

THE ROLE OF NUTRITION IN SKIN DISEASES

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Abstract

Nutrition is essential for maintaining the structure, function, and health of the skin. As the largest organ of the human body, the skin acts as a protective barrier against environmental, chemical, and microbial factors. There is growing evidence that nutritional status plays a significant role in the development, progression, and management of various skin conditions. Nutrients including vitamins, minerals, essential fatty acids, proteins, and antioxidants contribute to skin regeneration, immune response, collagen synthesis, and protection against oxidative stress.

Various dermatological conditions, such as acne vulgaris, atopic dermatitis, psoriasis, rosacea, and eczema, have been linked to dietary factors and nutritional deficiencies. Diets that are high in processed foods, high glycemic index carbohydrates, saturated fats, and excessive dairy may lead to inflammation and worsen certain skin issues. Conversely, diets that include fruits, vegetables, omega-3 fatty acids, probiotics, and antioxidant-rich foods may enhance skin health and decrease inflammation. Micronutrients like Vitamin A, Vitamin C, Vitamin D, Vitamin E, zinc, selenium, and biotin play significant roles in maintaining skin integrity and aiding dermatological treatments. Furthermore, gut microbiota and the gut-skin axis have gained attention as relevant elements connecting nutrition and skin diseases.

This review aims to summarize existing knowledge about the connection between nutrition and skin diseases, emphasizing the effects of dietary patterns, micronutrients, and nutritional interventions on skin health. Understanding nutrition's role in dermatology may enhance prevention strategies and supportive treatment approaches for different skin conditions.

Keywords: nutrition, skin diseases, minerals, vitamins, tretman

Introduction

The role of nutrition in skin health and disease has received great attention in recent years, showing the importance of dietary factors in maintaining skin homeostasis (Katta *et al.*, 2014; Barrea *et al.*, 2025). As we know, the skin is the largest organ of the body, whose function is a protective barrier against external factors and which actively participates in metabolic and immunological processes (Katta *et al.*, 2014). Its structural and functional integrity directly depends on the adequate supply of nutrients, including proteins, lipids, vitamins, and minerals, which are essential for cell regeneration, collagen synthesis, and the maintenance of oxidative balance (Katta *et al.*, 2014; Barrea *et al.*, 2025).

Scientific research suggests that diet has an impact on a variety of biological processes related to the pathogenesis of dermatological diseases (Katta *et al.*, 2014; Barrea *et al.*, 2025). For example, foods with a high glycemic index can increase insulin levels and growth factors such as IGF-1, stimulating keratinocyte proliferation and sebum production, processes associated with the development of acne vulgaris.

On the other hand, a diet rich in antioxidants, such as vitamins A, C, and E, as well as bioactive compounds such as polyphenols, helps neutralize oxidative stress and reduce inflammation, having a protective effect against skin damage (Barrea *et al.*, 2025).

It should be noted that some dietary ingredients affect the worsening of certain skin diseases. Consumption of dairy products and processed foods has been linked to worsening acne, while a lack of essential fatty acids and micronutrients may contribute to epidermal barrier disorders, such as in atopic dermatitis (Katta *et al.*, 2014; Barrea *et al.*, 2025). In this context, nutrition should not only be seen as a supporting factor, but as an integral component in the prevention and management of skin diseases. Understanding the interactions between diet, metabolism,

and skin functions is essential for the development of effective therapeutic and preventive strategies in dermatology (Katta *et al.*, 2014; Barrea *et al.*, 2025).

This review aims to summarize current knowledge regarding the relationship between nutrition and skin diseases, focusing on the impact of dietary patterns, micronutrients, and nutritional interventions on skin health. Recognizing the role of nutrition in dermatology may improve prevention strategies and supportive treatments for various skin conditions.

