Formulation and Evaluation of Aloe Vera and Neem Cream for Skin Infections

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Abstract- Skin infections are common dermatological disorders caused mainly by bacteria and fungi, leading to symptoms such as itching, redness, inflammation, pain, and discomfort. The excessive use of synthetic topical preparations often results in adverse effects including skin irritation, allergic reactions, and microbial resistance. Therefore, there is an increasing demand for herbal formulations that are safe, economical, and effective. Aloe vera and Neem (*Azadirachta indica*) are well-known medicinal plants traditionally used for the treatment of skin disorders. Aloe vera exhibits wound healing and moisturizing properties, whereas Neem possesses strong antibacterial and antifungal activity.

The present study was aimed to formulate and evaluate a herbal cream containing Aloe vera and Neem extracts for skin infections. The cream was prepared using the oil-in-water emulsification technique and evaluated for physicochemical parameters such as pH, viscosity, spreadability, homogeneity, washability, skin irritation, and stability. Antimicrobial activity was evaluated using the agar well diffusion method against *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. The formulated cream showed acceptable physical properties, good stability, and significant antimicrobial activity. The study concludes that Aloe vera and Neem based herbal cream can be considered a safe and effective alternative for the management of skin infections.

Keywords- Aloe vera, Neem, Herbal cream, Skin infections, Antimicrobial activity, Topical formulation

I. INTRODUCTION

Skin infections are among the most prevalent health problems affecting people of all age groups worldwide. These infections occur when pathogenic microorganisms invade the skin through cuts, wounds, or damaged tissues [1]. Bacterial and fungal infections are the most common forms of skin infections and are mainly caused by organisms such as *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans* [2]. The symptoms include redness, itching, swelling, burning sensation, pus formation, and pain [3].

The skin is the largest organ of the human body and acts as a protective barrier against external harmful agents. It also plays a vital role in regulating body temperature and preventing excessive water loss [4]. Any damage to the skin due to infections can disturb these essential functions and negatively affect overall health.

Synthetic topical formulations such as antibiotics, antifungal agents, and corticosteroids are commonly prescribed for skin infections. However, prolonged and indiscriminate use of these drugs may lead to adverse effects such as skin irritation, allergic reactions, and microbial resistance [5]. These limitations have encouraged researchers to explore herbal medicines as alternative therapeutic options.

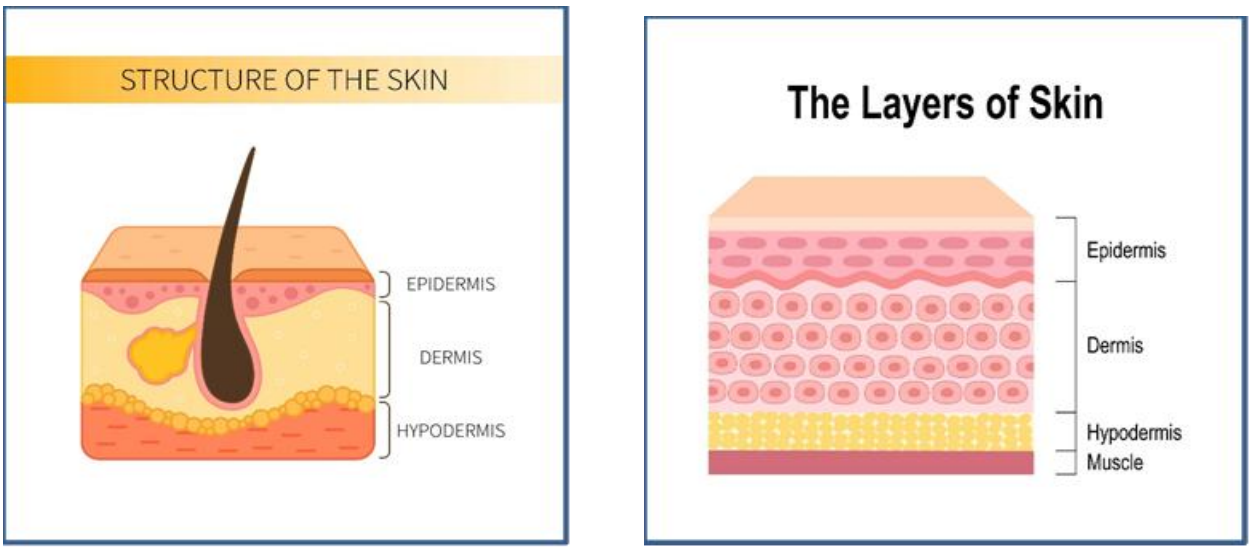


Figure 1: Structure of human skin

Herbal medicines have been used since ancient times for the treatment of various diseases and are widely accepted due to their safety, low cost, and minimal side effects [6]. Medicinal plants contain bioactive compounds that exhibit antimicrobial, anti-inflammatory, antioxidant, and wound healing properties.

