

Microplastics and the Skin: Environmental Exposure, Dermatologic Implications, and Global Policy Perspectives

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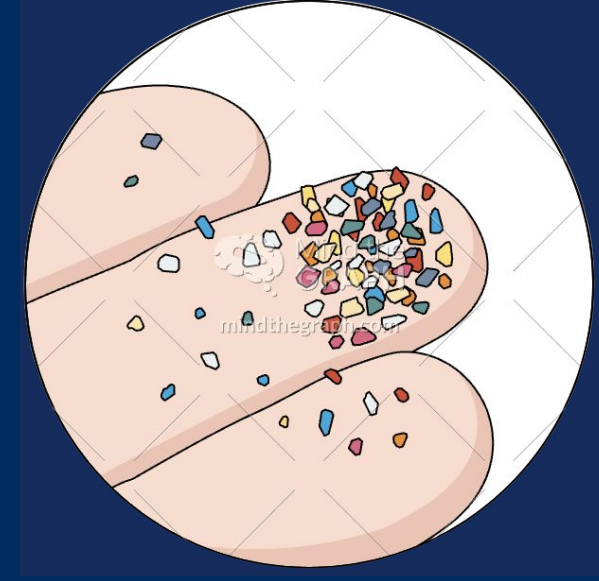
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Introduction

- Microplastics (<5 mm) are now widely detected in air, water, food, and consumer products. Nanoplastics (<100-1000 μm) are smaller fragments generated from microplastic degradation. The skin is repeatedly exposed through personal care products, occupational contact, and environmental deposition, yet dermatologic relevance is poorly defined.¹

Methods

- Structured literature review conducted using PubMed, Scopus, and Web of Science (2000–2026) with search terms related to microplastics, nanoplastics, dermatology, skin absorption, pollution, and personal care products.
- Included peer-reviewed studies evaluating cutaneous exposure, penetration, cellular toxicity, dermatologic implications, or policy-relevant human data; excluded non-translational environmental surveys, opinion pieces without primary data, and animal studies without dermatologic relevance.

Results

Personal Care and Consumer Exposure

- Review of **2,379 personal care products** showed **16.4% contained microplastics**, with more than one-quarter of facial scrubs still containing microplastics despite regulatory bans; given that >90% of personal care products are applied directly to skin, consumer products represent a major exposure route, with polymer film-formers and encapsulated ingredients emerging as additional sources.²

Mechanisms of Skin Interaction

- Experimental studies demonstrate microplastics/nanoplastics can adhere to the stratum corneum, penetrate via follicular or eccrine ostia, and enter barrier-disrupted skin, with cellular uptake potentially leading to keratinocyte cytotoxicity, mitochondrial oxidative stress, inflammasome activation, and increased cellular senescence, suggesting biologically active skin interaction that may overlap with inflammatory dermatosis pathways.³

Chemical and Microbial Vector Effects

- Microplastics can bind and transport endocrine disruptors, persistent pollutants, heavy metals, and microbes, functioning as vectors that may amplify toxicologic and inflammatory effects at the skin surface while also serving as substrates for microbial adherence and potential dysbiosis.⁴

Dermatologic Disease Relevance

- Microplastics may amplify irritant and allergic dermatitis, contribute to occupational eczema, and activate oxidative and inflammatory pathways implicated in atopic dermatitis, psoriasis, and hidradenitis suppurativa; they may also influence skin microbiome composition and antimicrobial resistance reservoirs, although direct epidemiologic causality is currently limited.⁵

Vulnerable Populations

- Infants and children demonstrate higher exposure due to thinner skin barriers and behavioral factors (teething), with fecal microplastic levels reported at roughly tenfold adult concentrations;⁶ low-income and frontline communities often reside near pollution sources with estimated microplastic burdens 3–5 times urban averages, while coastal populations experience additional exposure through seafood consumption containing approximately **0.1–4 particles/g** of microplastics.⁷

Global Policy Landscape

- Regulatory responses vary globally, with the EU REACH framework requiring reporting of synthetic polymers beginning in 2026 and projected to prevent approximately **150,000 metric tons** of microplastic release annually, while international treaty negotiations remain ongoing and labeling standards rarely disclose microplastic presence or particle characteristics.

Occupational Exposures

Population	Estimated Microplastic Exposure
Textile workers	8.7 ± 4.3 mg/kg/year
Urban adults	2.37–3.27 mg/kg/year

- Textile, beauty, and waste-sector workers experience sustained skin contact with synthetic fibers and polymer-containing materials, and although occupational eczema and irritant dermatitis are common in these populations, the contribution of microplastics remains poorly characterized.

Discussion

- Evidence supports microplastics as continuous environmental and consumer exposures capable of biologically active skin interaction, with plausible roles in irritant, occupational, and inflammatory skin disease; however, exposure quantification and direct clinical causality remain insufficiently defined.
- Dermatology can address these gaps through exposure-aware history taking, integration of exposure data into cohorts, development of skin biomonitoring methods, occupational exposure studies, and engagement in regulatory and advocacy efforts.

Conclusion

- Microplastic exposure is increasingly relevant to skin health, particularly for patients with barrier dysfunction or occupational exposure, and exposure burden disproportionately affects vulnerable populations.
- Dermatologists can mitigate potential harms through patient education, exposure-aware care, research integration, and advocacy for clearer labeling and safer product formulation, with routine incorporation of exposure awareness into dermatologic practice offering a practical step toward improving environmental skin health and equity.

References & Disclosures

