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Why Does Facial Eczema Differ From Body Eczema?

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ABSTRACT

Background: The pathophysiology of atopic dermatitis (AD) is multifactorial, influenced by genetics, skin barrier dysfunction, and environmental stressors. There is a lack of research comparing the etiologies and pathologic mechanisms accounting for differences in facial vs body eczema.

Objectives: To explore reasons why facial eczema may differ from body eczema.

Results: There are key differences in the environments of the face and body that may lead to AD exacerbation. These include differences in the skin microbiome, sebaceous glands concentration, and levels of natural moisturizing factor. The face is exposed to more environmental stress compared with the rest of the body. These stresses include aeroallergens, ultraviolet radiation, and cosmetic products. Management of facial eczema also differs from that of body eczema due to the avoidance of high potency topical steroids on the face. Topical steroids increase microbiome diversity, and lack of topical steroid use on the face can lead to decreased microbiome diversity and increased AD severity.

Conclusion: Facial and body eczema differ due to differences seen in anatomical structure and environmental exposures. These differences should be further researched and used in the management of facial vs body eczema and can also be used in the development of new AD treatments.

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INTRODUCTION

Facial eczema presents a challenging entity in patients with atopic dermatitis (AD).[1] Facial eczema differs from body eczema in both management and severity. Facial eczema has unique challenges to treatment due to adverse effects of potent topical corticosteroid steroid (TCS). Furthermore, recent reports regarding "dupilumab facial redness" or drug-associated face and neck dermatitis (DAFND) highlight the distinctions in facial vs body eczema.[2] While many agree that management and presentation of facial vs body eczema differ,[3] little research has explored why these differences might exist. Herein, we propose the biological and environmental differences contribute to variations in presentation and management of facial and body eczema.

