The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 5, 2025

NUTRITIONAL STRATEGIES FOR ENHANCING SKIN MICROBIOME HEALTH: A REVIEW OF DIET AND DERMATOLOGICAL OUTCOMES

Maria Haris[*1], Mahpara Sajid[2], Noor-Ul-Ain[3], Shiraz Rafaqat[4], Dr. Muhammad Akhtar[5], Zunaira Farooq[6], Rumaisa Atif[7]

[*1]*Associate Lecturer, Department of Food Science and Technology University of Central Punjab, Lahore*
[2]*Health Assessor, Abbott Nutrition International*
[3]*Student, Department of Food Science and Technology*
[4]*Phd Scholar, National Institute of Food Science and Technology University of Agriculture Faisalabad*
[5]*Assistant Professor, Department of Food Science and Technology University of Central Punjab, Lahore*
[6]*Student*
[7]*Student, Department of Food Science and Technology University of Central Punjab, Lahore*

[*1]mariaharis@ucp.edu.pk, [2]mahparasajid192@gmail.com, [3]noorirfan@outlook.com, [4]shirazrafaqit@gmail.com, [5]muhammadakhtar@ucp.edu.pk, [6]zunairafarooq078@gmail.com [7]rumaisaatif94@gmail.com

DOI: https://doi.org/10.5281/zenodo.15493759

Keywords
Dermatology, nutritional supplements, diet and skin health, the gut-skin connection, probiotics, prebiotics, skin microbiome

Article History
Received on 14 April 2025
Accepted on 14 May 2025
Published on 23 May 2025

Corresponding Author: *
Maria Haris

Abstract

This narrative review highlights recent research on the impact of dietary practices on skin microbiomes and their associated dermatological effects. The skin microbiome, composed of various bacteria, fungi, and viruses, plays a crucial role in immune regulation and maintaining barrier function. Dysbiosis in this ecosystem has been linked to conditions such as psoriasis, atopic dermatitis, acne, and premature aging. We carried out comprehensive search on Google Scholar, PubMed, and ScienceDirect for open-access review papers published between 2015 and 2024. Our study centered on the relationships among probiotics, prebiotics, certain micronutrients and their impact on skin health. A total of ten articles that fulfilled the inclusion criteria were examined thematically. Research indicates that the intake of probiotics and prebiotics from fibre- rich foods, as well as products like kefir, kimchi, and yogurt, can enhance skin hydration and barrier integrity, and reduce systemic inflammation. Essential micronutrients operate through various mechanisms: zinc is involved in anti-inflammatory processes and promotes epithelial repair, while copper and selenium support antioxidant defences and tissue remodeling; Vitamin D plays a role in enhancing innate immunity; vitamins C and E serve as antioxidants, promoting collagen synthesis and decreasing UV damage; additionally, vitamin A and its derivatives control the differentiation of keratinocytes and lessen acne lesions. Dietary approaches like the Mediterranean diet and those based on plants, rich in polyphenols, unsaturated fats, and fibers, are linked to improved microbial health. Diverse diets are linked to milder skin conditions, while Western diets high in refined sugars and fats worsen inflammation and imbalances in gut bacteria. These findings highlight the importance of personalized dietary approaches and indicate the need for further clinical research to clarify causation and establish dosage

recommendations, reinforcing the role of nutrition as a non-pharmacological method to enhance skin microbiota health.

INTRODUCTION

The skin, as the body's largest and most visible organ, serves as a protective barrier against infections from the environment while also offering a diverse ecological habitat for various microorganisms[1]. The biochemical conditions of the skin are demanding, featuring elevated salinity, acidic pH levels, dryness, and extended exposure to environmental elements. Nonetheless, numerous microbial species, including viruses (notably bacteriophages), fungi, and bacteria, can successfully inhabit the skin[2]. The makeup of the human skin microbiome shaped by genetic factors, environmental influences, and the specific microenvironment[3,4]. Additionally, skin features appendages such as glands and hair follicles, which carry out several homeostatic functions, including thermoregulation and wound healing[5,6,7]. Sweat glands generate antimicrobial peptides (AMPs) that assist in preventing the proliferation of harmful microbes[8], whereas sebaceous glands release non-polar lipids to maintain hydration by minimizing water loss. [9,10]. The epidermis serves as the main protective layer that interfaces with the external environment, while the dermis is responsible for the structural integrity of the skin. This barrier comprises numerous biological, structural, and chemical components that are vital for preventing internal infections. Nevertheless, disturbances to the skin barrier, caused by elements such as illness, injury, and the aging of the skin, can result in microbial imbalance and an increased risk of infection[11,12,13]. From the moment of birth, the gut microbiome has been essential in providing protection, facilitating metabolic functions, and aiding in the development and regulation of the immune system[14,15].

Diet plays a crucial role in several biological processes associated with skin wellness, aging, and illnesses. Eating habits and nutritional wellness affect the skin's ability to heal and resist harm. Recent studies have underscored the connection between dietary habits, nutrition, overall health, and skin health. Clinical research has successfully correlated nutrition with the health of tissues and organs, emphasizing the moderate impact of nutritional quality on aging and skin well-being. Visible indicators of deficiencies in vitamins, minerals, and fatty acids can emerge due to dietary excesses, shortages, imbalances, and harmful substances that disrupt the natural equilibrium of the skin. Recent studies suggest that dietary changes may play a role in treatment regimens for various skin conditions, including vitiligo, alopecia, psoriasis, and eczema[16]. The aim of this review is to identify dietary practices that enhance skin outcomes and support skin microbiota.

Methodology

A narrative approach was employed in this review to gather the latest insights regarding the relationship between skin microbiota and nutrition. An extensive literature search was performed to identify relevant peer-reviewed articles published between 2015 and 2024 using databases such as Google Scholar, PubMed, and ScienceDirect. The search was confined to studies that explored the link between diet, nutritional elements (including probiotics, prebiotics, vitamins, and minerals), and the skin microbiome, with an emphasis on dermatological outcomes like acne and skin barrier function. The search phrases used encompassed skin microbiome, nutrition, dietary impacts on skin health, gut-skin axis, probiotics and their relation to skin, along with "dermatological outcomes, their incorporation of nutritional approaches, and their exploration of both direct and indirect influences of diet on the makeup and function of the skin microbiome." In total, ten review articles were chosen and thematically analyzed.

A Beginner's Guide to the Skin Microbiome

The typical surface area of human skin is about 1.8 square meters. With around one million microorganisms found in every square centimeter, human skin, including hair follicles, sebaceous glands, and other related structures, harbors more than 10 billion microorganisms[17,18]. Considering the essential factors and makeup of the skin

microbiome, human skin can becategorized into four types of ecosystems: dry, moist, sebaceous (oily), and foot[19]. The diversity and abundance of cutaneous microbiota in healthy and pathological conditions varied significantly[20]. Numerous skin issues are recognized to be linked to dysbiosis and an imbalance in the skin microbiome[21,22,23].

