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Correspondence to:
Sakina Turabi
Email: sakinaturabi19111@gmail.com
ORCID: 0009-0000-6815-8726

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Review Article

Bioactive Nutraceuticals as Adjunct Therapies in the Management of Skin Disorders

Sakina Turabi[1], Shambaditya Goswami[2], Soumya Pathak[3]

1 Scholar, Department of Pharmacy, Divine College of Pharmacy, Siwan, Bihar, India
2 Professor, Department of Pharmaceutical Chemistry, Divine College of Pharmacy, Siwan, Bihar, India
3 Assistant Professor, Department of Pharmaceutics, Divine College of Pharmacy, Siwan, Bihar, India

ABSTRACT

Introduction: Skin disorders such as acne, eczema, psoriasis, ulcers, and skin ageing have a major impact on global health and quality of life. With their anti-inflammatory and antioxidant qualities and fewer side effects than traditional medications, nutraceuticals have become promising therapeutic and preventive agents.

Methods: A comprehensive literature search (2020–2025) was conducted in PubMed, Scopus, and ScienceDirect using terms such as "nutraceuticals," "skin disorders," "phytochemicals," and "dermatology." Studies of vitamins, minerals, collagen peptides, probiotics, omega-3 fatty acids, and plant-based bioactives were reviewed for effectiveness and mechanisms of action.

Findings: Nutraceuticals demonstrated clinical efficacy in modulating inflammation, promoting collagen synthesis, improving hydration, and accelerating wound repair. Compounds such as curcumin, aloe vera, green tea polyphenols, and vitamin C showed notable dermo-protective effects.

Discussion: Research indicates that nutraceuticals can serve as effective adjunct therapies in dermatological care, promoting skin health through cellular defense and renewal.

Conclusions: The addition of nutraceuticals in dermatology could lead to better therapeutic results and decrease the use of chemicals.

Key words: Acne, antioxidants, dermatology, eczema, nutraceuticals, phytochemicals, psoriasis, skin health, wound healing

INTRODUCTION

The term "nutraceutical" was introduced in 1989 by Dr. Stephen DeFelice. The word combines "nutrition" and "pharmaceutical." Nutraceuticals are dietary products or bioactive food components that provide health benefits beyond basic nutrition. They offer preventive or therapeutic support for skin-related ailments. [1] In dermatology, interest in nutraceuticals is growing rapidly. The skin is the largest and most visible organ and is often affected by acne, photoaging, dryness, wrinkles, and poor wound healing. These conditions result from both internal and external factors. [2] Conventional medications, lotions, and creams are still useful for skin care. However, they often face challenges such as localized targeting, variable penetration, and side effects like irritation or allergic reactions. [3] These products can contain toxic chemicals such as parabens and sulfates, which disrupt hormones or strip natural oils. Frequent dosing causes rapid irritation and poor long-term tissue concentration. [4] As a result, researchers are exploring internal

