

Review

Optimizing Skin Health through Nutrition: Evidence-Based Insights

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Abstract

Dietary and lifestyle choices have considerable effects on skin health, which reflects overall well-being. Nutrition is now a key component in the management and prevention of skin-related issues due to the increasing incidence of dermatological disorders and the growing demand for anti-aging remedies. This review examines the complex relationship between nutrition, diet, and skin aging, with a focus on the functions of probiotics, vitamins, minerals, essential fatty acids, and antioxidants. Evidence suggests that micronutrients like vitamins A, C, D, E, and B-complex, as well as trace elements like zinc, copper, selenium, and magnesium, are important for preserving skin structure, hydration, and elasticity while reducing inflammation and oxidative damage. Emerging insights into the gut-skin axis further underscore the contribution of probiotics and gut microbiota in modulating dermatological outcomes. Furthermore, dietary patterns that include foods high in antioxidants, low glycemic load, and a balanced intake of macronutrients are important in the treatment of diseases like atopic dermatitis, psoriasis, and acne. Conventional systems like Ayurveda offer supplementary viewpoints and support holistic eating habits, which help to reduce oxidative stress and support collagen production. This review highlights nutrition as a safe, attainable, and effective method for enhancing skin health, delaying visible signs of aging, and enhancing quality of life by fusing contemporary scientific research with conventional dietary knowledge.



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Keywords

Nutrition; skin health; diet; aging; nutrition deficiency

1. Introduction

Skin diseases rank among the top global health concerns, placing 10th in the Global Burden of Disease Study 2017, even above cardiovascular diseases [1]. As the skin—the body’s largest organ—reflects overall internal health, the influence of nutrition on skin function and aging has gained increasing scientific attention [2]. Skin performs essential mechanical, immune, endocrine, and barrier functions [3], yet is highly sensitive to environmental exposures, genetics, lifestyle, chronic illnesses, medications, and dietary habits [4-6].

In the current digital era, rising awareness about wellness and appearance—largely driven by accessible information and social media—has encouraged individuals to seek natural, convenient, and seemingly quick solutions for healthier, younger-looking skin and hair [7]. However, the heightened focus on healthy eating has also contributed to restrictive eating patterns, while modern lifestyles characterized by long work hours, stress, and irregular meals further compromise nutritional status [8, 9].

Amid rising interest and emerging claims surrounding the role of food and nutrients in skin health [10], this review synthesizes current evidence on how dietary patterns and key nutrients affect skin structure, elasticity, and age-related changes. It highlights the critical role of a balanced, nutrient-rich diet in supporting overall skin health and mitigating the progression of visible aging.

2. Methodology

This narrative review was conducted using a structured, transparent approach to synthesize current evidence on the role of nutrition in skin health, aging, and dermatological conditions. A literature search was performed in PubMed, Scopus, Web of Science, and Google Scholar for studies published between 2000 and 2025. Search terms included combinations of *nutrition*, *diet*, *skin health*, *skin aging*, *micronutrients*, *probiotics*, *gut-skin axis*, *acne*, *psoriasis*, and *atopic dermatitis*. Reference lists of key articles were also manually screened (Table 1).

Table 1 Database Search Strategy and Search Strings.

Database	Search Terms/Strings Used	Filters Applied
PubMed	("nutrition" [MeSH] OR "diet" [MeSH] OR "micronutrients" OR "vitamins" OR "minerals" OR "probiotics") AND ("skin" OR "dermatology" OR "skin aging" OR "acne" OR "psoriasis" OR "atopic dermatitis")	2000-2025; Humans; English
Scopus	TITLE-ABS-KEY ("nutrition" AND "skin") OR ("diet" AND "dermatology") OR ("gut-skin axis") OR ("essential fatty acids" AND "skin")	Article, Review; 2000-2025; English
Web of Science	TS = ("nutrition" OR "diet" OR "micronutrients" OR "probiotics") AND TS = ("skin" OR "skin aging" OR "acne" OR "psoriasis" OR "dermatitis")	2000-2025; Science Citation Index; English
Google Scholar	"nutrition and skin health" OR "diet and skin aging" OR "micronutrients in dermatology" OR "probiotics acne" OR "probiotics atopic dermatitis"	Review relevance; first 200 results screened
Manual Reference Search	Screening bibliographies of selected review articles and clinical guidelines	Not applicable

Eligible sources included randomized controlled trials, observational studies, systematic reviews, meta-analyses, mechanistic studies, and authoritative clinical guidelines published in English. Studies focusing solely on pharmacologic treatments or unrelated cosmetic formulations were excluded.