Certain strains and their primary metabolites can serve as markers for skin disorders or as potential treatment targets. Research on the interactions between the human skin and microbiota—including the typical skin microbiota—what disturbs the skin microbiota, and how microorganisms aid in wound healing is especially intriguing understanding the basic physiology of skin and its microbial interactions not only enhances one's comprehension of homeostatic processes but also illuminates the link between diseases and disruptions in normal skin function. Aside from being determined by the location on the body, skin characteristics and microbial makeup can be affected by various internal factors (such as genetics, age, and gender) as well as external factors (including lifestyle, climate, air pollution, and use of cosmetics)[24,25,26]. Because of its natural complexity and variety, it is challenging to define the role of the skin microbiome in particular physiological processes[27]. However, numerous relevant studies have illuminated how an individual's skin microbiota changes over time[28,29,30] and how shifts in microbial composition relate to aging and skin disorders[31,32,33].

The Gut-Skin Axis

Disruption in microbial populations and a compromise of gut integrity can greatly influence the overall state of the skin[34]. This intricate relationship between the gut and the skin is known as the "gut-skin axis"[35]. Essentially, the gut microbiota collaborates with the skin to regulate both local and systemic inflammation by interacting with the immune system[36,37]. The microbial communities mainly preserve the gut barrier's integrity by transforming indigestible complex polysaccharides into short-chain fatty acids (particularly butyrate and propionate) and producing vitamins (especially K and B12)[38,39].

For example, butyrate decreases the intestinal barrier's permeability and strengthens the epithelial barrier[40]. The primary barrier that prevents microbes from spreading to other host tissues is the mucus layer in the gut[41,42]. The innate immune cells in GALT assist in protecting the gut mucosa. They enhance both the innate and adaptive immune responses and identify general illnesses by presenting particular antigens[43,44]. Eliminating harmful bacteria, AMPs, macrophages, and CD103+ CD11b+ dendritic cells primarily prevent their spread[45,46]. Defensins fight against bacteria by making holes in their membranes. Cell death results from crossing the appropriate thresholds. Cathelicidins (LL-37) help in preserve the epithelial barrier's integrity. They possess immunomodulatory properties alongside their primary function, which involves disrupting bacterial membranes. The primary mechanisms that maintain the integrity of the gut epithelial barrier include enhanced synthesis of tight junction proteins and post- translational events such as the repositioning of tight junctions. Consequently, cathelicidins are primarily employed when there is a compromise in the epithelial barrier[47]. Tregs, IgA- producing B cells, and Th17 cells that are exclusive to gut commensal bacteria differentiate in response to commensal antigens presented by DCs[48]. DCs control CD4+ Th17 cells' selectivity for commensal microorganisms by presenting the Major Histocompatibility Complex II (MHCII) antigen.

Host AMP release is stimulated by the cytokine Interleukin 22 (IL-22), which is generated by CD4+ Th17 cells[49,50]. The integrity of the intestinal barrier, mucus, immune cells, IgA, and antimicrobial peptides (AMPs) produced by epithelial cells all contribute to the maintenance of skin homeostasis by preventing gut bacteria from entering the bloodstream[51].

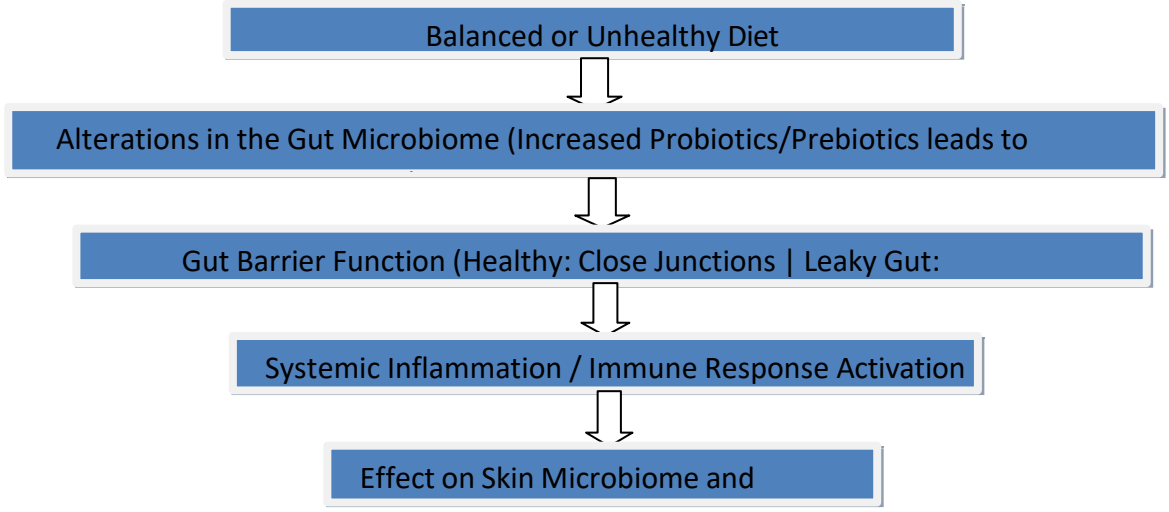

Figure 1. Flowchart depicting the mechanism of the gut–skin axis.

This illustration demonstrates how our dietary choices impact the makeup of the gut microbiome, which subsequently influences the integrity of the intestinal barrier and immune responses throughout the body. These shifts internally can disrupt the skin's microbial balance and barrier function, potentially resulting in skin issues such as acne, eczema, and psoriasis. Diets rich in nutrients, particularly those abundant in fiber, omega-3 fatty acids, and antioxidants, may enhance both gut and skin health by lessening inflammation and fostering microbial diversity. This figure serves as a conceptual overview based on various review sources.

Prebiotics, fermented foods, and probiotics

Prebiotics, which include specific fermented foods or dietary supplements that aren't digested, enhance gut health by fostering the growth of beneficial bacteria[52]. In contrast, probiotics are live microorganisms, typically bacteria or yeast, that offer health advantages to the host when administered in sufficient amounts[53,54]. First-generation probiotics are commonly available products used to address microecological imbalances. The development of "metabiotics" marks the next evolutionary step, consisting of small compounds or chemicals derived from probiotic microorganisms. These metabiotics can be created or partially created using the bioactive components produced by symbiotic bacteria (a combination of probiotics and prebiotics) from naturally occurring probiotic strains or natural sources. They are known as "pharmacobiotics," "metabolic probiotics," "postbiotics," or "biological drugs." These compounds may influence human metabolic processes, signaling pathways, host-related physiological functions, and the microbiome. Additionally, specific elements related to immunology, neurohormone biology, and metabolic and behavioral responses have been identified as chemical structures in postbiotics that may improve the composition and function of the host's native microbiota[55]. For instance, butyrate, a postbiotic produced by various beneficial bacteria, serves as a crucial energy source for the colon and is essential for intestinal growth, differentiation, and the regulation of inflammation[56,57]. Additionally, when bacteria lyse, they produce or release postbiotics, which are effector substances derived from probiotics. They have the same ability to exert qualities as the original probiotics[58,59]. They try to achieve the advantages of probiotics without the risk of giving live bacteria. Despite being commonly associated with dietary supplements that target the gut microbiota, these probiotics, prebiotics, and postbiotics are used for purposes other than the digestive system, such as the skin and other parts of the body[60]. As researchers explore their possibilities in topical formulations and cosmetics goods, these concepts are pertinent to dermatology, particularly for treating skin problems. The gut-skin axis theory states that there is a strong

correlation between gut health and skin conditions like AD[61].

