NATURALISTA CAMPANO
ISSN: 1827-7160
Volume 30 Issue 1, 2026

Formulation And Development Of An Anti-Dermatitic Herbal Soap Using Aloes, Jojoba Oil And Activated Charcoal

Lakshmi Priya[1], Sandhiya V, Hari Narayanan K[2], Sakthi Priyadarsini S[3*]

[1,2,3*]Department of Pharmacognosy, SRM College of Pharmacy, Faculty of Medicine and Health Sciences, SRM Institute of Science & Technology, SRM Nagar, Kattankulathur, 603203, Chengalpattu District, Chennai TN, India.

Abstract: Dermatitis is a chronic inflammatory skin condition characterized by itching, and dryness. The present study aimed to formulate and evaluate an anti-dermatitic herbal soap *Aloe barbadensis* Miller (Aloe vera), Jojoba oil, and activated charcoal. *Aloe barbadensis* was known for its skin-soothing, anti-inflammatory, and healing properties, while Jojoba oil reduced itching and redness. Activated charcoal was incorporated for its detoxifying and purifying effects. The anti-dermatetic soap was formulated by the Melt and Pour method and evaluated for antibacterial efficacy against *Staphylococcus aureus* and antifungal activity against *Candida albicans* agar well diffusion method. Physicochemical parameters, including pH, foaming capacity, cleansing ability, moisture content, and rinsability were assessed to ensure optimal functionality and skin compatibility. The Anti-dermatitic property of the different formulations of Herbal Soap (F1, F2, F3) was evaluated by Antibacterial and Antifungal activity. The soap exhibited ideal pH for skin use, high foaming capacity, excellent cleansing action, sufficient moisture retention, and easy rinsability. The results demonstrate the potential of this herbal soap as an effective and natural treatment for dermatitis, combining antimicrobial and skin-soothing properties, with formulation F3 showing a zone of inhibition of 15.45 ± 0.35 mm against *Staphylococcus aureus* and formulation F2 showing a zone of inhibition of 18.6 ± 0.56 mm against *Candida albicans* at 500 µg/mL concentration. In the study of Antifungal activity of Herbal soap formulations F1, F2, F3 against *Candida albicans* F2 was found to have an effective Anti-fungal activity Though the Herbal Soap Formulation F3 was effective against *Staphylococcus aureus*, Anti-dermatitis Soap Formulation F2 with good foam stability was found to be effective. Future prospects include conducting in vivo studies, stability testing, and clinical evaluation to validate the safety, efficacy, and commercial potential of the optimized herbal soap formulation.

Keywords: *Aloe barbadensis* Miller, Anti-microbial, Charcoal, Dermatitis treatment, Jojoba oil, Melt and Pour method.

1. Introduction

Dermatitis is a chronic inflammatory condition of the skin characterized by persistent inflammation, itching, redness, and dryness, often leading to significant discomfort and reduced quality of life (1).The incorporation of herbal ingredients in skincare formulations has gained considerable attention due to their multifaceted benefits, including anti-inflammatory, antimicrobial, and skin-nurturing properties. Aloe vera (*Aloe barbadensis* Miller) is enriched with anthraquinones such as aloin and emodin, polysaccharides like acemannan, and essential vitamins A, C, and E that nourish and protect the skin (13). Jojoba oil, obtained from *Simmondsia chinensis*, primarily consists of long-chain wax esters composed of fatty acids and fatty alcohols, with major constituents including α-linolenic acid, nervonic acid, palmitic acid, oleic acid, and unsaponifiable compounds such as 9-octadecen-1-ol and 1,22-docosanediol (14). Activated charcoal, prepared from natural carbon-rich materials like coconut shells or bamboo, contains amorphous carbon along with trace elements and surface functional groups such as phenolic, carboxylic, and lactonic groups that contribute to its high adsorption capacity. These active constituents collectively form a gentle yet effective base for soothing and detoxifying formulations used in dermatitis care (15). The incorporation of herbal ingredients in skincare formulations has gained considerable attention due to their multifaceted benefits, including anti-inflammatory, antimicrobial, and skin-nurturing properties. The management of dermatitis typically involves the use of topical corticosteroids, emollients, and other synthetic formulations, which may lead to adverse effects upon prolonged use. Consequently, there is a growing demand for natural and safer alternatives that offer therapeutic benefits while being gentle on the skin (1).
Aloe barbadensis Miller, Jojoba oil, and activated charcoal in a synergistic herbal soap formulation, providing a