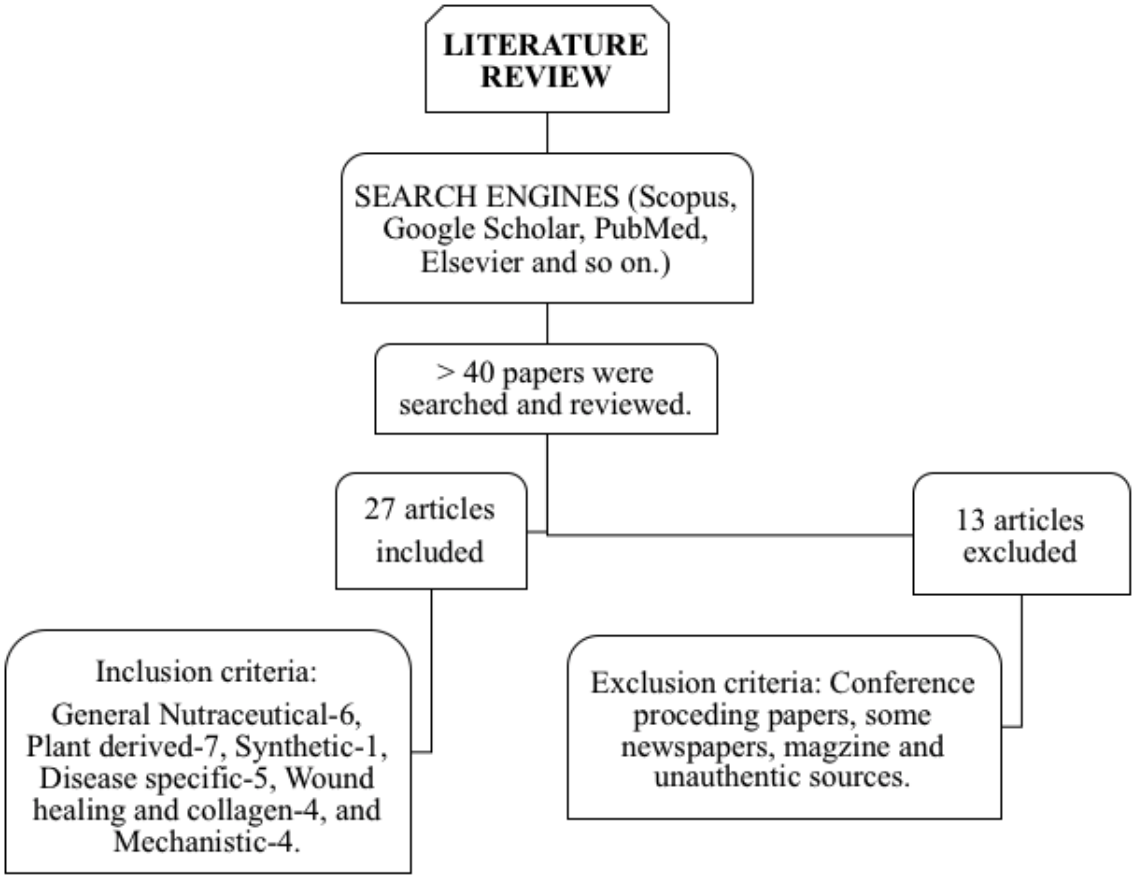
strategies to promote skin health. [5] Folk remedies from various cultures hold beliefs that certain foods improve skin complexion or heal wounds faster. Modern nutraceutical science aims to validate these traditional concepts by identifying and testing beneficial components that promote skin health from within. [6] Many nutraceutical products claim to improve skin hydration and elasticity or reduce wrinkles. [7] This review discusses skin anatomy, various skin diseases, and nutraceutical approaches for skin disorders, including acne, eczema, psoriasis, ulcers, and wrinkles. It focuses on synthetic and plant-derived nutraceuticals, highlighting possible mechanisms of action, clinical efficacy, and future research directions in dermatological therapeutics.

SEARCH STRATEGY

The literature review was conducted by searching medical terms such as "Nutraceuticals", "Skin health," "Dermatology," "Antioxidants," "Vitamins and minerals," "Plant derived compounds," "Collagen peptides," "Anti-aging," "Skin disorders," "Wound healing" in online databases including Scopus, Google Scholar, PubMed, and Elsevier. More than 40 recent (2020–2025) research articles, review papers, magazines, and newspapers were reviewed. After full-text analysis, 27 articles were included: peer-reviewed clinical trial papers, preclinical research papers (in vitro/in vivo), observational studies, and systematic reviews proving the effectiveness, mechanisms, or safety of nutraceuticals for skin disorders were all included in the inclusion criteria. Among the selected literature, nine studies were clinical in nature, while eight were preclinical. While 13 were excluded due to non-English language, conference papers, newspapers, duplicates, editorials, and studies lacking primary data on the designated outcomes, and unauthorized or unreliable information.