Role of Specific Nutrients

Vitamin A can prevent microbial infections and skin disease, and deficits are associated with an increase in the former[62]. All-trans-retinoic acid has been shown to be beneficial when applied topically for mild acne, atopic dermatitis is associated with impaired retinoid signalling and decreased vitamin A status, and deficiency has been connected to delayed wound healing[63]. It has also been shown that retinoid can reduce the appearance of skin discolouration and ageing[64]. The plant-derived carotenoid β-carotene has been demonstrated to alleviate UV-induced skin redness [65]. The skin contains β-carotene and other plant-based carotenoids that change with the seasons, including lutein, zeaxanthin, and lycopene.

Vitamin C is crucial for the health of skin since it prevents the development of melanin and encourages the synthesis of collagen and elastin. Vitamin C also shields against UV-A and UV-B radiation by inhibiting apoptosis and proinflammatory cytokinesIt might offer defense against various skin conditions, including atopic dermatitis, herpes, and malignant melanoma, although the exact way it works as a treatment remains unclear[66]. The systemic route is more effective even if vitamin C is found in skin care products because oxidised vitamin C rapidly loses its reducing action, which is what gives it its function[67]. Vitamin C also increases the moisture levels in the epidermis[68].

7-dehydrocholesterol is converted into vitamin D within the epidermis. Vitamin D has demonstrated effectiveness in managing psoriasis due to its ability to modulate cAMP, decrease inflammation, and promote wound healing, although it might worsen atopic dermatitis[69]. In the fight against infections and UV-induced cell damage, vitamin D is essential. However, the body's ability to generate vitamin D from sunshine decreases with age, raising the risk of UV damage and infections[70]. Pretreated keratinocytes appear to be protected against UV-B DNA damage in vitro by active vitamin D[71]. However, both active vitamin D and its synthesis, which absorbs UV, may be responsible for the UV protection effects[72,73].

Supplementing with vitamin E (α-tocopherol) may help people with psoriasis and atopic dermatitis because it protects lipids from oxidative stress[74]. Vitamin E protects the skin against the breakdown of collagen and reduces inflammation; however, a lack of it has been associated with abnormal collagen arrangement and the formation of skin ulcers[75]. With a lengthy history in dermatology, this vitamin has been shown to be effective in treating hyperpigmentation, delaying the development of skin cancer, and preserving the integrity of the dermal and epidermal structures to delay the ageing process of the skin[76].

Zinc is a mineral that serves as a cofactor for numerous metalloenzymes. The effects of zinc on skin health have been evaluated[77,78,79]. A lack of zinc can result in skin issues such as dermatitis, as zinc is crucial for preserving skin balance[80]. Zinc, which has anti-inflammatory and apoptosis-regulating qualities, is mostly found in the epidermis[81]. Zinc's antibacterial and wound-healing properties have led to its topical application[82]. Zinc oxide, the main ingredient in mineral sunscreens, prevents UV rays from entering the skin. In addition, it aids in protecting against infections by working in conjunction with several other micronutrients[83].

Zinc has demonstrated positive effects not just in sun protection, but also in addressing inflammatory skin conditions, pigmentation issues, wound recovery, and conditions like alopecia areata and actinic keratoses[84,85].

Copper is one micronutrient that can protect the skin from UV radiation. Copper aids in the development of collagen and helps in the production of melanin. Copper has antimicrobial properties, and copper peptides, including glycyl-histidyl-lysine (GHK) or γ-glutamyl-cysteinyl- glycine (GSH), have been shown to reduce oxidative skin damage and heal skin tissue[86]. It promotes the production and binding of hypoxia-inducible factor 1-alpha (HIF-1α) for angiogenesis and vascular endothelial growth factor (VEGF) for the regeneration of new skin during wound healing[87]. These properties render it a vital part of wound dressings. Furthermore, a reduced Zn–Cu ratio and reliant antioxidant enzymes in male patients with acne vulgaris might suggest that copper

supplementation could have therapeutic advantages[88]. Selenium safeguards against damage from UV radiation and are crucial for the activity of various antioxidant enzymes. Research has indicated that selenium supplementation can benefit individuals with psoriasis; however, a lack of selenium has been associated with skin cancer development and epidermolysis bullosa[89,90]. However, its presence may be linked to a decreased risk of skin cancer, particularly basal cell carcinoma (BCC) and squamous cell carcinoma (SCC)[90]. By encouraging collagen and fibroblasts, a food-derived, selenium-rich extract has been shown to successfully prevent wrinkles and ageing[91].

Trends in eating habits

The effects of a plant-based diet on atopic dermatitis are significant. Due to their high antioxidant, vitamin, and mineral content, these foods can help combat the oxidative stress and inflammation associated with AD. Produce like fruits and vegetables, along with nuts, seeds, and whole grains, are packed with nutrients that support the skin's barrier function, enhance hydration, and reduce inflammation. Moreover, diets centered around plant-based foods generally limit the intake of processed products and unhealthy fats, which might exacerbate the symptoms of Alzheimer's disease. Prioritizing a plant-based diet improves overall health and wellbeing in addition to reducing the severity of AD [92,93].

Fatty acids, particularly omega-3 and omega-6 polyunsaturated fatty acids (PUFAs), are vital for good skin. Omega-3 fatty acids, present in walnuts, flaxseeds, and fish, possess anti- inflammatory qualities that could aid in alleviating the inflammation linked to AD. Additionally, they contribute to maintaining the skin's barrier function. Omega-6 fatty acids, often found in processed foods and vegetable oils, may exacerbate inflammation when ingested in large amounts. It is essential to balance the intake of these fatty acids to effectively manage AD.