promising alternative for dermatitis treatment that is both effective and user-friendly. *Aloe barbadensis* Miller (Aloe vera) is widely recognized for its skin-soothing, healing, and anti-inflammatory capabilities, making it a preferred ingredient in dermatological applications (7). Similarly, Jojoba oil is known for its ability to alleviate itching and redness, while providing hydration and enhancing skin barrier function (1). Activated charcoal, renowned for its adsorptive and detoxifying properties, contributes to skin purification and pore cleansing (5).
According to the literature, the combination of *Aloe barbadensis* Miller (Aloe vera), Jojoba oil, and Activated charcoal in a single formulation exhibits a synergistic effect, offering enhanced antimicrobial, anti-inflammatory, and detoxifying properties. This combination provides a balanced and effective approach for soothing, cleansing, and protecting the skin, making it highly beneficial for the treatment and management of dermatitis.

2. Materials and Methods

Collection and Procurement of Plant Material

The *Aloe barbadensis* Miller (Aloe vera) was collected from Medicinal Plant Garden, SRM College of Pharmacy, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu-603203,Tamilnadu. The Jojoba oil and Activated Charcoal was purchased from Nat Habit Fresh Ayurveda and Indus Valley Bio Organic Activated Charcoal powder.

Test Organisms, Culture Media, Chemicals, and Reagents

Staphylococcus aureus and *Candida albicans* were used as test organisms. Nutrient agar medium, nutrient broth, potato dextrose agar, gentamicin, and Amphotericin B

Preparation of Aloe Vera Gel

The outer skin of the *Aloe vera* leaf was carefully removed to expose the inner transparent pulp which was shown in shown in Fig 1(7). The fleshy portion was separated and washed thoroughly with clean water three times to remove any impurities or traces of latex. The washed *Aloe vera* flesh was then transferred into a clean blender and ground with a small quantity of distilled water to obtain a smooth and uniform gel consistency. The blended mixture was filtered to remove coarse particles and fibers. The filtrate obtained represented the pure *Aloe vera* gel, which was then collected.

Figure 1: Aloe vera pulp

Preparation of Soap Base by Cold Press Preparation of Soap Base by Cold Press

The soap base was prepared by the Cold Process Method. Sodium hydroxide (NaOH) was dissolved in distilled water and placed on a heating mantle at a temperature of 40–50°C. In another beaker, coconut oil was added and placed on a heating mantle at a temperature of 40–50°C. Once both mixtures reached 50°C, the sodium hydroxide solution was added slowly to the coconut oil phase with continuous stirring until the base consistency was attained. The prepared soap base was used for the soap formulation (Table 1) (3).

Table 1: Composition of herbal soap base

Ingredients	Role	Quantity
Sodium hydroxide	Lye	6.5g
Coconut oil	Anti-inflammatory, Soothe skin	31ml
Distilled water	Vehicle	q.s

Formulation of Anti-Dermatitic Herbal Soap by Melt and Pour Method

The required quantities of *Aloe vera* gel, Jojoba oil, and Activated charcoal were blended to obtain a homogeneous mixture, ensuring uniform distribution of the active ingredients. The soap base, previously prepared by the cold process method, was transferred to a beaker and melted using a water bath maintained at 50°C. The blended active mixture was then gradually added to the melted soap base with continuous stirring to ensure proper mixing. The final mixture was poured into soap moulds and allowed to solidify, as shown in Figure 2. The composition of the herbal soap formulations is presented in Table 2 (6).

