A Novel *Abrus precatorius* (Gunja) plant Seed Powder-Based Cosmeceutical Cream for Acne Management

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Abstract

Acne vulgaris is a widespread inflammatory disorder of the skin primarily associated with bacterial involvement. Medicinal plants have been utilized for centuries in traditional systems of medicine such as Ayurveda, Siddha, and Homeopathy. In recent years, plant-based therapies have gained substantial recognition for their promising role in managing acne as well as their growing significance in promoting overall human health and treating various diseases.Their usage continues to increase due to their perceived quality, efficacy, and safety. The present study focuses on the development of a novel cream formulation (oil-in-water type) containing a detoxified extract (Gunja shodhana) of *Abrus precatorius* seed. Two formulations were prepared: F1, which contained purified *Abrus* seed powder, and F2, which served as the control and did not include the seed powder. The cream was formulated using excipients such as purified *Abrus* seed powder, beeswax, xanthan gum, glycerin, jojoba oil, vitamin E, and Euxyl PE 9010.The prepared creams were evaluated for various pharmaceutical parameters, including color, odor, consistency, stability, pH, phase separation, spreadability, washability, after-feel, irritancy, antimicrobial activity against the Gram-positive bacterium *Staphylococcus aureus*, shelf life, and storage stability. Both formulations exhibited satisfactory results with an appealing white color, smooth consistency, pleasant odor, and semi-solid nature. The pH values of F1 and F2 were found to be 6 and 7, respectively, which are suitable for topical application. The spreadability of F1 and F2 was recorded as 14.25 g cm/s and 13.06 g cm/s, respectively. No phase separation was observed in either formulation, and both were easily washable with tap water. The after-feel evaluation indicated that the creams were non-irritating, non-greasy, and stable without any separation. Antimicrobial studies revealed that formulation F1 exhibited effective activity against *S. aureus*, whereas F2 showed no significant antibacterial effect.

Keywords: Acne vulgaris, Abrus precatorius, Cream formulation, Pharmaceutical parameters, Antimicrobial activity, Staphylococcus aureus.

Introduction

Acne is a common skin condition that affects millions of people worldwide, although its severity varies significantly among individuals. Multiple factors contribute to its development, with genetics playing a primary role. Other important contributors include stress, which can directly influence the skin due to the strong connection between the brain and the skin. Acne is also a hormonally driven condition; imbalances such as those seen in Polycystic Ovary Syndrome can increase sebum production and alter estrogen and testosterone levels, thereby worsening acne. Metabolic and endocrine disorders, including prediabetes and thyroid dysfunction, may further promote its occurrence. The frequent use of chemically formulated cosmetic products, particularly fairness creams containing low doses of steroids, can clog pores and lead to acne formation. In addition, diets high in insulin-stimulating foods may trigger or aggravate breakouts. Certain medications, such as long-term oral corticosteroids, lithium, and anti-tuberculosis drugs, are also known to induce acne. Therefore, early and appropriate treatment is essential to prevent disease progression. The earliest stage of acne, referred to as Comedogenic sacne, is characterized by the presence of blackheads and whiteheads (Kameswararao et al., 2019). Human skin functions as an external barrier while accommodating a diverse commensal microbial community, or microbiota that is intrinsically associated with skin health. Among the predominant genera are *Corynebacterium*, *Propionibacterium*, *Streptococcus*, *Malassezia*, and *Staphylococcus*. Disruption in the equilibrium of these natural microbial populations has been associated with skin disorders, including acne. Culture-based and metagenomic studies show that propionibacteria are predominant in sebaceous areas, whereas staphylococci and corynebacteria are mainly present in humid regions (Findley et al., 2013; Oh et al., 2014; Grice and Segre, 2011). In the

pharmaceutical field, a wide range of drug delivery approaches has been developed to facilitate the targeted administration of therapeutic agents to specific sites within the body. Several critical factors must be considered when selecting an appropriate delivery system. Among these, cream-based topical formulations are regarded as highly effective for dermal application. Topical drug delivery systems involve the direct application of medicated formulations onto the skin for the management of various dermatological conditions. They are commonly employed in the treatment of skin infections, blisters, and acne-related disorders. Compared with other delivery approaches, topical systems provide notable benefits, including enhanced therapeutic efficacy, reduced systemic toxicity, and improved patient compliance (Swetha et al., 2022).