Additionally, as we've already covered, vitamins serve several purposes in preserving the health of your skin. For instance, vitamin D has the ability to modulate the immune system and can affect the intensity of atopic dermatitis (AD). Low vitamin D levels have been shown to exacerbate AD symptoms. Vitamin E, known for its antioxidant properties, aids in diminishing oxidative stress within the skin, a factor that can worsen atopic dermatitis (AD). Because it maintains the operation of the skin barrier and immune system, vitamin A is crucial for skin maintenance and healing. Vitamin C is necessary to produce collagen, supports skin structure, and has antioxidant properties. Vitamin B Complex, especially B6, is essential for healthy skin and a strong immune system.

Essential nutrients such as zinc and selenium influence skin health as well. Zinc aids in the healing of damaged skin and possesses anti-inflammatory qualities. Selenium, an antioxidant, helps protect the skin from oxidative damage[94].

Nutritional Elements Influencing Skin Wellness in Typical Dermatological Issues

Between two and three percent of adults are affected by psoriasis, a long-lasting inflammatory disorder influenced by genetic predispositions as well as environmental elements. The pathogenesis of psoriasis depends on the gut-skin axis, which links skin inflammation to an imbalance in the gut microbiota. The fact that stomach dysbiosis can trigger immunological responses, leading to systemic inflammation and exacerbating psoriatic symptoms, underscores the connection between gut health and skin conditions such as psoriasis[95]. A Mediterranean diet and a gluten-free diet (GFD) could also offer advantages[96].

The Mediterranean diet places a strong emphasis on plant-based foods such fruits, vegetables, whole grains, nuts, and legumes. Alcohol, red meat, and sugars all cause inflammatory pathways that worsen psoriasis, whereas n-3 polyunsaturated fatty acids, vitamins D and B12, and other nutrients lessen inflammation. Although this link has not been shown, some people think that psoriasis may be related to deficiencies in vitamin D and selenium [98].

Alopecia areata, a prevalent autoimmune-driven hair loss disorder that affects about 2% of adults, can result in anything from localized patches to total body hair loss[99]. Vitamin D is essential for the growth of keratinocytes, and a lack of vitamin D has been linked to autoimmune diseases[100]. Topical calcipotriol, which is a vitamin D derivative, has been demonstrated to be

effective in treating alopecia areata (AA) only when used as a supplementary therapy. Research is currently exploring the possibility that anti-inflammatory diets—particularly those rich in antioxidants and free of gluten—might help alleviate the inflammation linked to AA[101-102].

Pemphigus is a blistering disorder resulting from autoantibodies that target desmoglein cadherins. Pemphigus vulgaris (PV), pemphigus foliaceus (PF), and severe paraneoplastic pemphigus (PNP), which is associated with hematologic neoplasms, are among the disease's variations[103]. Traditional corticosteroid therapy is helpful, but it has a significant risk of death because of possible congenital abnormalities, aseptic joint necrosis, osteoporosis, adrenal insufficiency, hyperlipidemia, growth suppression, and negative effects on the gastrointestinal tract, liver, and eyes. Nutritional issues during treatment involve hydro electrolytic imbalances, increased catabolism due to skin peeling, and difficulties with feeding[104]. In severe cases, a diet high in protein is recommended as part of intensive nutritional therapy, and in specific circumstances, the use of a nasogastric feeding tube is suggested[105]. Vitamin D3 supplementation may be part of the pharmaceutical treatment for pemphigus. Pemphigus may be triggered by a wide variety of foods and drinks, and dietary factors, such as compounds like tannins and phenols, are implicated in its development[106]. This emphasizes how crucial individualized nutritional care is for people with pemphigus. Nonetheless, pemphigus is often, though not universally, linked to dietary factors. Dermatologists once denied that food and acne were related, but current research indicates that they are. The gut microbiota is thought to influence skin health and the development of acne because it influences the immune system and the quantity of inflammation that the immune system is designed to create. Consuming dairy products has been linked to acne, particularly when it comes to skim milk due to its steroids and growth hormones[107]. A diet typical of Western countries, rich in high glycemic load foods like refined wheat and sugar, has been linked to the development of acne. Fast absorption of glucose raises levels of insulin and IGF-1, which correlate positively with the severity of acne and stimulates the production of sebum and testosterone. Randomized controlled trials support this, demonstrating that a 10-week low-glycemic load diet combined with probiotics reduces acne by increasing insulin sensitivity and reducing androgen-related factors[108]. Moreover, polycystic ovarian syndrome (PCOS) exacerbates acne because too much insulin increases androgen levels[109]. Reducing sugar and carbohydrates can help PCOS sufferers' hormones return to normal, which will lessen their oil production and acne.

Conclusion

The information acquired for this review suggests that certain dietary strategies can change skin microbiomes to have beneficial dermatological consequences. Eating foods rich in nutrients, probiotics, and prebiotics enhances the skin barrier, promotes microbial diversity, and reduces the inflammation associated with common skin issues. On the other hand, diets that contain high levels of processed sugars and unhealthy fats disrupt microbial balance and worsen skin problems. Personalised nutrition plans, which are based on the individual microbiota profile and clinical presentation of each patient, offer a possible substitute for conventional therapies. Future studies should concentrate on large-scale, randomized controlled trials to identify the optimal nutrient combinations, intake levels, and intervention periods. As we gain deeper insights into the gut-skin connection, comprehensive nutritional approaches may revolutionize both preventative and treatment strategies in dermatology.

REFERENCES

Belkaid, Y. and Segre, J.A., 2014. Dialogue between skin microbiota and immunity. Science, 346: 954-959. DOI: 10.1126/science.1260144; PMID: 25414304

Lunjani, N., Hlela, C. and O'Mahony, L., 2019. Microbiome and skin biology. Curr. Opin. Allergy Clin. Immunol., 19: 328-333. DOI: 10.1097/ACI.0000000000000542; PMID: 31219889

Oh, J., Byrd, A.L., Park, M., Kong, H.H. and Segre, J.A., 2016. Temporal stability of the human skin microbiome. Cell, 165: 854-866. DOI: 10.1016/j.cell.2016.04.008; PMID: 27153496

Kemter, A.M. and Nagler, C.R., 2019. Influences on allergic mechanisms through gut, lung, and skin microbiome exposures. J. Clin. Invest., 129: 1483-1492. DOI: 10.1172/JCI124610; PMID: 30830878

Ito, M., Liu, Y., Yang, Z., Nguyen, J., Liang, F., Morris, R.J. and Cotsarelis, G., 2005. Stem cells in the hair follicle bulge contribute to wound repair but not to homeostasis of the epidermis. Nat. Med., 11: 1351-1354. DOI: 10.1038/nm1328; PMID: 16288281

Lu, C.P., Polak, L., Rocha, A.S., Pasolli, H.A., Chen, S.C., Sharma, N., Blanpain, C. and Fuchs, E., 2012. Identification of stem cell populations in sweat glands and ducts reveals roles in homeostasis and wound repair. Cell, 150: 136-150. DOI: 10.1016/j.cell.2012.04.045; PMID: 22770217