Results and discussions

Skin Diseases

Acnet vulgaris-

Acne vulgaris is a chronic dermatosis, very prevalent in the Western population and common in adolescents (Khan *et al.*, 2022; Rygula *et al.*, 2024). It is characterized by follicular keratinization, intense sebum secretion, colonization of *Propionibacterium acnes*, with excessive intrafollicular growth and inflammation. There are different types of lesions: open and closed comedones (non-inflammatory lesions), papules, pustules, cysts and nodules (inflammatory lesions). Acne is usually treated as an aesthetic problem, but it also affects psychologically by lowering self-esteem, with emotional and social consequences for some people (Khan *et al.*, 2022; Rygula *et al.*, 2024). They usually appear during adolescence, due to hormonal changes. The main etiological factors, currently accepted in the literature, are genetics (heredity), age (hormonal changes in adolescence), physical condition (body composition and insulin resistance) and finally nutrition (diet, supplements and phytotherapy) (Smith *et al.*, 2022; Kowalska *et al.*, 2024). Among these, physical condition and nutrition are factors that can be modified. Classic treatments for acne vulgaris are various including mainly antibiotics and reduction of fat production (oral and topical). These are effective but can cause side effects and nutritional damage to the body. In this context, nutrition has been indicative of potential beneficial interactions (Smith *et al.*, 2022). Evidence related to nutrition and dermatology is still scarce but it already suggests possible interventions (Rygula *et al.*, 2024). Nutrients with a negative impact on acne-Milk is an extremely specialized functional food designed through evolution to support anabolic reactions and the growth of newborn mammals. Milk consumption significantly increases the amount of IGF-1 (Rygula *et al.*, 2024). We know that 80% of milk protein from cows is casein, while 20% is whey protein. Whey protein is involved in the insulinotropic action of milk, and casein is more likely to stimulate IGF-1 than whey (Rygula *et al.*, 2024). Athletes used whey protein for oral supplements in order to increase muscle weight. Thus, hyperinsulinemia caused by the insulinotropic function of such proteins significantly increases the concentration of IGF-1 during puberty, which explains why these people are more likely for the onset or worsening of acne lesions (Rygula *et al.*, 2024). Also, cow's milk, mainly from pregnant cows, contains not only placental progesterone but also other dihydrotestosterone precursors, such as 5-alpha pregnandione and 5-alpha androstendione. It is worth noting that dihydrotestosterone is the most biologically reactive type of testosterone, which is important in the formation of acne lesions through increased androgen receptor expression (Rygula *et al.*, 2024). But according to some case studies it is generally suggested that the effects of acne-causing dairy products are unlikely to be due to the fat content but rather due to the hormones and other bioactive molecules contained in milk (Rygula *et al.*, 2024). Theses proposed to clarify the potential impact of chocolate intake on acne symptoms. One suggestion is that the saccharides present in chocolate and milk cause insulin secretion causing signaling pathways that ultimately imply increased keratinocyte tendencies, resulting in acne lesions (Rygula *et al.*, 2024). Saturated fatty acids which include, for example, palmitoleic,

stearic and myristic acids and isomers of trans fatty acids, the main source of which is hydrogenated vegetable fats which are found in margarine, sweets or fast foods, negatively affect the skin affected by acne vulgaris (Rygula *et al.*, 2024). The high content of palmitic acid leads to the progression of skin infection, increased blackheads and increased sebum production. Also, many cross-border surveys in the European and Asian populations have shown that alcohol abusers have a significantly higher probability of acne than those who do not drink. It is worth noting that alcohol has been shown to increase testosterone values as well as the secretion of pro-inflammatory cytokines (Rygula *et al.*, 2024). In longer use it damages the immune system, linking the tendency of bacteria to changes in the skin microbiome and worsening acne and when expelled with sweating it works as a food ingredient for *Cutibacterium acnes* (Khan *et al.*, 2022; Rygula *et al.*, 2024).