The growing interest in herbal cosmetics is driven by the introduction of novel natural ingredients, the economic benefits associated with successful product development, and the need to uphold high-quality standards. Cosmetics are substances applied to the body for care and enhancement, with face creams commonly used to promote skin softness and cleansing. The Ayurvedic system of medicine is one of the most significant traditional approaches, utilizing plant-based materials and extracts for the treatment and management of various disease conditions (Gupta et al., 2024).

Abrus precatorius is a well-known medicinal plant in India, traditionally utilized in Ayurvedic and indigenous systems of medicine (Kuber et al., 2019). Various parts of the plant, including the roots, stems, leaves, and seeds, have been reported to exhibit a wide range of pharmacological activities, such as antibacterial, antifertility, antitumor, anti-inflammatory, and antimicrobial effects (Ross, 2005; Zore et al., 2007; Ghosh and Maiti, 2007; Adelowotan, 2008; Georgewill and Georgewill, 2009). In Ayurveda, *Abrus* seeds are regarded as toxic and therefore undergo a purification process called *Sodhana*, which is believed to improve their therapeutic effectiveness and potency (Bobbarala and Vadlapudi, 2009). Traditionally, the seed paste is applied topically for the treatment of alopecia and various skin disorders (Shingadiya et al., 2017).

Traditionally, jojoba oil has been employed for numerous medicinal purposes, including the management of cancer-related conditions, enhancement of liver function, relief of urinary disorders, strengthening of immune response, stimulation of hair growth, and support in weight reduction. Numerous pharmacological and biological investigations on jojoba oil and its derivatives have demonstrated a broad spectrum of therapeutic activities following topical application. These biological effects are believed to be associated with the distinctive chemical composition of its wax esters. The major pharmacological properties of jojoba oil include antioxidant, hepatoprotective, anti-inflammatory, anti-acne, antiviral, antimicrobial, antipyretic, antipsoriatic, and antihyperglycemic activities (Gad et al., 2021). Owing to its unique physicochemical characteristics, jojoba oil has gained considerable importance across multiple industries, including pharmaceuticals, cosmetics, thermal insulation materials, high-pressure lubricants, foam suppressants, heating oils, fire-resistant agents, plasticizers, and transformer oils (Sanchez et al., 2016).

Herbs used in cosmetic formulations possess a wide range of properties, including antibacterial, antioxidant, and anti-inflammatory activities. Herbal products are generally considered to have fewer side effects compared to synthetic formulations. The primary objective of the present study was to formulate and evaluate a herbal anti-acne cream prepared from purified *Abrus* seeds.

Methodology

Gunja shodhana (purification method)

The purification procedure was conducted in accordance with the Ayurvedic method known as *Gunja Shodhana*, as outlined in the Ayurvedic Pharmacopoeia of India (2008), which is traditionally employed to eliminate toxic constituents from *Abrus precatorius* seeds. It is one of the classically approved methods in Ayurveda. 250g of seeds were kept in muslin cloth, which was tied into a pottali. The pottali was placed into the steel vessel, and freshly collected milk was added to the vessel. The milk should be used to immerse the pottali. During this process, the milk should be maintained at 100°C for three hours. 2.5 litres of milk were utilised in this process. After boiling, the seeds were taken out of the pottali and washed 5 – 6 times with warm water. The skin of the seed was removed shade dried. The dried seeds were pulverised and stored in an airtight glass container.

Formulation of purified *Abrus* seed powder infused acne cream

The cream formulation was prepared using purified *Abrus* seed powder as the herbal ingredient. Beeswax, glycerine, xanthan gum, jojoba oil, Emulsifier, and Euxyl PE 9010 were incorporated into the formulation.

