Review Article

Traditional Diets and Skin Longevity: Okinawan, Nordic, and Blue Zone Insights

Andres Parga, MD[1], Hannah Coven, RDN[2]

[1] HCA Florida Oak Hill Hospital, [2] College of Health Solutions, Arizona State University

Keywords: Skin aging, Cutaneous health, Anti-inflammatory nutrition, Collagen integrity, Nutritional dermatology, Barrier repair, Dermonutrition, Traditional diets, Blue Zones

Journal of Integrative Dermatology

Relevance

Skin aging is influenced not only by environmental exposures and genetics but also by nutrition. Traditional diets from longevity regions, such as Relevance: Skin aging is influenced not only by environmental exposures and genetics but also by nutrition. Traditional diets from longevity regions, such as Okinawa, the Nordic countries, and Mediterranean Blue Zones, are rich in antioxidants, polyphenols, and anti-inflammatory nutrients that may modulate biological pathways related to skin health, photoprotection, and aging.

Objective

To evaluate the dermatologic benefits of traditional Okinawan, Nordic, and other Blue Zone diets by synthesizing molecular, nutritional, and clinical evidence on skin aging prevention, photoprotection, and barrier support.

Methods

A comprehensive review of peer-reviewed literature was conducted, including clinical trials, case reports, in vitro and in vivo studies, and nutritional epidemiology from 2009 to 2025. Sources were analyzed for skin-relevant outcomes, such as collagen preservation, ultraviolet protection, inflammation reduction, and barrier enhancement, related to traditional dietary components (e.g., anthocyanins, omega-3s, carotenoids, fermented foods).

Results

Traditional diets demonstrated consistent dermatologic benefits via shared mechanisms when compared to Western dietary patterns: **Okinawan diet:** Rich in turmeric, purple sweet potatoes, seaweed, and tofu, reduced inflammatory markers (IL-6, TNF-α), improved collagen integrity, and suppressed matrix metalloproteinases. **Nordic diet:** High in bilberries, fermented dairy, and fatty fish, associated with microvascular skin improvements, reduced lipid peroxidation, and enhanced epidermal hydration. **Blue Zone diets (Ikaria, Nicoya, Loma Linda):** Emphasized whole plant-based foods, fermented products, and polyphenol-rich staples (e.g., olive oil, papaya, legumes), linked to reduced glycation, preserved dermal structure, and microbiome support. Mechanistically, key pathways modulated included NF-κB, mTOR, TGF-β, MAPK/AP-1, and autophagy regulators (Nrf2, AMPK, SIRT1). Anthocyanins, curcumin, epigallocatechin-3-gallate, and omega-3s were among the most potent agents in reducing oxidative damage and slowing visible aging.

Conclusion

Traditional diets from longevity regions offer promising models for dermonutrition. Their polyphenol-rich, anti-inflammatory, and low-glycemic profiles may extend not only lifespan but also “skin span”, the duration of healthy, functional skin. These findings support integrative dietary approaches for dermatologic aging prevention and call for further clinical trials to validate specific food-based interventions.

INTRODUCTION

The human pursuit of longevity has traditionally focused on metrics like lifespan and disease prevention, yet a more novel concept, skin span," has emerged to reflect the importance of maintaining dermatologic vitality into older age. Skin aging, a highly visible manifestation of overall health, is influenced by both intrinsic factors (eg, genetics, hormone levels) and extrinsic factors such as ultraviolet (UV) exposure, pollutants, and nutrition. In recent years, epidemiologic and molecular studies have drawn attention to the role of diet in modulating cutaneous aging, inflammation, and barrier function. Among the most compelling natural experiments in longevity are the Blue Zones, geographic regions like Okinawa (Japan), Sardinia (Italy), Ikaria (Greece), Nicoya (Costa Rica), and Loma Linda (California), where diet plays a central role in extending health span. Notably, the Nordic Diet, while not officially designated as a Blue Zone, shares similar traits: high intake of omega-3-rich fish, antioxidant-dense berries, and fermented whole grains.[1] These traditional diets are rich in polyphenols, flavonoids, carotenoids, and essential micronutrients that promote skin resilience and delay dermatologic aging through diverse molecular pathways. Emerging evidence from food-based dermatologic studies underscores the need for culturally contextualized models of dermonutrition. For instance, bilberries, a Nordic staple, are abundant in anthocyanins such as delphinidin and cyanidin, which protect keratinocytes from UV-induced oxidative damage and reduce skin inflammation.[2] Conversely, Western dietary patterns, characterized by high-glycemic foods and omega–6–dominant fats, have been shown to elevate pro-inflammatory cytokines (eg, IL-6, TNF-α), accelerate glycation, and degrade collagen and elastin in the dermis.[3] This review explores the dermatologic benefits of traditional diets from Okinawa, the Nordic countries, and other Blue Zones. It aims to synthesize mechanistic, clinical, and ethnonutritional insights into how these food patterns may extend skin healthspan. By grounding our analysis in both molecular dermatology and population-level nutrition, we hope to inform evidence-based dietary strategies for aging skin in diverse cultural settings.

