signs of irritation. The inclusion of Bael leaves enhanced the therapeutic efficacy, particularly in reducing inflammation and itchiness associated with eczema. These findings support the use of Bael-based herbal formulations as an effective and natural remedy for eczema, encouraging further research and development into plant-based dermatological products.

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