Aloe vera is one of the most widely used medicinal plants in traditional medicine. It contains bioactive compounds such as polysaccharides, glycoproteins, vitamins, enzymes, and amino acids, which contribute to its antimicrobial, anti-inflammatory, moisturizing, and wound healing effects [7]. Aloe vera is extensively used in cosmetic and pharmaceutical products for skin care.

Neem (*Azadirachta indica*) is another important medicinal plant with remarkable therapeutic properties. Neem leaves contain various phytochemicals such as nimbin, azadirachtin, quercetin, flavonoids, and tannins, which exhibit strong antibacterial, antifungal, antiviral, and anti-inflammatory activities [8]. Neem is traditionally used in the treatment of acne, eczema, ulcers, and skin infections.

The combination of Aloe vera and Neem in a topical cream formulation may provide synergistic antimicrobial and healing effects. Therefore, the present study was undertaken to formulate and evaluate a herbal cream containing Aloe vera and Neem extracts for the treatment of skin infections.

Figure 2: Aloe vera plant and Neem plant

II. AIM OF THE STUDY

To formulate and evaluate a herbal cream containing Aloe vera and Neem extracts for skin infections.

III. OBJECTIVES OF THE STUDY

1. To collect and authenticate Aloe vera and Neem leaves.
2. To prepare plant extracts using suitable solvents.
3. To formulate a herbal cream using the prepared extracts.
4. To evaluate the cream for physicochemical parameters.
5. To study the antimicrobial activity of the formulated cream.
6. To perform stability studies.

IV. REVIEW OF LITERATURE

The literature review provides a detailed understanding of the previous scientific work carried out on Aloe vera and Neem in relation to skin infections and herbal topical formulations. Several researchers have investigated the antimicrobial, anti-inflammatory, and wound healing properties of these medicinal plants.

Aloe vera has been widely studied for its therapeutic potential in dermatological applications. Surjushe et al. reported that Aloe vera contains polysaccharides and glycoproteins which promote wound healing and exhibit anti-inflammatory effects [9]. The authors also stated that Aloe vera gel helps in maintaining skin moisture and improves epithelial regeneration. Sharma et al. evaluated the wound healing potential of Aloe vera gel in experimental models and observed faster tissue repair and reduced inflammation compared to control groups [10].

Neem (*Azadirachta indica*) has also gained significant attention due to its strong antimicrobial properties. Biswas et al. reviewed the biological activities of Neem and concluded that Neem exhibits broad-spectrum antibacterial and antifungal activity against several pathogenic microorganisms [11]. Patel et al. studied the antimicrobial activity of Neem leaf extract and reported significant inhibition against *Staphylococcus aureus* and *Escherichia coli*, indicating its effectiveness in treating skin infections [12].

Singh et al. formulated a herbal cream containing Aloe vera and Neem extracts and evaluated its antimicrobial activity. The study reported good skin compatibility and significant inhibition of bacterial growth, suggesting that the combination of these two plants provides synergistic therapeutic effects [13]. Rao et al. conducted a comparative study on Aloe vera and Neem extracts and found that the combined formulation showed better antimicrobial and wound healing activity than individual extracts [14].

Gupta and Sharma reviewed various herbal remedies for dermatological disorders and highlighted that plant-based topical formulations are safer and more effective than synthetic drugs due to their minimal side effects [15]. Chanda and Rakholiya evaluated the antimicrobial activity of several medicinal plants and concluded that Aloe vera and Neem are among the most potent herbal agents for skin infections [16].

These studies clearly demonstrate that Aloe vera and Neem possess significant antimicrobial and wound healing properties. However, limited experimental studies are available on the formulation and evaluation of combined Aloe vera and Neem-based herbal creams using standardized evaluation parameters. Therefore, the present study was undertaken to scientifically formulate and evaluate a herbal cream containing Aloe vera and Neem extracts for skin infections.

Sr. No.	Author	Year	Plant Used	Major Findings
1	Surjushe et al.	2008	Aloe vera	Wound healing and anti-inflammatory
2	Sharma et al.	2019	Aloe vera	Faster tissue regeneration
3	Biswas et al.	2002	Neem	Broad-spectrum antimicrobial
4	Patel et al.	2020	Neem	Inhibition of skin pathogens
5	Singh et al.	2021	Aloe + Neem	Effective herbal cream
6	Rao et al.	2021	Aloe + Neem	Better combined activity
7	Gupta & Sharma	2015	Herbal plants	Safer topical formulations