MATERIALS AND METHODS

This literature review was conducted to evaluate the dermatologic benefits of traditional diets from longevity regions, specifically Okinawan, Nordic, and Mediterranean Blue Zone dietary patterns, by synthesizing evidence from clinical trials, case reports, in vitro and in vivo studies, and nutritional epidemiology published between 2009 and 2025. A comprehensive search was performed using PubMed, Scopus, and Web of Science with keywords such as: *skin aging*, *dietary polyphenols*, *nutritional antioxidants*, *omega-3 fatty acids*, *traditional diets and skin health*, *dermonutrition*, *Blue Zone*, *collagen preservation*, *anti-inflammatory foods and dermatology*, *nutrigenomics*, *gut–skin axis*, *fermented foods and skin barrier*, *photoprotective botanicals*, *anthocyanins and dermal aging*, and *whole-food dietary patterns in dermatology*. Eligible literature was in English, peer-reviewed, and focused on skin-relevant outcomes including collagen preservation, inflammation reduction, UV protection, and barrier repair. Articles were excluded if they lacked dermatologic endpoints or were non-peer-reviewed. Two reviewers independently screened titles and abstracts, extracting data on dietary region, food sources, bioactive compounds, mechanistic pathways (eg, NF-κB inhibition, matrix metalloproteinases (MMP) suppression), and clinical cutaneous outcomes. Findings were categorized into six mechanistic domains: antioxidant defense, anti-inflammatory signaling, photoprotection, collagen modulation, anti-glycation effects, and microbiome–skin axis enhancement. Data were synthesized into comparative tables and visual diagrams created using Adobe Illustrator and BioRender to highlight the dermatologic relevance of each dietary pattern.

RESULTS

1.0. OKINAWAN DIET AND DERMATOLOGIC BENEFITS

The Okinawan diet, renowned for its anti-aging and longevity-promoting effects, is rich in antioxidant and anti-inflammatory compounds that support skin integrity and delay cutaneous aging. Core dietary staples include purple sweet potatoes, seaweed, tofu, bitter melon, and turmeric, each contributing unique dermonutritional benefits.

Purple sweet potatoes (*Ipomoea batatas*, Ayamurasaki cultivar), a dietary staple in Okinawa, are abundant in pH-stable anthocyanins such as delphinidin- and cyanidin-glucosides. Compared to white or orange sweet potatoes, these purple varieties offer superior antioxidant, anti-inflammatory, and UV-protective effects, including inhibition of MMPs, reactive oxygen species (ROS), and inflammatory cytokines, with animal and cell models demonstrating improved dermal barrier and delayed aging markers.[4,5] Steam-cooking these tubers enhances their bioavailability without compromising anthocyanin content.[6]

Curcumin, the bioactive polyphenol in turmeric, is widely used in Okinawan cuisine and herbal teas. It modulates nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) and activator Protein-1 (AP-1) signaling pathways, suppressing inflammatory cytokines like interleukin-6 (IL-6) and tumor necrosis factor alpha (TNF-α) while upregulating antioxidant enzymes such as glutathione peroxidase and superoxide dismutase. These actions collectively preserve collagen, reduce photoaging, and inhibit glycation when compared to populations with low dietary curcumin intake.[7,8]

Fermented soy products such as tofu and miso enhance isoflavone bioavailability, particularly genistein and daidzein, which have been shown to stimulate collagen synthesis, improve elasticity, and exert estrogenic effects on skin through estrogen receptor beta (Erβ) receptor activation.[9] Compared to unfermented soy, fermented forms lead to higher early serum isoflavone peaks and greater biologic activity, enhancing skin elasticity and photoprotection.[9] Seaweed varieties commonly consumed in Okinawa,

such as *Ecklonia cava*, contain phlorotannins that protect fibroblasts from UV-induced DNA damage and inhibit tyrosinase, reducing hyperpigmentation.[10]

Green tea (*Camellia sinensis*), frequently consumed in Okinawa, is high in EGCG catechins that enhance cutaneous microvascular blood flow, upregulate nitric oxide, and support antioxidant status, with intervention studies demonstrating improved dermal perfusion and oxygenation in both young and older adults after just two weeks of daily intake.[11,12]

An interesting aspect of the Okinawan diet is the practice of caloric moderation, "hara hachi bu," a traditional Japanese practice of eating until you are 80% full, rather than completely full. This practice may reduce the formation of advanced glycation end-products (AGEs), which degrade skin structure via collagen cross-linking and receptor for advanced glycation end-products (RAGE) mediated inflammation.[3]

These synergistic effects, spanning photoprotection, glycation inhibition, collagen preservation, and barrier repair, highlight the Okinawan diet as a dermatologically relevant blueprint for healthy aging.

