World Journal of Pharmaceutical and Life Sciences

www.wjpls.org

Impact Factor: 8.21 Coden USA: WJPLA7

HERBAL PHYTOSOMAL GEL OF BOSWELLIA SERRATA BARK FOR ANTI-ACNE THERAPY: DEVELOPMENT AND EVALUATION

Ankita Yadav[1], Prem Prasad[2], Sanjay Kumar Kushwaha[3]*

[1]Student, Bhavdiya Institute of Pharmaceutical Sciences and Research Ayodhya-224126.
[2]Associate Professor, Bhavdiya Institute of Pharmaceutical Sciences and Research Ayodhya-224126.
[3]Director (Professor), Bhavdiya Institute of Pharmaceutical Sciences and Research Ayodhya-224126.

***Corresponding Author: Sanjay Kumar Kushwaha**

Director (Professor), Bhavdiya Institute of Pharmaceutical Sciences and Research Ayodhya-224126.

DOI: https://doi.org/10.5281/zenodo.20443840

How to cite this Article: Ankita Yadav[1], Prem Prasad[2], Sanjay Kumar Kushwaha[3]*. (2026). Herbal Phytosomal Gel of Boswellia Serrata Bark For Anti-Acne Therapy: Development And Evaluation. World Journal of Pharmaceutical and Life Sciences, 12(6), 26–35.

Article Received on 17/04/2026 **Article Revised on 07/05/2026** **Article Published on 01/06/2026**

ABSTRACT

Acne vulgaris is one of the most common chronic inflammatory skin disorders affecting adolescents and adults worldwide. It is characterized by the formation of comedones, papules, pustules, nodules, and excessive sebum production, mainly due to follicular hyperkeratinization, bacterial colonization, and inflammation. Conventional anti-acne therapies such as antibiotics, retinoids, and benzoyl peroxide are widely used for treatment; however, their long-term use is often associated with adverse effects including skin irritation, dryness, allergic reactions, and antimicrobial resistance. These limitations have increased the demand for safer and more effective herbal-based therapeutic alternatives. Herbal formulations have gained considerable attention in dermatological research because of their natural origin, improved safety profile, multifunctional pharmacological activities, and better patient acceptability. The bark of Boswellia serrata contains bioactive phytoconstituents such as boswellic acids, which are known to inhibit inflammatory mediators and reduce microbial growth associated with acne pathogenesis. Despite the therapeutic potential of herbal extracts, their clinical effectiveness is often limited by poor solubility, low bioavailability, and inadequate skin penetration. Phytosomal drug delivery systems have therefore become an important strategy to overcome these challenges. Phytosomes are phospholipid-based vesicular systems that enhance the stability, permeability, and bioavailability of phytoconstituents, thereby improving therapeutic efficacy in topical applications. Incorporation of phytotomies into gel formulations further enhances skin retention, spread ability, and patient compliance, making phytosomal gels a promising approach for anti-acne therapy. The present review focuses on the development and evaluation of herbal phytosomal gel containing Boswellia serrata bark extract for anti-acne treatment. The review highlights the pathophysiology of acne vulgaris, therapeutic potential of Boswellia serrata, principles of phytosomal drug delivery, formulation strategies, characterization methods, and evaluation parameters of phytosomal gels. Furthermore, the review emphasizes the significance of herbal nanocarrier systems in modern dermatological therapy and discusses future prospects for the development of effective and safe anti-acne formulations.

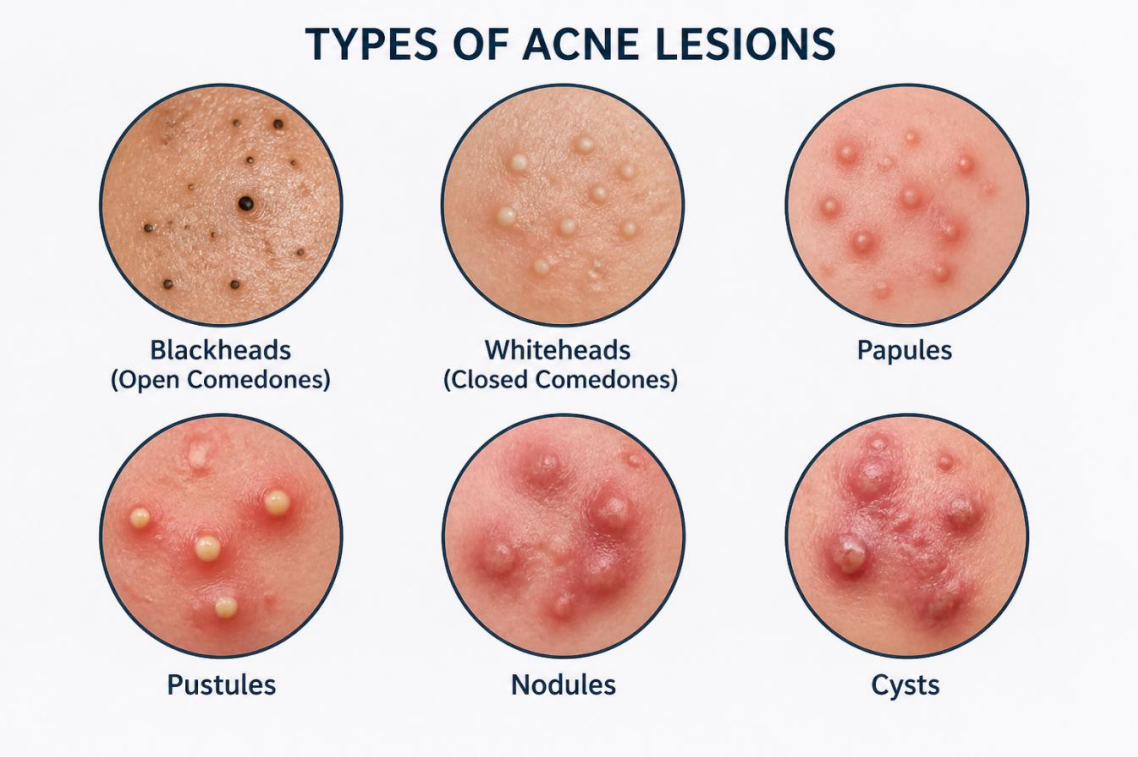
KEYWORDS: Acne vulgaris, *Boswellia serrata*, herbal phytosomal gel, phytosomes, anti-acne therapy. Boswellic acids, topical formulation, herbal drug delivery system, anti-inflammatory activity, dermal delivery.