8	Chanda & Rakholiya	2016	Multiple plants	Strong antimicrobial effect

Table 1: Summary of Previous Studies on Aloe vera and Neem

Plant Used	Major Findings
Aloe vera	Wound healing and anti-inflammatory
Aloe vera	Faster tissue regeneration
Neem	Broad-spectrum antimicrobial
Neem	Inhibition of skin pathogens
Aloe + Neem	Effective herbal cream
Aloe + Neem	Better combined activity
Herbal plants	Safer topical formulations
Multiple plants	Strong antimicrobial effect

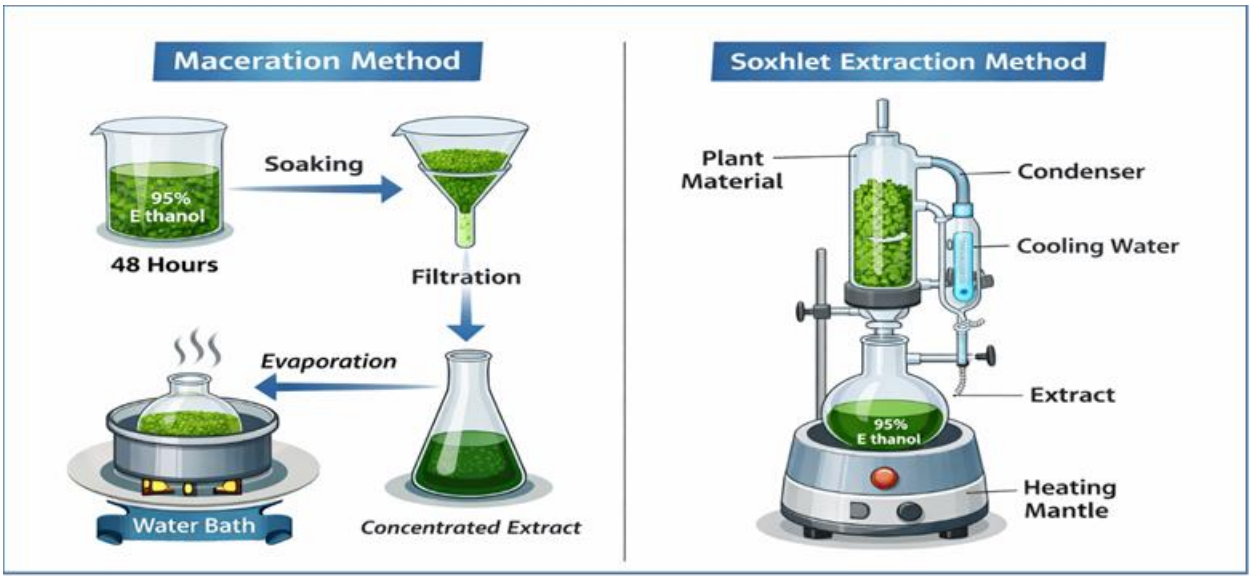


Figure 3: Therapeutic applications of Aloe vera and Neem in skin disorders

V. MATERIALS AND METHODS

3.1 Materials Required

Fresh Aloe vera leaves, fresh Neem leaves, stearic acid, cetyl alcohol, glycerin, methyl paraben, propyl paraben, potassium hydroxide (KOH), distilled water, ethanol (95%), nutrient agar medium, Mueller Hinton agar, Petri dishes, test tubes, beakers, conical flasks, measuring cylinders, centrifuge, water bath, incubator, pH meter, viscometer, glass slides, micropipettes, and analytical balance were used in the present study [17].

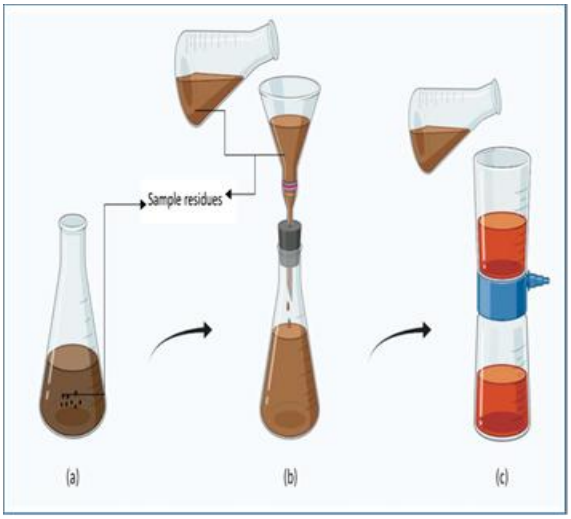
3.2 Collection and Authentication of Plant Material

Fresh Aloe vera and Neem leaves were collected from the local area of Shevgaon, District Ahilyanagar, Maharashtra, India. The collected plant materials were washed thoroughly with distilled water to remove dust and impurities. The plants were authenticated by the Department of Pharmacognosy. The leaves were shade dried at room temperature for 5–7 days and then powdered using a mechanical grinder [18].