Table 2: Composition of Anti-dermatitic herbal soap formulations: F1,F2,F3

Ingredients	Role	F1	F2	F3
Aloe vera gel	Anti-microbial	30g	25g	20g
Jojoba oil	Anti-inflammatory	6ml	8ml	10ml
Charcoal	Cleanses skin	2g	3g	4g
Soap base	Cake formation	60g	60g	60g
Water	Solvent	q.s	q.s	q.s

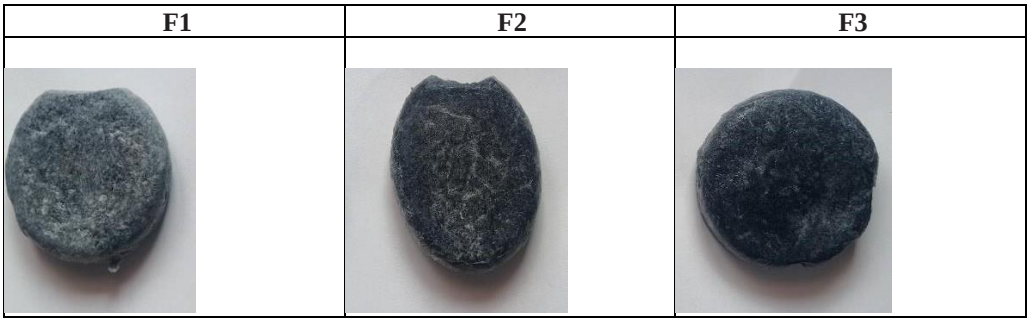

Figure 2: **F1**- Formulation 1, **F2**- Formulation 2, **F3**- Formulation 3.

Evaluation of Antimicrobial Herbal Soap

The efficacy and safety of different compositions of Antimicrobial Herbal Soap was evaluated by the following organoleptic parameters and Physicochemical characters.

Organoleptic Evaluation

The colour of the Antimicrobial Herbal Soap of different compositions such as F1, F2, and F3 was evaluated against a white background to observe any variation in appearance. The odor of the Antimicrobial Herbal Soap of the same formulations was assessed by directly smelling the samples by six to ten different people to determine the acceptability of fragrance. The shape of the Antimicrobial Herbal Soap of different compositions, including F1, F2, and F3, was evaluated through visual examination to ensure uniformity and proper formation.

Physicochemical Characterization

pH: The pH meter was calibrated using pH 4 and pH 7 buffer solutions. A 1% (w/v) soap solution of F1, F2, and F3 was prepared. The pH of each solution was recorded and noted.

Foam Stability: Foam stability of the soap was evaluated using the Cylinder Shake Method. For this purpose, a 1% (w/v) solution of the soap was prepared, and 25 ml of this solution was taken in a 100 ml measuring cylinder. The cylinder was then shaken vigorously for 10 minutes to generate foam. After shaking, the height of the foam formed in the cylinder was observed, which indicates the stability of the foam over time. The foam volume was subsequently calculated based on this measurement, providing a quantitative assessment of the soap's foam stability.

Dirt Dispersion: Add 1% (w/v) of soap solution in a measuring cylinder and add two drops of Indian ink and shake the measuring cylinder vigorously. Observe the amount of ink present in the foam.

Skin Irritation: Prepared Antimicrobial herbal soap F1, F2, F3, was applied on the clean skin for ten minutes and observed for the skin irritation (3)(4).

Antimicrobial Activity of Herbal Soap

Antibacterial Activity by Agar-well Diffusion Method

The formulated herbal soaps F1, F2, and F3 were evaluated for antibacterial activity against *Staphylococcus aureus* using the Agar-well diffusion technique on Nutrient Agar and Nutrient Broth. The antimicrobial agents in the soap

samples diffused into the medium and interacted with the test microorganism on freshly inoculated plates. This interaction produced clear, circular zones of inhibition due to the uniform growth of the bacterial lawn. The size of these inhibition zones was measured in millimetres.

Antifungal activity by Disc Diffusion Method
The prepared Herbal Soap formulations F1, F2, F3 were subjected to antifungal screening against *Candida albicans* by the Disc Diffusion Method using Potato Dextrose Agar Medium. The anti-fungal agent present in the given sample was allowed to diffuse out into the medium and interact in a plate freshly seeded with the test organism. The resulting zones of inhibition will be uniformly circular as there will be a confluent lawn of growth. The diameter of zone of inhibition can be measured in millimeters(6)(8)(11).