DISCUSSION

Biological Differences Between Facial and Body Atopic Dermatitis

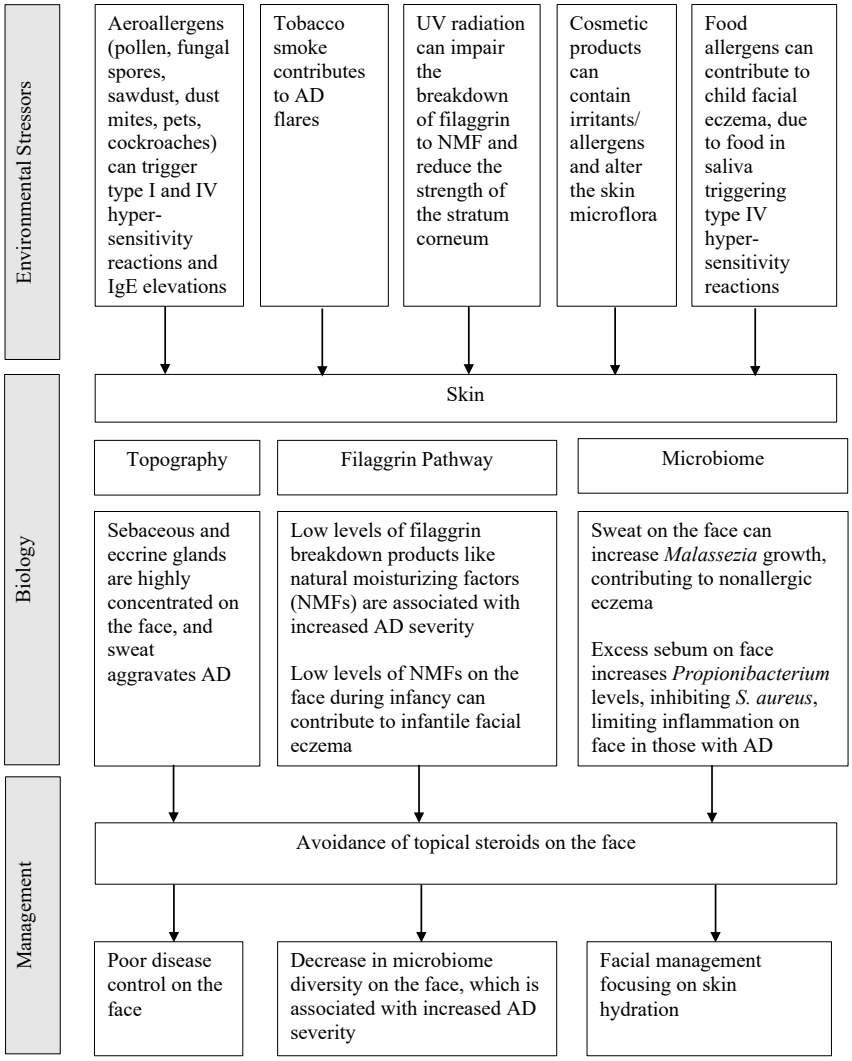
Microbiome

The microflora directly interacts with the epidermal barrier and cutaneous immune system, supporting immune development, homeostasis, and skin barrier maintenance. Alterations in the skin microbiota, including increases in *Staphylococcus* species, is a hallmark feature of AD.[4] On the forehead, patients with AD have a significant increase in *Staphylococcus* species (36%) compared with healthy controls (11%), and in patients with moderate-to-severe forehead AD, the *Staphylococcus* ratios reached more than 70%.[5] Furthermore, research demonstrates an inverse relationship between the diversity of the cutaneous microbiome and AD severity.[6]

Microbial imbalance, specifically increased *S. aureus* and decreased commensal skin bacteria, results in deficient skin barrier function and inflammation.[7] *S. aureus* enhances inflammation via its Toll-like receptor ligands, which cause interleukin (IL)-4 mediated suppression of IL-10, ultimately supporting the development of AD.[8] Compared with other commensal bacteria, *S. aureus* is prone to adhere to injured skin regions, such as the excoriated skin seen in AD.[9] Studies comparing the microbiome of lesional skin vs non-lesional skin demonstrate an increase in *S. aureus* as well as a decrease in microbiome diversity. Subsequent treatment with topical ozone therapy restores microbiome diversity and decreases severity of inflammatory papules and edema.[10]

Reduced quantities of *Propionibacterium acnes (P. acnes)* and *Lawsonella clevelandensis* in lesions is also a feature of AD. The levels of *S. aureus* and *P. acnes* are inversely correlated, due to the fermentation product of *P. acnes*, propionic acid, inhibiting

FIGURE 1. Summary of the reasons facial eczema can differ from body eczema.



AD – Atopic Dermatitis
NMF – Natural Moisturizing Factors

the growth of both *S. aureus* and *S. epidermidis*. This suggests that topical treatments promoting *P. acnes* growth may reduce *S. aureus* growth, which could help in AD management.[9]

Propionibacterium is the primary genus on the forehead and cheeks of healthy females. As sebum on the cheek increases, so the prevalence of Propionibacterium increases while the microbiome diversity decreases.[11] The excess of sebum on the face compared with the body can therefore lead to increased *Propionibacterium* levels, ultimately inhibiting *S. aureus*, and limiting inflammation when compared with those with AD. Clinical studies support using topical commensal organisms, specifically *Staphylococcus hominis* and *Roseomonas mucosa*, to treat AD.[12]

The topography of skin influences its microflora balance.[13] Eccrine sweat glands are more highly concentrated in the forehead and cheeks than in the trunk.[14] Sebaceous glands, which are highly concentrated on the face, chest, and back, favor the growth of lipophilic organisms, such as *Malassezia* species. Sweat, a known aggravator of AD, also increases *Malassezia* growth.[15] *Malassezia* plays a role in the pathogenesis of AD through the production of proinflammatory cytokines and activation of auto-reactive T cells.[16-17] Furthermore, adults with AD are often sensitized to yeast, as evidenced by specific IgE antibodies to *Malassezia* species.[18] Specifically, the fungal protein MGL_1304 derived from *Malassezia globosa* can induce basophils to release histamine, and IgE antibodies against this antigen are in the sera of patients with AD, contributing to a type I hypersensitivity reaction.[19]