Case Study-(Rubin *et al.*, 2008)

In this study of 5 patients with inflammatory acne vulgaris, the initial condition was characterized by the presence of active acnetic lesions (papules and pustules), visible inflammation of the facial skin and moderate to pronounced severity of the disease, which in some cases was also associated with psychological impact. The



Fig.2-after use of omega-3 poly-nutrient capsules

diagnosis was inflammatory acne vulgaris, while the intervention consisted of food supplementation with omega-3 (EPA from fish oil) and antioxidants such as zinc and selenium in order to reduce systemic inflammation and oxidative stress. After a few weeks of treatment, there was a significant clinical improvement, with a reduction in acne lesions, a reduction in inflammation and fewer appearances of new acne, suggesting a positive effect of the nutritional intervention in controlling inflammatory acne (Rubin *et al.*, 2008)



Fig.1-before use of omega-3 poly-nutrient capsules

Psoriasis-

Psoriasis is considered to be a T-cell-mediated inflammatory skin disease, which is characterized by hyperproliferation and poor differentiation of epidermal keratinocytes (Ricketts *et al.*, 2010). While susceptibility to psoriasis is hereditary, the disease is influenced by environmental factors, such as infections and stress (Ricketts *et al.*, 2010). Diet has been suggested to be involved in the etiology and pathogenesis of psoriasis (Ricketts *et al.*, 2010). The fasting period, low-energy diets, and vegetarian diets have been shown to improve psoriasis symptoms in several studies, and the diet rich in polyunsaturated fatty acids from fish oil have also shown beneficial effects (Ricketts *et al.*, 2010). Consuming vegetables and fruits can be beneficial in psoriasis due to their high content with antioxidant action (vitamins C, E, B2, zinc, selenium), improved energy metabolism (vitamin B complex, magnesium, vitamin C), modulation of immune function (vitamins A, D, C, folic acid, selenium, copper) and stimulation of collagen synthesis (vitamin C, lysine, proline) (Ricketts *et al.*, 2010).

Here we have a case study-(Wong *et al.*, 2015)



A 36-year-old woman presented to the clinic with psoriasis since the age of 22. She stated that the psoriasis outbreak originated on the scalp and slowly descended down towards her feet. Eventually, the psoriatic lesions covered a large area of her body, with the exception of the face (Fig. 1). That He had been prescribed topical steroid cream for the past 14 years. The possible cause may be the use of anti-dandruff

Supplement	Amount (mg)	Amount (mg)	Amount (mg)	Amount (mg)
Omega-3 (EPA)	1000	1000	1000	1000
Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
Omega-3 (EPA)	1000	1000	1000	1000
Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
Omega-3 (EPA)	1000	1000	1000	1000
Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
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Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
Omega-3 (EPA)	1000	1000	1000	1000
Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
Omega-3 (EPA)	1000	1000	1000	1000
Omega-3 (DHA)	1000	1000	1000	1000
Omega-3 (Total)	2000	2000	2000	2000
Omega-3 (EPA)	1000	100		

shampoo (which contains charcoal tar) since adolescence. The patient stopped using anti-dandruff shampoo from the first consultation. Discontinuing shampoo would not relieve psoriasis in the current study timelines, but it may help speed up healing. At the beginning of the treatment, the patient was advised to consume a healthy diet with plenty of vegetables, minimal meat, no fast foods, and to avoid taking any form of sugar in food or beverages. The following supplements were prescribed: Vitacor Plus-1 tablet 3 times a day, ProLysinC-2 tablets 3 times a day, VitaCforte-2 tablets 3 times a day, and LysinC Drink mix-1 tablespoon 4 times a day. Table I shows the list of ingredients in these supplements. The patient was advised to stop using the steroid cream immediately at the beginning of treatment. Return appointments were scheduled once a month. During the first month, the patient experienced worsening of the skin condition with the removal of the dead skin. From the second month onwards, the psoriasis spots looked thinner. Spots on the upper body (neck, shoulder, upper arms) seemed to heal faster than the lower parts of the body. This healing process continued and the psoriatic spots on the legs were the last to heal. By the end of 6 months, the patient's psoriasis had completely disappeared (Fig. 2). The patient reported worsening of itching and pain in the first month, followed by gradual improvement of these symptoms over 6 months. The patient had no complaints/side effects related to the diet (Wong *et al.*, 2015)

