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Research Article

Formulation, Stability and Anti-Bacterial Assessment of an Herbal Soap Prepared from *Jasminum sambac* Leaves

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ABSTRACT

The present study was undertaken to explore the potential of *Jasminum sambac* leaves extract in the management of acne, a prevalent dermatological disorder. The research primarily focused on two key objectives: (1) the phytochemical screening and in-vitro evaluation of the antimicrobial activity of *Jasminum sambac* leaf extract against acne-causing bacteria, and (2) the formulation and quality assessment of herbal soap incorporating the extract for topical application. Acne vulgaris is largely associated with the overgrowth of skin-residing bacteria such as *Propionibacterium acnes* (now *Cutibacterium acnes*), *Staphylococcus epidermidis*, and *Staphylococcus aureus*, which contribute to inflammation and lesion formation. In India, acne affects approximately 72.3% of adolescents and 27% of adults, indicating a significant public health concern that necessitates safe and effective treatment alternatives. To address this, leaves of *Jasminum sambac* a medicinal plant known for its traditional therapeutic uses were extracted and subjected to phytochemical screening, revealing the presence of bioactive constituents such as flavonoids, tannins, saponins, and alkaloids. The antimicrobial activity of the extract was evaluated using the agar well diffusion method against the mentioned pathogenic strains. Results indicated notable zones of inhibition, confirming the antibacterial potential of the extract. Following this, an anti-acne herbal soap was formulated by incorporating the leaf extract into a suitable base. The finished product was subjected to various evaluation parameters including pH, foamability, hardness, spreadability, stability, and antimicrobial efficacy. The results demonstrated that the formulated soap met acceptable quality standards and retained antibacterial activity, suggesting its utility in reducing acne symptoms with minimal side effects. In conclusion, the study supports the potential of *Jasminum sambac* leaves extract as a natural, effective agent in acne management. The formulated herbal soap showed promising results in both laboratory testing and quality evaluation, indicating its safety

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and applicability for regular skincare use.

INTRODUCTION

Acne vulgaris is a common chronic inflammatory skin condition that affects a significant portion of the global population, particularly adolescents and young adults. It is primarily caused by a combination of factors, including increased sebum production, follicular hyper keratinization, hormonal fluctuations (especially increased androgen levels), and the colonization of skin follicles by bacteria such as *Cutibacterium acnes* (formerly *Propionibacterium acnes*), *Staphylococcus aureus*, and *Staphylococcus epidermidis*. Among these, *S. Epidermidis* plays a notable role in promoting inflammation within acne lesions [1]. While conventional acne treatments—such as benzoyl peroxide, topical retinoids, and antibiotics are commonly prescribed, they are often associated with undesirable side effects, including dryness, irritation, and the growing concern of antibiotic resistance. These drawbacks have led to an increased interest in natural and plant-based alternatives that are perceived to be safer, more tolerable, and environmentally sustainable [2]. Herbal soaps, formulated with plant-derived bioactive ingredients, have gained attention as a promising alternative for acne management. One such plant is *Jasminum sambac* (Arabian jasmine), traditionally used in various cultures for its medicinal and aromatic properties. The leaves of *Jasminum sambac* are known to contain phytochemicals with antimicrobial, anti-inflammatory, and skin-soothing properties, making them suitable for managing skin disorders such as acne, eczema, and dermatitis [3].

Phytochemicals, *Jasminum sambac* leaves are rich in compounds such as benzyl benzoate, which possesses significant anti-bacterial activity.

Benzyl benzoate acts by disrupting bacterial cell membranes, impairing energy production, and ultimately inhibiting bacterial growth within clogged skin pores. In addition, the presence of terpenoids like linalool and phenolic constituents further contributes to its antimicrobial potency by altering bacterial membrane permeability. [4] From a botanical perspective, *Jasminum sambac* belongs to the family Oleaceae and is classified under the order Lamiales. It is a highly variable evergreen shrub or vine native to Southeast Asia and is widely known by its common names in various languages, such as "Arabian jasmine" in English, Mo li hua in Chinese, and Jasmín de Arabia in Spanish. Given the increasing global demand for safer and more natural skincare options, this study aims to evaluate the potential of herbal soap formulations containing *Jasminum sambac* leaf extract. The research focuses on investigating the soap's antibacterial activity against acne-causing microorganisms, its ability to regulate sebum production, and its overall suitability for daily skincare use. Furthermore, the study emphasizes the broader advantages of herbal soaps, including their sustainability, accessibility, and potential to promote long-term skin health [5].