1. INTRODUCTION

1.1 Overview of Acne Vulgaris

Acne vulgaris is one of the most common chronic inflammatory skin disorders affecting adolescents and young adults worldwide. It occurs mainly in areas rich in sebaceous glands such as the face, chest, shoulders, and back. Acne develops due to multiple factors including excessive sebum production, follicular hyperkeratinization, bacterial colonization, and inflammation. According to global dermatological studies, acne affects nearly 80–90% of teenagers and may also persist into adulthood, significantly impacting

quality of life and psychological health. Acne lesions are broadly classified into non-inflammatory and inflammatory types.[1] Non-inflammatory lesions include open comedones (blackheads) and closed comedones (whiteheads), whereas inflammatory lesions include papules, pustules, nodules, and cysts. Severe acne may lead to permanent scarring and pigmentation, which can negatively affect self-esteem and social confidence.[2] The pathophysiology of acne vulgaris involves overactivity of sebaceous glands stimulated by androgens, leading to excessive sebum secretion. Increased keratin production causes blockage of hair follicles, creating a favorable environment for the growth of *Cutibacterium acnes*. The proliferation of these bacteria further triggers inflammatory responses and oxidative stress, resulting in redness, swelling, and formation of acne lesions. Environmental factors, stress, hormonal imbalance, cosmetic products, and dietary habits may also contribute to acne development.[3]



1.2 Limitations of Conventional Anti-Acne Therapy

Several conventional therapies such as topical antibiotics, benzoyl peroxide, retinoids, and oral antimicrobial agents are commonly used for acne management. Although these medications provide symptomatic relief, prolonged use is often associated with various limitations and adverse effects.[4] One of the major concerns is the development of antibiotic resistance caused by excessive and long-term use of antibiotics against *Cutibacterium acnes*. This resistance reduces treatment effectiveness and creates challenges in acne management. In addition, many synthetic anti-acne agents cause skin irritation, dryness, peeling, burning sensation, erythema, and photosensitivity. Topical retinoids and benzoyl peroxide are particularly associated with irritation and poor skin tolerability, which may reduce patient satisfaction and treatment adherence.[5] Oral medications may also produce systemic side effects and require long-term monitoring. Poor patient compliance is another important limitation of conventional therapies. Acne treatment often requires prolonged application, and visible improvement may take several weeks or months. The occurrence of side effects and dissatisfaction with treatment outcomes may discourage patients from continuing therapy regularly.[6] Therefore, safer and more effective alternative therapies are required for long-term acne management. Conventional anti-acne therapies mainly include topical retinoids, antibiotics, benzoyl peroxide, hormonal therapy, and oral isotretinoin. Although these treatments are effective in reducing acne symptoms, long-term use is associated with several limitations and adverse effects. One of the major concerns is antibiotic resistance caused by prolonged and irrational use of topical and systemic antibiotics. Resistant strains of *Cutibacterium acnes* reduce therapeutic effectiveness and complicate acne management.[7] In addition, many synthetic anti-acne agents produce skin irritation, dryness, peeling, erythema, burning sensation, and photosensitivity. Retinoids and benzoyl peroxide commonly cause skin discomfort, leading to poor tolerability among patients. Oral medications may also produce systemic side effects including gastrointestinal disturbances and hormonal imbalance.[8] Poor patient compliance is another major challenge because acne treatment often requires long-term therapy and continuous application. Delayed

therapeutic response, side effects, and dissatisfaction with treatment outcomes may reduce adherence to medication. Therefore, safer and more patient-friendly therapeutic alternatives are required for effective acne management.[9]

1.3 Herbal Medicines in Dermatology

In recent years, herbal medicines have gained considerable attention in dermatology due to their natural origin, therapeutic potential, and improved safety profile. The growing demand for herbal cosmetics and plant-based skincare products reflects increasing consumer preference toward natural and eco-friendly therapies. Medicinal plants contain a wide variety of bioactive phytoconstituents such as flavonoids, tannins, terpenoids, alkaloids, and phenolic compounds that exhibit antimicrobial, anti-inflammatory, antioxidant, and wound-healing activities beneficial in acne treatment.[10] Plant-based therapies offer several advantages over conventional synthetic drugs, including reduced side effects, better skin compatibility, improved patient acceptability, and multifunctional pharmacological actions.[11] Herbal formulations may help control bacterial growth, reduce inflammation, minimize oxidative stress, and promote skin healing simultaneously. Because of these benefits, herbal drug delivery systems such as phytosomal gels are increasingly being explored for effective and safe anti-acne therapy.[12]

Table No. 1: Herbal Medicines in Dermatology.

Section	Key Points	References
Overview of Acne Vulgaris	Acne is a chronic inflammatory skin disorder caused by excess sebum, bacterial growth, and inflammation	[7]
Types of Acne Lesions	Includes blackheads, whiteheads, papules, pustules, nodules, and cysts	[8]
Pathophysiology	Involves follicular blockage, *C. acnes* colonization, and inflammatory response	[9]
Limitations of Conventional Therapy	Antibiotic resistance, irritation, dryness, and poor compliance	[10]
Herbal Medicines in Dermatology	Herbal therapies provide anti-inflammatory and antimicrobial benefits with fewer side effects	[11]
Advantages of Plant-Based Therapies	Natural, safer, multifunctional, and patient-friendly	[12]