Figure 4: Collected Aloe vera leaves and Neem leaves

3.3 Preparation of Plant Extracts

The dried powdered leaves of Aloe vera and Neem were subjected to solvent extraction by maceration method. About 50 g of each powdered material was soaked separately in 250 ml of ethanol (95%) for 48 hours with occasional shaking. The mixtures were filtered using Whatman filter paper and the filtrates were concentrated using a water bath. The extracts were stored in airtight containers at 4°C for further use [19].



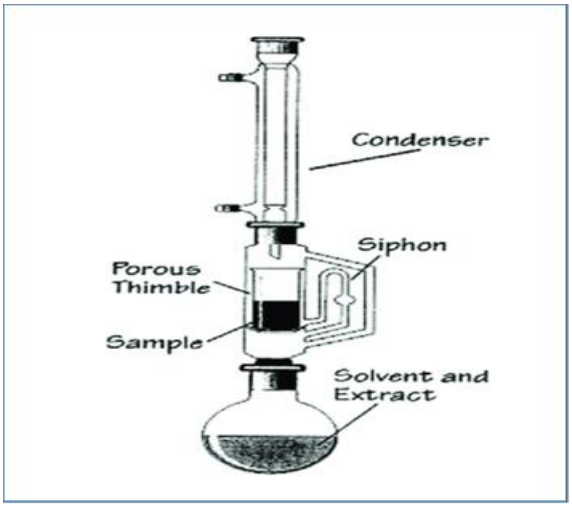


Figure 5: Extraction process of Aloe vera and Neem

3.4 Formulation of Herbal Cream

The herbal cream was prepared using the oil-in-water (O/W) emulsification method. The oil phase consisted of stearic acid and cetyl alcohol, while the aqueous phase contained glycerin, preservatives, plant extracts, and distilled water. Both phases were heated separately at 70°C and then mixed together with continuous stirring until a uniform cream was obtained. The prepared cream was allowed to cool and stored in a suitable container [20].

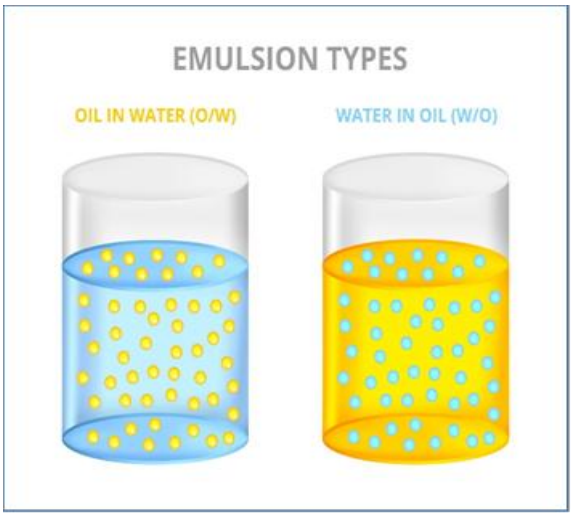


Figure 6: Flow chart of herbal cream formulation

3.5 Composition of Herbal Cream

Ingredient	Quantity	Function
Aloe vera extract	2 g	Wound healing
Neem extract	2 g	Antimicrobial
Stearic acid	5 g	Cream base
Cetyl alcohol	2 g	Emollient
Glycerin	3 ml	Moisturizer
Methyl paraben	0.2 g	Preservative
Propyl paraben	0.1 g	Preservative
Distilled water	q.s.	Vehicle

Table 2: Composition of Aloe vera and Neem Herbal Cream

3.6 Evaluation Parameters

The formulated herbal cream was evaluated for various physicochemical parameters including physical appearance, pH, viscosity, spreadability, homogeneity, washability, skin irritation, antimicrobial activity, and stability [21].

3.7 Determination of pH

The pH of the cream was measured using a digital pH meter. About 1 g of cream was dissolved in 10 ml of distilled water and the pH was recorded. The experiment was performed in triplicate and the average value was calculated [22].

3.8 Determination of Viscosity

The viscosity of the cream was determined using a Brookfield viscometer at room temperature. The readings were taken at different spindle speeds and the average value was noted [23].