SKIN ANATOMY

The skin is the most extensive organ in the human body, constituting approximately 1.5 to 2 m^2 and comprising 15% of the total body weight. As an essential physical and chemical barrier, it serves as the first line of defense against various external stressors, such as ultraviolet (UV) radiation, pathogenic microbes, chemical agents, temperature fluctuations, and excessive water loss. Anatomically, skin is composed of three main layers: the epidermis, dermis, and subcutaneous tissue. [7, 8] Understanding the intricate structure and function of the skin layers is essential for exploring how nutraceuticals can support skin health. The epidermis develops from the ectoderm and acts as a primary barrier against the environment. It consists of four layers: the stratum corneum, stratum lucidum, stratum granulosum, and stratum basale. Stratum corneum: It is the outermost layer made up of dead cells known as corneocytes, which are 10 to 30 µm thick, and prevents water loss. Stratum lucidum: Present only in thick skin, such as palms and soles, and it provides extra protection. Stratum granulosum: It has predominant keratinocytes, which produce keratin. Stratum



basale: The deepest layer that contains keratinocytes, melanocytes, and Langerhans cells. [8] The dermis is formed from the mesodermal layer and connective tissue, providing strength and elasticity. It contains sensory nerve endings, sweat glands, hair follicles, immune cells, blood vessels, and lymph vessels. The dermal matrix contains collagen fibers that retain water and provide the skin with tensile strength. However, reduced collagen production with age leads to wrinkles. [7] The hypodermis regulates body temperature and stores energy. [8] Nutraceutical interventions involve the use of dietary supplements such as vitamins, antioxidants, fatty acids, and bioactive compounds to support skin health. These nutrients help improve hydration, enhance collagen synthesis, protect against oxidative stress, and promote skin repair. Proper nutraceutical intake can contribute to maintaining skin integrity and slowing premature aging (**Figure 1**). [5]

NUTRACEUTICALS IN SKIN AILMENTS

Nutraceuticals play a significant role as adjuvants in the management, prevention, and treatment of skin diseases. The most widely available types are synthetic nutraceuticals, which are used to correct deficiencies, modulate immune responses, reduce inflammation, and support skin regeneration. [6, 10] In addition, plant-derived nutraceuticals are important due to their antioxidant, anti-inflammatory, antimicrobial, and immune-modulating properties. These may be added to standard treatments for conditions such as acne, atopic dermatitis, psoriasis, wound healing, and skin ageing. [9, 12] Several studies report that combining synthetic and plant-derived nutraceuticals can enhance efficacy by simultaneously correcting deficiencies, reducing oxidative stress, modulating immune function, and improving skin barrier integrity. [6, 9] The strength of evidence varies considerably, as standard nutraceuticals, such as vitamins, minerals, and omega-3 fatty acids, generally show stronger clinical evidence. In comparison, many plant-derived compounds show moderate or limited evidence, often influenced by extraction methods, dosage, and bioavailability.

SKIN AILMENTS AND THEIR NUTRACEUTICAL APPROACH

Acne Vulgaris

Acne vulgaris is a common inflammatory disease of the skin characterized by comedones, papules, pustules, and nodules, primarily in sebaceous gland-rich areas. The pathogenesis includes increased sebum production, follicular hyperkeratinization, *Cutibacterium acnes* colonization, and inflammation. Nutraceuticals have gained attention as potential aids in managing acne due to their ability to modulate these underlying mechanisms. Nutraceuticals target these via oral and topical routes. Synthetic nutraceuticals such as zinc, omega-3 fatty acids, and vitamin D have been reported to lessen sebum production, inhibit bacterial growth, and modulate inflammatory pathways. [6, 9] Oral zinc reduces dihydrotestosterone-induced sebum production by up to 30% and inhibits *P. acnes* via reduced chemotaxis, omega-3 fatty acids reduce cytokine-mediated inflammation by 40% to 50%, and vitamin D supports immune balance, decreasing lesion severity in deficient patients. Plant-derived nutraceuticals such as green tea extract (*Camellia sinensis*; epigallocatechin-3-gallate [EGCG]), aloe vera (*Aloe vera*; aloin), turmeric (*Curcuma longa*; curcuminoids), and liquorice (*Glycyrrhiza glabra*; glabridin) exhibit antioxidant, anti-inflammatory, and antibacterial properties, targeting