2.3 Herbal Medicines in Dermatology

In recent years, herbal medicines have gained considerable attention in dermatological therapy due to their natural origin, therapeutic efficacy, and reduced side effects. The growing demand for herbal cosmetics and plant-based skincare products reflects increasing public awareness regarding the safety and effectiveness of natural therapies.[13] Medicinal plants contain bioactive phytoconstituents such as flavonoids, tannins, alkaloids, terpenoids, and phenolic compounds that possess antimicrobial, anti-inflammatory, antioxidant, and wound-healing properties beneficial for acne treatment. Plant-based therapies offer several advantages over conventional synthetic formulations, including better skin compatibility, improved patient acceptance, reduced toxicity, and multifunctional therapeutic action.[14] Herbal formulations may simultaneously reduce microbial growth, control inflammation, and protect the skin from oxidative damage, making them promising candidates for anti-acne therapy.[15]

2.4 Introduction to Phytosomal Drug Delivery

Phytosomes are advanced vesicular drug delivery systems in which phytoconstituents are complexed with phospholipids to improve their absorption and therapeutic effectiveness. Unlike conventional herbal formulations, phytosomes enhance the stability, solubility, permeability, and bioavailability of plant-derived active compounds. The phospholipid component helps phytoconstituents interact effectively with biological membranes, thereby improving dermal and systemic delivery.[16] Phytosomal formulations provide several advantages such as enhanced skin penetration, improved drug retention, controlled release, and increased therapeutic efficacy. Incorporation of phytosomes into topical gels further improves spreadability, skin hydration, and patient compliance. Because of these properties, phytosomal gels are increasingly explored in modern dermatological and cosmetic applications.[17]

2.5 Rationale for Using *Boswellia serrata*

Boswellia serrata, commonly known as Indian frankincense, is an important medicinal plant traditionally used in Ayurvedic medicine for the treatment of inflammatory disorders and skin diseases. The bark and resin of the plant contain boswellic acids and other bioactive compounds responsible for various pharmacological activities.[18] The anti-inflammatory activity of *Boswellia serrata* is mainly attributed to inhibition of inflammatory mediators such as leukotrienes and pro-inflammatory enzymes. In addition,

the plant possesses strong antioxidant potential that helps neutralize free radicals and reduce oxidative stress associated with acne lesions.[19] Several studies have also reported antimicrobial effects of *Boswellia serrata* against skin pathogens, making it beneficial for acne management. Traditionally, *Boswellia serrata* has been used for wound healing, skin protection, and inflammatory conditions, highlighting its therapeutic significance in dermatology. Therefore, incorporation of *Boswellia serrata* extract into phytosomal gel formulations may provide a safe and effective herbal approach for anti-acne therapy.[20]

Table no. 2: Role of *Boswellia serrate.*

S. No.	Pharmacological Activity	Role of *Boswellia serrata*	REFERENCE
1	Anti-inflammatory Activity	Boswellic acids inhibit inflammatory mediators such as leukotrienes and reduce redness, swelling, and inflammation associated with acne lesions	[21]
2	Antioxidant Potential	Rich in terpenoids and phenolic compounds that help neutralize free radicals and reduce oxidative stress in skin tissues	[22]
3	Antimicrobial Effects	Exhibits inhibitory activity against skin pathogens including *Cutibacterium acnes* and other microorganisms involved in acne development	[23]
4	Wound Healing Activity	Promotes tissue repair and accelerates healing of damaged skin and acne scars	[24]
5	Traditional Medicinal Importance	Traditionally used in Ayurveda for treatment of skin diseases, inflammation, wounds, and infections	[25]

3. Acne Vulgaris: Etiology and Pathogenesis

Acne vulgaris is a chronic inflammatory skin disorder that commonly affects adolescents and young adults worldwide. It mainly develops in areas rich in sebaceous glands such as the face, chest, shoulders, and back. Acne occurs due to multiple factors including hormonal imbalance, excessive sebum production, bacterial colonization, follicular blockage, and inflammation.[26] The condition is characterized by the formation of blackheads, whiteheads, papules, pustules, nodules, and cysts, which may sometimes lead to permanent scarring and pigmentation. Besides affecting physical appearance, acne also causes psychological stress, anxiety, and reduced self-confidence among patients.[27] Hormonal imbalance plays a major role in acne development, particularly during puberty when androgen levels increase and stimulate sebaceous glands to produce excess sebum. This excessive oil secretion blocks skin pores and creates a favorable environment for bacterial growth. *Cutibacterium acnes*, a gram-positive anaerobic bacterium naturally present on the skin, proliferates within blocked follicles and releases inflammatory substances that trigger redness, swelling, and pustule formation.[28] In addition to hormonal and microbial factors, diet and lifestyle habits such as consumption of oily foods, high glycemic diet, stress, inadequate sleep, smoking, and pollution may also aggravate acne severity. The mechanism of acne development involves follicular hyperkeratinization, increased sebaceous gland activity, and inflammation.[29] Abnormal accumulation of dead skin cells blocks hair follicles and forms comedones. Excess sebum produced by sebaceous glands further worsens follicular blockage and supports bacterial proliferation. The bacterial activity stimulates inflammatory mediators and oxidative stress, resulting in tissue damage and inflammatory acne lesions. Several conventional therapies are currently available for acne treatment, including topical agents, oral antibiotics, and retinoids.[30] Topical therapies such as benzoyl peroxide, salicylic acid, and clindamycin are commonly used to reduce bacterial growth and inflammation. Oral antibiotics including doxycycline and tetracycline are effective in moderate to severe acne, but prolonged use may cause antibiotic resistance and gastrointestinal side effects. Retinoids such as tretinoin and isotretinoin help regulate keratinization and reduce sebum production; however, they are often associated with dryness, irritation, peeling, and photosensitivity. Due to the limitations of synthetic drugs, herbal formulations have gained increasing attention in dermatological therapy.[31] Medicinal plants possess antimicrobial, anti-inflammatory, antioxidant, and wound-healing properties that may help manage acne effectively with fewer side effects. Herbal gels and phytosomal formulations are now being explored as promising alternatives for safer, more effective, and patient-friendly anti-acne therapy.[32]