2. METHODOLOGY

2.1 Materials

Plant collection

Fresh leaves of *Jasminum sambac* were collected from Sagarshwar Nursery, Vita, Maharashtra. The plant was authenticated by the Department of Botany, Balwant College, Vita, on 3rd December 2024 (Specimen No: RAS001). The plant, *Jasminum sambac* (L.) Aiton, is an evergreen shrub or vine native to Southeast Asia, ranging from Bhutan to India. It is traditionally propagated through cuttings and layering and is recognized for its medicinal and aromatic properties. [6]



Materials Used:

1. *Jasminum sambac* leaves extract – used for phytochemical screening and formulation.
2. Herbal soap base – composed of natural oils, colorants, fragrance, and dried flower petals.
3. Chemicals – analytical grade reagents for standard phytochemical tests (e.g., for alkaloids, flavonoids, tannins, saponins, phenols, and terpenoids).

2.2 Extract preparation Steps of Maceration

1. **Soaking:** The plant material, of *Jasminum Sambac* 100gm leaves either in coarse or powdered form, passed through the sieve no.80 for the uniform particle size, then is soaked in 500ml of 95% ethanol at room temperature for at least three days. Intermittent stirring or agitation is essential to enhance the extraction process.
2. **Straining and Pressing:** After extraction, the liquid is separated from the solid plant material (marc) by straining through sieves or muslin cloth. The marc is often pressed to recover additional extract.
3. **Filtration or Decantation:** The ethanolic extract is further cleaned by filtration method the filtration is done by using Whatman filter paper no.1.[7, 8]

2.3 Preparation of soap

The herbal anti-acne soap was prepared using the melt-and-pour method. A measured quantity (50 g) of soap base was melted using gentle heat on a gas stove. Once liquefied, 25 ml of *Jasminum sambac* leaf extract was added and mixed thoroughly for 10–15 minutes to ensure uniform dispersion of the extract. A few drops of jasmine essential oil were added to enhance fragrance and sensory appeal. After complete mixing, the molten mixture was poured into soap molds and allowed

to cool and solidify at room temperature. Once properly set, the soap was demolded and stored for further evaluation.[9]

Table 1:- Composition of Herbal Soap

Sr. No.	Ingredient	Quantity	Role
1	<i>Jasminum sambac</i> Extract	25 ml	Anti-bacterial, Anti-acne
2	Soap base	50 g	Binding agent, base structure
3	Jasmine oil	Q.S.	Perfume, improves sensory appeal

3. Evaluation of Herbal Soap

The following tests were performed to evaluate the properties and performance of the herbal anti-acne soap.

3.1 Soap Characterization

Several characteristics of the prepared soaps were analyzed.

Organoleptic Properties:

- **Colour:** The soap colour was checked visually for consistency and appropriateness.
- **Odor:** The scent was assessed manually to ensure it was pleasant and not overpowering.
- **Shape:** The shape of the soap was confirmed to be as intended.

II. Washability: The soap's ability to rinse off easily was tested after application on the hand.

III. Greasiness: Greasiness was evaluated by applying the soap to the hand, washing it off with Water and checking for any remaining oily residue.[10, 12]

3.2 Moisture Content

To determine the moisture content, the hot air oven method was used. About 5 grams of soap were



placed in a pre-weighed, dry Petri dish. Water was added to the soap and the mixture was weighed accurately. The sample was then heated at 80°C for 30 minutes in a hot air oven and the process was repeated until the weight stabilized, indicating that the moisture had evaporated. [13]

$$\text{Moisture content} = (\text{Initial weight} - \text{final weight}) / \text{final weight} \times 100$$

3.3 Ph Determination

The ph of the soap was determined using a ph meter: The 1% (w/v) soap solution was prepared by dissolving 1gm of soap in 10 ml of distilled water, bringing the total volume to 100 ml. The ph meter electrode was immersed in the solution and ph value was recorded. [14, 15]

3.4 Foaming Ability/Foam Height

Foaming ability was evaluated by placing 0.2g of soap in a 100 ml measuring cylinder containing 10 ml of distilled water. The mixture was vigorously shaken for 2 minutes. After letting it stand for 10 minutes, the height of the foam was measured and recorded. [16]

3.5 Foam Retention Test

Foam retention time was evaluated by placing 1gm of soap in 50 ml water in 100 ml measuring cylinder. The mixture was vigorously shaken for 2 minutes. After shaking letting it stand for 10 minutes, the height of the foam was measured and recorded. Foam retention time was recorded as duration took for the soap solution to completely eliminate.[17, 18]

3.6 Solubility Test

For the solubility test, 0.2g of soap sample was added to a 100 ml measuring cylinder containing

10 ml of distilled water. The soap dissolution rate was observed after continuous shaking.[19]

3.7 Skin Irritability Test

A small amount of soap was applied to the skin using water and the area was observed for any signs of irritation or discomfort after a few minutes. [20]

