Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
Impact Factor (RJIF): 6.35
www.phytojournal.com
JPP 2025; 14(5): 200-205
Received: 14-06-2025
Accepted: 17-07-2025

Aman Gupta
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Shrisha Iyengar
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Mrunali Late
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Saloni Shetty
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Mitali Rane
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Yogeshwar Sharma
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area, Dombivli (East), Maharashtra, India

Corresponding Author:
Aman Gupta
Vidya Bhavan's College of Pharmacy, Sankara Nagar, Sonarpada, MIDC Area,

A holistic overview of herbal and allopathic therapeutics of *Acne Vulgaris*

Aman Gupta, Shrisha Iyengar, Mrunali Late, Saloni Shetty, Mitali Rane and Yogeshwar Sharma

DOI: https://www.doi.org/10.22271/phyto.2025.v14.i5c.15574

Abstract
Acne is the most common skin disease that affects approximately 85% of teenagers and can persist into adulthood. Acne leads to both inflammatory and non- inflammatory lesions that may cause prolonged erythema, scarring and excess pigmentation. *Acne vulgaris* is a chronic inflammatory disease associated with significant cutaneous and physiological impact. It is characterized by papules, red skin, pimples, nodules, whiteheads, black heads. *Propionibacterium acnes* (now known as *Cutibacterium acnes*) is acknowledged as a pus - producing microbes that induce inflammatory response in acne.
Conventional treatment includes drugs like retinoid, antibiotics but they show some side effects and resistance problems. Therefore present study aims to raise interest in herbal medicine as an integrative approach for treatment of acne.
Herbal medicines, which utilizes natural extracts or plant extracts can be used as safer alternatives in comparison to synthetic medicine. The primary goal of herbal therapy is to provide a treatment that is effective, safe, and cost-effective for use. This review highlights the role of herbal medicines or herbal plants in treatment of acne. Various scientific databases were searched to identify plants with documented anti- acne activity.

Keywords: Acne, *Propionibacterium acnes*, herbal medicines, skin disease

Introduction
Acne is a skin condition which is genetic or acquired affection of the pilosebaceous units. It is derived from the Greek word "akme" which means a peak. It is most common in the age group of 18 to 25 [1]. Around 70% - 80% people are affected by acne and it is more common in male in comparison to females [2].
Acne is a type of skin disease caused due to many reasons like due to blockage of hair follicles with the departed skin cells. Increase of sebum production, sloughing of keratinocytes, bacterial growth and inflammation. The bacteria involved in acne production is named *Propionibacterium acnes* (*P. acne*) which is a main etiological factor in acne vulgaris [3].
The acne treatment completely depends upon its severity and its type. Severe acne contain papules and need both oral as well as topical treatment and for non-severe acne topical treatment is sufficient [4]. For mild to moderate acne, common topical treatments like benzoyl peroxide (BPO), retinoids, and antibiotics—either on their own or in combination—are usually the first choice. These medicines often work well, but they can also cause side effects such as dryness and irritation, which may make it harder for patients to stick with treatment. Recently, dermocosmetic products have been gaining attention as another option. They can be used alone in mild cases or alongside standard therapies to improve results, make treatments more tolerable, and support overall skin health and quality of life in people with more stubborn acne. At the same time, the growing problem of antibiotic resistance highlights the need to explore new antimicrobial agents as part of future acne therapies [5].
Plant extracts contain various active compounds or phyto constituent which can target several factors responsible for formation and recurrence of acne. They show multiple benefits, like controlling excess oil production, reducing inflammation, fighting bacteria, promoting gentle skin renewal, and protection against oxidative stress. When used either or in combination with synthetic acne medication, these natural remedies provide a more holistic approach to skin care. They not only support the effectiveness of standard first - line treatment but also minimize unwanted side effects [5]. Herbal treatment for acne have gained increasing priority because they are generally well-tolerated, have a long history of traditional use, and show fewer side effects, and are more cost effective than synthetic one. Many plants which are used

in traditional medicine are now entering the expanding cosmeceutical market. Their effectiveness in acne treatment is largely attributed to their antibacterial properties, as well as their ability to regulate sebum production, reduce inflammation, and counteract hyperkeratinisation, which are all key factors in acne development. This review aims to present current evidence on medicinal plants and their bioactive constituents that play a role in acne treatment [6].