Rittie, L., Sachs, D.L., Orringer, J.S., Voorhees, J.J. and Fisher, G.J., 2013. Eccrine sweat glands are major contributors to reepithelialization of human wounds. Am. J. Pathol., 182: 163-171. DOI: 10.1016/j.ajpath.2012.09.019; PMID: 23069725

Pappas, A., 2009. Epidermal surface lipids. Dermatoendocrinol., 1: 72-76. DOI: 10.4161/derm.1.2.7811; PMID: 20046582

Rieg, S., Seeber, S., Steffen, H., Humeny, A., Kalbacher, H., Stevanovic, S., Kimura, A., Garbe, C. and Schittek, B., 2006. Generation of multiple stable dermcidin-derived antimicrobial peptides in sweat of different body sites. J. Investig. Dermatol., 126: 354-365. DOI: 10.1038/sj.jid.5700041; PMID: 16417235

Schittek, B., Hipfel, R., Sauer, B., Bauer, J., Kalbacher, H., Stevanovic, S., Schirle, M., Schroeder, K., Blin, N., Meier, F., et al., 2001. Dermcidin: A novel human antibiotic peptide secreted by sweat glands. Nat. Immunol., 2: 1133-1137. DOI: 10.1038/ni732; PMID: 11713464

Zeeuwen, P.L., Boekhorst, J., van den Bogaard, E.H., de Koning, H.D., van de Kerkhof, P.M., Saulnier, D.M., van Swam, I.I., van Hijum, S.A.F.T., Kleerebezem, M., Schalkwijk, J., et al., 2012. Microbiome dynamics of human epidermis following skin barrier disruption. Genome Biol., 13: R101. DOI: 10.1186/gb-2012-13-11-r101; PMID: 23153041

Howard, B., Bascom, C.C., Hu, P., Binder, R.L., Fadayel, G., Huggins, T.G., Jarrold, B.B., Osborne, R., Rocchetta, H.L., Swift, D., et al., 2022. Aging-Associated Changes in the Adult Human Skin Microbiome and the Host Factors that Affect Skin Microbiome Composition. J. Investig. Dermatol., 142: 1934-1946.e21. DOI: 10.1016/j.jid.2021.11.029; PMID: 34906562

Kong, H.H., Oh, J., Deming, C., Conlan, S., Grice, E.A., Beatson, M.A., Nomicos, E., Polley, E.C., Komarow, H.D., NISC Comparative Sequencing Program, et al., 2012. Temporal shifts in the skin microbiome associated with disease flares and treatment in children with atopic dermatitis. Genome Res., 22: 850-859. DOI: 10.1101/gr.131029.111; PMID: 22310490

Guarner, F., Khan, A.G., Garisch, J., Eliakim, R., Gangl, A., Thomson, A., Krabshuis, J., Lemair, T., Kaufmann, P., de Paula, J.A., et al., 2012. World Gastroenterology Organisation global guidelines. J. Clin. Gastroenterol., 46(6): 468-481. DOI: 10.1097/mcg.0b013e3182549092; PMID: 22647633

Renz, H., Brandtzaeg, P. and Hornef, M., 2011. The impact of perinatal immune development on mucosal homeostasis and chronic inflammation. Nat. Rev. Immunol., 12(1): 9-23. DOI: 10.1038/nri3112; PMID: 22158411

Basavaraj, K.H., Seemanthini, C. and Rashmi, R., 2010. Diet in dermatology: present perspectives. Indian J. Dermatol., 55: 205-210. DOI: 10.4103/0019-5154.70662; PMID: 21063507

Grice, E.A., et al., 2008. A diversity profile of the human skin microbiota. Genome Res., 18: 1043-1050. DOI: 10.1101/gr.075549.107; PMID: 18502944

Grice, E.A. and Segre, J.A., 2011. Erratum: the skin microbiome. Nat. Rev. Microbiol., 9: 626-626. DOI: 10.1038/nrmicro2618; PMID: 21808292

Belkaid, Y. and Segre, J.A., 2014. Dialogue between skin microbiota and immunity. Science., 346: 954. DOI: 10.1126/science.1260144; PMID: 25414347

Flowers, L. and Grice, E.A., 2020. The skin microbiota: balancing risk and reward. Cell Host Microbe., 28: 190-200. DOI: 10.1016/j.chom.2020.06.014; PMID: 32619477

Barnard, E., Shi, B., Kang, D., Craft, N. and Li, H., 2016. The balance of metagenomic elements shapes the skin microbiome in acne and health. Sci. Rep., 6: 39491. DOI: 10.1038/srep39491; PMID: 28000852

Alekseyenko, A.V., et al., 2013. Community differentiation of the cutaneous microbiota in psoriasis. Microbiome., 1: 31. DOI: 10.1186/2049-2618-1-31; PMID: 24451285

Yan, D., et al., 2017. The role of the skin and gut microbiome in psoriatic disease. Curr. Dermatol. Rep., 6: 94-103. DOI: 10.1007/s13671-017-0169-0

Grice, E.A. and Segre, J.A., 2011. The skin microbiome. Nat. Rev. Microbiol., 9: 244-253. DOI: 10.1038/nrmicro2537; PMID: 21407241

Vierkötter, A. and Krutmann, J., 2012. Environmental influences on skin aging and ethnic-specific manifestations. Dermatoendocrinol., 4: 227-231. DOI: 10.4161/derm.19858; PMID: 23467476

Dimitriu, P.A., Iker, B., Malik, K., Leung, H., Mohn, W.W. and Hillebrand, G.G., 2019. New insights into the intrinsic and extrinsic factors that shape the human skin microbiome. mBio., 10: e00839-19. DOI: 10.1128/mBio.00839-19; PMID: 31209109

Ursell, L.K., Clemente, J.C., Rideout, J.R., Gevers, D., Caporaso, J.G. and Knight, R., 2012. The interpersonal and intrapersonal diversity of human-associated microbiota in key body sites. J. Allergy Clin. Immunol., 129: 1204-1208. DOI: 10.1016/j.jaci.2012.03.010; PMID: 22541293

Fyhrquist, N., Muirhead, G., Prast-Nielsen, S., Jeanmougin, M., Olah, P., Skoog, T., Jules-Clement, G., Feld, M., Barrientos-Somarribas, M., Sinkko, H., et al., 2019. Microbe-host interplay in atopic dermatitis and psoriasis. Nat. Commun., 10: 4703. DOI: 10.1038/s41467-019-12253-y; PMID: 31558719

Kim, H.J., Oh, H.N., Park, T., Kim, H., Lee, H.G., An, S. and Sul, W.J., 2022. Age-related human skin microbiome and mycobiome in Korean women. Sci. Rep., 12: 2351. DOI: 10.1038/s41598-022-06189-5; PMID: 35193914