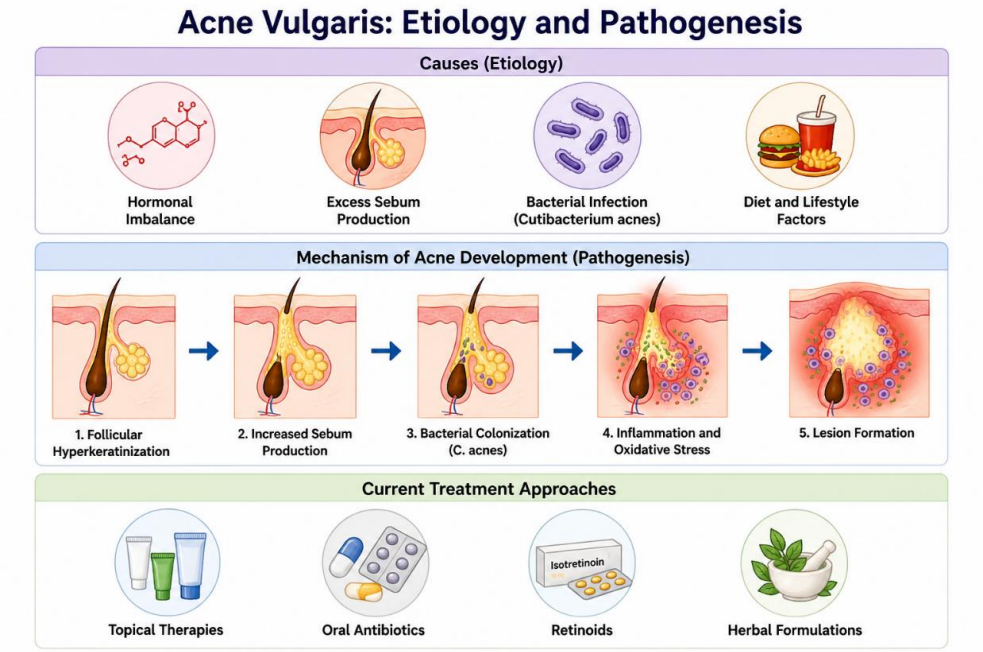


Fig. No. 1: Acne Vulgaris: Etiology and Pathogenesis.

4. Herbal Approaches in Anti-Acne Therapy

Herbal medicines have gained significant importance in dermatological therapy because of their natural origin, therapeutic effectiveness, and reduced side effects. Acne vulgaris is commonly associated with inflammation, bacterial infection, oxidative stress, and excessive sebum production, and many medicinal plants possess pharmacological activities that help target these factors simultaneously. Due to increasing concerns regarding antibiotic resistance and irritation caused by synthetic anti-acne agents, herbal therapies are now widely explored as safer and more effective alternatives for acne management.[33]

4.1 Importance of Herbal Anti-Acne Agents

Herbal anti-acne agents play an important role in modern skincare and dermatology because they contain naturally occurring phytoconstituents with antimicrobial, anti-inflammatory, antioxidant, and wound-healing properties. These bioactive compounds help reduce bacterial growth, control inflammation, minimize oxidative stress, and promote healing of acne lesions. Herbal therapies are generally considered safer and better tolerated compared to conventional synthetic drugs, making them suitable for long-term use. The growing demand for herbal cosmetics and plant-based skincare products has encouraged the development of herbal gels, creams, lotions, and nanocarrier systems for acne treatment.[34] Herbal formulations also provide better skin compatibility and lower risk of adverse effects such as dryness, peeling, irritation, and photosensitivity commonly associated with synthetic medications. Therefore, medicinal plants have become promising candidates for effective and patient-friendly anti-acne therapy.[35]

Table no. 3: Medicinal Plants Used in Acne Management.

S. No.	Herbal Agent	Major Pharmacological Activity	Role in Acne Management	Reference
1	Neem (*Azadirachta indica*)	Antimicrobial, anti-inflammatory	Reduces bacterial growth and skin inflammation	[36]
2	Aloe vera	Wound healing, soothing, moisturizing	Promotes skin repair and reduces irritation	[37]
3	Tea Tree Oil	Antimicrobial, antiseptic	Inhibits *Cutibacterium acnes* and reduces acne lesions	[38]
4	Turmeric (*Curcuma longa*)	Anti-inflammatory, antioxidant	Reduces oxidative stress and inflammation	[39]
5	*Boswellia serrata*	Anti-inflammatory, antioxidant, antimicrobial	Reduces redness, swelling, and bacterial infection	[40]
6	Herbal Gels	Better spreadability and skin compatibility	Improve patient compliance and reduce irritation	[41]
7	Herbal Formulations	Multifunctional therapeutic	Provide antimicrobial, antioxidant, and	[42]

		effects	wound-healing actions	

4.3 Advantages of Herbal Gels

Herbal gels are increasingly preferred in topical dermatological therapy because they provide several advantages over conventional formulations. One major advantage is better patient compliance due to their non-greasy nature, smooth texture, easy spreadability, and pleasant feel on the skin. Gels are rapidly absorbed and do not leave oily residues, improving user acceptability.[43] Herbal gels also produce reduced irritation compared to synthetic topical agents. Since they contain natural bioactive compounds, they are generally associated with fewer adverse effects such as dryness, peeling, burning sensation, and erythema. This makes herbal gels suitable for prolonged use in acne management. Another important advantage is their multifunctional therapeutic effects. Herbal gels can simultaneously provide antimicrobial, anti-inflammatory, antioxidant, wound-healing, and skin-protective activities. This combined action helps manage multiple pathogenic factors involved in acne development and enhances overall therapeutic effectiveness. Because of these benefits, herbal phytosomal gels are emerging as promising delivery systems for safer and more effective anti-acne therapy.[44]

5. Botanical Profile of *Boswellia serrata*

Boswellia serrata Roxb., commonly known as Indian frankincense or Salai guggul, is an important medicinal plant belonging to the family Burseraceae. It is widely distributed in India and has been extensively used in traditional Ayurvedic medicine for the treatment of inflammatory disorders, arthritis, wounds, skin diseases, and respiratory conditions. The plant is well known for producing an aromatic oleo-gum-resin rich in boswellic acids, which are responsible for its significant pharmacological activities including anti-inflammatory, antioxidant, antimicrobial, and wound-healing effects.[45] *Boswellia serrata* is a moderate-sized deciduous tree commonly found in dry hilly regions of India. The bark of the tree is thin, papery, and grayish in color, while the leaves are compound and clustered at the ends of branches. The plant produces small white flowers and oval-shaped fruits. The bark and resin are considered the major medicinally important parts of the plant and are widely utilized in pharmaceutical and cosmetic preparations. The medicinal importance of *Boswellia serrata* has gained considerable attention in recent years due to its potential application in herbal formulations and advanced drug delivery systems. Its bioactive constituents, particularly boswellic acids, contribute significantly to anti-inflammatory and dermatological activities, making the plant a promising candidate for anti-acne therapy and topical phytosomal formulations.[46]

5.1 Taxonomy[47,48]

Table No. 4.