3. RESULTS

The prepared herbal soap formulations F1, F2, and F3 were evaluated for various organoleptic and physicochemical parameters. All the formulations exhibited a black color with a characteristic odor. The shape of the soaps varied, with F1 and F3 being round, while F2 was oval in shape.

Evaluation Tests
Herbal Soap of different formulation F1, F2, F3 were subjected to various Organoleptic and Physicochemical parameters evaluation and the results were tabulated in Table 4 (6).
In terms of physicochemical characterization, the pH of the formulations was found to be 8.0, 8.5, and 8.6 for F1, F2, and F3 respectively, indicating that all formulations were within the acceptable range for skin application. The foam stability values were observed to be 12, 10, and 9 for F1, F2, and F3 respectively, suggesting that F1 produced a more stable foam compared to the others. All the formulations showed good dirt dispersion ability, and no skin irritability was observed, confirming their suitability for topical use.

Table 3: Organoleptic parameters and Physicochemical characterization of Antimicrobial Herbal Soap

Parameters	**F1**	**F2**	**F3**
	Organoleptic Parameters		
Color	Black	Black	Black
Odour	Characteristic	Characteristic	Characteristic
Shape	Round	Oval	Round
	Physicochemical Characterization		
pH	8	8.5	8.6
Foam stability	12	10	9
Dirt Dispersion	Good	Good	Good
Skin irritability	No	No	No

F1 – Antimicrobial Soap Formulation 1 F2 – Antimicrobial Soap Formulation 2 F3 – Antimicrobial Soap Formulation 3

Anti-Dermatitic Effect of Herbal Soap Formulation
The antibacterial activity of different herbal soap formulations F1, F2, F3 were tested against *Staphylococcus aureus* at various concentrations (500 µg/mL, 250 µg/mL, 100 µg/mL, and 50 µg/mL) shown in Fig.3. The zone of inhibition (ZOI) in mm (Mean ± SD) was measured, with Gentamicin as positive control (PC) included for comparison which is shown in Table 5 (9)(12).