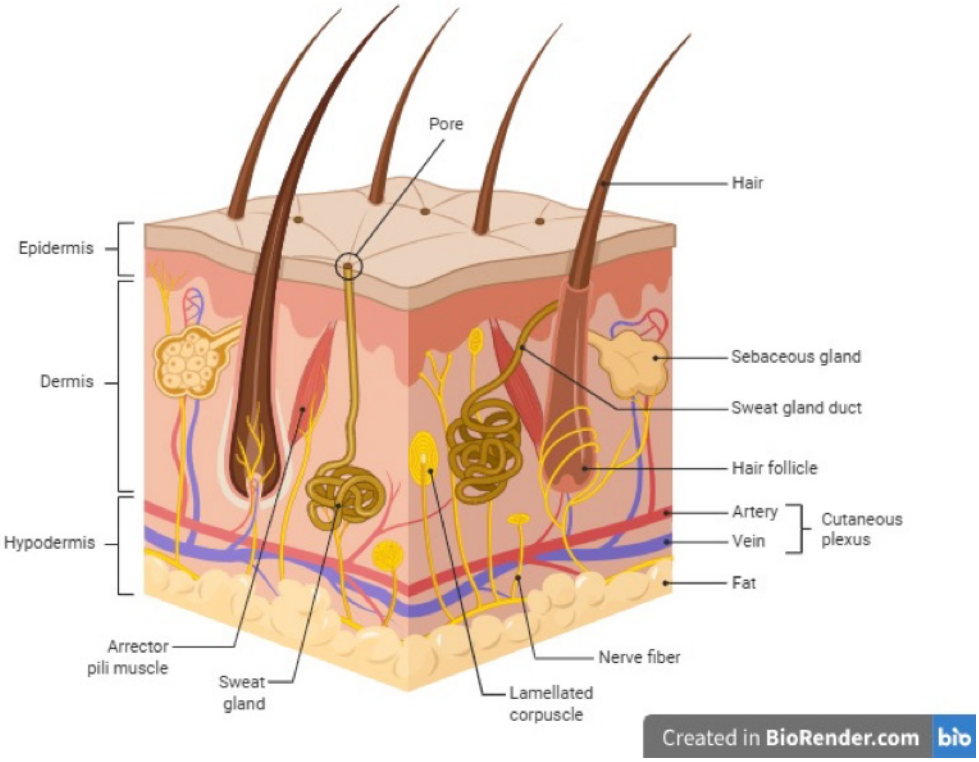


Figure 1: The structure of the skin (created in BioRender.com). [7]

multiple pathogenic pathways of acne. [9, 10] Clinical trials show that the combined use reduces lesion counts by 25% to 50% and erythema in mild-moderate acne. However, large-scale controlled trials are still lacking. [6, 10]

Atopic Dermatitis (Eczema)

Atopic dermatitis (eczema) is a chronic inflammatory disorder with dry, itchy, and red skin due to impaired skin barrier function and immune dysregulation. Nutraceuticals play a significant role in managing eczema by modulating inflammation, restoring skin barrier integrity, and supporting immune balance. Vitamin D supplements improve disease severity by enhancing skin barrier function and regulating immune responses. [11] Omega-3 fatty acids show anti-inflammatory properties that reduce itching and erythema. *Lactobacillus* probiotics regulate the gut–skin axis and suppress the production of inflammatory cytokines by 20-30%. [10] Additionally, plant-derived nutraceuticals such as chamomile (*Matricaria chamomilla*; apigenin), evening primrose oil (*Oenothera biennis*; gamma-linolenic acid [GLA]), aloe vera, and turmeric calm irritated skin and support barrier repair. [13] However, clinical results are still inconsistent. More testing is needed to confirm their effectiveness in managing eczema. [10–12] Although nutraceuticals are not substitutes for topical therapies, combining these interventions can provide a complementary approach to reduce symptom severity, improve comfort, and potentially reduce flare frequency. Clinical studies show that sustained supplementation, especially with probiotics and vitamin D, yields the most reproducible therapeutic benefits in the management of atopic dermatitis. [11–13]