Types of Acne

- **Acne Vulgaris:** According to most studies this is the most widespread type of acne. Most of the time it begins during puberty but can continue well into adulthood. It mainly seen on the face, neck, and back as pimples, whiteheads, blackheads, pustules, or nodules [7].
- **Acne Fulminans:** This type of acne is also called acne maligna, this is a very rare and severe type of nodular acne and has sudden onset with systemic symptoms like fever and joint pain. It also leads to ulcers and deep scars. Standard acne treatments don't work well, but oral steroids or isotretinoin may help [7].
- **Gram-Negative Folliculitis:** This is a bacterial infection involving cysts and pustules. It is a very rare type of acne. It sometimes develops after long-term antibiotic use for acne. Though not fully understood, isotretinoin is considered an effective treatment [7].
- **Acne Conglobata:** It is a severe form of the acne vulgaris it shows symptoms like appearance as large, interconnected lesions and blackheads. It is mostly seen in men of the age range between 18-30 and can cause permanent scarring. It commonly occurs on the face, chest, back, upper arms, and thighs. Treatment usually involves strong medications such as isotretinoin (Accutane) [7].
- **Pyoderma Faciale (*Rosacea Fulminans*):** It is not only rare but also a severe type of acne which is only seen in women. It suddenly appears on the face as painful nodules, sores, and pustules—even in women without prior acne history. It can leave deep scars if untreated. Therapy may involve corticosteroid injections and isotretinoin [7].
- **Acne Rosacea:** *Acne vulgaris* and *Acne rosacea* both confuse people due to the same symptoms, rosacea appears as a persistent red rash on the nose, cheeks, chin, or forehead, sometimes with bumps and pimples. Unlike acne, blackheads are usually absent. If untreated, it can cause facial swelling. A dermatologist's care is needed since common acne medicines can worsen rosacea [7].

Etiology of Acne

The given below are some factors responsible for the cause of acne.

- **Genetics:-**As the disease does not follow Mendelian inheritance pattern, the genetics of acne susceptibility is polygenic. Some of the gene candidates includes the polymorphism in Tumor necrosis factor alpha, Interleukin-1 alpha, CYP1A1 [9].
- **Psycological:** The increased stress levels are associated with the increased acne severity. The National Institutes of Health (USA) shows that stress can cause acne flare. A study of adolescents observed a positive correlation between stress levels and acne severity [9].
- **Environmental Factors:** Various factors like prolonged sweating, increase in skin hydration, exposure to dirt or vaporized cooking oil or certain chemicals like petroleum derivatives can cause acne [9]
- **Medications:-**Some medications such as anticonvulsants, steroids, lithium and so on can cause acne [8]
- **Occlusive wears:-**Use of occlusive wear, such as shoulder pads, headbands, backpacks, and underwire brassieres [8].
- **Cosmetics:** Oil-based cosmetics and facial massage [8].
- **Disorders:** Endocrine disorders, such as polycystic ovarian syndrome, and even pregnancy. A premenstrual flare-up in acne seems to follow edema of the pilosebaceous duct. This occurs in 70% of female patients [8].
- **Stress and mechanical trauma:** Repetitive mechanical trauma resulting from scrubbing affected skin with soaps and detergents. Psychological stress is associated with increased acne severity, probably by stimulating stress hormones [8]
- **Diet:** Increased milk and high glycemic index foods consumption can cause acne. This could be attributed to the rich constituents of insulin-like growth factor (IGF) and natural hormonal components of milk [8].
- **Insulin resistance:** Insulin resistance may also have a significant role in acne, as individuals with insulin resistance have increased levels of IGF, which is linked to increased facial sebum excretion [8].