2.0. NORDIC DIET AND DERMATOLOGIC BENEFITS

The Nordic diet emphasizes whole, seasonal foods such as berries (bilberries and lingonberries), oily fish (salmon, herring), whole grains (rye, oats, barley), root vegetables, and rapeseed oil. This dietary pattern is rich in omega-3 polyunsaturated fatty acids (PUFAs), polyphenols, and fiber, all of which have been linked to skin longevity and barrier integrity.

Oily fish in the Nordic diet provide eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), essential fatty acids that reduce UV-induced inflammation, enhance photoprotection, and improve skin barrier function through anti-inflammatory eicosanoid pathways and reduced MMP activation. These effects are not observed in diets low in fish.[1,13] Clinical studies also show omega-3s promote dermal resilience by decreasing erythema and restoring lipid composition in aging skin.[14]

Fermented dairy products such as yogurt and cultured buttermilk, common in Nordic cuisine, may improve skin conditions like acne and rosacea by modulating the gut-skin axis, reducing systemic inflammation, and enhancing nutrient bioavailability.[15] These probiotic-rich foods support immune regulation and barrier restoration, especially in inflammatory dermatoses.

Berries such as bilberries (*Vaccinium myrtillus*) and lingonberries (*Vaccinium vitis-idaea*) are antioxidant powerhouses, with high levels of anthocyanins, quercetin, and catechins. Bilberries have demonstrated strong dermatologic potential by protecting keratinocytes from UVA/UVB-induced lipid peroxidation and apoptosis, enhancing hydration, and suppressing pro-inflammatory cytokines like IL-6 and C-reactive protein (CRP).[2,16] Similarly, lingonberries inhibit MMPs, reduce ROS, and support collagen preservation, positioning them as key contributors to anti-photoaging effects.[17]

Rapeseed oil, the primary fat source in the Nordic diet, is rich in α-linolenic acid (ALA), a plant-based omega-3 that has been shown in animal and metabolic studies to enhance skin hydration, barrier repair, and reduce inflammatory markers.[18] Together with fiber-rich whole grains and legumes, which support microbiome health and reduce systemic glycation, the Nordic diet creates a synergistic platform for delaying cutaneous aging.

Emerging evidence also links Nordic dietary adherence with improvements in skin microcirculation, oxygenation, and vascular tone—all essential for dermal health and repair— through enhanced nitric oxide bioavailability and endothelial function.[19] In fact, a four-week Nordic diet intervention in older adults improved axon-mediated and endothelium-dependent vasodilation in the skin, enhancing nutrient and oxygen delivery to dermal tissue and supporting vascular health in aging skin, benefits not observed in control diets.[19] These findings, alongside consistent antioxidant intake, suggest the Nordic diet may serve as a model for dietary interventions targeting skin resilience and longevity.

3.0. MEDITERRANEAN DIET IN BLUE ZONES (SARDINIA, IKARIA) AND DERMATOLOGIC BENEFITS

The Mediterranean diet, particularly as practiced in Blue Zones such as Sardinia and Ikaria, is characterized by the abundant consumption of seasonal vegetables, legumes, whole grains, and fruits, with olive oil as the principal fat source. These regions consume minimal red meat and emphasize a high intake of extra virgin olive oil (EVOO), rich in monounsaturated fats and phenolic compounds, which collectively contribute to skin health and longevity when compared to diets using animal fats or low-antioxidant oils.

EVOO contains high levels of vitamin E, oleuropein, hydroxytyrosol, and squalene, compounds with potent antioxidant and anti-inflammatory effects. These bioactives help prevent oxidative lipid damage in the epidermis and dermis, reduce MMP activity, and preserve dermal collagen and elastin, all contributing to delayed signs of photoaging and enhanced skin elasticity (Table 1).[1,20] Additionally, EVOO polyphenols inhibit NF-κB and other proinflammatory pathways, offering protective benefits against UV-induced skin aging and pigmentation disorders.

The Mediterranean diet also includes carotenoid-rich foods such as tomatoes, carrots, and leafy greens, which provide lycopene, β-carotene, and lutein, nutrients that accumulate in the skin and protect against actinic damage through singlet oxygen quenching and modulation of MMP expression.[13,21] These effects are supported by improved skin hydration and tone, with reduced wrinkle depth noted in both clinical and in vitro studies.