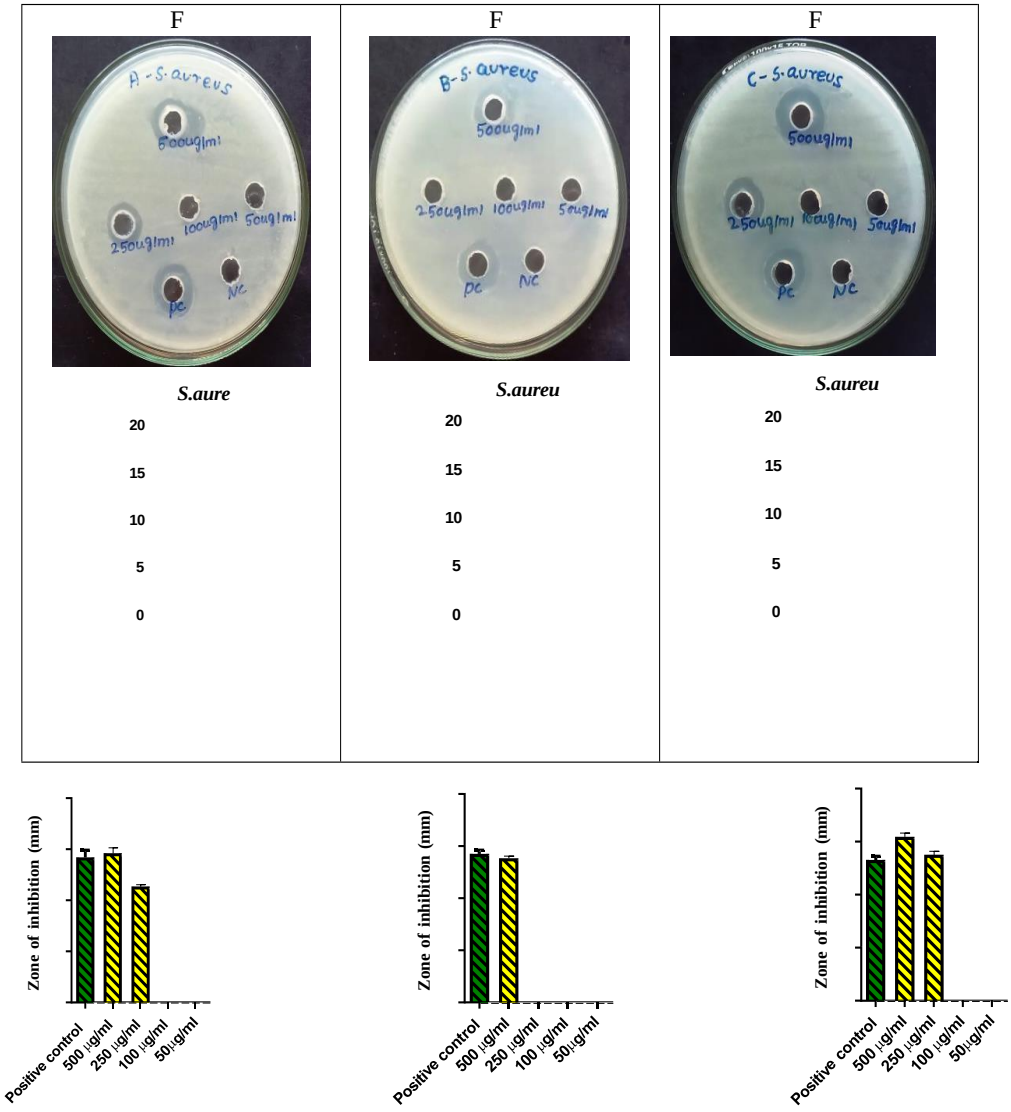

Figure. 3: Anti-bacterial effect of different formulations of Antimicrobial Soap F1, F2, F3 against *Staphylococcus aureus* by Agar-well diffusion method
F1 –Formulation 1 F2 –Formulation 2 F3 –Formulation 3

The results showed that the herbal soap formulations F1, F2, and F3 exhibited dose-dependent antibacterial activity. At a concentration of 500 µg/mL, the zones of inhibition were 14.6 ± 0.56 mm, 13.85 ± 0.21 mm, and 15.45 ± 0.35 mm against *Staphylococcus aureus*, respectively, with Gentamicin serving as the positive control. Among the three formulations, F3 demonstrated the highest antibacterial activity, showing a zone of inhibition of 15.45 ± 0.35 mm at 500 µg/mL

The anti-fungal activity of different herbal soap formulations F1, F2, F3 were tested against *Candida albicans* at various concentrations (500 µg/mL, 250 µg/mL, 100 µg/mL, and 50 µg/mL) shown in Fig.4. The zone of inhibition (ZOI) in mm (Mean ± SD) was measured, with Amphotericin B as positive control (PC) included for comparison which is shown in Table 6 (6, 8, 11, 12)

The results showed that the herbal soap formulations F1, F2, and F3 exhibited dose-dependent antifungal activity. At a concentration of 500 µg/mL, the zones of inhibition were 15.85 ± 0.21 mm, 18.6 ± 0.56 mm, and 13.85 ± 0.21 mm against *Candida albicans*, respectively, with Amphotericin B serving as the positive control. Among the three formulations, F2 demonstrated the highest antifungal activity, showing a zone of inhibition of 18.6 ± 0.56 mm at 500 µg/mL.