Pathophysiology of acne

The pathophysiology of acne is complex and varies significantly across the individuals. The given below are the two examples of causes of acne:-

1. Genetic factors

Genetics play a crucial role in acne development. Studies shows that there is a higher prevalence of acne in individuals having family history of this condition. Genes influence various aspects of acne pathogenesis including sebum overproduction, keratinization, and immune response to *C.acnes*. Variations in gene related to androgen receptors can lead to development of acne. Genetic factors can also influence body's inflammatory responses thereby contributing in formation of acne and severity of acne lesions [10].

2. Environmental Factors

Environmental factors like climate, diet, pollution and lifestyle can also influence formation of acne. Consumption of high glycemic index foods and dairy products, have been linked to acne severity, possibly due to their role in insulin like growth factor 1(IGF-1) signaling which can increase sebum production and inflammation. Climate factors like humidity causes epidermal kerotinocyte swelling, leading to the acute hair follicle occlusion, which is a favorable environment for *C.acnes*. Air pollutants like NO2 and sulfur dioxide can increase oxidative stress on skin contributing to acne flares. Increase in temperature can lead to an increase in sebum production which promotes growth of lipophilic organisms such as *C.acnes* [10].

Treatment of Acne

Treatment of acne can help reduce skin lesions, control the production of sebum and it helps in the inhibition of further infections. Hence, anti-inflammatory drugs and anti-bacterial drugs are most preferred ones for the treatment of acne. These medications can be administered topically, systemically or orally. For acne pathogenesis, combinational therapy is more effective [11].

Topical Treatment

Topical treatments are administered topically on the affected region, hence the systemic absorption of these dosage forms are very low. Topical treatments include gels, lotions, creams, solutions, washes. Cases of mild to moderate acne can be treated via topical treatment [11].

1 Retinoids: Retinoid is used as a first line treatment for inflammatory and non-inflammatory acne. Retinoids help to control sebum production, treat hyperpigmentation, reduce acne lesions, reverse the damaged epithelium, and prevent scarring. Retinoids show slow therapeutic action and increase skin sensitivity, hence consistent use and care is essential. Retinoids can also lead to dryness of skin and skin irritations. Example of Retinoid is Tazarotene. It helps in hindering hyper proliferation of *P.acnes* and hyperkeratinization. Some commonly available retinoids in the market are as follows: [11]

- **Tretinoin:** Tretinoin is an anti-inflammatory agent and a derivative of vitamin A. It is used in conjugation with other retinoids to treat acne. It helps to smoothen the epithelial surface and reduce the sebum production. Tretinoin, in the market, is available in the form of gels, creams and ointments. Tretinoin can increase sun sensitivity, redness, dryness, itching, muscle aches or headaches [11].
- **Adapalene:** Adapalene is used in the treatment of mild to moderate acne. It is a first line treatment for acne and has more advantages as compared to tretinoin and tazarotene. It helps to treat inflammation caused by acne and reduces hyperkeratinization. The adverse effects include redness, irritation and skin itching [11].

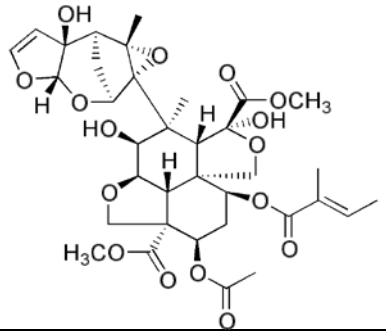
2. Antibiotics: Topical antibiotics can be used for mild to moderate acne. They possess anti *P.acnes* activity. Hence they act on the surface of skin and target inflammatory lesions. Not all topical antibiotics are considered for treatment of acne due to their ineffectiveness and adverse effects. eg: tetracycline.Topical antibiotics help in reducing inflammation of acne and *P.acnes* colonization. Some topically used antibiotics are: [11]

