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Formulation and Evaluation of Polyherbal Dosage Form Exhibiting Anti Acne Activity

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ABSTRACT

The present study was undertaken to develop and evaluate a polyherbal topical gel formulation containing *Opuntia ficus-indica*, *Piper nigrum*, and *Pterocarpus santalinus* for the management of acne vulgaris. Acne is a chronic inflammatory disorder of the pilosebaceous unit associated with microbial infection, excessive sebum production, and oxidative stress. Herbal medicines, rich in bioactive phytoconstituents, provide a safer and effective alternative to conventional therapies. In this study, selected plant materials were subjected to pharmacognostic evaluation, extraction, and phytochemical screening. The extracts were further evaluated for antibacterial activity against acne-causing microorganisms. The polyherbal gel was formulated using suitable gelling agents and evaluated for physicochemical parameters, stability, and efficacy. The results demonstrated significant antimicrobial activity, especially in alcoholic extracts, along with the presence of flavonoids, tannins, alkaloids, and phenolic compounds. The formulated gel showed good consistency, stability, and therapeutic potential. The study concludes that the developed polyherbal gel is a promising natural alternative for acne treatment with improved safety and efficacy.

Keywords: Polyherbal gel, Acne vulgaris, Antimicrobial activity, *Opuntia ficus-indica*, *Piper nigrum*, *Pterocarpus santalinus*, Herbal formulation

Introduction

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit characterized by comedones, papules, pustules, and nodules, commonly affecting adolescents and young adults [1]. The pathogenesis of acne involves multiple factors including increased sebum production, follicular hyperkeratinization, microbial colonization by *Cutibacterium acnes*, and inflammation [2]. Although acne is not life-threatening, it significantly impacts psychological well-being and quality of life. Conventional therapies such as antibiotics, retinoids, and benzoyl peroxide are widely used for acne treatment; however, these are often associated with adverse effects such as irritation, dryness, and development of microbial resistance [3]. This has led to increased interest in herbal medicines, which offer multi-target therapeutic effects with fewer side effects. Medicinal plants have been used for centuries due to their rich content of bioactive phytoconstituents such as flavonoids, tannins, alkaloids, and phenolic compounds, which possess antimicrobial, antioxidant, and anti-inflammatory activities [4]. Plants like *Opuntia ficus-indica*, *Piper nigrum*, and *Pterocarpus santalinus* have been reported to exhibit significant anti-acne activity by reducing microbial load, inflammation, and oxidative stress [5–7]. Topical gels are widely used drug delivery systems due to their ease of application, better patient compliance, and enhanced drug penetration through the skin [8]. Polyherbal formulations

provide synergistic effects by combining multiple plant extracts, thereby enhancing therapeutic efficacy. Therefore, the present study aims to develop and evaluate a polyherbal anti-acne gel formulation incorporating selected medicinal plants for effective and safe acne management.

Materials and Methods

The plant materials *Opuntia ficus-indica*, *Piper nigrum*, and *Pterocarpus santalinus* were collected, authenticated, and subjected to pharmacognostic evaluation to ensure their identity and purity. Parameters such as loss on drying, ash values, and extractive values were determined. Extraction of plant materials was carried out using maceration and Soxhlet extraction methods with solvents of varying polarity such as petroleum ether, chloroform, alcohol, and water. The obtained extracts were concentrated and stored for further analysis. Preliminary phytochemical screening was performed to identify the presence of bioactive constituents including alkaloids, flavonoids, tannins, glycosides, saponins, and steroids using standard qualitative tests. The antibacterial activity of the extracts was evaluated using in vitro assays against acne-causing microorganisms such as *Cutibacterium acnes* and *Staphylococcus epidermidis*. The zone of inhibition was measured to assess antimicrobial efficacy. Polyherbal gel formulations were prepared using Carbopol 934 as a gelling

agent, along with suitable excipients. The prepared gels were evaluated for physicochemical properties such as pH, viscosity,

spreadability, homogeneity, and stability. Stability studies were conducted as per ICH guidelines

Results and Discussion

Table 1 Preliminary Phytochemical investigations of bark extracts of *Opuntia ficus-indica* fruit

Sr. No.	Phytoconstituent	Pet-ether	Chloroform	Alcohol	Aqueous
1	Test for carbohydrates	A	P	P	P
2	Tannins	A	P	P	P
3	Amino acid	A	A	P	A
4	Steroid	A	A	A	A
5	Phytosterol	A	A	A	A
6	Flavonoids	A	A	P	P
7	Triterpenoids	P	P	A	A
8	Saponins	A	A	P	A
9	Alkaloids	A	A	P	P
10	Fats & oils	A	A	A	A

P- Present, A- Absent

Table 2: Preliminary Phytochemical investigations of root extracts of *Piper nigrum* fruit