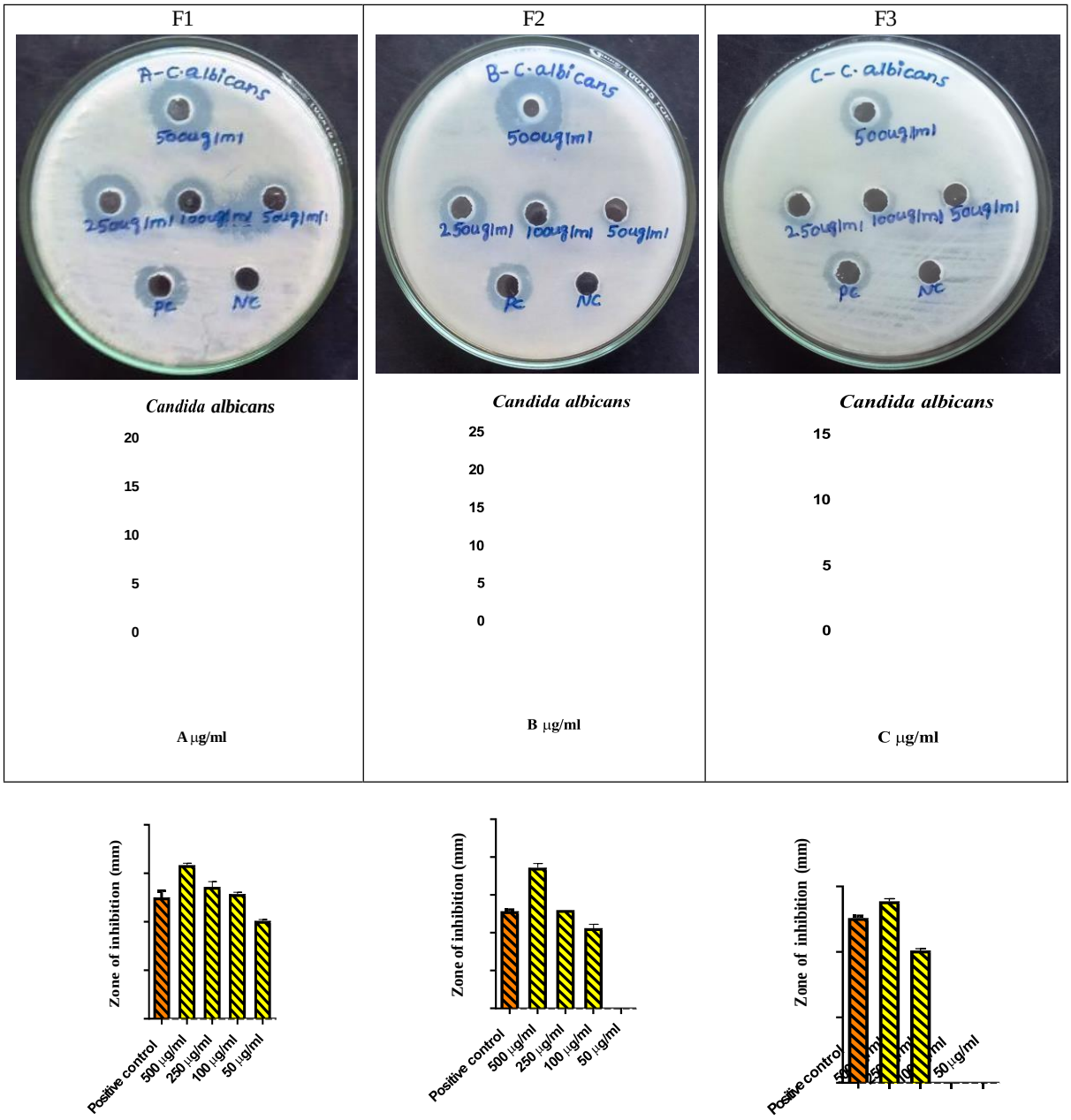

Figure 4: Anti-fungal effect of Herbal soap formulation F1, F2, F3 against Candida albicans by Disc diffusion method **F1** Formulation 1 **F2** –Formulation 2 **F3** –Formulation 3

4. Discussion

Plant-derived formulations have been widely investigated for their antimicrobial and dermatological benefits, owing to the presence of secondary metabolites such as alkaloids, flavonoids, terpenoids, and phenolics, which contribute to therapeutic efficacy and product stability (16,17). These bioactive constituents play a crucial role in the management of inflammatory skin conditions, including dermatitis, while minimizing the adverse effects associated with synthetic topical agents (18).

In the present study, an anti-dermatitic herbal soap containing *Aloe barbadensis* Miller (Aloe vera), *Simmondsia chinensis* (Jojoba oil), and Activated charcoal was formulated using the melt and pour method and evaluated for its physicochemical and antimicrobial properties. All three formulations (F1, F2, and F3) were uniform in color, odor, and shape, with pH values ranging between 8 and 8.6, which are within the acceptable range for topical

application (20). Foam stability was found to be highest for F1 (12), followed by F2 (10) and F3 (9), indicating good cleansing performance and consumer acceptability. No skin irritation was observed in any formulation, suggesting that the soaps are safe and suitable for external use.