Filaggrin

Filaggrin and its breakdown products are essential to epidermal homeostasis, and mutations in filaggrin are associated with AD.[20-22] The breakdown products of filaggrin protein include the components of natural moisturizing factor (NMF), which helps maintain adequate skin hydration.[23] Decreased NMF levels are associated with increased AD severity and early-onset AD with marked elevations of total IgE levels.[24-25] Cheeks have the lowest levels of NMF within the first year of life, which correlates with the fact that the cheeks are frequently the initial site of infantile AD.[26] Products that replenish NMF levels through topical application of moisturizers containing NMF successfully treat xerotic skin, and there is evidence that NMF components could be incorporated into the treatment of AD.[23] Ultraviolet (UV) radiation impairs filaggrin breakdown to NMF, which is significant since the face tends to be exposed to UV radiation more than the body, thus contributing to further differences in facial vs body eczema.[27]

Filaggrin mutations also increase transepidermal water loss (TEWL).[23] TEWL is much higher in the facial skin than in the forearm/upper arm, and high levels of TEWL are associated with acutely inflamed, eczematous facial lesions of AD.[28] The high TEWL on the face can contribute to the reasons that facial eczema may be more severe.

Environmental Exposures Between Facial and Body Skin

Environmental exposures, such as pollutants, cosmetic products, soaps, and hygiene products, are associated with AD development and exacerbation. Facial skin, unlike most other body sites, is continually exposed to environmental stress and this is a contributor to the differences seen between face and body eczema.[26]

Aeroallergens/Pollutants

Airborne etiologies such as pollens, fungal spores, sawdust, dust mites, pets, and cockroaches contribute to AD exacerbations on air-exposed skin, including the head and neck. These exposures can cause both type I and type IV hypersensitivity reactions, and elevated IgE following sensitization.[29] Tobacco smoke is an aeroallergen more specific to the face and known to contribute to AD flares.[30] Airborne etiologies are often refractory to standard AD treatments.

Ultraviolet Radiation

Ultraviolet (UV) radiation can have deleterious effects on the skin, leading to macroscopic damage and decreasing the intercellular strength, strain, and cohesion of the stratum corneum.[31] UV radiation impairs filaggrin breakdown to its NMF components.[24,27] Increased daily sun exposure has been associated with poorly controlled AD.[32] Despite these deleterious effects of UV radiation on the skin, it can also have protective effects through facilitation of the conversion of trans-urocanic acid, another filaggrin breakdown product, into the cis-urocanic isoform, which has immunosuppressive effects.[33] Overall, UV radiation has been shown to have beneficial effects in those with AD, with most patients having complete resolution of AD during periods of increased sunlight exposure.[34] Inverse associations have been found between childhood AD and number of sunny hours per climactic region.[35] Phototherapy is often a second-line treatment for AD due to its immunosuppressive effects and antibacterial activity, suppressing superantigen production by S. aureus, which can prevent S. aureus and P. orbiculare infections that are common in patients with AD.[33,36] UVB in particular stimulates synthesis of pre-vitamin D in the skin, and some studies show that oral vitamin D supplementation improved AD severity.[33,37] The lifetime accumulation of UV radiation may be one reason why adults are less likely to have facial eczema compared with infants.