3.9 Spreadability Test

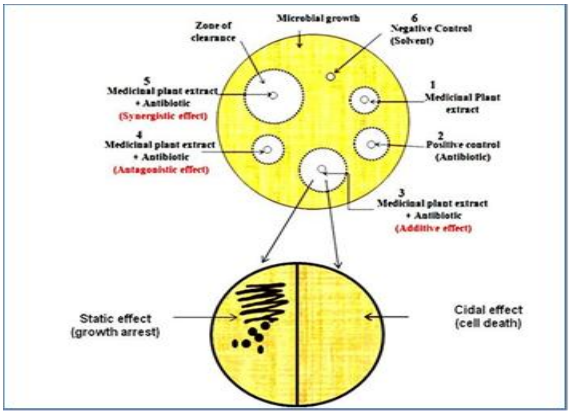
Spreadability was determined by placing a small quantity of cream between two glass slides and applying a known weight. The time taken for the slides to separate was recorded and spreadability was calculated using standard formula [24].

3.10 Skin Irritation Test

A small amount of cream was applied on a small area of skin of healthy volunteers and observed for 24 hours for any signs of redness, itching, or irritation [25].

3.11 Antimicrobial Activity

The antimicrobial activity of the herbal cream was evaluated using the agar well diffusion method against *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*. The zones of inhibition were measured after incubation at 37°C for 24 hours [26].



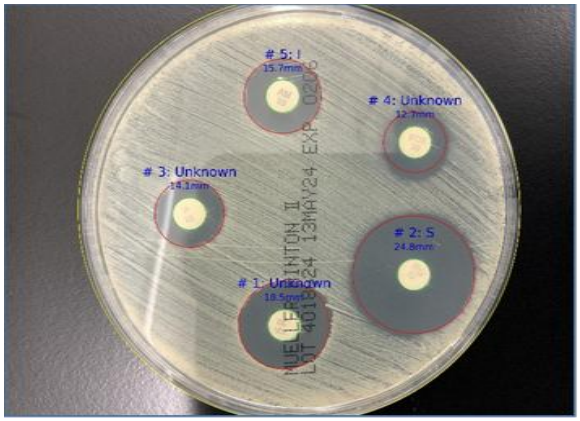


Figure 7: Agar well diffusion method for antimicrobial study

3.12 Stability Studies

The stability of the formulated cream was studied by storing it at room temperature for 30 days. The formulation was evaluated at regular intervals for changes in color, pH, phase separation, and consistency [27].

VI. RESULTS AND EVALUATION STUDIES

4.1 Physical Evaluation

The formulated Aloe vera and Neem herbal cream was evaluated for physical parameters such as color, odor, appearance, and consistency. The cream was found to be smooth, homogeneous, and white in color with a pleasant odor. No grittiness or phase separation was observed, indicating good formulation characteristics.

Parameter	Observation
Color	White
Odor	Pleasant
Appearance	Smooth
Consistency	Semi-solid
Homogeneity	Good
Phase separation	Absent

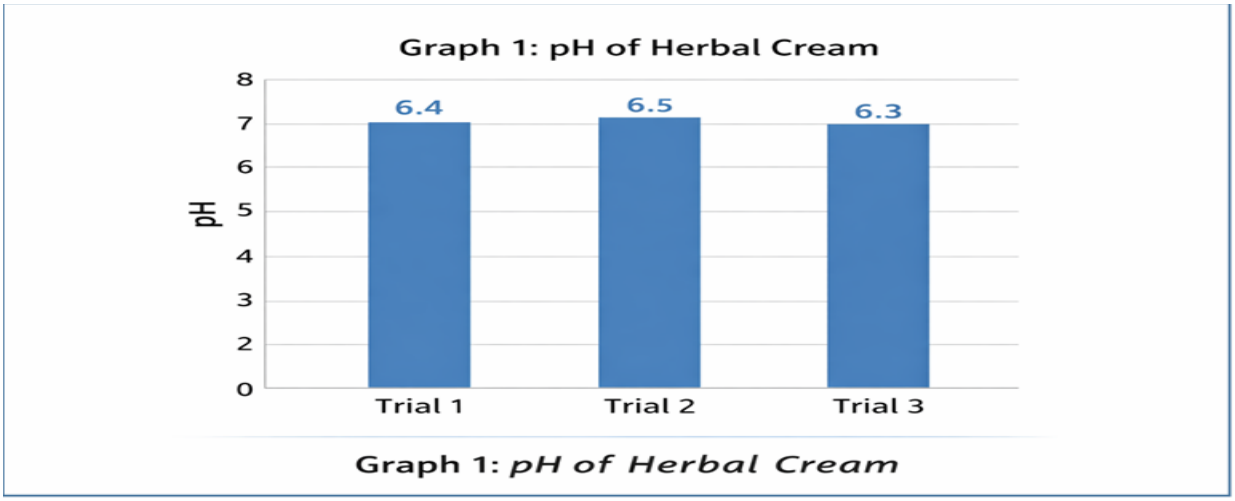
Table 3: Physical Characteristics of Herbal Cream

4.2 pH Determination

The pH of the herbal cream was measured using a digital pH meter. The experiment was performed in triplicate and the mean value was calculated. The pH was found to be within the acceptable range for topical application, indicating that the formulation is suitable for skin use.