The antibacterial study conducted against *Staphylococcus aureus* revealed a concentration-dependent activity among all formulations. At 500 µg/mL, the zones of inhibition were 14.6 ± 0.56 mm, 13.85 ± 0.21 mm, and 15.45 ± 0.35 mm for F1, F2, and F3, respectively, with Gentamicin as the standard drug. The antifungal activity against *Candida albicans* also demonstrated a dose-dependent response, with inhibition zones of 15.85 ± 0.21 mm, 18.6 ± 0.56 mm, and 13.85 ± 0.21 mm for F1, F2, and F3, respectively, when compared with Amphotericin B as the standard (21,22). These findings indicate that F3 exhibited superior antibacterial activity, while F2 showed the strongest antifungal effect.

The observed antimicrobial activity can be attributed to the synergistic effect of the herbal ingredients used. *Aloe barbadensis* Miller contains anthraquinones such as aloin and emodin, known for their potent antimicrobial and wound-healing properties (19). *Simmondsia chinensis* (Jojoba oil) is rich in long-chain wax esters and unsaturated fatty acids, which not only enhance skin hydration but also provide anti-inflammatory and bacteriostatic effects (17). Activated charcoal, composed of amorphous carbon with high adsorption capacity, removes impurities and toxins while reducing microbial load on the skin surface (18). Together, these ingredients provide a balanced combination of cleansing, antimicrobial, and skin-soothing actions, essential for managing dermatitis and maintaining healthy skin.

The outcomes of this research are consistent with previous findings where herbal soaps containing Aloe vera and other natural additives demonstrated significant antimicrobial potential and favorable physicochemical properties (19,20). The optimized F2 formulation displayed excellent antifungal activity, desirable foam stability, and non-irritant characteristics, making it a promising anti-dermatitic herbal soap for safe topical application.

However, further investigations includes preclinical studies, including in vivo antimicrobial and anti-inflammatory evaluations, as well as stability and compatibility testing, should be performed to validate the efficacy, safety, and shelf life of the optimized formulation (23). Additionally, controlled clinical trials would provide stronger evidence for its dermatological benefits and potential commercialization as a natural therapeutic product for dermatitis management.

5. Conclusion

In the current study, the Antimicrobial Herbal Soap was formulated using *Aloe barbadensis* Miller(Aloe vera), jojoba oil and activated charcoal by melt and pour method. The organoleptic parameters and physicochemical parameters were evaluated and was found to be effective. The antimicrobial property of the different formulation of herbal Soap (F1, F2, F3) was evaluated by antibacterial and antifungal activity. In the study of antibacterial activity of herbal soap formulations F1, F2, F3 against *Staphylococcus aureus*, F3 was found to have an effective anti-bacterial activity with 15.45±0.35mm Zone of Inhibition at 500 µg/ml. In the study of Antifungal activity of Herbal soap formulations F1, F2, F3 against *Candida albicans* F2 was found to have an effective anti-fungal activity with 18.6±0.56mm Zone of Inhibition at 500 µg/ml. Though the herbal soap formulation F2 was effective against *Staphylococcus aureus* and F3 was effective against *Staphylococcus aureus*, Herbal Soap Formulation F2 with good foam stability was found to be effective antimicrobial herbal soap formulation against dermatitis treatment.

6. References

1. Kotnala A, Verma K, Sharma A, Parashar S, Rathi B, Kumar R, et al. Indian medicinal plants for skin care and cosmeceuticals: a review. *J Biomed Ther Sci*. 2019;6(2):24–60.
2. Erinoso SM, Fawibe OO, Oyelakin AS, Ajiboye AA, Agboola DA. Herbal recipes used for the traditional management of infantile dermatitis in Odeda, southwestern Nigeria. *Afr J Tradit Complement Altern Med*. 2016;13(3):33–43.
3. Mishra DP. Preparation of soap using different types of oils and exploring its properties.
4. Talreja S, Tiwari D, Bharti A. Formulation and evaluation of herbal soap by using *Moringa oleifera* as main active constituents. *Eur Chem Bull*. 2023;12:2121–2141.
5. Sajjad M, Sarwar R, Ali T, Khan L, Mahmood SU. Cosmetic uses of activated charcoal. *Int J Community Med Public Health*. 2021;8(9):4572–4574.
6. Vijetha J. Formulation and evaluation of antifungal herbal soaps using natural ingredients by melt and pour method.
7. Dharajiya D, Pagi N, Jasani H, Patel P. Antimicrobial activity and phytochemical screening of *Aloe vera*