Psoriasis

Psoriasis is a chronic inflammatory disease characterized by red, scaly patches caused by rapid skin cell growth and an overactive immune response, which often affects the elbows, knees, and scalp and is often associated with itching, pain, and psychological distress. Nutraceuticals support the reduction of inflammation and improve skin health in psoriasis. Synthetic nutraceuticals such as oral omega-3 fatty acids, eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA) help reduce inflammatory mediators and improve skin barrier function. [14] Vitamin D supplementation modulates immune cell activity and normalizes keratinocyte growth by 30%. [15] Selenium, an antioxidant trace element, protects skin cells from oxidative stress. [16] Plant-derived nutraceuticals such as curcuminoids inhibit NF-κB and STAT3, reducing flares. [17] Aloin provides soothing and healing effects. Oregon grape (*Mahonia aquifolium*; berberine) and indigo (*Indigo naturalis*; indirubin) modulate immune responses and reduce scaling. [18] Adjunctive use improves symptoms safely, though large clinical studies are still needed to confirm effectiveness. [14–18]

Wound Healing/Ulcers

Wound healing and chronic ulcers represent a significant clinical challenge, especially in diabetic foot ulcers and pressure ulcers, where tissue repair is significantly delayed. Such wounds often present with erythema, edema, and infection. Recent research highlights the potential of nutraceuticals in promoting faster and better tissue healing. Synthetic nutraceuticals such as collagen peptides, L-arginine, zinc, and vitamin C assist in collagen synthesis, enhancing cellular proliferation and reducing oxidative stress. Oral collagen peptides increase fibroblast collagen type I by 20% to 50%, while L-arginine is a substrate for nitric oxide, supporting vasodilation and improved blood flow to the wound site. Zinc and vitamin C act synergistically to enhance immune function. The nutraceuticals derived from plant ingredients such as Aloe vera promote fibroblast proliferation, *Centella asiatica* stimulates collagen deposition, and curcuminoids from turmeric reduce local area inflammation and oxidation. Early clinical and preclinical studies suggest that combining these nutraceuticals may help with wound closure and improve tissue repair. However, larger trials are required. [19–21]

Skin Ageing/Wrinkles

Skin ageing is a natural process associated with a progressive reduction in elasticity, increased dryness, fine lines, and wrinkles due to cumulative oxidative stress, ultraviolet exposure, and decreased collagen synthesis. Synthetic nutraceuticals such as collagen peptides (2.5–10 g/day) boost dermal density by 10% to 20% and hydration via upregulated procollagen-1. Vitamin C (ascorbic acid) supports cross-linking, reducing wrinkle depth. Plant-derived nutraceuticals such as green tea (*Camellia sinensis*; EGCG), grape seed (*Vitis vinifera*; proanthocyanidins), pomegranate (*Punica granatum*; punicalagins), and turmeric possess strong antioxidant and anti-inflammatory properties that defend against UV-induced oxidative damage and photoaging. Clinical and preclinical studies suggest that a combination of oral collagen supplementation with these bioactive plant compounds improves skin elasticity, hydration, and overall appearance in ageing individuals. However, longer trials are needed for confirmation (**Table 1**). [22–24]

DISCUSSION

Conventional therapies are the mainstay for treating common skin diseases, but they often come with side effects and limitations that reduce long-term effectiveness. For example, in acne vulgaris, topical retinoids, benzoyl peroxide, and oral antibiotics are widely used to reduce sebum and bacterial growth. However, these agents can cause dryness, irritation, antibiotic resistance, and relapse once treatment is stopped. [10, 11] Similarly, atopic dermatitis is usually managed with corticosteroids, emollients, or immunomodulators, which can lead to skin thinning, infection risk, and dependence after prolonged use. [12] Psoriasis management with biologics can result in liver toxicity, high cost, and immune suppression. [14] In wound healing, antibiotics and dressings may not be enough, while skin ageing procedures like peels or lasers are expensive and temporary. [21, 25]

These challenges have increased interest in nutraceuticals, which act from within the body to promote healthier skin without major side effects. Nutraceuticals provide essential nutrients, antioxidants, and bioactive compounds that correct nutritional deficiencies, control inflammation, and enhance tissue repair. For acne, nutrients like zinc, omega-3 fatty acids, and vitamin D help regulate sebum, reduce bacterial growth, and calm inflammation, while green tea and turmeric offer natural antibacterial and antioxidant effects. [10, 11] In eczema, vitamin D and omega-3 improve the skin barrier and

Table 1: Skin ailments and nutraceutical treatments.