Approximately 320 records were screened, and 148 studies were included based on relevance. Extracted information covered nutrient mechanisms, dermatologic outcomes, and strength of evidence. Due to heterogeneity in study types and outcomes, findings were synthesized narratively and organized thematically.

2.1 Role of Nutrients in Skin Health

A balanced diet, rich in macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals), supports the skin's barrier function. Deficiencies in these nutrients can lead to conditions such as rosacea, acne vulgaris, stomatitis, pellagra, and alopecia [11, 12].

2.2 Essential Fatty Acids (EFA)

Omega-3 and omega-6 fatty acids, essential nutrients for skin health, cannot be synthesized by the body and must be obtained through diet. These fatty acids support cell membrane structure and function, as well as the synthesis of intracellular lipids in the stratum corneum, which form a natural skin barrier [3]. Omega-3 fatty acids also possess anti-inflammatory properties, helping reduce acne, redness, polymorphic light eruption (PLE), psoriasis, and skin cancer risk. Essential Fatty Acid Deficiency (EFAD) impairs skin appearance and function, causing epidermal hyperproliferation, dermatitis, and increased transepidermal water loss (TEWL). TEWL reflects the skin's barrier integrity and is linked to the EFA composition of stratum corneum lipids [13]. A 10-

week RCT on 45 acne patients found that omega-3 supplementation significantly reduced inflammatory and non-inflammatory lesions, supporting its role as an adjunct treatment for acne [14]. EFAs are crucial for maintaining epidermal permeability and reducing trans-epidermal water loss.

2.2.1 Fat-Soluble Vitamins

Fat-soluble vitamins—namely vitamins A, D, E, and K—play crucial roles in maintaining and enhancing skin health, offering both preventive and therapeutic benefits for various dermatological conditions. Vitamin A, found in the forms of beta-carotene (from plant sources) and retinol (from animal products), supports skin regeneration and helps treat disorders like acne, psoriasis, eczema, and rosacea. Its deficiency often results in dryness, peeling, and premature wrinkles. Clinical evidence supports its anti-aging effects, with studies showing that retinol reduces wrinkles and pigmentation significantly [15]. Vitamin D, known as the “sunshine vitamin”, is essential for skin repair, cell turnover, and controlling inflammation. Its deficiency has been associated with conditions like eczema, psoriasis, alopecia, and even skin cancer. Supplementation has shown marked improvement in eczema symptoms [16] and acne vulgaris [17]. Vitamin E acts as a potent antioxidant that protects the skin from UV-induced damage, delays aging, and offers photoprotective and anti-tumor properties. It is used in the treatment of melasma, pigmentation disorders, and AD, often in combination with vitamin A to reduce the risk of skin cancers. A study demonstrated that combined supplementation of vitamins E and D led to significant improvement in AD over 60 days [18]. Lastly, Vitamin K contributes to wound healing, reduces bruising, pigmentation, and dark circles, and is known for its anti-inflammatory action. It is used in treating psoriasis, eczema, and stretch marks, with topical applications showing enhanced healing effects, as seen in a study where Vitamin K cream outperformed Eucerin in wound recovery [19]. Together, these fat-soluble vitamins form a cornerstone in promoting healthy, resilient skin and managing a wide range of skin conditions. Excessive intake of vitamins A, D, and E can negatively impact skin health. Vitamin A toxicity may cause skin dryness, peeling, and increased sensitivity. Vitamin D overdose is rare but can lead to skin rashes and exacerbate inflammatory conditions [20]. Similarly, high doses of vitamin E may impair wound healing and cause dermatitis in some individuals [21]. Therefore, balanced supplementation is critical to avoid adverse skin effects.

2.2.2 Water Soluble Vitamins

The B-complex vitamins consist of eight essential nutrients that play a key role in maintaining healthy skin and preventing conditions such as acne and psoriasis. Among them, biotin (Vitamin B7) is widely recognized for supporting hair and nail health, while niacinamide (Vitamin B3) is commonly used to manage acne and pigmentation issues [3]. Evidence supporting the effectiveness of B vitamins includes a 12-week clinical trial by Yang et al. [22], where Vitamin B5 supplementation significantly reduced acne lesions in a group of 480 participants. Furthermore, Patel et al. [23] reported multiple patient cases showing clinical improvement of alopecia and hair regrowth after biotin treatment, categorized by factors such as age, dosage, symptoms, and treatment duration [24]. A previous study also reported a 23% reduction in risk of non-melanoma skin cancer after consuming 500 mg nicotinamide twice daily for 12 months [25].