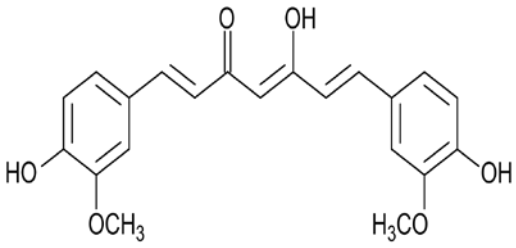
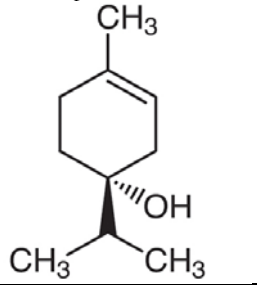
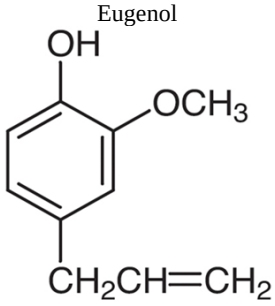
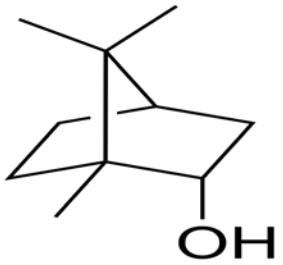
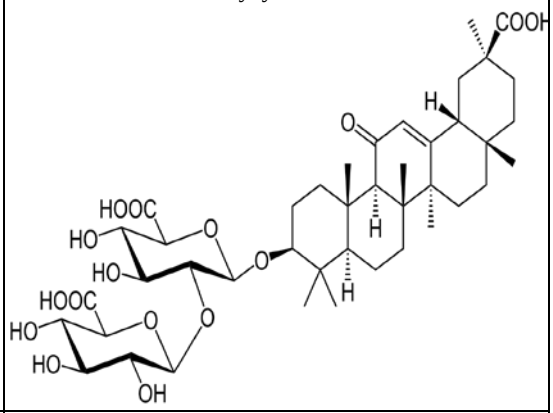
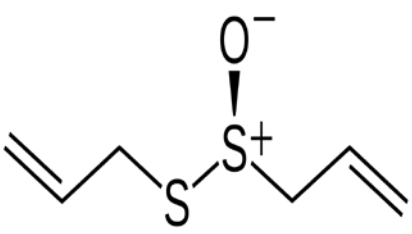
- **Clindamycin:** This topical antibiotic is semi synthetic in nature, used in the treatment of acne. It helps to inhibit growth of *P. acnes* and control inflammation. Here, combinational treatment is highly encouraged as topical antibiotics monotherapy must be avoided for treating *Acne vulgaris* [11].
- **Erythromycin:** Erythromycin is also a topical antibiotic for acne. It has properties similar to clindamycin I.e. inhibition of *P. acnes* growth and inflammation control. In comparison to monotherapy, combinational therapy is beneficial as it is found after research that erythromycin contains only 60% of bacterial resistance. Combinational therapy includes: Salicylic acid, Benzoyl Peroxide, Azelaic Acid, Dapsone, Niacinamide [11]

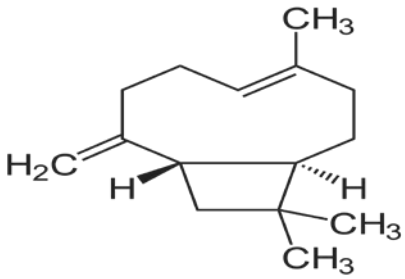
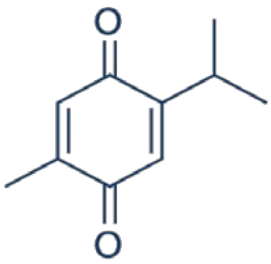
3. Vitamins, Anti-Inflammatory and Anti-Oxidants