Preparation of ointment base

Oil in water (O/W) emulsion-based cream (semisolid formulation) was formulated. The ointment base was prepared by dispersing xanthan gum in distilled water with glycerin to form the aqueous phase, while beeswax, the emulsifier, and oil were melted together to form the oil phase and heated to 75 °C. The oil phase was then slowly incorporated into the aqueous phase with continuous stirring to obtain a uniform cream. The formula for the base is given in Table 1 (Sharma and Prasar, 2013; Swetha et al., 2022).

Table 1 Formula for the base

S.NO	INGREDIENTS	AMOUNT
1	Bee wax	1g
2	Emulsifier	3g

3	Xanthan gum	0.3
4	Glycerin	6g
5	Distilled water	60ml
6	Oil	16ml

Cream formulation

After selecting suitable base ingredients, two different cream formulations were prepared. In Formulation 1, the purified *Abrus* seed powder was incorporated and designated as F1. In Formulation 2, no powder was added, and it was used as the control formulation F2. The ingredients for formula 1 and formula 2 are tabulated in Table 2 and Table 3.

Preparation of formula 1 (F1) cream

For the aqueous phase, glycerin and xanthan gum were mixed together and added to distilled water, and the beaker was sealed with silver foil. For the oil phase, beeswax, the emulsifier, and oil were taken in a separate container. Both containers were placed in a double-boiling water bath at 70 °C. Once the oil phase had completely melted, the aqueous phase was slowly added to the oil phase and mixed thoroughly using an electric beater. After mixing, the cream base was allowed to cool, and the temperature was monitored using a thermometer. When the temperature reached 40 °C, the purified *Abrus* seed powder, vitamin E, and preservative were added and mixed well using an electric beater. The prepared cream was then stored in airtight containers for further analysis.

Table 2: The Ingredients of formula 1 (F1) cream

S.NO	INGREDIENTS	AMOUNT
1	Bee wax	1g
2	Emulsifier	3g
3	Xanthan gum	0.3
4	Glycerin	6g
5	Distilled water	60ml
6	Jojoba Oil	16ml
7	Purified *Abrus* seed powder	0.5 g
8	Vitamin E	0.2 g
9	Exuyl PE 9010	1 g

Preparation of control cream

For the aqueous phase, glycerin and xanthan gum were mixed together and added to distilled water and the beaker was sealed with silver foil. For the oil phase, beeswax, the emulsifier, and oil were taken in a separate container. Both containers were placed in a double-boiling water bath at 70 °C. Once the oil phase had completely melted, the aqueous phase was slowly added to the oil phase and mixed thoroughly using an electric beater. After mixing, the cream base was allowed to cool, and the temperature was monitored using a thermometer. When the temperature reached 40 °C, vitamin E, and preservative were added and mixed well using an electric beater. The prepared cream was then stored in airtight containers for further analysis.

Table 3: The Ingredients of control (F2) cream

S.NO	INGREDIENTS	AMOUNT
1	Bee wax	1g
2	Emulsifier	3g
3	Xanthan gum	0.3
4	Glycerin	6g
5	Distilled water	60ml
6	Jojoba Oil	16ml
7	Vitamin E	0.2 g
8	Exuyl PE 9010	1 g

Evaluation of the formulated cream

Physical properties of cream
The formulated product was kept in sealed plastic containers until various parameters were analyzed. The physical evaluation of the cream was carried out based on parameters such as colour, odour, consistency, and formulation stability (Badwalk et al., 2022; Babu et al., 2022; Rajvanshi et al., 2011; Rahil et al., 2018).

Determination of pH
A quantity of 0.5 g of cream was dispersed in 15 ml distilled water, and the pH was determined using pH paper (Estefania et al., 2022).

Analysis of Phase separation
The prepared cream was stored in a tightly closed container at room temperature, protected from sunlight, and observed for 24 hours to detect any signs of phase separation (Babu et al., 2022).