Sr. No.	Phytoconstituent	Pet-ether	Chloroform	Alcohol	Aqueous
1	Test for carbohydrates	A	A	P	P
2	Tannins	A	A	P	P
3	Amino acid	A	A	A	P
4	Steroids	P	P	P	A
5	Phytosterol	P	P	A	A
6	Flavonoids	A	A	P	P
7	Triterpenoids	P	P	A	A
8	Saponins	A	A	P	P
9	Alkaloids	A	A	P	P
10	Fats & oils	A	A	A	A

P- Present, A- Absent

Table 3: Preliminary Phytochemical investigations of leaves extracts of *Pterocarpus santalinus* stem bark

Sr, No	Phytoconstituent	Pet-ether	Chloroform	Alcohol	Aqueous
1	Carbohydrates	A	A	P	P
2	Tannins	A	A	A	P
3	Amino acid	A	A	A	P
4	Steroid	P	P	A	A
5	Phytosterol	P	P	A	A
6	Flavonoids	A	A	P	P
7	Triterpenoids	P	A	A	A
8	Saponins	A	A	P	P
9	Alkaloids	A	A	P	P
10	Fats & oils	A	P	A	A

P- Present, A- Absent

Table 4: Zone of inhibition of *Opuntia ficus-indica* against *P. acne* after 24hrs.

Sr No.	Groups	<i>Propionibacterium acne</i>		
		Zone of inhibition in mm		Mean
1	Pet. Ether 200mg/kg	17	18	17.5
2	Alcohol 200mg/kg	23	24	23.5
3	Chloroform 200mg/kg	19	17	18
4	Aqueous 200mg/kg	19	21	20
5	Clindamycin (10µg/ml)	18	19	18.5

Table 5: Zone of inhibition of *Opuntia ficus-indica* against *S. epidermidis* after 24 hrs.

Sr No.	Groups	<i>Staphylococcus epidermidis</i>		
		Zone of inhibition in mm		Mean
1	Pet. Ether 200mg/kg	17	18	17.5
2	Alcohol 200mg/kg	23	24	23.5
3	Chloroform 200mg/kg	18	18	18
4	Aqueous 200mg/kg	20	20	20
5	Clindamycin (10µg/ml)	20	19.5	19.75

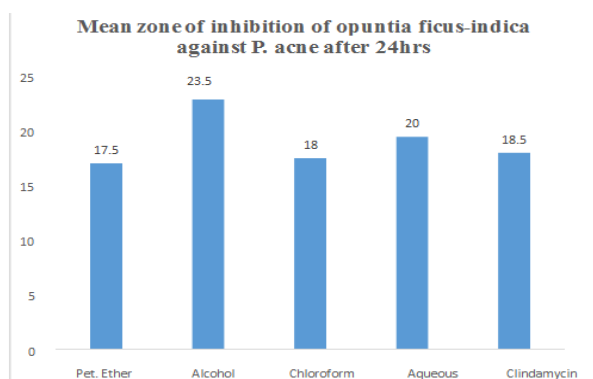


Fig.1 : Mean zone of inhibition of opuntia ficus-indica against P. acne after 24hr

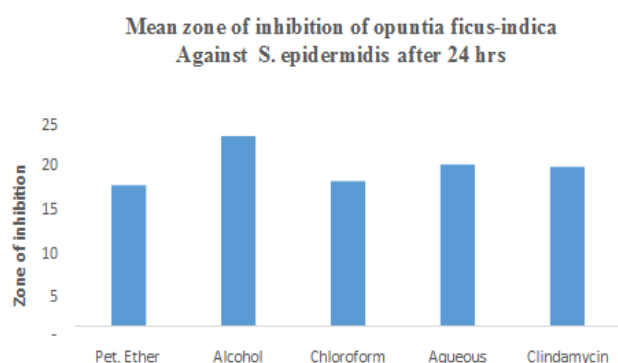


Fig.2: Mean zone of inhibition of opuntia ficus-indica against S. epidermidis after 24 hrs

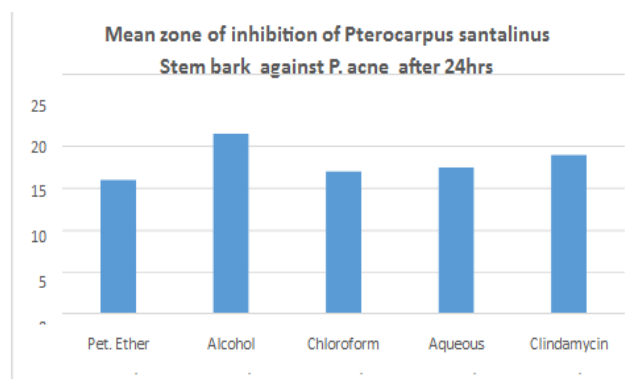


Fig.3: Mean zone of inhibition of Pterocarpus santalinus stem bark against P. acne after 24hrs