Trial	pH Value
1	6.4
2	6.5
3	6.3
Mean ± SD	6.4 ± 0.10

Table 4: pH of Herbal Cream



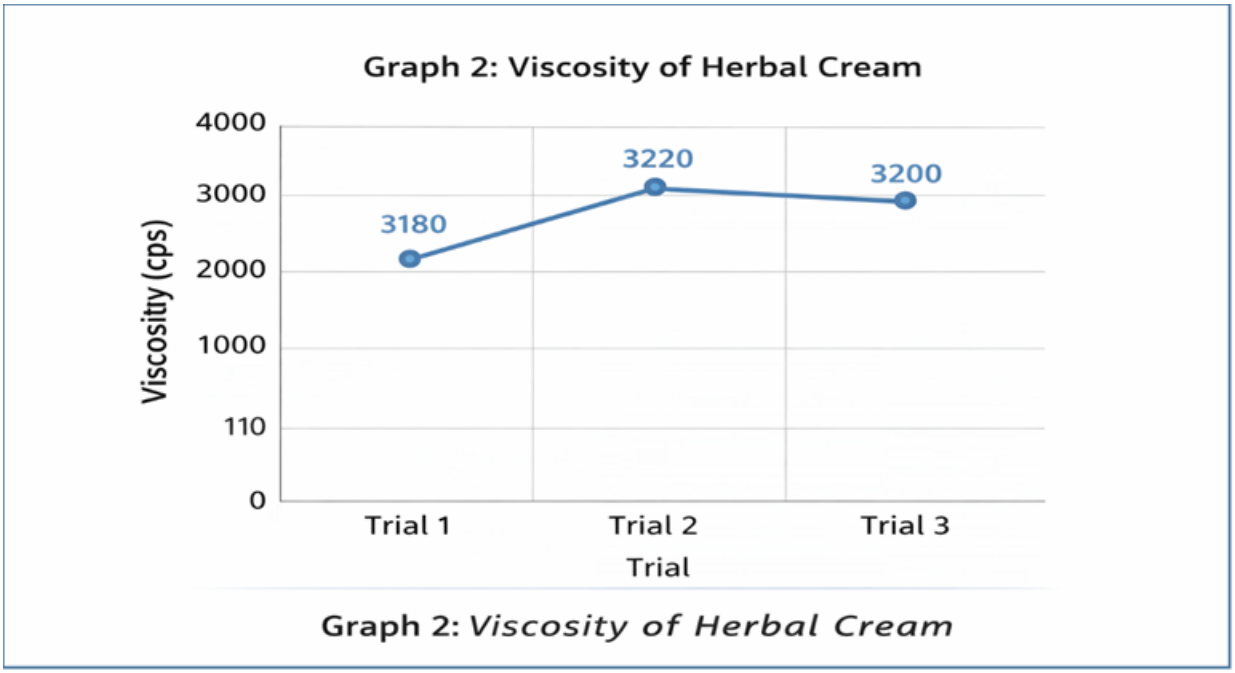
Graph 1: pH of Herbal Cream

4.3 Viscosity

The viscosity of the herbal cream was determined using a Brookfield viscometer. The viscosity indicates the thickness and flow property of the cream. The results showed that the cream had suitable viscosity for topical application.

Trial	Viscosity (cps)
1	3180
2	3220
3	3200
Mean ± SD	3200 ± 20

Table 5: Viscosity of Herbal Cream



2: Viscosity of Herbal Cream

4.4 Spreadability

Spreadability is an important parameter that indicates ease of application of the cream on the skin. The herbal cream showed good spreadability.

Trial	Spreadability (g·cm/sec)
1	6.0
2	6.2
3	6.1
Mean ± SD	6.1 ± 0.10

Table 6: Spreadability of Herbal Cream

4.5 Washability and Skin Irritation

The formulated cream was easily washable with tap water. No redness, itching, or irritation was observed on the skin during the skin irritation test, indicating that the formulation is safe for topical use.