Li, Z., Bai, X., Peng, T., Yi, X., Luo, L., Yang, J., Liu, J., Wang, Y., He, T., Wang, X., et al., 2020. New insights into the skin microbial communities and skin aging. Front. Microbiol., 11: 565549. DOI: 10.3389/fmicb.2020.565549; PMID: 33192610

Salem, I., Ramser, A., Isham, N. and Ghannoum, M.A., 2018. The gut microbiome as a major regulator of the gut-skin axis. Front. Microbiol., 9: 1459. DOI: 10.3389/fmicb.2018.01459; PMID: 29977236

Shibagaki, N., Suda, W., Clavaud, C., Bastien, P., Takayasu, L., Iioka, E., Kurokawa, R., Yamashita, N., Hattori, Y., Shindo, C., et al., 2017. Aging-related changes in the diversity of women's skin microbiomes associated with oral bacteria. Sci. Rep., 7: 10567. DOI: 10.1038/s41598-017-10834-9; PMID: 28883541

Thevaranjan, N., Puchta, A., Schulz, C., Naidoo, A., Szamosi, J.C., Verschoor, C.P., Loukov, D., Schenck, L.P., Jury, J., Foley, K.P., et al., 2017. Age-associated microbial dysbiosis promotes intestinal permeability, systemic inflammation, and macrophage dysfunction. Cell Host Microbe., 21: 455-466.e4. DOI: 10.1016/j.chom.2017.03.002; PMID: 28392194

Ying, S., Zeng, D.N., Chi, L., Tan, Y., Galzote, C., Cardona, C., Lax, S., Gilbert, J. and Quan, Z.X., 2015. The influence of age and gender on skin-associated microbial communities in urban and rural human populations. PLoS ONE., 10: e0141842. DOI: 10.1371/journal.pone.0141842; PMID: 26510185

De Pessemier, B., Grine, L., Debaere, M., Maes, A., Paetzold, B. and Callewaert, C., 2021. Gut–skin axis: current knowledge of the interrelationship between microbial dysbiosis and skin conditions. Microorganisms., 9(2): 353. DOI: 10.3390/microorganisms9020353; PMID: 33557215

LeBlanc, J.G., Milani, C., de Giori, G.S., Sesma, F., van Sinderen, D. and Ventura, M., 2013. Bacteria as vitamin suppliers to their host: a gut microbiota perspective. Curr. Opin. Biotechnol., 24(2): 160-168. DOI: 10.1016/j.copbio.2012.08.005; PMID: 22940255

Polkowska-Pruszyńska, B., Gerkowicz, A. and Krasowska, D., 2019. The gut microbiome alterations in allergic and inflammatory skin diseases – an update. J. Eur. Acad. Dermatol. Venereol., 34(3): 455-464. DOI: 10.1111/jdv.15951; PMID: 31661378

Scott, K.P., Gratz, S.W., Sheridan, P.O., Flint, H.J. and Duncan, S.H., 2013. The influence of diet on the gut microbiota. Pharmacol. Res., 69(1): 52-60. DOI: 10.1016/j.phrs.2012.10.020; PMID: 23103769

Vojvodic, A., Peric-Hajzler, Z., Matovic, D., Vojvodic, P., Vlaskovic-Jovicevic, T., Sijan, G., Dimitrijevic, S., Stepic, N., Wollina, U., Badr, B.A.E., et al., 2019. Gut microbiota and the alteration of immune balance in skin diseases: from nutraceuticals to fecal transplantation. Open Access Maced. J. Med. Sci., 7(18): 3034-3038. DOI: 10.3889/oamjms.2019.827

Belkaid, Y. and Harrison, O.J., 2017. Homeostatic immunity and the microbiota. Immunity., 46(4): 562–576. DOI: 10.1016/j.immuni.2017.04.008; PMID: 28411060

Brandtzaeg, P., Kiyono, H., Pabst, R. and Russell, M.W., 2007. Terminology: nomenclature of mucosa-associated lymphoid tissue. Mucosal Immunol., 1(1): 31–37. DOI: 10.1038/mi.2007.9; PMID: 17579762

De Pessemier, B., Grine, L., Debaere, M., Maes, A., Paetzold, B. and Callewaert, C., 2021. Gut–skin axis: current knowledge of the interrelationship between microbial dysbiosis and skin conditions. Microorganisms., 9(2): 353. DOI: 10.3390/microorganisms9020353; PMID: 33557215

Gubatan, J., Holman, D.R., Puntasecca, C.J., Polevoi, D., Rubin, S.J. and Rogalla, S., 2021. Antimicrobial peptides and the gut microbiome in inflammatory bowel disease. World J. Gastroenterol., 27(43): 7402–7422. DOI: 10.3748/wjg.v27.i43.7402; PMID: 33439555

Konrad, A., Cong, Y., Duck, W., Borlaza, R. and Elson, C.O., 2006. Tight mucosal compartmentation of the murine immune response to antigens of the enteric microbiota. Gastroenterology., 130(7): 2050–2059. DOI: 10.1053/j.gastro.2006.02.055; PMID: 16790690

Macpherson, A.J. and Uhr, T., 2004. Induction of protective IgA by intestinal dendritic cells carrying commensal bacteria. Science (New York, N Y)., 303(5664): 1662–1665. DOI: 10.1126/science.1091334; PMID: 14976327

Mowat, A.M., 2003. Anatomical basis of tolerance and immunity to intestinal antigens. Nat. Rev. Immunol., 3(4): 331–341. DOI: 10.1038/nri1057; PMID: 12671617

Naik, S., Bouladoux, N., Linehan, J.L., Han, S.J., Harrison, O.J., Wilhelm, C., Conlan, S., Himmelfarb, S., Byrd, A.L., Deming, C., et al., 2015. Commensal–dendritic-cell interaction specifies a unique protective skin immune signature. Nature., 520(7545): 104–108. DOI: 10.1038/nature14052; PMID: 25730669

Goto, Y., Panea, C., Nakato, G., Cebula, A., Lee, C., Diez, M., Laufer, T., Ignatowicz, L. and Ivanov, I., 2014. Segmented filamentous bacteria antigens presented by intestinal dendritic cells drive mucosal Th17 cell differentiation. Immunity., 40(4): 594–607. DOI: 10.1016/j.immuni.2014.03.005; PMID: 24656019

Liang, S.C., Tan, X.Y., Luxenberg, D.P., Karim, R., Dunussi-Joannopoulos, K., Collins, M. and Fouser, L.A., 2006. Interleukin (IL)-22 and IL-17 are coexpressed by Th17 cells and cooperatively enhance expression of antimicrobial peptides. J Exp Med., 203(10): 2271–2279. DOI: 10.1084/jem.20061308; PMID: 16880356