Vitamin C is a powerful antioxidant that plays a crucial role in protecting the skin from free radical damage, reducing hyperpigmentation, and promoting collagen synthesis. It is widely used to treat acne, wrinkles, and pigmentation issues and is commonly found in serums and creams formulated for anti-aging purposes. According to Niaimi [26], topical application of vitamin C twice daily significantly reduced acne lesions. In addition to vitamin C, nicotinamide has shown promising results in dermatological application [27, 28]. Dietary intake of vitamin C is crucial for skin health, more so than topical application alone. Scientific evidence shows that vitamin C is vital for collagen biosynthesis, acting as a cofactor for prolyl and lysyl hydroxylases necessary for collagen stability. Moreover, oral vitamin C enhances the skin's antioxidant defense, neutralizing oxidative stress from UV exposure throughout the skin layers, which topical application may not fully achieve due to absorption limits. Thus, a vitamin C-rich diet ensures systemic support for skin structure and repair [29].

2.2.3 Role of Minerals in Dermatology

Minerals play a crucial role in dermatology by contributing to essential skin functions such as elasticity, repair, protection, and overall structural maintenance. These micronutrients are integral in enzymatic reactions, antioxidant defense, and cellular regeneration, making them indispensable for maintaining healthy, youthful skin (Table 2).

Table 2 Important Minerals for Skin Health [30-36].

Mineral	Primary Dermatological Functions	Deficiency Effects	Food Sources
Copper	• Supports elastin and collagen synthesis • Enhances skin elasticity • Anti-inflammatory and antimicrobial	• Loss of skin firmness • Increased inflammation and breakouts	Shellfish, nuts, seeds, leafy vegetables, whole grains
Zinc	• Anti-inflammatory • Aids in wound healing • UV protection • Reduces acne lesions	• Acne, dermatitis, hair loss, delayed healing	Meat, legumes, dairy, nuts
Iron	• Supports oxygen transport, collagen synthesis, and wound healing; involved in skin cell proliferation	• Pale skin, brittle nails, hair loss, delayed wound healing	Red meat, poultry, legumes, fortified cereals
Selenium	• Antioxidant • Protects against UV damage • Enhances skin elasticity via glutathione activity	• Dull skin, acne, premature aging	Nuts (Brazil nuts), seafood, meat and poultry, eggs, legumes, grains
Magnesium	• Maintains hydration and skin barrier • Soothes inflammation • Delays aging	• Dry, sensitive skin, fine lines, rosacea	Leafy greens, whole grains, Pulses like cowpea, moth beans, soyabean, spices and condiments like cumin seeds, cloves, turmeric powder, Seeds like gingelly seeds, Niger seeds, linseed, sunflower seeds, etc.

Copper is essential for forming and stabilizing elastin, which helps maintain skin elasticity and firmness. It also has antimicrobial and anti-inflammatory properties that support acne prevention. By promoting collagen synthesis and cross-linking, copper contributes to overall skin rejuvenation and resilience [30].

Zinc is a key mineral with strong anti-inflammatory, antimicrobial, and wound-healing properties. It supports tissue regeneration, helps manage acne and redness, and offers protection against UV-induced damage. Zinc deficiency can impair immunity, delay wound healing, and lead to skin issues such as dermatitis and alopecia [31, 32].

Selenium is a potent antioxidant that protects the skin from sun- and toxin-induced oxidative stress. By enhancing glutathione peroxidase activity, it supports elastin development, maintains skin suppleness, and guards against free radical damage. Selenium-rich foods like salmon, turkey, and lamb may help reduce acne and improve overall skin texture [33].

Iron supports skin health by enabling oxygen transport, energy metabolism, cell repair, and collagen synthesis. It also helps maintain healthy skin tone and aids wound healing. However, excess iron can promote oxidative stress and accelerate aging, as seen in elevated ferritin levels during menopause. Maintaining proper iron balance is essential, since both deficiency and overload can impair skin function and appearance [34, 35].

Magnesium has strong anti-inflammatory effects and supports key cellular processes that help maintain skin hydration and barrier function. It helps prevent premature aging and can soothe conditions like eczema and rosacea. Low magnesium levels may increase skin sensitivity, dryness, and early signs of aging such as fine lines and sagging [36].

Together, these minerals form a synergistic network that upholds skin health, reinforces its barrier function, combats inflammation and oxidative damage, and preserves a youthful, radiant appearance. Incorporating mineral-rich foods and targeted supplementation can significantly contribute to dermatological well-being and prevention of age-related skin issues.