3.8 Saponification value

Take 2 gm soap in conical flask add 0.5 M KOH. Heat the mixture up to 55 °C and increase the temperature up to 100°C. Boil the mixture for 1 hour. Titrate the above mixture with 0.5M HCL by using phenolphthalein indicator. End point is disappearance of pink colour.[21, 22]

$$\text{Saponification value} = (b-a) \times 28.056/ w$$

Where, b= Blank, a =sample reading, w= Weight of soap

3.9 Fatty Matter Content

To determine the total fatty matter in the soap, 10gm (denoted as m) of the soap were dissolved in 150 ml of water. Heat the solution while treating with 20% sulfuric acid until it becomes clear. After few minute fatty acids appear on surface. Add 7gm wax in solution (denoted as x). Cool the solution and heat again. Cake will be formed which is separate and weight. [23, 24]

$$\% \text{ Fatty Matter} = (a - x)/\text{Weight of soap sample} \times 100$$

Where, M= weight of soap a = weight of cake x=weight of wax

3.10 Anti-bacterial test and anti-acne test

The anti-bacterial and anti-acne activity was performed by using agar well diffusion method.



The activity performed against the bacterium *E. Coli* and *P. Acne*. The activity is estimated by comparing the zone of inhibition of growth of sensitive micro-organism produced by known concentration of the extract to be examined against reference standard. 2ml culture suspension of both strains inoculate separately into 200 ml sterile molten and cooled medium. 15-20 ml of sterile agar medium is poured into sterile petri plate. After the hardening of the medium make ensure that layer of medium is uniform in thickness. Make 4-5 cup on each agar plate by using 6mm SS borer. 5mg/ml and 10mg/ml sample is added into cup. Streptomycin 1mg/ml is used as standard and one cup used as control by using DMSO. Leave the plate standing for 15-20min at 2-8 °C further incubate them for about 24-48 hour at the temperature 30-35°C for bacteria. After completion of incubation accurately measure the diameter of areas of circular inhibition zones. [25]

3.11 Stability study

Stability tests were carried out on the soap. The soap was stored for one month at room temperature and 4±2 °C in the refrigerator. Physical appearance and cleaning effect were all assessed on the samples. [26]

4.0 RESULT AND DISCUSSION

4.1 Organoleptic Characteristics

The prepared herbal soap was evaluated for its physical attributes using organoleptic (sensory) assessment. The observations are summarized below:

Table 2:- Result of organoleptic properties

Test	Observation
Colour	Greenish brown
Odour	Pleasant, jasmine-like fragrance
Shape	Leaf-shaped mold

4.2 Greasiness:

In addition to its antimicrobial and anti-acne effects, the prepared herbal soap was found to be non-greasy upon application, addressing a common concern associated with both synthetic and some herbal formulations. The absence of greasiness enhances user comfort and supports the soap's suitability for oily and acne-prone skin types, thereby contributing to improved compliance and satisfaction in regular skincare routines.

4.3 Washability:

The washability of a topical formulation is an important parameter that influences user satisfaction and ease of use, especially for daily personal care products like soap. The formulated herbal soap containing *Jasminum sambac* extract was evaluated for its washability using both hot and cold water. It was observed that the soap exhibited excellent washability. It rinsed off easily without leaving behind any residue or greasy film on the skin. This property was consistent in both hot and cold water conditions, indicating that the formulation is suitable for use in varying climates and household water temperatures. [27]

4.4 Moisture Content

The moisture content of the prepared herbal soap was evaluated using the gravimetric method by heating the sample and recording the gradual weight loss over time. The process was conducted using a pre-weighed empty porcelain dish. The soap sample was subjected to heat, and weight was recorded at regular 5-minute intervals after the initial 30 minutes. The reduction in weight corresponds to the loss of moisture content. [28]

Table 3 Weight Observations of herbal soap

Time (min)	Weight (g)
30	142.63
35	142.11
40	141.65



45	141.00
50	140.75
55	139.55
60	139.25
65	139.06

The final constant weight was reached at 139.06 g, indicating complete moisture loss.

- **Final weight of dried sample:** 139.06 g – 116.33 g = 22.73 g
- **Moisture lost:** 27.85 g – 22.73 g = 5.12 g

Moisture content = (Initial weight - final weight) / Final weight

$$= (144.18 - 139.06) / 139.06 \times 100$$

$$= 3.68\%$$



Figure 1:- Moisture content

4.5 pH Determination

The pH value of 9.46 indicates that the soap is mildly alkaline, which is typical for most natural and handmade soap formulations. This alkalinity is beneficial for cleansing the skin effectively by removing excess oil and dirt. However, it remains within a safe range for topical application and does not pose a risk of significant skin irritation. The slightly alkaline pH may also contribute to the soap's antimicrobial activity, making it suitable for acne-prone skin. Overall, the pH of the formulation supports its intended purpose as a cleansing and anti-acne herbal soap.[29]



Figure 2. pH determination

4.6 Foaming ability test:

The present study includes the evaluation of the foaming capacity of the formulated Jasminum sambac-based herbal soap as one of its key physicochemical parameters. The soap demonstrated sufficient foaming ability, with a recorded foam height of 5 cm, indicating good surfactant action and effective cleansing potential. Importantly, this level of foam was achieved without the use of synthetic foaming agents, aligning with the formulation's natural and skin-friendly focus.