S. No.	Skin disease	Oral nutraceuticals	Active compounds (oral)	Mechanism (oral)	Topical nutraceuticals	Active compounds (topical)	Mechanism (topical)	References
1	Acne vulgaris	Zinc, omega-3, vitamin D	Zinc, EPA/DHA, cholecalciferol	Reduces sebum production and systemic inflammation, inhibits *P. acnes* growth.	Green tea extract, turmeric	EGCG, curcuminoids	Antioxidant protection, local anti-inflammatory, and antibacterial effects	[6, 9, 10]
2	Eczema	Vitamin D, omega-3, probiotics	Cholecalciferol, EPA/DHA, *Lactobacillus*	Modulates immune response and restores the barrier function systemically	Chamomile, evening primrose oil, and aloe vera	Apigenin, GLA, aloin	Soothes irritation and reduces inflammation	[11–13]
3	Psoriasis	Fish oil (EPA/DHA), vitamin D, selenium	EPA/DHA, cholecalciferol, selenium	Inhibits pro-inflammatory cytokines and slows keratinocyte turnover	Turmeric, *Mahonia aquifolium, Indigo naturalis*	Curcuminoids, berberine, indigotin	Suppresses local T-cell activation and oxidative stress	[14–18]
4	Ulcers	Collagen peptides, arginine, vitamin C, zinc	Hydrolyzed collagen, L-arginine, ascorbic acid, zinc	Promotes systemic collagen synthesis and angiogenesis	*Aloe vera, Centella asiatica*, turmeric	Aloin, asiaticoside, curcuminoids	Accelerates local wound closure and reduces inflammation	[19–21]
5	Wrinkles	Collagen peptides, vitamin C	Collagen hydrolysate, ascorbic acid	Enhances dermal collagen and improves hydration from within	Green tea, grape seed extract, pomegranate	EGCG, proanthocyanidins, punicalagins	Protects against UV damage and boosts antioxidant enzymes locally	[22–24]

Table 2. Comparison of conventional therapies and nutraceutical alternatives.

Disease	Conventional therapy	Limitations	Nutraceutical alternatives	References
Acne vulgaris	Retinoids, antibiotics	Irritation, resistance, relapse	Zinc, omega-3, vitamin D, green tea, turmeric	[10, 11]
Atopic dermatitis	Corticosteroids, emollients	Skin thinning, infection risk	Vitamin D, omega-3, probiotics, evening primrose oil	[12, 14]
Psoriasis	Methotrexate, biologics	Toxicity, cost, and immune suppression	Omega-3, vitamin D, curcumin, selenium	[17]
Wound healing	Dressings, antibiotics	Delayed healing, infection	Collagen peptides, vitamin C, *Aloe vera*, *Centella asiatica*	[19]
Skin ageing	Retinoids, cosmetic procedures	Expense, short effect	Collagen, vitamin C, green tea, pomegranate, grape seed	[24]

immune balance, while probiotics restore the gut–skin axis to reduce flare-ups. [12, 14] Psoriasis patients benefit from omega-3 fatty acids, vitamin D, selenium, and curcumin, which together reduce oxidative stress and abnormal cell growth. [17] For wound healing, collagen peptides, L-arginine, vitamin C, and plant compounds like Centella asiatica and Aloe vera stimulate new tissue formation and faster repair. [21] In ageing, collagen peptides, vitamin C, and plant polyphenols from green tea, pomegranate, and grapes improve elasticity and hydration while protecting against UV damage. [25]

One of the major challenges to nutraceuticals in dermatology is bioavailability. Common plant-derived nutraceuticals generally exhibit low water solubility and fast metabolism, leading to poor absorption and low therapeutic plasma levels. However, recent studies have shown promise with nano-formulated drugs, phospholipid complexes, and bioavailability enhancer co-administration, resulting in 5 to 20 times improved absorption, but these findings have not been consistently reproduced in a standardized manner. In order to translate the preclinical efficacy into clinical effect, these pharmacokinetic limitations need to be overcome via novel drug delivery systems. [26]

Although results are promising, most studies use different dosages and forms, making it difficult to compare outcomes. Therefore, more large-scale, standardized clinical trials are needed. Overall, nutraceuticals offer a safe and effective complementary approach to conventional therapies by targeting the root causes of skin disorders such as inflammation, oxidative stress, and nutrient deficiency (**Table 2**).