2.2.4 Gut-Skin Axis

The gut-skin axis refers to the bidirectional communication between the gut microbiota and the skin through immune, endocrine, and metabolic pathways. Gut dysbiosis can disrupt skin homeostasis and contribute to acne, psoriasis, rosacea, and atopic dermatitis [37]. Increased intestinal permeability (“leaky gut”) allows inflammatory molecules to enter circulation, triggering systemic inflammation and skin flares. Beneficial microbes such as *Lactobacillus* and *Bifidobacterium* help restore microbial balance, strengthen the gut barrier, and reduce inflammation [37], while *Akkermansia muciniphila* supports skin barrier function [38]. Conversely, an overgrowth of *Clostridium* and *Escherichia* species is associated with worsening inflammatory skin conditions. Gut-derived metabolites like short-chain fatty acids—especially butyrate—and neurotransmitters such as serotonin also influence skin immunity and physiology. Overall, maintaining a balanced gut microbiota is essential for gastrointestinal health, preserving skin quality, and delaying visible aging [39].

2.3 Probiotics

The United Nations Food and Agriculture Organization defines probiotics as “live microorganisms, which, when administered in adequate amounts, confer a health benefit to the host” [40]. Research has shown a link between intestinal dysbiosis and inflammatory dermatological conditions such as AD, acne vulgaris, psoriasis, rosacea, and melasma [41]. Probiotics can influence acne pathophysiology by modifying contributing factors and may also enhance treatment compliance [42]. Acne pathogenesis is primarily associated with altered follicular colonization and inflammatory responses involving *Cutibacterium acnes*, along with excess sebum production, follicular hyperkeratinization, and immune activation [43]. As a result, probiotic skincare has gained popularity as a strategy for combating skin aging and promoting overall skin health. A 2018 systematic review by Petersen et al. found that probiotics reduced the severity of AD by altering the gut microbiota, and a 2015 meta-analysis of randomized controlled trials by Panduru et al. reported that probiotics were protective against the development of AD [44, 45].

Probiotics may protect against the development and progression of atopic dermatitis through several biological mechanisms. They help restore gut microbial diversity, strengthen intestinal barrier function, and reduce systemic inflammation. Certain probiotic strains, particularly *Lactobacillus* and *Bifidobacterium* species, promote the development of regulatory T cells (Tregs), suppress Th2-mediated immune responses, and decrease the production of pro-inflammatory cytokines such as interleukin-4 and interleukin-13. These immunomodulatory effects may reduce allergic sensitization, improve skin barrier integrity, and lower the risk of eczema flare-ups. Furthermore, probiotics enhance the production of short-chain fatty acids, which exert anti-inflammatory effects and contribute to immune homeostasis along the gut-skin axis [37].

2.3.1 Understanding Skin Health Issues and Solutions

Healthy skin is essential for physical and emotional well-being. Over the past two decades, demand for cosmetic treatments has risen, especially among adolescents seeking solutions for acne, hair, and nail concerns. Middle-aged adults are also turning to beauty and anti-aging approaches, often focusing on nutrition for detoxification and rejuvenation. As a result, the use of vitamins, minerals, and bioactive compounds has increased, given their role in preventing skin aging and supporting hydration [46].

Skin Aging. Skin aging is a multifactorial process comprising intrinsic (chronological) aging and extrinsic (photo-aging). Intrinsic aging is driven by genetics, hormonal decline, and metabolic changes, leading to reduced collagen production, weakened barrier function, dermal thinning, dryness, and fine wrinkles. Photo-aging results from chronic UV exposure, which causes oxidative stress, DNA damage, inflammation, and activation of matrix metalloproteinases—especially MMP-1—resulting in collagen breakdown, pigmentation changes, and coarse wrinkles. Environmental factors such as pollution, smoking, and poor diet further amplify oxidative and inflammatory damage. Nutritional deficits in antioxidants like vitamins C, E, and carotenoids reduce the skin’s defence capacity, while high-glycemic and high-fat diets promote inflammation and glycation, accelerating visible aging. Together, intrinsic mechanisms and environmental insults shape the aging process, underscoring the value of antioxidant-rich diets and healthy lifestyle habits [2, 47, 48].

Acne. Acne pathogenesis is driven by four key factors: excess sebum production, overgrowth of *Cutibacterium acnes* bacteria, hyperkeratinization of pilosebaceous follicles, and inflammatory mechanisms. Excess sebum is produced due to increased activity of androgen hormones and IGF-1, which activate mTORC1, leading to sebaceous gland hyperproliferation, lipid synthesis, and keratinocyte hyperplasia. Additionally, leucine from meat and dairy proteins and hyperinsulinemia, which raises IGF-1 levels, further stimulate these processes, exacerbating acne (Figure 1) [43].