Atopic dermatitis-

Atopic dermatitis (AD) is a chronic eczematous disease characterized by allergic immunity displaced by T helper 2(Th2), skin barrier damage and itching (Khan *et al.*, 2022). Oral intake of certain nutrients may help regulate AD. Serum 25-hydroxyvitamin D levels are often low in these patients, and oral vitamin D supplementation improves AD. The way vitamin D acts is by increasing regulatory T(Market) cells which promote allergen tolerance and prevent allergic inflammation by promoting the expression of filagrin and catelicide in keratinocytes (Khan *et al.*, 2022). Vitamin A strengthens regulatory T cells by promoting the expression of the P3 forkhead box and inhibits the release of mediators by mast cells and eosinophils. Serum levels of γ -linolenic acid (GLA) and its metabolism, dihomo- γ -linoleic acids (DGLA), are also low. Thus, GLAs improve AD through DGLA-derived prostaglandin D1 and E1. OMEGA-3 (Ac. eicosapentaenoic and Ac. docosahexaenoic) acts by decreasing the production of leukotriene B4, increasing ceramides in the stratum corneum, and through their metabolites, resolvins E1 and D1, which resolve inflammation (Khan *et al.*, 2022). It should be noted that the level of zinc is also low. Zinc induces the expression of the P3 forkhead box and increases Treg cells, and the zinc-finger protein A20 decreases the nuclear-factor- κ B-dependent expression of inflammatory cytokines. Oral supplementation of the above nutrients may have a therapeutic or preventive role in AD (Khan *et al.*, 2022).

Rosacea

Rosacea is a chronic inflammatory skin disease that mainly affects the face and is characterized by recurrent redness, persistent erythema, telangiectasis and some papules and pustules with progress that passes into phases of deterioration. It is divided into several subtypes (erythematotelangiectatic, papulopustular, phymatous and ocular), often with mixed symptoms in the same patient. Its cause is not clear, but it is related to a combination of factors: immune disorder born with increased inflammatory mediators, dysfunction of the nervous and vascular system that increases sensitivity and vasodilation, as well as the influence of skin microorganisms such as Demodex Folliculorum and various bacteria that can promote inflammation. External factors such as food, heat and irritants can worsen the condition. Treatment often includes topical creams and in more severe cases oral antibiotics, but their

long-term use is limited due to side effects and bacterial resistance, so lifestyle modification is also becoming important.

Dietary triggers are often cited by patients, although there is a lack of research in this area. In a survey by the National Rosacea Association over 400 patients, 78% had changed their diet due to rosacea. Of this group, 95% reported a later decrease in deterioration. The reported triggers in this group can be divided into heat-related, alcohol-related, capsaicin-related, and cinnamaldehyde-related. Specifically, hot beverages acted as triggers, including hot coffee (33% describe it as the trigger) and hot tea (30%). Alcohol was another frequent trigger, including wine (52%) and hard liquor (42%). Capsaicin is found in some spices and peppers. Respondents frequently reported spices as triggers (75%), as well as spicy sauce (54%), cayenne pepper (47%), and red pepper (37%). Lastly, cinnamaldehyde is found in some seemingly unrelated foods, including tomatoes, citrus fruits, cinnamon, and chocolate. In this study, foods containing cinnamaldehyde were also described as frequent triggers, including tomatoes (30%), chocolate (23%), and citrus fruits (22%) -(Weiss *et al.*, 2017)

The role of vitamins and minerals

Vitamins and minerals are micronutrients essential for the proper functioning of the human body, required in small amounts. They play various chemical and physiological roles and are commonly present in many natural food sources (Alija *et al.* 2024).

Vitamin C

Vitamin C (ascorbic acid) plays an important role in the functioning and health of the skin, which is not produced by the body but must be obtained externally. It is part of the synthesis of collagen in the dermis contributing directly to the structure, elasticity and strength of the skin, as well as to the formation of the barrier. In addition, vitamin C acts as a powerful antioxidant, protecting the skin from oxidative damage caused by external factors such as UV radiation, and thus helps slow down the aging process and reduce wrinkles. At the cellular level, it participates in the signalling pathways that regulate cell growth and differentiation, processes associated with the development of various skin diseases. An important characteristic of vitamin C is its dual role as an antioxidant and pro-oxidant. Under certain conditions, especially in the presence of transition metals such as iron (Fe^{2+}), it can generate reactive oxygen species (ROS). While in normal cells this balance is controlled, in tumor cells where the antioxidant system is impaired the increase in ROS can lead to DNA damage, decreased ATP and failure of cellular metabolism hindering their survival. For this reason, vitamin C is also of interest in the context of anticancer therapies. Also, vitamin C helps reduce melanogenesis (melanin production), which makes it important in the treatment of hyperpigmentation, and stimulates keratinocyte differentiation, improving skin regeneration. Its deficiency leads to serious systemic disorders, the most well-known being scurvy, which is characterized by weakening of connective tissues due to impaired collagen synthesis (Wang *et al.*, 2018)