- **Niacinamide:** Niacinamide is a form of vitamin B3 called nicotinamide. They help in reduction of sebum and inhibit worsening of acne. Niacinamide contains anti-inflammatory properties. Hence, it can be used to treat mild to moderate acne. It also helps with other skin issues such as fine lines, sun damage, wrinkles and redness [11].
- **Benzoyl Peroxide:** Benzoyl peroxide works as an antibacterial and displays disinfectant activity. This can be used for treatment of mild to moderate acne. BPO helps to degrade bacterial proteins by producing free oxygen. They show bactericidal action against *P.acnes*. For better results, when BPO is used in combination with topical antibiotics, it inhibits *P.acnes* species resistance and increases therapeutic action. Adverse effects are redness, peeling, itching and irritation [11].
- **Azelaic Acid:** Azelaic acid is derived from barley and wheat which contain anti-oxidative, antibacterial, anti keratolytic and anti-inflammatory properties. It is used in treatment of acne, skin disorders like hyperpigmentation. Some adverse effects include redness, itching, burning sensation and difficulty in breathing [11].

Herbal Drugs Used in the Treatment of Acne

Sr. No.	Herbal Drug	Habitat	Key constituents	Pharmacological action	Structure
1	Neem (*Azadirachta indica*)	*Azadirachta indica* is indigenous to South Asia, possibly originating in northern Myanmar and the Assam region of India. [12]	1.Azadirachtin [13]	Antibacterial (against *C. acnes*), antiinflammatory, antioxidant. [13]	Azadirachtin 
			2. Nimbin [14].	Anti-inflammatory, antimicrobial, reduces acne-causing pathogens [14]	
2	Aloe vera	*Aloe* species are mostly inhabitants of arid climates, and are widely distributed in Africa, India, and other arid areas. [15]	1.Acemannan (Polysaccharide) [16]	Acemannan is a bioactive polysaccharide with anti-inflammatory (TNF-α, IL-6, IL-1β inhibition) and antimicrobial effects against *Cutibacterium acnes*, reducing acne lesions. [16]	Acemannan
			2.Anthraquinones (Aloin, Emodin) [17]		
3	Turmeric (*Curcuma*	*Curcuma longa* (turmeric) is native to	1. Curcumin [19]	Curcumin's anti-inflammatory,	Curcumin