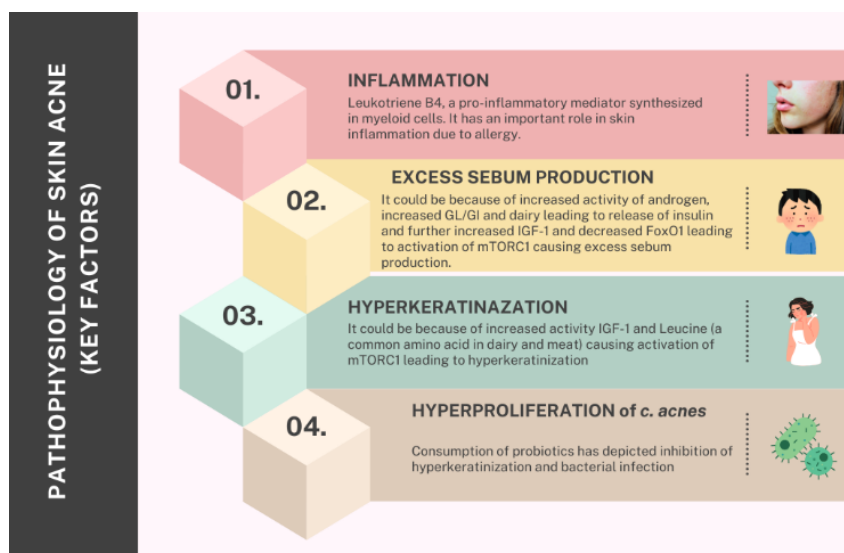


Figure 1 Key Factors Affecting Pathophysiology of Skin.

Atopic Dermatitis (AD). Atopic dermatitis (AD) is a chronic, relapsing inflammatory skin disorder marked by intense itching, dryness, and eczematous lesions, often beginning in childhood. It arises from a combination of genetic, immune, and environmental factors. A key feature is a defective skin barrier—frequently linked to filaggrin mutations—which increases transepidermal water loss and sensitivity to allergens and irritants. AD is driven largely by a Th2-mediated immune response, leading to elevated IgE and eosinophilia. Nutritional deficiencies, such as low essential fatty acids, zinc, or vitamin D, may worsen symptoms. Management focuses on hydration, topical anti-inflammatory therapy, trigger avoidance, and, when needed, systemic treatment or dietary support to improve skin barrier and immune function [49].

Psoriasis. Psoriasis is a chronic autoimmune skin disorder characterized by rapid skin cell turnover, leading to thick, scaly, inflamed patches—most commonly on the scalp, elbows, knees, and lower back. According to NIAMS, it results from an overactive immune response that accelerates skin cell growth. Its causes are multifactorial, involving genetic and environmental triggers such as stress, infections, injuries, and certain medications. Psoriasis is also linked to conditions like psoriatic arthritis, cardiovascular disease, and depression. While there is no cure, treatments including topical agents, phototherapy, and systemic medications can effectively manage symptoms and improve quality of life [49].

2.3.2 Impact of Diet on Skin Health and Disease

Diet plays a significant role in the development, progression, and management of various skin conditions, including psoriasis, acne, and atopic dermatitis. Nutrients influence inflammation,

immune function, skin barrier integrity, and hormonal regulation, making dietary choices a vital component of dermatologic care.

Nutrition and Aging. Nutrition is essential for maintaining healthy, youthful skin, with multiple nutrients supporting its structure and function. Adequate hydration preserves moisture and elasticity, while trace elements like zinc, copper, and selenium enhance cell growth, collagen synthesis, and antioxidant protection against UV damage. Vitamins also play a major role—vitamin C supports collagen formation and antioxidant defense, and vitamin E helps prevent lipid peroxidation (Table 3) [50].

Table 3 Nutrition and Aging.

Nutrient/Dietary Factor	Role in Skin Health	Effect on Skin Aging
Water	Maintains skin hydration and elasticity	Improves skin moisture levels; reduces dryness and fine lines
Zinc (meats and poultry, legumes, nuts and seeds, dairy products, etc.)	Supports skin cell proliferation and differentiation	Enhances skin repair and regeneration; may reduce aging signs
Copper (shellfish, nuts, seeds, leafy vegetables, whole grains)	Aids in collagen synthesis; supports skin elasticity	Helps maintain skin firmness and structure
Selenium (nuts, seafoods, meat and poultry, eggs, legumes, grains)	Acts as an antioxidant; protects against UV-induced oxidative stress	Reduces oxidative damage, delaying signs of photoaging
Vitamin C (citrus fruits, Guava, melons, raw vegetables-capsicum etc)	Essential for collagen synthesis; powerful antioxidant	Improves skin firmness; reduces wrinkles and protects them from oxidative stress
Vitamin E (green leafy vegetables, nuts and seeds, seed oils or fortified foods)	Prevents lipid peroxidation in skin	Helps maintain skin barrier; reduces inflammation and signs of aging
Proteins (pulses/legumes, nuts and seeds, milk and milk products, meat and meat products)	Necessary for tissue repair and regeneration	Support skin structure and healing
Essential Fatty Acids (fatty fish- mackerel, salmon; plant oils)	Maintain lipid barrier and hydration	Improve skin texture; prevent dryness and premature aging
Antioxidant-rich foods (e.g., fruits, vegetables, nuts)	Neutralize free radicals; reduce inflammation	Delay aging process; promote even tone and skin clarity
Poor diet (high sugars, processed foods)	Promotes inflammation; forms AGEs (Advanced Glycation End Products)	Accelerates collagen and elastin damage; speeds up skin aging