Category	Details
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Sapindales
Family	Burseraceae
Genus	*Boswellia*
Species	*Boswellia serrata* Roxb.

S. No.	Botanical Parameter	Description	Reference
1	Common Name	Indian frankincense / Salai guggul	[49]
2	Family	Burseraceae	[50]
3	Plant Type	Moderate-sized deciduous tree	[51]
4	Medicinal Part	Bark and oleo-gum-resin	[52]
5	Major Constituents	Boswellic acids, terpenoids, essential oils	[53]
6	Traditional Uses	Inflammation, arthritis, skin disorders, wound healing	[54]
7	Pharmaceutical Importance	Used in anti-inflammatory and dermatological formulations	[55]

8. Phytosomal Drug Delivery System

Phytosomal drug delivery systems are advanced vesicular formulations developed to enhance the therapeutic effectiveness of herbal extracts and phytoconstituents. Many herbal compounds possess excellent pharmacological activities but suffer from poor solubility, low stability, inadequate absorption, and limited skin penetration, which reduce their clinical efficacy.[56] Phytosomes are designed to overcome these limitations by complexing plant-derived active constituents with phospholipids, thereby improving their bioavailability and permeability. Due to their enhanced delivery properties, phytosomal systems have gained considerable importance in pharmaceutical and cosmetic applications, particularly in topical and dermatological formulations.[57]

8.1 Introduction to Phytosomes

Phytosomes are phospholipid-based vesicular systems in which herbal extracts or phytoconstituents form molecular complexes with phospholipids, mainly phosphatidylcholine. Unlike conventional herbal formulations, phytosomes improve the interaction of phytoconstituents with biological membranes, resulting in enhanced absorption and therapeutic activity.[58] The phospholipid component acts as a carrier and protects the active compounds from degradation while improving their penetration through the skin. Phytosomal formulations are widely used for topical drug delivery because they provide controlled release, better skin retention, and enhanced stability of herbal constituents. Incorporation of phytosomes into gel systems further improves spreadability, hydration, and patient compliance, making phytosomal gels promising carriers for anti-acne therapy.[59]

8.4 Advantages of Phytosomal Systems

Phytosomal systems offer several advantages over conventional herbal formulations. One of the major advantages is improved stability of phytoconstituents due to protection provided by phospholipid complexes. This helps reduce degradation and prolong shelf life of herbal products. Phytosomes also provide better skin permeation because phospholipids interact effectively with biological membranes and enhance penetration of active compounds through the skin layers.[60] Improved permeation increases drug retention at the target site and enhances therapeutic response. Another important advantage is enhanced therapeutic efficacy. Phytosomal systems improve bioavailability, controlled release, and absorption of herbal constituents, leading to better pharmacological activity even at lower doses. Additionally, phytosomal gels are non-greasy, easy to apply, and associated with better patient compliance, making them suitable carriers for dermatological and anti-acne applications.[61]

Table No. 5: Role in Phytosomal System.

S. No.	Component/Parameter	Role in Phytosomal System	Reference
1	Phospholipids	Improve vesicle formation, permeability, and bioavailability	[62]
2	Cholesterol	Enhances membrane rigidity and stability	[63]
3	Herbal Extract	Provides therapeutic activity	[64]
4	Thin-Film Hydration Method	Common technique for vesicle preparation	[65]
5	Solvent Evaporation Method	Produces stable phytosomal complexes	[66]
6	Improved Stability	Protects phytoconstituents from degradation	[67]
7	Better Skin Permeation	Enhances dermal penetration and retention	[68]
8	Enhanced Therapeutic Efficacy	Improves absorption and pharmacological activity	[69]

12. Challenges and Future Perspectives

Herbal phytosomal formulations have gained significant attention in modern dermatological therapy because of their improved therapeutic efficacy, enhanced skin penetration, and reduced side effects. Despite their promising potential in anti-acne treatment, several scientific, technical, and regulatory challenges still limit their large-scale development and commercialization. Therefore, understanding these limitations and exploring future opportunities are essential for the successful application of herbal phytosomal gels in pharmaceutical and cosmeceutical industries.[70] One of the major challenges associated with phytosomal formulations is stability. Phytosomes contain phospholipids that are susceptible to oxidation and hydrolysis, which may affect vesicle integrity and reduce therapeutic effectiveness during storage. Environmental factors such as temperature, humidity, and light exposure can also influence the physical and chemical stability of phytosomal systems. Instability may result in leakage of entrapped phytoconstituents, aggregation of vesicles, and reduced shelf life of the formulation. Therefore, proper formulation strategies, use of stabilizers, and optimized storage conditions are necessary to maintain product quality and effectiveness. Another important challenge is the standardization of herbal extracts.[71] Medicinal plants contain complex mixtures of phytoconstituents whose composition may vary depending on geographical location, climate, harvesting conditions, extraction methods, and storage practices. Such variations can influence the therapeutic activity and reproducibility of herbal formulations. Lack of standardized extraction procedures and quality control parameters often creates difficulties in ensuring batch-to-batch consistency. Advanced analytical techniques such as HPLC, FTIR, and chromatographic fingerprinting are therefore required for proper characterization and standardization of herbal extracts used in phytosomal systems.[72] Despite these challenges, phytosomal drug delivery systems offer immense future potential in dermatological therapy. Nanophytosomal systems are emerging as advanced delivery platforms capable of providing enhanced drug loading, improved skin permeation, controlled release, and targeted delivery of herbal phytoconstituents. The incorporation of nanotechnology into phytosomal formulations may significantly improve anti-acne efficacy and therapeutic outcomes. Clinical evaluation of herbal phytosomal gels is another important future perspective. More clinical trials are required to evaluate their safety, efficacy, tolerability, and long-term therapeutic benefits in human subjects. Scientific evidence generated through clinical studies will help improve physician confidence and regulatory approval of herbal anti-acne formulations.[73]