CONCLUSIONS

This review highlights the growing relevance of nutraceuticals in dermatology. It discusses the fundamental aspects of skin anatomy and explains how both synthetic and plant-derived nutraceuticals act as supportive agents in the management of dermatological disorders. The objective of this review was to provide an in-depth overview of the mechanisms, active constituents, and scientific validation underlying the applications of nutraceuticals in dermatological therapy. However, scientific validation remains limited due to the lack of standardized formulations, consistent dosing, and large-scale clinical trials to confirm the long-term effectiveness and safety of nutraceuticals in dermatological therapy. Many existing studies lack standardized formulations, adequate sample sizes, and long-term evaluations. Future research should focus on determining the optimal dosages, improving bioavailability, ensuring safety, and synergistic combinations of bioactive compounds. In conclusion, nutraceuticals bridge the gap between dermatological therapy and nutrition by offering a progressive and comprehensive approach to skin health. With improved formulations and strong clinical data, they may become established therapeutic agents in clinical dermatology through continued research.

AUTHOR'S CONTRIBUTION

All authors have significantly contributed to the work, whether by conducting literature searches, drafting, revising, or critically reviewing the article. They have given their final approval of the version to be published, have agreed with the journal to which the article has been submitted, and agree to be accountable for all aspects of the work.

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CONFLICT OF INTEREST

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REFERENCES

1. Puri V, Nagpal M, Singh I, Singh M, Dhingra GA, Huanbutta K, et al. A comprehensive review on nutraceuticals: Therapy support and formulation challenges. Nutrients. 2022;14(21):4637. http://doi.org/10.3390/nu14214637
2. Lephart ED. Skin aging and oxidative stress: Equol's anti-aging effects via biochemical and molecular mechanisms. Ageing Res Rev. 2016;31:36-54. http://doi.org/10.1016/j.arr.2016.08.001
3. Cheng T, Tai Z, Shen M, Li Y, Yu J, Wang J, et al. Advance and challenges in the treatment of skin diseases with the transdermal drug delivery system. Pharmaceutics. 2023;15(8):2165. https://doi.org/10.3390/pharmaceutics15082165
4. Raina N, Rani R, Thakur VK, Gupta M. New insights in topical drug delivery for skin disorders: From a nanotechnological perspective. ACS Omega. 2023;8(22):19145-19167. https://doi.org/10.1021/acsomega.2c08016
5. Streker M, Proksch E, Kattenstroth JC, Poeggeler B, Lemmnitz G. Comparative assessment of nutraceuticals for supporting skin health. Nutraceuticals. 2025;5(2):13. http://doi.org/10.3390/nutraceuticals5020013