Parameter	Result
Washability	Easily washable
Skin irritation	Nil

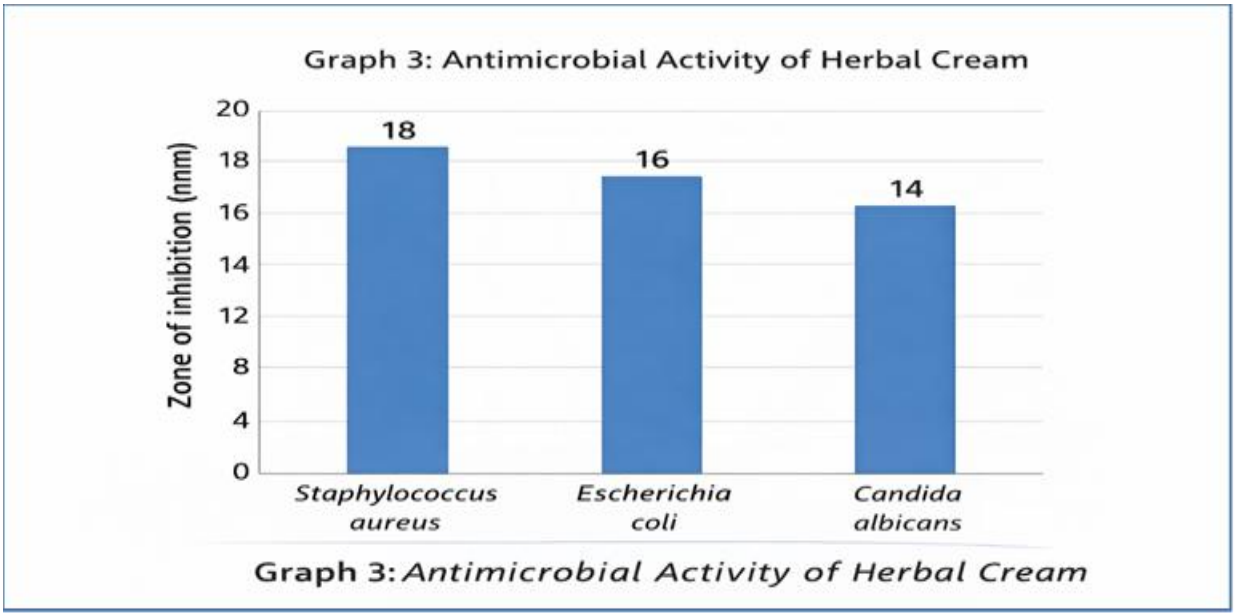
Table 7: Washability and Skin Irritation

4.6 Antimicrobial Activity

The antimicrobial activity of the herbal cream was evaluated using the agar well diffusion method. The results showed significant zones of inhibition against all test microorganisms.

Microorganism	Zone of Inhibition (mm)
Staphylococcus aureus	18
Escherichia coli	16
Candida albicans	14

Table 8: Zone of Inhibition of Herbal Cream



Graph 3: Antimi.crobial Activity of Herbal Cream

4.7 Stability Studies

The stability study was carried out for 30 days. The herbal cream did not show any significant change in color, odor, pH, or phase separation, indicating good stability.

Day	pH	Color	Phase Separation
0	6.4	White	Absent
15	6.4	White	Absent
30	6.3	White	Absent

Table 9: Stability Data of Herbal Cream

VII. DISCUSSION

The results of the present study indicate that the formulated Aloe vera and Neem herbal cream possesses good physicochemical properties and significant antimicrobial activity. The pH of the formulation was within the normal skin pH range, making it suitable for topical application [28]. The viscosity and spreadability results suggest that the cream can be easily applied and spread over the skin surface.

The antimicrobial activity observed may be attributed to the presence of bioactive compounds in Aloe vera and Neem. Aloe vera contains polysaccharides and glycoproteins which promote wound healing and reduce inflammation [29]. Neem contains flavonoids, tannins, and azadirachtin which exhibit strong antimicrobial effects against skin pathogens [30].

The findings of the present study are in good agreement with previous research reported by Singh et al. and Patel et al., who also observed strong antimicrobial activity in Aloe vera and Neem-based formulations [13,11]. Therefore, the combination of Aloe vera and Neem provides synergistic therapeutic benefits in the management of skin infections.

VIII. CONCLUSION

The present research work successfully formulated and evaluated a herbal cream containing Aloe vera and Neem extracts. The formulation exhibited good physical characteristics, acceptable pH, suitable viscosity, excellent spreadability, and significant antimicrobial activity. No skin irritation was observed, indicating safety of the formulation.

The study scientifically supports the traditional use of Aloe vera and Neem in the treatment of skin infections and suggests that the formulated herbal cream can be considered a safe, effective, and economical alternative to synthetic topical preparations.

IX. FUTURE SCOPE

- Clinical studies can be conducted to evaluate therapeutic efficacy in patients.
- Large-scale production and commercialization of the herbal cream can be explored.

- Further studies can be carried out to isolate and identify active phytoconstituents responsible for antimicrobial activity.

REFERENCES

[1] Ncube NS, Afolayan AJ, Okoh AI. Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends. *African Journal of Biotechnology*. 2008;7(12):1797–1806.

[2] Cowan MM. Plant products as antimicrobial agents. *Clinical Microbiology Reviews*. 1999;12(4):564–582.