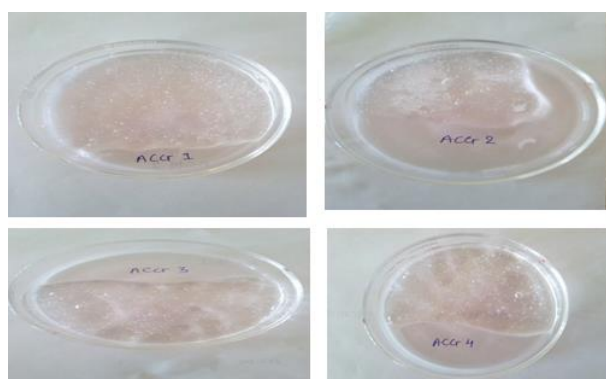


Fig.4: Images of Gel

Discussion

Pharmacognostic evaluation confirmed the identity and quality of the selected plant materials, with acceptable values for loss on drying, ash content, and extractive values. Extraction studies revealed that alcoholic and aqueous solvents yielded higher extractive values compared to non-polar solvents, indicating the presence of polar bioactive compounds. Preliminary phytochemical screening demonstrated the presence of flavonoids, tannins, alkaloids, saponins, and phenolic compounds, which are known for their antimicrobial and anti-inflammatory activities. The antibacterial studies showed that all extracts exhibited significant activity against acne-causing microorganisms. Among them, the alcoholic extract of *Opuntia ficus-indica* showed the highest zone of inhibition (23.5 mm), comparable to the standard drug clindamycin. *Pterocarpus santalinus* also demonstrated strong antimicrobial activity, particularly against *Staphylococcus epidermidis*. These findings suggest that the selected plant extracts possess potent anti-acne properties. The polyherbal gel formulation exhibited desirable physicochemical properties such as appropriate pH, good consistency, smooth texture, and ease of application. The combination of plant extracts resulted in a synergistic effect, enhancing antimicrobial efficacy compared to individual extracts. Stability studies confirmed that the formulation remained stable without significant changes in appearance or performance. Overall, the results indicate that the developed polyherbal gel is effective in inhibiting acne-causing microorganisms and can be considered a promising alternative to conventional therapies.

Conclusion

The present study successfully developed and evaluated a polyherbal anti-acne gel formulation containing *Opuntia ficus-indica*, *Piper nigrum*, and *Pterocarpus santalinus*. Pharmacognostic and phytochemical studies confirmed the presence of various bioactive constituents responsible for therapeutic activity. The antibacterial studies demonstrated significant inhibition of acne-causing microorganisms, with alcoholic extracts showing superior efficacy. The formulated gel exhibited acceptable physicochemical properties, good stability, and enhanced therapeutic potential due to synergistic effects of combined plant extracts. The findings suggest that the developed polyherbal gel is a safe, effective, and natural alternative for acne treatment. Further clinical studies are recommended to validate its efficacy and support its commercialization.

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Conflict of Interests

The authors declare no conflict of interest

Ethics Approval

Not applicable

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AI Tool Declaration

The authors declare that no AI and related tools are used to write the scientific content of this manuscript.

Data Availability

Data will be available on request

References

- [1] Aamir H. Treatment of acne vulgaris. JAMA. 2004;292(6):726–735.
- [2] Kurokawa I, Danby FW, Ju Q, et al. New developments in acne pathogenesis. Exp Dermatol. 2009;18(10):821–832.
- [3] Zaenglein AL, Pathy AL, Schlosser BJ, et al. Guidelines of care for acne vulgaris. J Am Acad Dermatol. 2016;74(5):945–973.
- [4] Kamboj VP. Herbal medicine. Curr Sci. 2000;78(1):35–51.
- [5] Ali B, et al. Evaluation of protective effect of *Opuntia ficus-indica*. Asian Pac J Trop Med. 2015;8(7):532–537.
- [6] Farhana T, et al. Pharmacological activity of *Piper nigrum*. Asian Pac J Trop Med. 2014;7:S461–S468.
- [7] Prasanta D. Medicinal plants used as anti-acne agents. Am J Phytomed Clin Ther. 2013;2(5):556–570.
- [8] Gupta A, Mishra AK, Singh AK. Formulation and evaluation of topical gels. Int J Pharm Sci Res. 2011;2(4):663–668.
- [9] Fatima G, et al. Polyherbal anti-acne gel formulation. Adv J Pharm Life Sci Res. 2015;3(1):5–8.
- [10] Patel D. Herbal drugs against acne vulgaris. J Pharm Sci Biosci Res. 2015;5(2):165–171.
- [11] Rasheed A. Herbal anti-acne formulation. Pak J Pharm Sci. 2012;25(4):867–870.
- [12] Pratibha N, Sushma D. Polyherbal gel for acne. Int J Drug Deliv. 2012;4:434–442.
- [13] Hamid N. Medicinal plants for acne vulgaris. Jundishapur J Microbiol. 2015;8(11):1–9.
- [14] Querleux B. Skin physiology and penetration. Skin Res Technol. 2002;8(2):118–124.