Vitamin E

Vitamin E is an essential fat-soluble antioxidant that's primarily obtained through diet, especially from vegetable oils, nuts, seeds, and green leafy vegetables. From a nutritional perspective, it plays a key role in protecting cell membranes as it settles in their lipid layers and protects them from lipid peroxidation caused by free radicals. By donating an electron, vitamin E neutralizes these reactive molecules and interrupts chain reactions of oxidative

damage. At the skin level, this translates into protection against damage caused by UV radiation, environmental pollutants and chemical substances, factors that contribute to premature aging and the development of inflammatory processes. Additionally, vitamin E has anti-inflammatory effect, helping to reduce erythema, irritation, and damage to the epidermal barrier. Metabolically, vitamin E does not act alone. It is part of an antioxidant network where it interacts with other vitamins, especially vitamin A and vitamin C, contributing to the maintenance of the redox balance in the body. In this context, it helps stabilize vitamin A, which is essential for epithelial cell differentiation and skin regeneration. Although the main function of vitamin E is antioxidant, under certain conditions (such as the high presence of free radicals or a lack of other antioxidants) it may also exhibit pro-oxidant activity, reflecting the complexity of its role in the body. Getting enough through diet is essential for maintaining the structural and functional integrity of the skin, improving the immune response, and protecting against chronic inflammatory and degenerative processes.

On the other hand, vitamin E deficiency, while rare, can lead to increased susceptibility to oxidative stress and tissue damage (Cassano *et al.*, 2012)

Vitamin A

Vitamin A is an essential fat-soluble vitamin obtained through the diet in the form of retinoids (from animal sources) and carotenoids (from plant sources like beta-carotene). From a nutritional point of view, it plays a key role in the differentiation, growth, and function of epithelial cells, making it one of the most important vitamins for skin health. At the skin level, vitamin A is essential for maintaining the integrity of the epidermal barrier and for cell regeneration. It regulates the keratinization process, preventing excessive thickening of the corneal layer and clogging of pores, which makes it particularly important in acne management. Additionally, vitamin A stimulates collagen production in the dermis, contributing to improved skin elasticity and reduced wrinkles. Functionally, vitamin A also plays a role in modulating the skin's immune system, helping to protect against infections and control inflammatory processes. It also affects the activity of melanocytes, playing a role in regulating skin pigmentation. Vitamin A acts in synergy with other antioxidants such as vitamins E and C, contributing to redox balance and protecting against oxidative damage caused by environmental factors such as UV radiation and pollution. Vitamin A deficiency leads to obvious skin disorders, such as dryness, hyperkeratosis and loss of the protective function of the epidermal barrier, while in more severe cases it also affects other systemic functions. On the other hand, adequate intake through diet is essential for maintaining healthy, functional, and damage-resistant skin (Park *et al.* 2015).

Zinc-

Zinc is an essential micronutrient that should be taken regularly through the diet, as the body does not store it in large quantities. It is mainly found in meat, fish, dairy products, nuts and grains and is better absorbed from animal sources. The specific roles zinc plays in skin health and function are less well known but likely to be equally critical based on manifestations of zinc deficiency in the diet, which include moderate to severe dermatitis. The skin is in a constant state of rejuvenation, placing a high demand for enzymes and zinc-based proteins that drive this process. The importance of zinc physiologically is particularly evident in studies of wound healing and inflammation reduction. During these processes, high zinc needs can be met externally, generally increasing the rates of natural processes (Schwartz *et al.*, 2006)

The findings of this review emphasize the increasing evidence that nutrition influences the development, progression, and management of various skin diseases. Historically,

dermatological conditions were viewed as unrelated to diet; however, recent studies have shown that nutritional factors can significantly affect skin health outcomes (Draelos, 2010, Boelsma *et al.* 2001).