Figure 3. Foam height

4.7 Determination of Saponification value:

The calculated saponification value was 56.1, which falls within an acceptable range for herbal

and handcrafted soap formulations. This indicates a balanced composition of fatty acids in the soap base, contributing to desirable qualities such as lather formation, cleansing efficiency, and skin conditioning.

B =blank

A= sample reading

W = Weight of soap

$$\begin{aligned}\text{Saponification value} &= (b-a) \times 28.056 / W \\ &= (50-46) \times 28.056 / 2 \\ &= 56.1\end{aligned}$$

4.8 Determination of total fatty matter in the soap

The Total Fatty Matter content of the formulated herbal soap was found to be 79.75%, which is

considered high and desirable for skincare applications. This indicates that the soap is rich in fatty acids, offering improved emollient and moisturizing properties. Such a value reflects the soap's potential to be gentle on the skin, making it suitable for daily use, especially for individuals with sensitive or acne-prone skin. [30,31]

4.9 Anti-bacterial and Anti-acne Activity

The formulated *Jasminum sambac*-based herbal soap was evaluated for its antimicrobial efficacy using the agar well diffusion method. The test was conducted against two common acne-causing bacteria: *Escherichia coli* and *Propionibacterium acnes* (*P. Acnes*), and the results were compared with a standard antibiotic (Streptomycin).

Table 4 Summary of zone of inhibition

Sr. No.	Sample	Concentration	Zone of Inhibition (mm) <i>E. Coli</i>	Zone of Inhibition (mm) <i>P. Acnes</i>
1	Control	—	—	—
2	Standard (Streptomycin)	1 mg/ml	32	36
3	Soap Sample RS-01	5 mg/ml	2	1
		10 mg/ml	12	5

The herbal soap sample (RS-01) demonstrated dose-dependent antibacterial activity, with a greater zone of inhibition observed at 10 mg/ml compared to 5 mg/ml against both test organisms. At 10 mg/ml, the soap exhibited:

- A 12 mm zone of inhibition against *E. Coli*
- A 5 mm zone of inhibition against *P. Acnes*

While the standard antibiotic Streptomycin showed higher inhibition zones (32 mm for *E. Coli* and 36 mm for *P. Acnes*), the soap's activity is considered sufficient for topical use, especially as a natural formulation without synthetic antibiotics. These findings suggest that *Jasminum sambac*

extract possesses modest but effective antibacterial and anti-acne properties, supporting its inclusion in skincare formulations aimed at controlling acne-causing bacteria. [32,33]





Figure 4. Anti-bacterial and anti-acne activity

4.10 Stability Study

A preliminary one-month stability study was conducted to evaluate the physical and chemical stability of the formulated *Jasminum sambac* herbal soap under normal storage conditions.[34,35]

Table 5 - Observations after One Month

Parameter	Observation
Colour	Greenish brown
Odour	Pleasant, jasmine-like
Appearance	Good (no cracks or separation)
Ph	8.0

CONCLUSION

The present study successfully formulated and evaluated an anti-acne herbal soap using leaf extract of *Jasminum sambac*, highlighting its potential as a safe, effective, and eco-friendly alternative to conventional chemical-based acne treatments. The formulation was developed with a focus on incorporating natural plant-based ingredients that offer both therapeutic and cosmetic benefits. Comprehensive evaluation of the soap was carried out through a series of physicochemical and microbiological parameters. The soap characterization included organoleptic assessment, moisture content, ph determination, foaming ability, foam retention, solubility, and total fatty matter (TFM) all of which demonstrated favorable results. Notably, the ph (9.46 initially, reducing to 8.0 after one month) was within an acceptable range for skin products, ensuring safe

and effective cleansing without irritation. The irritancy test confirmed that the herbal soap was non-irritating and suitable for regular use, supporting its claim as a skin-safe product. The washability was found to be excellent with both hot and cold water, and the non-greasy feel enhanced user experience. The foaming ability, with a recorded foam height of 5 cm, indicated good surfactant performance, while the moisture content and TFM (79.75%) values reflected the soap's quality and emollient properties. Moreover, the in-vitro antimicrobial studies revealed that the herbal soap possesses anti-bacterial and anti-acne activity, especially at higher concentrations, suggesting its effectiveness against acne-causing microorganisms such as *Escherichia coli* and *Propionibacterium acnes*.

CONFLICT OF INTEREST

There is no conflict of interest.

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