Macpherson, A.J. and Uhr, T., 2004. Induction of protective IgA by intestinal dendritic cells carrying commensal bacteria. Science (New York, N Y)., 303(5664): 1662–1665. DOI: 10.1126/science.1091334; PMID: 14976327

Morelli, L. and Capurso, L., 2012. FAO/WHO guidelines on probiotics: 10 years later. J. Clin. Gastroenterol., 46: S1–S2. DOI: 10.1097/MCG.0b013e318261f1ee

Patel, S. and Goyal, A., 2012. The current trends and future perspectives of prebiotics research: A review. 3 Biotech., 2: 115–125. DOI: 10.1007/s13205-012-0050-1

Abbasi, A., Rad, A.H., Ghasempour, Z., Sabahi, S., Kafil, H.S., Hasannezhad, P., Rahbar Saadat, Y., and Shahbazi, N., 2022. The biological activities of postbiotics in gastrointestinal disorders. Crit. Rev. Food Sci. Nutr., 62: 5983–6004. DOI: 10.1080/10408398.2021.1934949

França, K., 2021. Topical probiotics in dermatological therapy and skincare: A concise review. Dermatol. Ther., 11: 71–77. DOI: 10.1111/dth.14843

Gao, J., Li, Y., Wan, Y., Hu, T., Liu, L., Yang, S., Gong, Z., Zeng, Q., Wei, Y., and Yang, W., 2019. A novel postbiotic from Lactobacillus rhamnosus GG with a beneficial effect on intestinal barrier function. Front. Microbiol., 10: 477. DOI: 10.3389/fmicb.2019.00477

Guéniche, A., Benyacoub, J., Buetler, T.M., Smola, H., and Blum, S., 2006. Supplementation with oral probiotic bacteria maintains cutaneous immune homeostasis after UV exposure. Eur. J. Dermatol., 16(5): 511–517. PMID: 17082456

Januszewski, J., Forma, A., Zembala, J., Flieger, M., Tyczynska, M., Dring, J.C., Dudek, I., Swiatek, K., and Baj, J., 2023. Nutritional supplements for skin health—A review of what should be chosen and why. Medicina., 60: 68. DOI: 10.3390/medicina60010068

Kim, J., Ko, Y., Park, Y.K., Kim, N.I., Ha, W.K., and Cho, Y., 2010. Dietary effect of lactoferrin-enriched fermented milk on skin surface lipid and clinical improvement of acne vulgaris. Nutrition., 26(9): 902–909. DOI: 10.1016/j.nut.2009.09.019

Novik, G., and Savich, V., 2020. Beneficial microbiota. Probiotics and pharmaceutical products in functional nutrition and medicine. Microbes Infect., 22: 8–18. DOI: 10.1016/j.micinf.2020.02.003

Sanders, M.E., Gibson, G.R., Gill, H.S., and Guarner, F., 2007. Probiotics: Their potential to impact human health. Counc. Agric. Sci. Technol. Issue Pap., 36: 1–20.

Swaby, A.M., and Agellon, L.B., 2022. The potential role of commensal microbes in optimizing nutrition care delivery and nutrient metabolism. Recent Prog. Nutr., 2: 1–16. DOI: 10.1002/rpn2.35

Darvin, M.E., Sterry, W., Lademann, J., and Vergou, T., 2011. The role of carotenoids in human skin. Molecules, 16: 10491–10506. DOI: 10.3390/molecules161210491

Michalak, M., Pierzak, M., Krecisz, B., and Suliga, E., 2021. Bioactive compounds for skin health: A review. Nutrients, 13: 203. DOI: 10.3390/nu13010203

Park, K., 2015. Role of micronutrients in skin health and function. Biomol. Ther., 23: 207–217. DOI: 10.4062/biomolther.2015.003

Schagen, S.K., Zampeli, V.A., Makrantonaki, E., and Zouboulis, C.C., 2012. Discovering the link between nutrition and skin aging. Derm.-Endocrinol., 4: 298–307. DOI: 10.4161/derm.22876

Al-Khafaji, Z., Brito, S., and Bin B.H., 2022. Zinc and zinc transporters in dermatology. Int. J. Mol. Sci., 23: 16165. DOI: 10.3390/ijms232416165

Januszewski, J., Forma, A., Zembala, J., Flieger, M., Tyczynska, M., Dring, J.C., Dudek, I., Swiatek, K., and Baj, J., 2023. Nutritional supplements for skin health—A review of what should be chosen and why. Medicina, 60: 68. DOI: 10.3390/medicina60010068

Michalak, M., Pierzak, M., Krecisz, B., and Suliga, E., 2021. Bioactive compounds for skin health: A review. Nutrients, 13: 203. DOI: 10.3390/nu13010203

Ogawa, Y., Kinoshita, M., Shimada, S., and Kawamura, T., 2018. Zinc and skin disorders. Nutrients, 10: 199. DOI: 10.3390/nu10020199

Park, K., 2015. Role of micronutrients in skin health and function. Biomol. Ther., 23: 207–217. DOI: 10.4062/biomolther.2015.003

Reichrath, J., 2012. Unravelling of hidden secrets: The role of vitamin D in skin aging. Derm.-Endocrinol., 4: 241–244. DOI: 10.4161/derm.21312

Schagen, S.K., Zampeli, V.A., Makrantonaki, E., and Zouboulis, C.C., 2012. Discovering the link between nutrition and skin aging. Derm.-Endocrinol., 4: 298–307. DOI: 10.4161/derm.22876

Mostafa, W.Z., and Hegazy, R.A., 2015. Vitamin D and the skin: Focus on a complex relationship: A review. J. Adv. Res., 6: 793–804. DOI: 10.1016/j.jare.2014.01.011

Al-Khafaji, Z., Brito, S., and Bin B.H., 2022. Zinc and zinc transporters in dermatology. Int. J. Mol. Sci., 23: 16165. DOI: 10.3390/ijms232416165

Lin, P.H., Sermersheim, M., Li, H., Lee, P.H.U., Steinberg, S.M., and Ma, J., 2017. Zinc in wound healing modulation. Nutrients, 10: 16. DOI: 10.3390/nu10010016

Michalak, M., Pierzak, M., Krecisz, B., and Suliga, E., 2021. Bioactive compounds for skin health: A review. Nutrients, 13: 203. DOI: 10.3390/nu13010203

Ogawa, Y., Kinoshita, M., Shimada, S., and Kawamura, T., 2018. Zinc and skin disorders. Nutrients, 10: 199. DOI: 10.3390/nu10020199

Park, K., 2015. Role of micronutrients in skin health and function. Biomol. Ther., 23: 207–217. DOI: 10.4062/biomolther.2015.003

Glutsch, V., Hamm, H., and Goebeler, M., 2019. Zinc and skin: An update. J. Dtsch. Dermatol. Ges., 17: 589–596. DOI: 10.1111/ddg.13811

Ahuja, K., and Lio, P., 2023. The role of trace elements in dermatology: A systematic review. J. Integr. Dermatol.