CONCLUSION

Acne vulgaris is a multifactorial inflammatory skin disorder that affects a large population worldwide and often requires long-term management. Conventional anti-acne therapies are effective to some extent; however, their prolonged use is frequently associated with adverse effects such as skin irritation, dryness, photosensitivity, and antibiotic resistance. Because of these limitations, herbal medicines have gained increasing attention as safer and more effective alternatives for dermatological therapy. Among various medicinal plants, *Boswellia serrata* has shown remarkable therapeutic potential due to its anti-inflammatory, antioxidant, antimicrobial, and wound-healing properties. The presence of boswellic acids and other bioactive phytoconstituents contributes significantly to the management of acne-associated inflammation and microbial infection. These pharmacological properties make *Boswellia serrata* a promising herbal candidate for topical anti-acne formulations. Phytosomal drug delivery systems further enhance the therapeutic efficacy of herbal extracts by improving their stability, bioavailability, and skin permeation. Incorporation of *Boswellia serrata* extract into phytosomal gel formulations provides better dermal delivery, controlled release, enhanced skin retention, and improved patient compliance. The non-greasy nature and multifunctional therapeutic effects of phytosomal gels make them highly suitable for modern dermatological applications. Despite certain challenges related to formulation stability, standardization, and regulatory approval, phytosomal herbal systems offer significant future opportunities in anti-acne therapy. Advances in nanotechnology, clinical research, and herbal cosmeceutical development are expected to improve the effectiveness and commercial applicability of herbal phytosomal formulations. Therefore, herbal phytosomal gel containing *Boswellia serrata* may serve as a promising and innovative approach for safer, more effective, and patient-friendly acne management in the future.

REFERENCES

1. Lynn, D. D., Umari, T., Dunnick, C. A., & Dellavalle, R. P. The epidemiology of acne vulgaris in late adolescence. *Adolescent health, medicine and therapeutics*, 2016; 13-25.
2. Zhu, Z., Zhong, X., Luo, Z., Liu, M., Zhang, H., Zheng, H., & Li, J. Global, regional and national burdens of acne vulgaris in adolescents and young adults aged 10–24 years from 1990 to 2021: a trend analysis. *British Journal of Dermatology*, 2025; *192*(2): 228-237.
3. Ozougwu, J. C. Physiology of the liver. *International Journal of Research in Pharmacy and Biosciences*, 2017; *4*(8): 13-24.
4. Alsaadoon, N. S. J., Al-Refaie, A. M., & Habashy, A. Y. Acne vulgaris in adolescents: A comprehensive review. *Benha Journal of Applied Sciences*, 2024; *9*(12): 5-13.
5. Heng, A. H. S., & Chew, F. T. Systematic review of the epidemiology of acne vulgaris. *Scientific reports*, 2020; *10*(1): 5754.
6. Sivakrishnan, S., & Pharm, M. Liver disease overview. *World Journal of Pharmacy and Pharmaceutical Sciences*, 2019; *8*(1): 1385-1395.
7. Leung, A. K., Barankin, B., Lam, J. M., Leong, K. F., & Hon, K. L. Dermatology: how to manage acne vulgaris. *Drugs in context*, 2021; *10*.
8. Spiering, M. J. Primer on the immune system. Alcohol research: current reviews, 2015; 37(2): 171.
9. Jaiswal, S., Jawade, S., Madke, B., Gupta, S., & Gupta, S. N. Recent trends in the management of acne vulgaris: a review focusing on clinical studies in the last decade. *Cureus*, 2024; *16*(3).
10. Nwozo, O. S., Effiong, E. M., Aja, P. M., & Awuchi, C. G. Antioxidant, phytochemical, and therapeutic properties of medicinal plants: A review. *International Journal of Food Properties*, 2023; *26*(1): 359-388.
11. Yatoo, M. I., Gopalakrishnan, A., Saxena, A., Parray, O. R., Tufani, N. A., Chakraborty, S., ... & Iqbal, H. M. Anti-inflammatory drugs and herbs with special emphasis on herbal medicines for countering inflammatory diseases and disorders-a review. *Recent patents on inflammation & allergy drug discovery*, 2018; *12*(1): 39-58.
12. Amparo, T. R., Seibert, J. B., Vieira, P. M. D. A., Teixeira, L. F. M., Santos, O. D. H. D., & de Souza, G. H. B. Herbal medicines to the treatment of skin and soft tissue infections: advantages of the multi-targets action. *Phytotherapy Research*, 2020; *34*(1): 94-103.
13. Rai, P. K., Sharma, D. R., & Sharma, A. Buchanania lanzan is a pharmacognostic miracle herb. *Research Journal of Pharmacognosy and Phytochemistry*, 2015; *7*(3): 182-188.
14. Mondal, M., Konar, A., Halder, S., Roy, A., Dalal, D. D., & Ghosh, P. An insight into the morphological, ethno medicinal, phytochemical and pharmaceutical properties of Buchanania lanzan. *J Med Plants Stud*, 2024; *12*(1): 11-17.
15. Elias, A., Habbu, P. V., & Iliger, S. An updated review on phyto-pharmacological and pharmacognostical profile of Buchanania lanzan: A pharmacognostic miracle herb. *International Journal of Scientific Research in Science and Technology*, 2021; *8*(6): 298-310.
16. Rai, P. K., Sharma, D. R., & Sharma, A. Buchanania lanzan is a pharmacognostic miracle herb. *Research Journal of Pharmacognosy and Phytochemistry*, 2015; *7*(3): 182-188.
17. Siddiqui, M. Z., Chowdhury, A. R., Prasad, N., & Thomas, M. Buchanania lanzan: a species of enormous potentials. *World journal of pharmaceutical sciences*, 2014; 374-379.
18. Vijay, M. K., Sharma, R. S., Maloo, S. R., Jain, V., & Sharma, A. Buchanania lanzan Spreng (Chironji): An endangered socioeconomic forest tree species of