Cosmetic Products

Personal cosmetics often contain irritants and allergens, which can result in allergic contact dermatitis.[38] Use of facial cosmetic products alters the skin's chemical environment and microflora. *Staphylococcus epidermidis* and *Cutibacterium acnes* are normally commensal organisms that help fight cutaneous pathogenic bacteria. However, these commensal microbes, upon exposure to changes in skin temperature and pH, become opportunistic pathogens, which develop virulence factors contributing to the onset or worsening of acne and AD.[39] Additionally, synthetics commonly used in cosmetics alter the natural state of the skin, thereby impacting not only the biodiversity of the skin but also the role of individual microbes on the host's cutaneous immune system.[40] Moisturizers with lipid components provide nutrients for the growth of lipophilic bacteria, including *Staphylococcus* and *Propionibacterium* species, which positively influence AD development.[41] Cosmetic products are more frequently applied to the face than the body, increasing the incidence of facial AD.

Food Allergens and Irritants

Almost a third of children with moderate-to-severe eczema also suffer from contact allergies to food.[42] Contact reactions from food-related allergens and irritants can exacerbate head and neck dermatitis. For example, while young children are teething/drooling and initiating solid foods into their diets, saliva mixed with food particles can aggravate AD and trigger irritant and type IV hypersensitivity reactions on the face.[29,43] Thus, application of a perioral and cheek barrier protectant as well as rinsing the child's cheeks and mouth with water, can prevent antigen entry through broken skin and minimize AD flaring.[29]

Management

Facial and body eczema differ in management. Topical steroids increase microbiome diversity and decrease *S. aureus* levels during an AD flare.[44] However, potent topical corticosteroids

are commonly avoided on the face due to deleterious side effects, contributing to poorer disease control of facial eczema compared with body eczema.[45] Furthermore, steroid withdrawal can follow prolonged inappropriate use of moderate-to-potent topical steroids primarily in the face and genital regions.[29]Topical steroid withdrawal following discontinuation of topical steroids can lead to a rebound dermatitis, which has been confused with head and neck dermatitis.[29] This is important to consider when trying to manage facial eczema with topical steroids.

The management of facial vs body eczema not only contributes to their differences but is important to recognize when suggesting treatment recommendations to patients. While gentle skin care is important in the management of all eczema, it is especially important in facial eczema when options for treatment with high potency topical steroids are more limited. Facial eczema treatments can focus on skin hydration, including use of a towel gently draped over the head and neck in the bathtub and prioritizing baths over showers to better hydrate the skin.[25] Non-steroid topicals like calcineurin inhibitors have been shown to be a safe alternative to topical steroids in the treatment of sensitive sites such as the head and neck.[46] A double-blinded randomized controlled trial assessing the safety and efficacy of pimecrolimus cream 1% in patients with AD on the face and neck who were dependent or intolerant of topical steroids demonstrated that it was effective at clearing facial AD, especially in eyelid dermatitis, and additionally helped to reverse skin thinning.[47]

CONCLUSIONS

This article highlights the multifactorial pathophysiology of AD and its contribution to the differences between facial and body eczema. Exposure to environmental triggers and host factors results in alterations in the microbiome and skin barrier function. Despite the rising prevalence of AD, there is little research investigating the causative factors contributing to the difference in facial and body eczema. The face and the body not only differ topographically, but also differ in their environmental exposures. Both of these factors contribute to different levels of skin barrier disruption and microbiome alteration.

Biological and environmental factors account for the differences in facial and body eczema (Figure 1). The topographical diversity of the skin results in differing regional environments and therefore the organisms that can reside in the regions. The face and the body are exposed to differing levels of aeroallergens, UV radiation, and personal hygiene and cosmetic products.

Although it is important to recognize the conditions that trigger AD, and how these conditions differ based on location, it is also important to focus attention on preserving the skin microbiome and skin barrier despite such exposures. With increased evidence of the importance of commensal organisms in maintaining structural integrity of the skin, future research should investigate the role of probiotics, both topical and oral, in treatment for both facial and body eczema. In addition to supporting the development of a robust microbiome at the site of AD, further research is needed on maintaining the integrity of the skin barrier through the use of products to replenish NMF levels. Understanding differences in structure and environmental exposures can be used in the management of facial vs body eczema, as well as for the development of new AD treatments.

DISCLOSURES

The authors report no conflicts of interest.

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