	longa)	India and widely cultivated across tropical and subtropical Asia, including China, Thailand, Indonesia, and Malaysia. [18]		antibacterial, and antioxidant properties make it effective against acne and help protect skin from aging. [19]	
4	Tea Tree oil (*Melaleuca alternifolia*)	*M.alternifolia* naturally grows in swampy, subtropical coastal areas of northeastern New South Wales and southern Queensland, and unlike other *Melaleuca* species, it is not found outside Australia. [20]	1.Terpinen-4-ol 2.α-terpineol 3.α-pinene	Terpinen-4-ol is primarily responsible for the oil's broadspectrum antimicrobial and antiinflammatory effects against *C. acnes* and other acne-related microbes. [20, 21]	Terpinen-4-ol 
5.	Basil (*Ocimum basilicum*)	The genus *Ocimum*, which belongs to the *Lamiaceae* (*Labiatae*) family, has distribution throughout tropical and subtropical America, Africa, and Asia continents. [22]	1.Eugenol	A potent antibacterial agent found in basil, it helps to fight acne-causing bacteria and prevent breakouts. [23]	Eugenol 
			2. Linalool, Ursolic Acid.	Anti-inflammatory compounds in basil that helps alleviate skin irritation, redness, and swelling associated with acne. [24]	
6.	Coriander (*Coriandrum sativum*)	Coriander is native to the eastern Mediterranean and southern Europe but is now cultivated worldwide. It thrives in full sun and deep, fertile, well-drained soil.	Volatile oils: Borneol, p-cymene, geraniol, hydroxy coumarins (umbelliferone, linalool, scopoletin, pertroselenic acid, and linolenic acid (fatty oils)	Potent activity against acne-inducing bacteria such as *P. acnes* and S. epidermidis, reduce inflammation, and protect against free radical damage, which are all contributing factors to acne. [25]	Borneol 
7.	Liquorice (*Glycyrrhiza glabra*)	*Glycyrrhiza glabra* is native to Eurasia, in central and south-western Asia and the Mediterranean region and prefers a temperate to subtropical climate with full sun. [26]	1.Glycyrrhizin (Glycyrrhizic acid) 2. Licochalcone A. 3. Glabiridin.	Glycyrrhizin has strong antiinflammatory, reduces redness and swelling in acne lesions by inhibiting proinflammatory mediators (TNF-α, IL6). Also shows antibacterial effects against acne-causing bacteria (*C.acnes*) [27]	Glycyrrhizin 
8.	Garlic (*Allium sativum*)	Garlic is native to central and south Asia, extending from the Black Sea through the southern Caucasus, northeastern Iran,and the Hindu Kush; it also grows wild in parts of Mediterranean Europe.	Organosulfur compounds, including allicin, diallyl sulfides (DAS), diallyl disulfides (DADS), and diallyl trisulfides (DATS)	These components provide garlic with antibacterial, antifungal, and antiinflammatory effects that help reduce acne-causing bacteria, inflammation, and redness. [28, 29]	Allicin 
9.	Clove (*Syzygium*	Native to the Maluku Islands of Indonesia,	1.Eugenol 2. Caryophyllene.	These components show Antibacterial properties	Caryophyllene

	aromaticum)	clove is now cultivated in other tropical regions including parts of India, Madagascar, and Zanzibar.	3. Eugenyl Acetate.	against acne-causing bacteria like *P. acnes*, reducing inflammation, and its antioxidant effects that protect against skin damage. [30]	
10.	Black cumin (*Nigella sativa*)	Native to western Asia (Arabia, the Levant, Cyprus, Turkey, Iran and Iraq), and eastern Europe (Bulgaria and Romania).	Thymoquinone (TQ) Thymohydroquinone (THQ)	These compounds help to reduce inflammation and the growth of acne-causing bacteria, making black cumin oil and extracts effective in treating acne and preventing future breakouts. [31]	Thymoquinone 

Allopathic and Herbal

Why to Choose Herbal Over Allopathic?

Nowadays, herbal treatment has been widely overtaken by the allopathic system of medicine. Herbal medicine aims to improve self-healing ability and immune system while Allopathic medicine focuses on treating specific diseases or symptoms. The herbal medicine often takes a holistic approach, addressing overall health and balance rather than just treating symptoms. For Anti-acne treatments some herbal options include Tea tree oil known for its antimicrobial and anti-inflammatory properties. Aloe-vera soothes skin and reduces inflammation. Turmeric contains curcumin which has anti-inflammatory and antioxidant effects. Neem traditionally used for its antibacterial and anti-inflammatory properties [32].

Conclusion

Acne is a common chronic skin disease caused by factors like excess sebum, bacterial growth (*Cutibacterium acnes*), genetics, hormones, and environment. Conventional treatments such as retinoids, antibiotics, and benzoyl peroxide are effective but may cause side effects and resistance. Herbal medicines are gaining attention as safer, cost-effective alternatives due to their anti-inflammatory, antibacterial, antioxidant, and sebum-regulating properties. Plants like neem, aloe vera, turmeric, tea tree oil, basil, liquorice, and black cumin show promising anti-acne activity, making herbal therapy a holistic approach compared to allopathic treatments.

Acknowledgement

We express our sincere gratitude to Mr.Aman Gupta (Assistant Professor in Department of Pharmacology at Saraswathi Vidya Bhavan's College of Pharmacy) and our institute Saraswathi Vidya Bhavan's College of Pharmacy for their contribution and guidance provided to us for the successful completion of our review article.