[3] Banerjee S, Mukherjee A. Enzyme therapy and herbal formulations in dermatology: current trends. *Journal of Drug Delivery and Therapeutics*. 2019;9(2):558–564.

[4] Rang HP, Dale MM, Ritter JM, Flower RJ, Henderson G. *Rang and Dale's Pharmacology*. 8th ed. London: Elsevier Churchill Livingstone; 2015.

[5] Sofowora A. *Medicinal Plants and Traditional Medicine in Africa*. 2nd ed. Ibadan: Spectrum Books Ltd; 2008.

[6] Kokate CK, Purohit AP, Gokhale SB. *Pharmacognosy*. 54th ed. Pune: Nirali Prakashan; 2021.

[7] Khandelwal KR. *Practical Pharmacognosy – Techniques and Experiments*. 25th ed. Pune: Nirali Prakashan; 2019.

[8] Trease GE, Evans WC. *Pharmacognosy*. 16th ed. London: Saunders Elsevier; 2009.

[9] Surjushe A, Vasani R, Saple DG. Aloe vera: A short review. *Indian Journal of Dermatology*. 2008;53(4):163–166.

[10] Sharma R, Gupta N, Patel V. Wound healing potential of Aloe vera gel in experimental animals. *Journal of Natural Remedies*. 2019;19(2):85–90.

[11] Biswas K, Chattopadhyay I, Banerjee RK, Bandyopadhyay U. Biological activities and medicinal properties of Neem (*Azadirachta indica*). *Current Science*. 2002;82(11):1336–1345.

[12] Patel SM, Mehta RM, Shah DA. Evaluation of antimicrobial activity of Neem (*Azadirachta indica*) leaf extract against skin pathogens. *Journal of Pharmacognosy and Phytochemistry*. 2020;9(3):1205–1210.

[13] Singh R, Kaur H, Verma S. Formulation and evaluation of herbal cream containing Aloe vera and Neem for skin infections. *International Journal of Herbal Medicine*. 2021;10(2):33–38.

[14] Rao M, Kulkarni S, Deshmukh A. Comparative antimicrobial study of Aloe vera and Neem extracts. *Asian Journal of Pharmaceutical Research*. 2021;13(1):45–50.

[15] Gupta A, Sharma D. Herbal remedies for dermatological disorders: A review. *Pharmacognosy Reviews*. 2015;9(18):60–65.

[16] Chanda S, Rakholiya K. In vitro evaluation of antimicrobial activity of medicinal plants against skin pathogens. *International Journal of Pharmacy and Life Sciences*. 2016;7(9):5200–5206.

[17] Harborne JB. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. 3rd ed. London: Chapman and Hall; 1998.

[18] WHO. *WHO Traditional Medicine Strategy 2014–2023*. Geneva: World Health Organization; 2013.

[19] Ajayi O, Akinwale T. Antimicrobial activity of plant extracts on skin pathogens. *African Journal of Biotechnology*. 2016;15(22):982–989.

[20] Pandey A, Singh S. Advances in herbal topical formulations for skin disorders. *Biotechnology Reports*. 2020;28:e00495.

[21] Iqbal J, Khan M. Herbal enzymes and phytochemicals in skin therapy. *Journal of Herbal Pharmacotherapy*. 2018;18(1):12–18.

[22] Verma K, Joshi A, Mishra R. Clinical evaluation of herbal topical preparations in skin infections. *Journal of Ethnopharmacology*. 2022; 289:115042.

[23] Bhat S, Rao P. Role of phytochemicals in wound healing and skin protection. *International Journal of Biological Chemistry*. 2017;11(3):145–150.

[24] Anjum N, Khan I. Standard methods for antimicrobial screening of plant extracts. *Journal of Biochemical Techniques*. 2014;5(3):721–725.

[25] Tripathi KD. *Essentials of Medical Pharmacology*. 7th ed. New Delhi: Jaypee Brothers Medical Publishers; 2013.

[26] Mehta P, Deshpande S. Plant-derived antimicrobial agents for dermatological

applications. *World Journal of Pharmaceutical Research*. 2023;12(5):1021–1030.

[27] Kumar A, Singh P. In vitro antimicrobial evaluation of Aloe vera extract. *International Journal of Pharmaceutical Sciences and Research*. 2019;10(4):210–215.

[28] Sharma P, Jain S. Evaluation of herbal formulations for skin disorders. *Journal of Ayurveda and Integrative Medicine*. 2021;12(4):640–646.

[29] Banerjee S, Mukherjee A. Current trends in herbal cosmetic formulations. *Journal of Cosmetic Science*. 2019;70(3):189–201.

[30] Nair R, Chanda S. Antimicrobial activity of medicinal plants against skin pathogens. *Journal of Applied Microbiology*. 2007;103(6):2206–2214.