The results indicate that dietary patterns high in refined carbohydrates, saturated fats, and processed foods may lead to increased inflammation and exacerbate conditions such as acne, psoriasis, and atopic dermatitis. Conversely, diets that are rich in antioxidants, vitamins, and minerals seem to provide protective and supportive effects on skin function.

These observations are in line with earlier research indicating that Vitamin A, Vitamin C, Vitamin E, and Zinc play important roles in preserving skin integrity, aiding collagen synthesis, and minimizing oxidative stress.

Moreover, nutrition seems to hold particular significance in chronic inflammatory diseases like psoriasis, where dietary changes can support pharmacological treatments and enhance overall patient outcomes. Likewise, in the case of acne, there is evidence that low-glycemic diets might alleviate disease severity by affecting hormonal and inflammatory mechanisms.

In summary, this discussion reinforces the idea that nutrition should be regarded as a key factor in both the prevention and management of dermatological conditions. Nonetheless, additional large-scale clinical studies are required to establish standardized dietary guidelines for the management of skin diseases.

The review emphasized the adverse impacts of high-glycemic diets and processed foods on skin inflammation. Likewise, Smith *et al.* (2007) found that individuals adhering to a low-glycemic-load diet experienced a reduction in acne severity, reinforcing the idea that insulin and IGF-1 pathways play a role in the development of acne (Smith *et al.* 2007).

Wolters (2005) primarily focused on psoriasis and its relationship with obesity, metabolic syndrome, and chronic inflammation. In contrast to studies that concentrate on acne, this research highlighted the systemic aspects of psoriasis and proposed that weight loss and anti-inflammatory diets could lead to improved disease outcomes. Both studies indicate that changes in diet may have a beneficial impact on inflammatory skin disorders, though the underlying mechanisms may vary (Wolters, 2005).

Stahl and Sies (2007) investigated the protective effects of antioxidants like carotenoids and flavonoids against oxidative damage caused by ultraviolet exposure. Their research differs from studies related to acne and psoriasis, as it emphasizes the prevention of premature aging and skin cancer rather than direct inflammatory processes. Nonetheless, all studies highlight the significance of minimizing oxidative stress for maintaining skin health (Stahl & Sies 2007). Boelsma *et al.* (2001) and Draelos (2010) focused on the importance of micronutrients in maintaining healthy skin. Their research indicated that vitamins and minerals, including Vitamin A, Vitamin C, Vitamin D, zinc, and selenium, play a role in collagen synthesis, antioxidant protection, and skin regeneration. Although these studies emphasized skin physiology and aging rather than inflammatory diseases, they align with research on inflammatory skin conditions by highlighting the necessity of proper nutrition for overall skin health (Boelsma *et al.* 2001; Draelos, 2010).

Research in North Macedonia has identified a connection between systemic health, metabolism, and skin diseases. Damevska *et al.* noted a higher prevalence of metabolic syndrome among patients with psoriasis, indicating that nutritional and metabolic factors may affect the severity and progression of the disease. Additionally, studies from dermatology centers in Skopje highlighted the impact of chronic inflammation and systemic conditions on skin-related issues. These findings align with the increasing evidence that links nutrition and metabolic health to skin diseases (Damevska *et al.* 2013).

Conclusion

Skin diseases are influenced by obesity, metabolic and dietary factors, emphasizing the need for an integrated and multidisciplinary approach to clinical management involving dermatologist, endocrinologist and nutritionist. Medical nutrition therapy offers promising results not only in improving obesity, metabolic changes, and cardiovascular risk, but, leading to reduced inflammation and oxidative stress, directly and indirectly reduces the clinical severity of major inflammatory skin diseases. While observational studies suggest beneficial associations between dietary patterns and skin disease severity, the lack of large-scale, randomized controlled studies limits the definitive conclusions. Future research should prioritize well-designed RCTs to determine causality, refine dietary recommendations, and standardize assessment methods for adherence to the diet. Personalized nutrition strategies should be incorporated into routine dermatological care to increase treatment efficiency and improve patient quality of life.

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