Analysis of Spreadability
Spreadability is carried out for both formulations that is, F1and F2. The less time take for the separation of both the slide better the spreadability. Therefore according to statement F2 had better spreadability. In this procedure, 1 g amount of the cream was positioned between two clean glass slides. A predetermined weight was subsequently placed on the upper slide to apply uniform pressure, allowing the formulation to spread evenly. The duration required for the upper slide to travel a specified distance was measured using a stopwatch. The spreadability was then determined by considering the applied load, the distance covered, and the time elapsed.
Spreabability was calculated using the formula $S = M \times L / T$
Where, S = Spreadability (g·cm/sec), M = weight tied to upper slide (g), L = length of glass slides moved (cm), T = time taken to separate the slides (sec) (Sabale et al., 2011).

Analysis of Washability
Wash ability test was carried out by applying a small amount of cream on the hand and then washing it with help of tap water (Bhide and Nitave, 2016).

After feel test
Emolliency, slippery texture, and residual deposition following the application of a predetermined amount of cream were examined (Lukic et al., 2012).

Irritency test
This test was conducted to evaluate the safety of materials and substances on the skin surface. Initially, a specific area on the dorsal surface of the left hand was marked. The cream formulation was then applied to the designated area, and the exposure time was recorded (Navindgikar er al., 2020).

Analysis of Antimicrobial activity
The antibacterial efficacy of the Anti-acne cream containing *Abrus* seed powder and Anti-acne cream base were evaluated using the agar well diffusion method against the Gram-positive bacterium *S. aureus*. The bacterial culture was uniformly spread onto Mueller–Hinton Agar (MHA) plates to ensure even growth. Wells of 10 mm diameter were aseptically created in the solidified agar using a sterile well borer. These wells were then filled with the cream formulations (F1 and F2) at a concentration of 100 µg/mg. Streptomycin (5 mg/ µg) was used as the positive control, while distilled water served as the negative control. All plates were incubated at 37 °C for 24 hours. After incubation, antibacterial activity was assessed by measuring the diameter of the zones of inhibition surrounding each well (Pattewar et al., 2013).

Shelf-life and storage stability assessment of the formulated product
The prepared cream formulations were stored for a period of approximately two months to evaluate the development of mold, fungal contamination, or other microbial growth. Throughout the storage duration, any alterations in appearance, odor, phase separation, and texture were carefully monitored and documented. Observations were carried out under refrigerated conditions (8°C) as well as at room temperature over a 60-day storage period (Grimm, 1998).

Result & Disscussion
Evaluation of the cream
The cream was prepared with the optimised ingredients and was evaluated. Two types of cream were prepared. In Formulation 1, the purified *Abrus* seed powder was incorporated and designated as F1. In Formulation 2, no powder was added, and it was used as the control formulation F2.

Physical properties of cream
Physical evaluation is a key parameter in assessing the quality of a cream. Accordingly, physical examination of the formulations was carried out in this study. Table 4 and the corresponding figure 1 present the physical characteristics of

the Formula 1 and Control skin creams, including colour, odour, physical state, and consistency. The colour of both formulations was assessed by visual inspection and was found to range from white to milky white. The odour of both creams was pleasant. The physical state of both formulations was examined visually and confirmed to be semisolid. Consistency was evaluated by manual application of the creams on the hand, which demonstrated a smooth and uniform texture.