References

1. Nagansurkar SB, Bais SK, Choragi R. A review: Herbal plants used in acne treatment. Int J Pharm Herb Technol. 2023;1(3):249-263.
2. Bilal M, Kumar P, Singh NK, Adil M, Arora K. A review on multi-herbal anti-acne facewash. World J Pharm Res. 2020;9(12):397-400. doi:10.20959/wjpr202012-18794.
3. Reddy DM, Jain V. An overview on medicinal plants for the treatment of acne. J Crit Rev. 2019;6(6):7-14. doi:10.22159/jcr.2019.v6i6.35696.
4. Nasri H, Bahmani M, Shahinfard N, Moradi Nafchi A, Saberianpour S, Rafieian-Kopaei M. Medicinal plants for the treatment of acne vulgaris: a review of recent evidence. Jundishapur J Microbiol. 2015;8(11):e25580. doi:10.5812/jjm.25580.
5. Leti M, Garidou L, Cuisiat SV, Stennevin A, Doat G, Mias C. Plant extracts in acne management: a narrative review. Dermatology. 2025;241(1):1-10. doi:10.1159/000547149.
6. Abozeid D, Fawzy G, Issa M, Abdeltawab N, Soliman F. Medicinal plants and their constituents in the treatment of acne vulgaris. Biointerface Res Appl Chem. 2023;13(2):189-198. doi:10.33263/BRIAC132.189.
7. Shadab K, Aney J, Anjum P. Anti-acne herbs: a review. World J Pharm Res. 2018;7(9):464-481. doi:10.20959/wjpr20189-12181.
8. Sutaria AH, Masood S, Saleh HM, Schlessinger J. Acne vulgaris. Treasure Island (FL): StatPearls Publishing; 2025.
9. Kameswararao K, Sujani C, Koteswararao NVN, Rajarao A, Satyanarayanamma PNS. A brief review on acne vulgaris. Res J Pharmacol Pharmacodyn. 2019;11(3):120-126. doi:10.5958/2321-5836.2019.00020.X.
10. Kim HJ, Kim YH. Exploring acne treatments: from pathophysiological mechanisms to emerging therapies. Int J Mol Sci. 2024;25(10):5432-5445. doi:10.3390/ijms25105432.
11. Vasam M, Korutla S, Bohara RA. Acne vulgaris: a review of the pathophysiology, treatment, and recent nanotechnology based advances. Biochem Biophys Rep. 2023;36:101578. doi:10.1016/j.bbrep.2023.101578.
12. Stoney C. *Azadirachta indica* - Neem, a versatile tree for the tropics and subtropics. Winrock International; 1997.
13. Alzohairy MA. Therapeutic role of *Azadirachta indica* (Neem) and their active constituents in diseases prevention and treatment. Evid Based Complement Alternat Med. 2016;2016:7382506. doi:10.1155/2016/7382506.
14. Sutar AK, Deshmukh AS. A comprehensive review on acne and their herbal remedies. Int J Pharm Res Appl. 2024;9(3):1653-1663. doi:10.35629/44940903-1653-1663.