(*Aloe barbadensis* Miller). *Int J Curr Microbiol App Sci*. 2017;6(3):2152–2162.
8. Santos Junior CJ, Lins FCCO, Santos PO, Silva VB, Barros YVR, Araújo MAS, et al. Evaluation of antibacterial and antifungal activity of antimicrobial soaps. *Braz J Biol*. 2022;84:e263364.
9. Viray MA, Morley JC, Coopersmith CM, Kollef MH, Fraser VJ, Warren DK. Daily bathing with chlorhexidine-based soap and prevention of *Staphylococcus aureus* transmission and infection. *Infect Control Hosp Epidemiol*. 2014;35(3):243–250.
10. Hęś M, Dziedzic K, Górecka D, Jędrusek-Golińska A, Gujska E. *Aloe vera* (L.) Webb.: natural sources of antioxidants – a review. *Plant Foods Hum Nutr*. 2019;74:255–265.
11. Javad G, Taheri Sarvtin M, Hedayati MT, Hajheydari Z, Yazdani J, Shokohi T. Evaluation of *Candida* colonization and humoral responses against *Candida albicans* in patients with atopic dermatitis. *BioMed Res Int*. 2015;2015:849206.
12. Verma H, Sharma M, Chahota R, Palial A. Assessment of antimycotic activity of seabuckthorn (*Hippophae rhamnoides*) leaf extracts against fungi associated with skin dermatitis. *World J Pharm Sci*. 2013;6(4):205–208.
13. Dagne E. Review of the chemistry of aloes of Africa. *Bull Chem Soc Ethiop*. 1996;10(1):1–16.
14. Halawa SM, Kamel AM, Abd El-Hamid SR. Chemical constituents of jojoba oil and insecticidal activity against *Schistocerca gregaria* and biochemical effects on albino rats. *J Egypt Soc Toxicol*. 2007;36:77–87.
15. Yang X, Xue X, Lin Y, Huang Q, Mo M, Wang S, Meng J. Chemical constituents from *Moutan Cortex* charcoal and their potential coagulation activities. *J Chin Pharm Sci*. 2018;27(9):601–608.
16. Surjushe A, Vasani R, Saple D. *Aloe vera*: a short review. *Indian J Dermatol*. 2008;53(4):163–166.
17. Pazyar N, Yaghoobi R, Ghassemi MR, Kazerouni A, Rafeie E, Jamshydian N. Jojoba in dermatology: a succinct review. *G Ital Dermatol Venereol*. 2013;148(6):687–691.
18. Sanchez N, Fayne R, Burroway B. Charcoal: an ancient material with a new face. *Clin Dermatol*. 2020;38(2):262–264.
19. Dharajiya D, Pagi N, Jasani H, Patel P. Antimicrobial activity and phytochemical screening of *Aloe vera* (*Aloe barbadensis* Miller). *Int J Curr Microbiol App Sci*. 2017;6(3):2152–2162.
20. Talreja S, Tiwari D, Bharti A. Formulation and evaluation of herbal soap using *Moringa oleifera* as active constituent. *Eur Chem Bull*. 2023;12:2121–2141.
21. Santos Junior CJ, et al. Evaluation of antibacterial and antifungal activity of antimicrobial soaps. *Braz J Biol*. 2022;84:e263364.
22. Nabila VK, Putra IB. Effect of *Aloe vera* ethanol extract on growth inhibition of *Candida albicans*. *Med Glas (Zenica)*. 2020;17(2):485–489.
23. Sanjay KV. Studies on evaluation and formulation of herbal soaps using *Moringa oleifera* oil by melt and pour method. *Plant Arch*. 2024;24(2).