Alotaibi, H.A., 2018. Effects of weight loss on psoriasis: A review of clinical trials. Cureus, 10: 3491. DOI: 10.7759/cureus.3491

Di Landro, A., Cazzaniga, S., Parazzini, F., et al., 2012. Family history, body mass index, selected dietary factors, menstrual history, and risk of moderate to severe acne in adolescents and young adults. J. Am. Acad. Dermatol., 67: 1129–1135. DOI: 10.1016/j.jaad.2012.02.018

Feliciani, C., Cozzani, E., Marzano, A.V., Caproni, M., Di Zenzo, G., Calzavara-Pinton, P., 2018. Italian Guidelines in Pemphigus - adapted from the European Dermatology Forum (EDF) and European Academy of Dermatology and Venerology (EADV). G Ital. Dermatol. Venereol., 153: 599–608. DOI: 10.23736/S0392-0488.18.06073-X

Flores-Balderas, X., Peña-Peña, M., Rada, K.M., et al., 2023. Beneficial effects of plant-based diets on skin health and inflammatory skin diseases. Nutrients, 15(13): 2842.

Grover, S., 2011. Scoring systems in pemphigus. Indian J Dermatol., 56: 145–149. DOI: 10.4103/0019-5154.80403

Hall, K.D., Guo, J., Courville, A.B., et al., 2021. Effect of a plant-based, low-fat diet versus an animal-based, ketogenic diet on ad libitum energy intake. Nat. Med., 27(2): 344-353.

Jensen, P., and Skov, L., 2016. Psoriasis and obesity. Dermatology, 232: 633–639. DOI: 10.1159/000455840

Kanda, N., Hoashi, T., Saeki, H., 2020. Nutrition and psoriasis. Int. J. Mol. Sci., 21: 5405. DOI: 10.3390/ijms21155405

Malloy, P.J., Pike, J.W., and Feldman, D., 1999. The vitamin D receptor and the syndrome of hereditary 1,25-dihydroxyvitamin D-resistant rickets. Endocr. Rev., 20: 156–188. DOI: 10.1210/edrv.20.2.0359

Michalak, M., Pierzak, M., Krecisz, B., and Suliga, E., 2021. Bioactive compounds for skin health: A review. Nutrients, 13: 203. DOI: 10.3390/nu13010203

Mohajeri, S., and Newman, S.A., 2014. Review of evidence for dietary influences on atopic dermatitis. Skin Therapy Lett., 19(4): 5-7.

Park, K., 2015. Role of micronutrients in skin health and function. Biomol. Ther., 23: 207–217. DOI: 10.4062/biomolther.2015.003

Park, H., Kim, C.W., Kim, S.S., and Park, C.W., 2009. The therapeutic effect and the changed serum zinc level after zinc supplementation in alopecia areata patients who had a low serum zinc level. Ann. Dermatol., 21: 142–146. DOI: 10.5021/ad.2009.21.2.142

Rajabi, F., Drake, L.A., Senna, M.M., and Rezaei, N., 2018. Alopecia areata: A review of disease pathogenesis. Br. J. Dermatol., 179: 1033–1048. DOI: 10.1111/bjd.16808

Roujeau, J.C., and Nowak, A., 2012. Dermatology in the intensive care unit. In: Our Dermatol Online. London, UK: Churchill Livingstone; pp. 298–303.

Salvo, J., and Sandoval, C., 2022. Role of copper nanoparticles in wound healing for chronic wounds: Literature review. Burn. Trauma, 10: tkab047. DOI: 10.1093/burnst/tkab047

Schagen, S.K., Zampeli, V.A., Makrantonaki, E., and Zouboulis, C.C., 2012. Discovering the link between nutrition and skin aging. Derm.-Endocrinol., 4: 298–307. DOI: 10.4161/derm.22876

Scoring systems in pemphigus. Grover, S. Indian J Dermatol., 2011; 56: 145–149. doi: 10.4103/0019-5154.80403.

Podder, I., Jaiswal, S., Das, A., 2023. Dietary strategies for chronic spontaneous urticaria: An evidence-based review. Int. J. Dermatol., 62: 143–153. DOI: 10.1111/ijd.15988

The Hair Follicle and Immune Privilege. Paus, R., Ito, N., Takigawa, M., and Ito, T., 2003. J. Investig. Dermatol. Symp. Proc., 8: 188–194. DOI: 10.1046/j.1087-0024.2003.00807.x

Alam M, Amin SS, Adil M, Arif T, Zahra FT, Varshney I. Comparative study of efficacy of topical mometasone with calcipotriol versus mometasone alone in the treatment of alopecia areata. Int J Trichology. 2019;11:123–127. doi: 10.4103/ijt.ijt_18_19.

Di Landro A, Cazzaniga S, Parazzini F, et al. Family history, body mass index, selected dietary factors, menstrual history, and risk of moderate to severe acne in adolescents and young adults. J Am Acad Dermatol. 2012;67:1129–1135. doi: 10.1016/j.jaad.2012.02.018.

Di Landro A, Cazzaniga S, Parazzini F, et al. Family history, body mass index, selected dietary factors, menstrual history, and risk of moderate to severe acne in adolescents and young adults. J Am Acad Dermatol. 2012;67:1129–1135. doi: 10.1016/j.jaad.2012.02.018.

Feliciani C, Cozzani E, Marzano AV, Caproni M, Di Zenzo G, Calzavara-Pinton P. Italian Guidelines in Pemphigus - adapted from the European Dermatology Forum (EDF) and European Academy of Dermatology and Venerology (EADV). G Ital Dermatol Venereol. 2018;153:599–608. doi: 10.23736/S0392-0488.18.06073-X.

Grover S. Scoring systems in pemphigus. Indian J Dermatol. 2011;56:145–149. doi: 10.4103/0019-5154.80403.

Malloy PJ, Pike JW, Feldman D. The vitamin D receptor and the syndrome of hereditary 1,25-dihydroxyvitamin D-resistant rickets*. Endocr Rev. 1999;20:156–188. doi: 10.1210/edrv.20.2.0359.

Park H, Kim CW, Kim SS, Park CW. The therapeutic effect and the changed serum zinc level after zinc supplementation in alopecia areata patients who had a low serum zinc level. Ann Dermatol. 2009;21:142–146. doi: 10.5021/ad.2009.21.2.142.

Podder I, Jaiswal S, Das A. Dietary strategies for chronic spontaneous urticaria: an evidence-based review. Int J Dermatol. 2023;62:143–153. doi: 10.1111/ijd.15988.

Roujeau JC, Nowak A. Dermatology in the intensive care unit. In: Our Dermatol Online. Vol. 3. London, UK: Churchill Livingstone; 2012. pp. 298–303.