15. Salehi B, Albayrak S, Antolak H, Kręgiel D, Pawlikowska E, Sharifi-Rad M, *et al*. *Aloe* genus plants: from farm to food applications and phytopharmacotherapy. Int J Mol Sci. 2018;19(9):2843-2855. doi:10.3390/ijms19092843.
16. Pal S, Raj M, Singh M, Saurav K, Paliwal C, Saha S, *et al*. The effect of *Aloe vera* on skin and its commensals: contribution of acemannan in curing acne caused by *Propionibacterium acnes*. Microorganisms. 2024;12(10):2070-2081. doi:10.3390/microorganisms12102070.
17. Surjushe A, Vasani R, Saple DG. *Aloe vera*: a short review. Indian J Dermatol. 2008;53(4):163-166. doi:10.4103/0019-5154.44785.
18. Srivastava BBL, Ripanda AS, Mwanga HM. Ethnomedicinal, phytochemistry and antiviral potential of turmeric (*Curcuma longa*). Compounds. 2022;2(3):200-221. doi:10.3390/compounds2030017.
19. Zhang YF, Wang DX, Liao CH, Liu XJ, Zhang LL, Wang PR, *et al*. Curcumin-mediated photodynamic therapy for mild to moderate acne: a self-controlled split-face randomized study. Photodiagnosis Photodyn Ther. 2024;45:103887. doi:10.1016/j.pdpdt.2024.103887.
20. Carson CF, Hammer KA, Riley TV. *Melaleuca alternifolia* (Tea tree) oil: a review of antimicrobial and other medicinal properties. Clin Microbiol Rev. 2006;19(1):50-62. doi:10.1128/CMR.19.1.50-62.2006.
21. Ahmad S, Afsana, Popli H. A review on efficacy and tolerability of tea tree oil for acne. J Drug Deliv Ther. 2019;9(3):609-612. doi:10.22270/jddt.v9i3.2838.
22. Azizah NS, Irawan B, Kusmoro J, Safriansyah W, Farabi K, Oktavia D, *et al*. Sweet basil (*Ocimum basilicum* L.): a review of its botany, phytochemistry, pharmacological activities, and biotechnological development. Plants. 2023;12(24):4148. doi:10.3390/plants12244148.
23. Saviuc C, Ciubucă B, Dincă G, Bleotu C, Drumea V, Chifiriuc MC, *et al*. Development and sequential analysis of a new multi-agent, anti-acne formulation based on plant-derived antimicrobial and anti-inflammatory compounds. Int J Mol Sci. 2017;18(1):175-187. doi:10.3390/ijms18010175.
24. Silva MG, Vieira IG, Mendes FN, Albuquerque IL, dos Santos RN, Silva FO, *et al*. Variation of ursolic acid content in eight *Ocimum* species from northeastern Brazil. Molecules. 2008;13(10):2482-2487. doi:10.3390/molecules13102482.
25. Önder A. Coriander and its phytoconstituents for the beneficial effects. InTech. 2018. doi:10.5772/intechopen.78656.
26. Ahmed NA. Phytochemicals and pharmacological review on licorice (*Glycyrrhiza glabra*). Int J Pharm Res Appl. 2021;6(2):304-313. doi:10.35629/7781-0602304313.
27. Ramsis T, Refat M, Selim HM, Elseedy H, Fayed EA. The role of current synthetic and possible plant and marine phytochemical compounds in the treatment of acne. RSC Adv. 2024;14(33):24287-24321. doi:10.1039/d4ra03865g.
28. Shang A, Cao SY, Xu XY, Gan RY, Tang GY, Corke H, *et al*. Bioactive compounds and biological functions of garlic (*Allium sativum* L.). Foods. 2019;8(7):246-258. doi:10.3390/foods8070246.
29. Patsute S, Mohite M. A review: Acne vulgaris and garlic. Int J Pharm Res Appl. 2022;7(3):2187-2189. doi:10.35629/7781-070321872189.
30. Aziz A, Rizkiyah DN, Qomariyah L, *et al*. Unlocking the full potential of clove (*Syzygium aromaticum*) spice: an overview of extraction techniques, bioactivity, and future opportunities in the food and beverage industry. Processes. 2023;11(8):2300-2315. doi:10.3390/pr11082300.
31. Hannan MA, Rahman MA, Sohag AAM, Uddin MJ, Dash R, Sikder MH, *et al*. Black cumin (*Nigella sativa* L.): a comprehensive review on phytochemistry, health benefits, molecular pharmacology, and safety. Nutrients. 2021;13(6):1784-1798. doi:10.3390/nu13061784.
32. Ahmad AS, Sharma R. A review on acne vulgaris. Eur J Mol Clin Med. 2020;7(7):120-126.