A balanced diet rich in antioxidants, proteins, and essential fatty acids helps delay skin aging by reducing oxidative stress, aiding tissue repair, and maintaining the skin's lipid barrier. Antioxidants from fruits, vegetables, and nuts neutralize free radicals, proteins promote regeneration, and essential fatty acids support hydration. In contrast, diets high in sugar, unhealthy fats, and processed foods can accelerate aging through inflammation and advanced glycation end products that damage collagen and elastin. Overall, hydration and a nutrient-dense diet are key to preserving youthful, healthy skin [51, 52].

Although nutrition cannot completely prevent intrinsic skin aging, growing evidence suggests that appropriate dietary practices can significantly delay the visible signs of skin aging and can improve skin health. Aging is associated with reduced collagen synthesis, impaired barrier function, decreased hydration, and increased oxidative stress. Diets rich in fruits, vegetables, nuts, seeds, whole grains, and healthy fats provide antioxidants, polyphenols, vitamins, and minerals that help neutralize free radicals and reduce chronic inflammation. Adequate protein intake supports collagen synthesis and tissue repair, while essential fatty acids help maintain skin barrier integrity and hydration. Conversely, diets high in refined sugars and ultra-processed foods may accelerate skin aging through the formation of AGEs, which contribute to collagen and elastin degradation [2].

Acne and Diet. Acne is a common skin condition affecting approximately 9.4% of the global population [53]. It is influenced by hormonal changes, inflammation, and sebaceous gland activity—all of which are modifiable by diet (Figure 2).