Central India. *The Pharma Innovation Journal*, 2022; *11*(6): 336-342.
19. Rajput, B. S., Gupta, D., Kumar, S., Singh, K., & Tiwari, C. Buchanania lanzan Spreng (Chironji): A vulnerable multipurpose tree species in Vindhyan region. *Journal of Pharmacognosy and Phytochemistry*, 2018; *7*(5): 833-836.
20. Srivastava, B., Singh, R., Bharthi, V., Meena, A. K., & Prakash, O. A comparative phytochemical approach for substitution of stem bark with small branches in Buchanania lanzan for medicinal use. *methods*, 2018; *13:* 14.
21. Siddiqui MZ. Boswellia serrata, a potential anti-inflammatory agent. *Indian J Pharm Sci.*, 2011.
22. Roy NK, et al. Therapeutic potential of Boswellia species. *Phytotherapy Research*, 2019.
23. Borrelli F, et al. Biological activities of Boswellia extracts. *Planta Medica*, 2006.
24. Al-Yasiry ARM, Kiczorowska B. Frankincense therapeutic properties. *Asian Pac J Trop Biomed*, 2016.
25. Sharma A, et al. Medicinal importance of Boswellia serrata. *Indian Forester*, 2004.
26. Pattnaik, A., Sarkar, R., Sharma, A., Yadav, K. K., Kumar, A., Roy, P., ... & Sen, T. Pharmacological studies on Buchanania lanzan Spreng.-A focus on wound healing with particular reference to anti-biofilm properties. *Asian Pacific journal of tropical biomedicine*, 2013; *3*(12): 967-974.
27. Elias, A., Habbu, P. V., & Iliger, S. An updated review on phyto-pharmacological and pharmacognostical profile of Buchanania lanzan: A pharmacognostic miracle herb. *International Journal of Scientific Research in Science and Technology*, 2021; *8*(6): 298-310.
28. Pekamwar, S. S., & Sonwane, P. P. Evaluation of the immunomodulatory activity of hydroalcoholic extracts of Buchanania lanzan fruits. *Ceylon Journal of Science*, 2025; *54*(2).
29. Elias, A., Habbu, P. V., & Iliger, S. An updated review on phyto-pharmacological and pharmacognostical profile of Buchanania lanzan: A pharmacognostic miracle herb. *International Journal of Scientific Research in Science and Technology*, 2021; *8*(6): 298-310.
30. Tandale, S., & Shekokar, S. S. A Literature Review of Importance Pharmacological Activities of Few Plants of Anacardiaceae Family.
31. Tandale, S., & Shekokar, S. S. A Literature Review of Importance Pharmacological Activities of Few Plants of Anacardiaceae Family.
32. Kadia, R., Bhavsar, S., & Modi, N. A Review on Phytochemical Constituents and Pharmacological Activities of Buchanania lanzan Sprang., Millettia peguenensis Ali., Evolvulus alsinoides L., 2023.
33. Bhatnagar, S., & Kumari, R. Morphological and anatomical studies of Buchanania lanzan Spreng. fruit and seed (Anacardiaceae) and the factors causing its extinction. *Vegetos*, 2023; *36*(4): 1366-1376.
34. Dahiya, M., Yadav, M., Kumar, S., Chauhan, S., & Lamba, D. GC–MS analysis and fabrication of nanoparticles of Buchanania lanzan oil for the anticancer activity. *Research Journal of Pharmacy and Technology*, 2024; *17*(10): 4699-4706.
35. Pradhan, R. (2018). *Vegetative Propagation of Char (Buchanania lanzan Spreng) From Stem Cuttings* (Doctoral dissertation, ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY).
36. Biswas K, et al. Biological activities of Neem (Azadirachta indica). Curr Sci., 2002.
37. Surjushe A, et al. Aloe vera: A short review. Indian J Dermatol, 2008.
38. Hammer KA, et al. Antimicrobial activity of tea tree oil. Clin Microbiol Rev., 2006.
39. Hewlings SJ, Kalman DS. Curcumin: A review of therapeutic effects. Foods., 2017.
40. Siddiqui MZ. Boswellia serrata: A potential anti-inflammatory agent. Indian J Pharm Sci., 2011.
41. Mukherjee PK, et al. Herbal medicines in skin care. Fitoterapia. 2011.
42. Arif T, et al. Herbal approaches in dermatology. Phytother Res., 2022.
43. Heymann, F., & Tacke, F. Immunology in the liver—from homeostasis to disease. *Nature reviews Gastroenterology & hepatology*, 2016; *13*(2): 88-110.
44. Yatoo, M. I., Gopalakrishnan, A., Saxena, A., Parray, O. R., Tufani, N. A., Chakraborty, S., ... & Iqbal, H. M. Anti-inflammatory drugs and herbs with special emphasis on herbal medicines for countering inflammatory diseases and disorders-a review. *Recent patents on inflammation & allergy drug discovery*, 2018; *12*(1): 39-58.
45. Ghosh, N., Ghosh, R., Mandal, V., & Mandal, S. C. Recent advances in herbal medicine for treatment of liver diseases. *Pharmaceutical biology*, 2011; *49*(9): 970-988.
46. Mondal, M., Konar, A., Halder, S., Roy, A., Dalal, D. D., & Ghosh, P. An insight into the morphological, ethno medicinal, phytochemical and pharmaceutical properties of Buchanania lanzan. *J Med Plants Stud*, 2024; *12*(1): 11-17.
47. Elias, A., Habbu, P. V., & Iliger, S. An updated review on phyto-pharmacological and pharmacognostical profile of Buchanania lanzan: A pharmacognostic miracle herb. *International Journal of Scientific Research in Science and Technology*, 2021; *8*(6): 298-310.
48. Rai, P. K., Sharma, D. R., & Sharma, A. Buchanania lanzan is a pharmacognostic miracle herb. *Research Journal of Pharmacognosy and Phytochemistry*, 2015; *7*(3): 182-188.
49. Al-Harrasi, A., Khan, A. L., Asaf, S., & Al-Rawahi, A. Taxonomy, distribution and ecology of Boswellia. In *Biology of Genus Boswellia*, 2019; 11-34. Cham: Springer International Publishing.