Figure1: Preparation of F1 and F2 cream formulations

Table 4: Evaluation of physical characteristics

CHARACTERISTIC	**FORMULA 1 (F1)**	CONTROL **(F2)**
Colour	White	Milky white
Odour	Pleasant	Pleasant
State	Semisolid	Semisolid
Consistency	Smooth	Smooth

pH of the cream

The pH of the cream base was found to be approximately 6, which is suitable for skin pH. The results were presented in **Figure 2. The formulated F1cream pH level was 6 and F2 (Control) cream pH level was 7.**

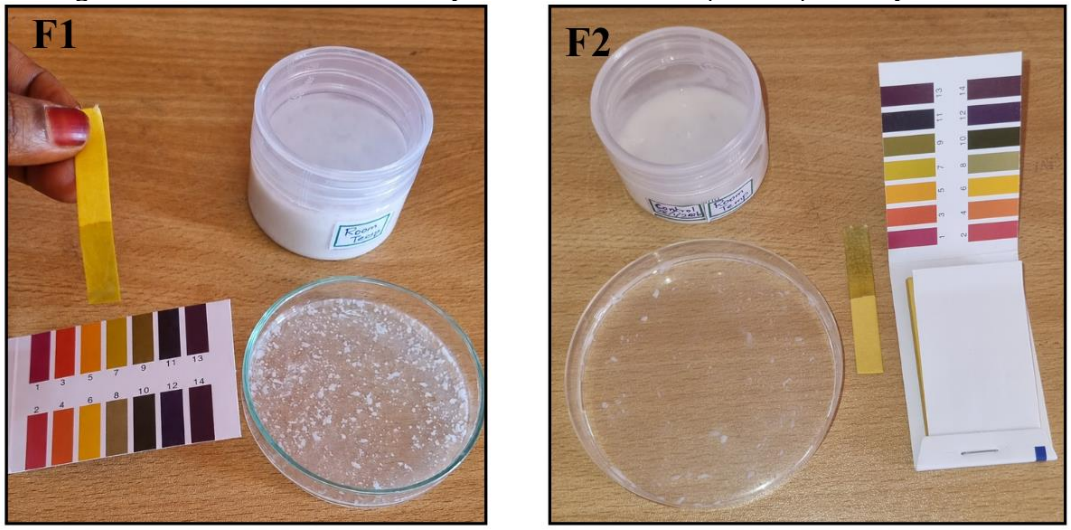

Figure 2: pH analysis of F1 and F2 cream formulations

Analysis of phase separation

The formulated cream was transferred into a suitable wide-mouthed container and kept under storage conditions. After 24 hours, the formulation was examined for any visible separation between the oil and aqueous phases and the results were shown in Table 5. Both F1 and the control formulation showed no evidence of phase separation, indicating

satisfactory physical stability and a well-maintained emulsion system. This suggested that the formulations had been properly prepared with good ingredient compatibility and were appropriate for topical use.

Table 5: Analysis of phase separation

S. No	Formulation	Phase Separation
1	F1	No phase separation
2	F2 (Control)	No phase separation

Analysis of spreadability test

The spreadability of the formulations was evaluated, and the results were presented in Table 6. A shorter separation time between the two slides indicated better spreadability. Formulation F1 exhibited a spreading time of 5.05 seconds and a spreadability value of 14.25 gcm/s. In contrast, F2 (control) showed a slightly longer spreading time of 5.88 seconds and a lower spreadability value of 13.06 gcm/s. Overall, F1 spread more rapidly and uniformly than the control, suggesting improved consistency and enhanced application properties.

Table 6: Analysis of spreadability test

S. No	Formulation	Spreadability values
1	F1	14.25g.cm/s
2	F2 (Control)	13.06g.cm/s

Analysis of washability test

Both formulations were applied to the skin, and the ease with which they could be washed off using water was evaluated and the results were tabulated in table 4.4. Easy washability indicated that the creams were non-greasy and not overly oily, making them comfortable for routine use. It reflected a well-balanced formulation, particularly between the oil and aqueous phases. This characteristic enhanced user acceptability, as easily removable products were generally preferred in cosmetic and pharmaceutical applications. It also suggested that the creams were less likely to leave residue or block pores, thereby improving skin compatibility.

Table 7: Analysis of washability test

S. No	Formulation	Phase Separation
1	F1	Easily washable
2	F2 (Control)	Easily washable

AFTER FEEL TEST

The observations were shown in the table 8. Both formulations were found to be satisfactory absorption, indicating effective skin penetration, a well-balanced composition, and enhanced efficacy along with improved comfort during application.