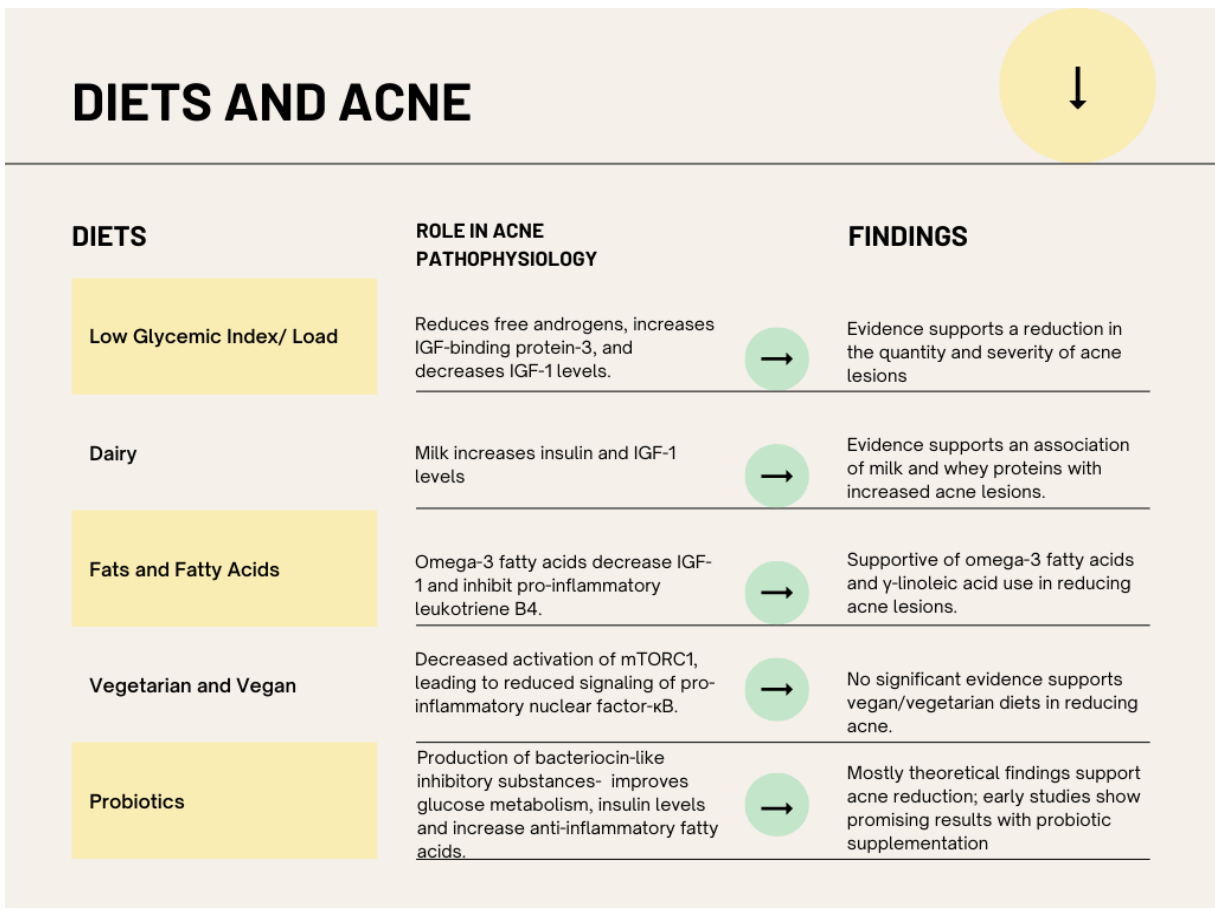


Figure 2 Diet and Acne [54, 55].

(i) Dietary Factors that Worsen Acne:

- **High Glycemic Index (GI) and Glycemic Load (GL) Diets:** Diets rich in refined carbohydrates spike blood glucose and insulin, increasing IGF-1 and androgens. These changes stimulate sebocyte proliferation and worsen acne.
- **Dairy and Whey Proteins:** Milk increases insulin and IGF-1 levels, contributing to excess sebum production and the formation of acne lesions.

(ii) Protective Dietary Interventions:

- **Omega-3 Fatty Acids:** Found in fish and flaxseed, omega-3 reduces IGF-1 levels and inhibit pro-inflammatory leukotriene B4, significantly improving acne.
- **Probiotics:** Though evidence is emerging, probiotics may produce bacteriocin-like compounds, improve insulin sensitivity, and increase anti-inflammatory fatty acids. Early studies suggest benefits in acne reduction.
- **Vegetarian/Vegan Diets:** These diets may reduce mTORC1 activity, a signaling pathway implicated in acne development. However, there is currently limited direct evidence supporting a significant impact on acne.

Atopic Dermatitis and Diet. Atopic dermatitis (AD) is a chronic inflammatory skin condition closely associated with immune dysregulation and impaired skin barrier function. Nutrition plays an important role in reducing symptoms and preventing flare-ups. A randomized controlled trial [56] showed that an exclusion diet—reducing sugary, gluten-containing, and processed foods while increasing fruits and vegetables—significantly improved AD symptoms, indicating that dietary modification can be a useful adjunct in AD management.

(i) Key Nutrients and Their Benefits in AD:

- **Vitamin D:** Frequently deficient in AD patients, vitamin D enhances regulatory T cells (Tregs), promotes immune tolerance, and strengthens the skin barrier by upregulating filaggrin and cathelicidin.
- **Vitamin A:** Supports Treg function, inhibits mast cell and eosinophil activation, and reduces inflammation. Lower levels are associated with more severe forms of AD.
- **γ-Linolenic Acid (GLA):** Found in evening primrose and borage oil, GLA improves skin hydration, reduces trans-epidermal water loss, and helps synthesize anti-inflammatory prostaglandins.
- **Eicosapentaenoic Acid (EPA) & Docosahexaenoic Acid (DHA):** These omega-3 PUFAs reduce leukotriene B4, increase skin ceramides, and resolve inflammation through their active metabolites.
- **Probiotics:** By modulating gut microbiota, probiotics enhance intestinal barrier function, increase Tregs, and decrease allergic inflammation.
- **Zinc:** Often deficient in AD patients, zinc helps maintain skin barrier function, supports Treg cell activity, and suppresses pro-inflammatory cytokines.

Psoriasis and Diet. Psoriasis is a chronic autoimmune skin condition characterized by red, scaly patches. Diet can influence its severity by modulating inflammatory pathways [49].

(i) Foods That Increase the Risk of Psoriasis:

- **Foods rich in Saturated Fatty Acids (SFAs):** Commonly found in butter and red meat, SFAs can worsen psoriasis by activating pro-inflammatory pathways like the NLRP3 inflammasome and the TNF- α /IL-23/IL-17 axis.
- **Simple Sugars:** High intake of refined sugars promotes Th17 cell differentiation, which plays a major role in the inflammation seen in psoriasis.
- **Alcohol:** Excessive alcohol consumption disrupts gut microbiota, increases intestinal permeability, and promotes the release of inflammatory cytokines, exacerbating psoriasis symptoms.