6. Januszewski J, Forma A, Zembala J, Flieger M, Tyczyńska M, Dring JC, et al. Nutritional supplements for skin health-A review of what should be chosen and why. Medicina (Kaunas). 2023;60(1):68. http://doi.org/10.3390/medicina60010068
7. Waugh A, Grant A. Ross and Wilson Anatomy and Physiology in Health and Illness. 13th ed. Edinburgh: Churchill Livingstone Elsevier; 2018.
8. Pérez-Sánchez A, Barrajón-Catalán E, Herranz-López M, Micol V. Nutraceuticals for skin care: A comprehensive review of human clinical studies. Nutrients. 2018; 10(4):403. https://doi.org/10.3390/nu10040403
9. Vaidya T, Hoffman L, Chapas A. Evaluating common ingredients contained in dietary acne supplements: An evidence-based review. J Clin Aesthet Dermatol. 2024; 17(3):34-41.
10. Bolatkyzy N, Shepilov D, Turmanov R, Berillo D, Vassilina T, Ibragimova N, et al. Medicinal plants for skin disorders: Phytochemistry and pharmacological insights. Molecules. 2025;30(15):3281. https://doi.org/10.3390/molecules30153281
11. Thompson KG, Kim N. Dietary supplements in dermatology: Evidence for vitamins, minerals, and botanicals. J Am Acad Dermatol. 2021;85(3):617-626. http://doi.org/10.1016/j.jaad.2020.04.123
12. Sánchez-Pellicer P, Navarro-Moratalla L, Núñez-Delegido E, Ruzafa-Costas B, Agüera-Santos J, Navarro-López V. Acne, microbiome, and probiotics: The gut-skin axis. Microorganisms. 2022;10(7):1303. http://doi.org/10.3390/microorganisms10071303
13. D'Elios S, Trambusti I, Verduci E, Ferrante G, Rosati S, Marseglia GL, et al. Probiotics in the prevention and treatment of atopic dermatitis. Pediatr Allergy Immunol. 2020;31(Suppl 26):43-45. https://doi.org/10.1111/pai.13364
14. Mustafa AM, Atwa AM, Elgindy AM, Alkabbani MA, Ibrahim KM, Esmail MM, et al. Targeting psoriatic inflammation with natural compounds: Mechanistic insights and therapeutic promise. Inflammopharmacology. 2025;33(7):3843-3870. http://doi.org/10.1007/s10787-025-01851-6
15. Mai M, Lazaridou I, Mirza FN, Costenbader KH, Qureshi AA, Cho E. Oral and topical vitamin D treatment strategies in psoriasis. Skin Health Dis. 2025;5(3):178-190. https://doi.org/10.1093/skinhd/vzaf010
16. Pincemail J, Meziane S. On the potential role of the antioxidant couple vitamin E/selenium taken by the oral route in skin and hair health. Antioxidants (Basel). 2022;11(11):2270. https://doi.org/10.3390/antiox11112270
17. Draelos ZD. The efficacy and tolerability of turmeric and salicylic acid in psoriasis treatment. Psoriasis (Auckl). 2022;12:63-71. https://doi.org/10.2147/PTT.S360448
18. Janeczek M, Moy L, Lake EP, Swan J. Review of the efficacy and safety of topical *Mahonia aquifolium* for the treatment of psoriasis and atopic dermatitis. J Clin Aesthet Dermatol. 2018;11(12):42-47.
19. Stanescu C, Chiscop I, Mihalache D, Boev M, Tamas C, Stoleriu G. The roles of micronutrition and nutraceuticals in enhancing wound healing and tissue regeneration: A systematic review. Molecules. 2025;30(17):3568. http://doi.org/10.3390/molecules30173568
20. Ganesan O, Orgill DP. An overview of recent clinical trials for diabetic foot ulcer therapies. J Clin Med. 2024;13(24):7655. https://doi.org/10.3390/jcm13247655
21. Yan R, Wang Y, Li W, Sun J. Promotion of chronic wound healing by plant-derived active ingredients and research progress and potential of plant polysaccharide hydrogels. Chin Herb Med. 2024;17(1):70-83. http://doi.org/10.1016/j.chmed.2024.11.005
22. Žmitek K, Žmitek J, Hristov H, Rogl Butina M, Keršmanc P, Pogačnik T. The effects of dietary supplementation with collagen and vitamin C and their combination with hyaluronic acid on skin density, texture and other parameters: A randomized, double-blind, placebo-controlled trial. Nutrients. 2024;16(12):1908. http://doi.org/10.3390/nu16121908
23. Chakkalakal M, Nadora D, Gahoonia N, Dumont A, Burney W, Pan A, et al. Prospective randomized double-blind placebo-controlled study of oral pomegranate extract on skin wrinkles, biophysical features, and the gut-skin axis. J Clin Med. 2022;11(22):6724. http://doi.org/10.3390/jcm11226724
24. Nowak-Perlak M, Olszowy M, Woźniak M. The natural defense: Anti-aging potential of plant-derived substances and technological solutions against photoaging. Int J Mol Sci. 2025;26(16):8061. https://doi.org/10.3390/ijms26168061
25. Farhan M. The promising role of polyphenols in skin disorders. Molecules. 2024;29(4):865. https://doi.org/10.3390/molecules29040865
26. Prathumwon C, Anuchapreeda S, Kiattisin K, Panyajai P, Wichayapreechar P, Surh YJ, et al. Curcumin and EGCG combined formulation in nanostructured lipid carriers for anti-aging applications. Int J Pharm X. 2025;9:100323. https://doi.org/10.1016/j.ijpx.2025.100323