50. Thulin, M. (2020). *The genus Boswellia (Burseraceae): the frankincense trees*. Acta Universitatis Upsaliensis.
51. Pramod, C., Ratheesh, M., Jose, S. P., & Paul, F. In vivo evaluation of anti-inflammatory activities of ethanolic extract of Buchanania lanzan Spreng bark. *Journal of Medicinal Plants Studies*, 2020; *8*(4): 212-17.
52. Al-Harrasi, A., Hussain, H., Csuk, R., & Khan, H. Y. Taxonomy of Boswellia tree, traditional medicinal uses of frankincense and historical aspects of boswellic acids. *Chemistry and Bioactivity of Boswellic Acids and Other Terpenoids of the Genus Boswellia; Elsevier: Amsterdam, The Netherlands*, 2018; 1.
53. Elias, A., Habbu, P. V., & Iliger, S. An updated review on phyto-pharmacological and pharmacognostical profile of Buchanania lanzan: A pharmacognostic miracle herb. *International Journal of Scientific Research in Science and Technology*, 2021; *8*(6): 298-310.
54. Basar, S. (2005). *Phytochemical investigations on Boswellia species* (Doctoral dissertation, Staats-und Universitätsbibliothek Hamburg Carl von Ossietzky).
55. Khan, A. L., Asaf, S., Al-Rawahi, A., Lee, I. J., & Al-Harrasi, A. Rhizospheric microbial communities associated with wild and cultivated frankincense producing Boswellia sacra tree. *PloS one*, 2017; *12*(10): e0186939.
56. Sharma, A., Gupta, N. K., & Dixit, V. K. Complexation with phosphatidyl choline as a strategy for absorption enhancement of boswellic acid. *Drug delivery*, 2010; *17*(8): 587-595.
57. Sharma, A., Gupta, N. K., & Dixit, V. K. Complexation with phosphatidyl choline as a strategy for absorption enhancement of boswellic acid. *Drug delivery*, 2010; *17*(8): 587-595.
58. Shailasree, S., Ruma, K., & Prakash, H. S. Curative properties of Buchanania lanzan: As evaluated by its anti-oxidant, anti-inflammatory and DNA protective properties. *J Nat Pharm.*, 2012; *3:* 71-7.
59. Sushma, N., Smitha, P. V., Gopal, Y. V., Vinay, R., Reddy, N. S., Mohan, C. M., & Raju, A. B. (2013). Antidiabetic, antihyperlipidemic and antioxidant activities of buchanania lanzan spreng methanol leaf extract in streptozotocin-induced types I and II diabetic rats.
60. Marbaniang, D., Das, A. K., Pal, P., Gogoi, N. R., Saikia, A., Ray, S., & Mazumder, B. Novel delivery technologies: triggering the biopharmaceutical potential of Boswellic acids. *The Natural Products Journal*, 2023; *13*(5): 57-64.
61. Siddiqui, M. Z., Chowdhury, A. R., Prasad, N., & Thomas, M. Buchanania lanzan: a species of enormous potentials. *World journal of pharmaceutical sciences*, 2014; 374-379.
62. Semalty A, et al. Phytosome: A novel drug delivery system. Indian J Pharm Sci., 2007.
63. Bombardelli E, et al. Phospholipid complexes in phytosome technology. Fitoterapia, 1989.
64. Gupta NK, et al. Advances in phytosomal drug delivery systems. J Drug Deliv Sci Technol, 2020.
65. Patel J, et al. Preparation and evaluation of phytosomes. Int J Pharm Sci Rev Res., 2009.
66. Lu M, et al. Stability enhancement using phytosomes. Drug Dev Ind Pharm., 2019.
67. El-Gizawy SA, et al. Dermal delivery through phytosomal systems. AAPS PharmSciTech., 2018.
68. Pattnaik, A., Sarkar, R., Sharma, A., Yadav, K. K., Kumar, A., Roy, P., ... & Sen, T. Pharmacological studies on Buchanania lanzan Spreng.-A focus on wound healing with particular reference to anti-biofilm properties. *Asian Pacific journal of tropical biomedicine*, 2013; *3*(12): 967-974.
69. Tauheed, A. M., Mamman, M., Ahmed, A., Sani, N. I. A., Suleiman, M. M., Sulaiman, M. H., & Balogun, E. O. Acute, sub-acute, sub-chronic and chronic toxicity studies of four important Nigerian ethnomedicinal plants in rats. *Clinical Phytoscience*, 2021; *7*(1): 1.
70. Abuelella, K. E., & Salem, A. Y. Advanced nanocarrier-based strategies for enhancing herbal actives in cosmetic and cosmeceutical applications. *Nanotechnology and Applied Sciences Journal*, 2025; *1*(2): 23-43.
71. Samu, M. J. (2014). *ACADEMY OF PHARMACEUTICAL SCIENCES* (Doctoral dissertation, Kerala University of Health Sciences).
72. Dwivedi, J., Wal, P., Kaushal, S., Tripathi, A. K., Gupta, P., & Rao, S. P. Phytosome based cosmeceuticals for enhancing percutaneous absorption and delivery. Journal of Research in Pharmacy, 2025; 29(1): 242-271.
73. Mishra, R., Singh, S., Mishra, S., & Bhatt, S. Planterosomal gel designed by different polyherbal herbs: a novel method for skin healing. Journal of Drug Discovery and Health Sciences, 2024; 1(02): 62-68.