(ii) Foods and Nutrients That Help Manage Psoriasis:

- **Foods high in n-3 Polyunsaturated Fatty Acids (PUFAs):** Found in fatty fish (e.g., salmon, sardines), EPA and DHA reduce inflammatory cytokines and inhibit Th17 responses.
- **Dietary Fiber:** Present in grains, legumes, and fruits, fiber promotes the production of short-chain fatty acids (SCFAs) in the gut, enhancing regulatory T-cell function and reducing inflammation.
- **Vitamin D:** Obtained from sunlight, fish, and eggs, vitamin D modulates immune function, reduces inflammatory cytokines, and improves skin barrier function.
- **Vitamin B12:** Found in liver, shellfish, and fish, vitamin B12 acts as an antioxidant and reduces oxidative stress, potentially alleviating psoriasis symptoms.
- **Genistein:** A soy-derived isoflavone with anti-inflammatory properties, genistein inhibits pro-inflammatory signaling pathways.
- **Selenium:** Present in fish, eggs, and whole grains, selenium supports antioxidant defense and immune regulation.
- **Probiotics:** Beneficial strains such as *Lactobacillus* and *Bifidobacterium* improve gut health, reduce systemic inflammation, and promote immune balance, potentially benefiting psoriasis patients.

2.3.3 Ayurvedic Perspective on Diet and Skin Health

Ayurveda emphasizes a holistic approach to skin health, where diet (Ahara), digestive strength (Agni), and purity of tissues (Dhatus) play central roles in maintaining youthful, healthy skin. A diet aligned with one's constitution (Prakriti) and seasonal needs helps balance the three doshas—Vata, Pitta, and Kapha—thereby preventing premature aging and skin disorders. Poor dietary habits can lead to the accumulation of Ama (toxins), which obstructs bodily channels and contributes to dullness, inflammation, and accelerated aging. A Sattvic diet rich in fresh fruits, vegetables, whole grains, legumes, nuts, and dairy—while limiting spicy, oily, salty, and processed foods—supports digestion, purifies the blood (Rakta), and nourishes the skin from within.

Given the growing global interest in natural, plant-based, and traditional health products, it is particularly relevant to highlight Ayurveda's contributions in this review. Ayurvedic herbs such as amla, turmeric, and gotu kola offer Rasayana (rejuvenating) benefits through antioxidant, anti-inflammatory, and collagen-enhancing effects. Practices like mindful eating, timely meals, and detoxifying herbal teas further strengthen digestion and nutrient absorption. Collectively, these principles provide a natural, sustainable framework for improving skin health and delaying the aging process, making Ayurveda an important system to consider in contemporary skin nutrition research [57-60].

3. Conclusion

Nutrition plays a profound and multifaceted role in promoting skin health and delaying the onset of aging. It influences not only the structural and functional integrity of the skin but also plays a preventive role in various inflammatory and degenerative dermatological conditions. While nutrition alone cannot halt the biological process of aging, evidence suggests that long-term adherence to a nutrient-rich dietary pattern can substantially improve skin resilience, reduce oxidative damage, and delay the onset of visible age-related skin changes. As this was a narrative review, the heterogeneity of study designs, populations, interventions, and dermatological outcomes may limit direct comparison across studies. As scientific research continues to deepen our understanding of the complex interplay between nutrition and dermatology, personalized dietary recommendations are likely to become a cornerstone in both clinical and cosmetic skin care practices. The integration of targeted nutritional strategies holds promise for fostering optimal skin health, improving quality of life, and supporting healthy aging in diverse populations.

Author Contributions

Dr. Neha Bakshi conceptualized the review, designed the structure, conducted the comprehensive literature search, analyzed and synthesized the findings, prepared the tables and figures, and drafted the full manuscript. Dr. Vritti Lumba contributed to the critical review of literature. Dr. A. S. Soin provided expert input. All authors reviewed and approved the final version of the manuscript before submission.

Competing Interests

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Data Availability Statement

As this is a review article, no new data were generated or analyzed during the study. All information presented is derived from previously published literature, which has been duly cited in the manuscript.

AI-Assisted Technologies Statement

AI-assisted tools were used only for language refinement and improvement of grammar and readability during manuscript preparation. The conceptualization, analysis, interpretation of findings, and overall intellectual content of the manuscript are entirely my own. AI was not used for generating scientific content, data analysis, references, or drawing conclusions. Its role was limited to enhancing clarity of expression.

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