Table 8: After feel test

S. No	Formulation	After feel
1	F1	Good absorption
2	F2	Good absorption

Irritancy test

The active ingredients and excipients incorporated into the formulation did not produce any signs of redness, itching, swelling, or rashes at the site of application. The treated area was carefully monitored for a period of 24 hours to evaluate any delayed skin reactions. The observations recorded during this period were presented in the Table 9.

Table 9: Irritancy test

S. No	Formulation	After feel
1	F1	Non-irritancy
2	F2	Non-irritancy

Analysis of antimicrobial activity

The antimicrobial activity of the anti-acne cream formulations against *S. aureus* was evaluated using the agar well diffusion method. The formulation containing *Abrus* seed powder (F1) exhibited a distinct zone of inhibition around the

well (Figure 3), indicating significant antibacterial activity against the Gram-positive bacterium *S. aureus*. The control formulation (F2) showed no noticeable inhibitory zone, suggesting the absence of antimicrobial activity. The positive control (PC), Streptomycin, produced the largest zone of inhibition, demonstrating superior antibacterial effectiveness. These observations confirmed that the formulated anti-acne cream containing *Abrus* seed powder possessed considerable inhibitory activity against acne-causing bacteria.

Table 10 presents the zone of inhibition of anti-acne cream formulations against acne-causing microorganisms. The formulation containing *Abrus* seed powder (F1) exhibited antimicrobial activity against *S. aureus*, producing a zone of inhibition of 23 mm. In contrast, the control formulation (F2) showed no inhibitory effect against the tested microorganism. The positive control, Streptomycin, demonstrated the highest antimicrobial activity with a zone of inhibition of 36 mm. These findings indicated that the anti-acne cream containing *Abrus* seed powder possessed considerable antibacterial activity against *S. aureus*.

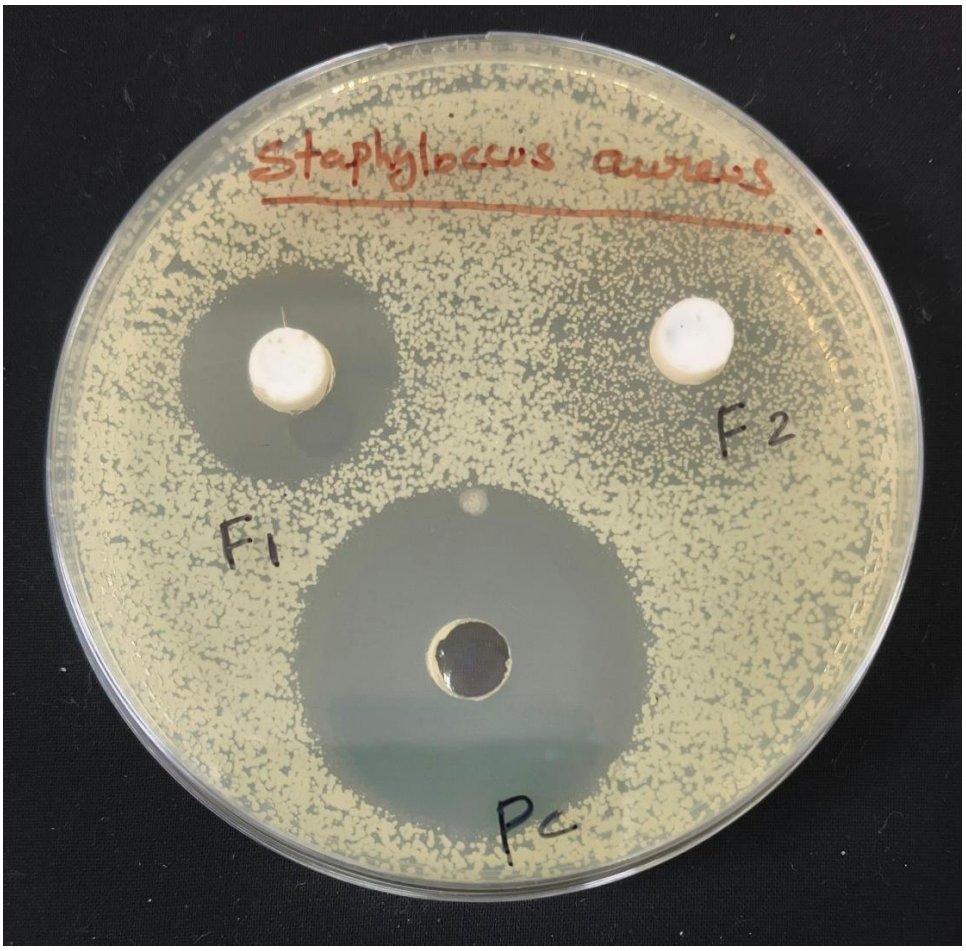

Figure 3: Zone of inhibition of anti-acne creams against *S.aureus*

Table 10: Zone of Inhibition of Anti-acne cream F1 & F2 against acne causing microorganisms.

Microorganism	Anti-acne cream containing *Abrus* seed powder (F1)	Control (F2)	Positive control Streptomycin
S. aureus	23 mm	--	36 mm

Analysis of stability test

The stability study of the cream formulation conducted over 60 days under both room temperature and refrigerated conditions (8°C) demonstrated consistent and satisfactory results. The findings were presented in Table 11. The color of the formulation remained unchanged throughout the study period in both storage environments, indicating good physical stability. The odor was reported as pleasant at all time intervals, suggesting no degradation or development of off-smells. No phase separation was observed during the entire duration, confirming the emulsion stability of the cream. Additionally, the spreadability of the formulation was consistently rated as good, ensuring ease of application. The irritation test results showed the formulation to be non-irritant under both conditions, highlighting its safety for topical use. Overall, the findings indicated that the cream formulation remained stable, effective, and safe throughout the 60-day storage period.

Table 11: stability study of cream formulation under different storage conditions (60 days)

PARAMETERS	STORAGE CONDITION	DAY 0	DAY 15	DAY 30	DAY 45	DAY 60
Color	Room Temperature	No change	No change	No change	No change	No change
	Refrigerator At 8 °C	No change	No change	No change	No change	No change
Odor	Room Temperature	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
	Refrigerator At 8 °C	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
Phase separation	Room Temperature	Absent	Absent	Absent	Absent	Absent
	Refrigerator At 8 °C	Absent	Absent	Absent	Absent	Absent
Spreadablility	Room Temperature	Good	Good	Good	Good	Good
	Refrigerator At 8 °C	Good	Good	Good	Good	Good
Irritation test	Room Temperature	Non-irritant	Non-irritant	Non-irritant	Non-irritant	Non-irritant
	Refrigerator At 8 °C	Non-irritant	Non-irritant	Non-irritant	Non-irritant	Non-irritant

Conclusion

A large segment of the population in developing countries still relies on herbal medicines for healthcare, and due to increasing scientific interest in their therapeutic benefits, extensive research is currently being undertaken in this area. In conclusion, the developed oil-in-water cream formulation containing detoxified *A. precatorius* seed extract demonstrated favorable pharmaceutical and physicochemical characteristics suitable for topical application. Both formulations exhibited acceptable stability, spreadability, washability, non-irritant nature, and aesthetic properties. The formulation incorporated with purified *Abrus* seed powder (F1) showed promising antimicrobial activity against *S. aureus*, indicating its potential effectiveness in the management of acne vulgaris. These findings suggest that the formulated herbal cream may serve as a safe, stable, and effective natural alternative for acne treatment and skin care applications.

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Conflict of Interest
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contributions
All authors contributed to the Conceptualization and designing of the study. **R. Kavitha:** Methodology, Data curation, and Writing- Original draft preparation, **J. Merrylin:** Investigation, Supervision, and Validation, **Lighty George:** Reviewing and Editing.