Legumes and fermented foods further enhance dermatologic resilience by modulating the gut-skin axis. Probiotic-rich cheeses and yogurts contribute to microbiome stability, systemic anti-inflammation, and nutrient absorption, indirectly supporting skin barrier function.[30] Moreover, the low glycemic load and reduced intake of processed sugars and meats in the Mediterranean pattern minimize ad-

Table 1. Key Bioactive Compounds by Food Source

Food Item	Region	Key Bioactives	Dermatologic Effects
Purple Sweet Potato[4–6,21-23]	Okinawa	Anthocyanins (delphinidin, cyanidin)	Collagen preservation, UV protection, Anti-inflammatory, antioxidant
Olive Oil (EVOO)[1,13,18,20,24,25]	Mediterranean	Oleuropein, squalene, hydroxytyrosol	Anti-inflammatory, photoprotective
Bilberries[2,16,17,22,26]	Nordic	Quercetin, anthocyanins	Barrier support, antioxidant, anti-wrinkle
Tofu/Miso (fermented soy)[1,8,9,14,23,27]	Okinawa	Genistein, daidzein (isoflavones)	Collagen synthesis, elasticity, estrogenic skin support
Salmon/Herring[13,18,24,28,29]	Nordic	EPA, DHA (omega-3s)	UV protection, reduced MMP activity

A summary of skin-relevant bioactives found in staple foods of Okinawan, Mediterranean, and Nordic diets, highlighting their roles in photoprotection, collagen support, and anti-inflammatory skin health.

Table 2. Mechanisms by Nutrient Class

Nutrient Class	Primary Mechanisms	Examples
Polyphenols/ Flavonoids[8,23,24,32]	↓ NF-κB, ↓ MMPs, ↑ antioxidant enzymes	Curcumin (turmeric), quercetin (berries, onions), resveratrol (grapes, red wine), anthocyanins (bilberry, purple sweet potato), catechins (green tea)
Omega-3 Fatty Acids[20,28]	↓ UV-induced cytokines, ↑ skin lipids, ↓ erythema	EPA, DHA (fatty fish), ALA (chia, flaxseed)
Fermented Probiotics[14,15]	↑ microbiome diversity, ↓ systemic inflammation, ↑ barrier repair	Yogurt, kefir, miso, fermented papaya, natto, kimchi
Carotenoids[6,13,21]	↑ UV absorption, ↓ singlet oxygen, ↑ dermal antioxidant status	Lycopene (tomato), β-carotene (sweet potato, carrot), lutein, zeaxanthin (leafy greens, bilberry)

Key nutrient groups and their primary pathways in promoting skin health, including inflammation reduction, antioxidant support, and barrier repair, with representative examples.

vanced glycation end-product accumulation, thereby protecting skin collagen from degradation and discoloration.[3]

The anti-inflammatory and antioxidant synergy within the Mediterranean diet is especially apparent in Blue Zone longevity studies, where centenarians often display fewer pigmentary disorders, lower rates of actinic keratoses, and slower skin thinning. Caloric moderation, moderate wine consumption (eg, flavonoid-rich Cannonau wine in Sardinia), and the integration of meals with physical activity and social connectedness contribute to a holistic model of "skin span" preservation that goes beyond nutrition alone.[31]

4.0. MECHANISTIC PATHWAYS LINKING TRADITIONAL DIETS TO SKIN LONGEVITY

Traditional diets such as the Okinawan, Nordic, and Mediterranean patterns influence skin aging through multiple interrelated biological pathways that preserve dermal structure, regulate inflammation, and enhance antioxidant defense (Table 2).

REDUCTION OF OXIDATIVE STRESS AND INFLAMMATION

These diets are rich in carotenoids, polyphenols, and omega-3 fatty acids, which quench ROS, protect cellular membranes, and reduce lipid peroxidation. For example, bilberries and lingonberries, prominent in Nordic diets, are abundant in anthocyanins like cyanidin and delphinidin that neutralize ROS and upregulate endogenous antioxidant enzymes such as superoxide dismutase (SOD) and glutathione peroxidase (GPx).[2] Similarly, carotenoids in purple sweet potatoes and tomatoes act as potent singlet oxygen quenchers, protecting against photoaging and telomere damage.[13,21]

POLYPHENOL-MEDIATED MODULATION OF MMPS AND COLLAGEN INTEGRITY

Polyphenols, including quercetin, resveratrol, curcumin, and anthocyanins, suppress the activation of MMPs, especially MMP-1 and MMP-9, which degrade collagen and elastin.[24,27] This MMP inhibition preserves extracellular matrix structure, improves skin elasticity, and delays wrinkle formation. For example, fermented honeybush polyphenols significantly reduced wrinkle depth and transepider-

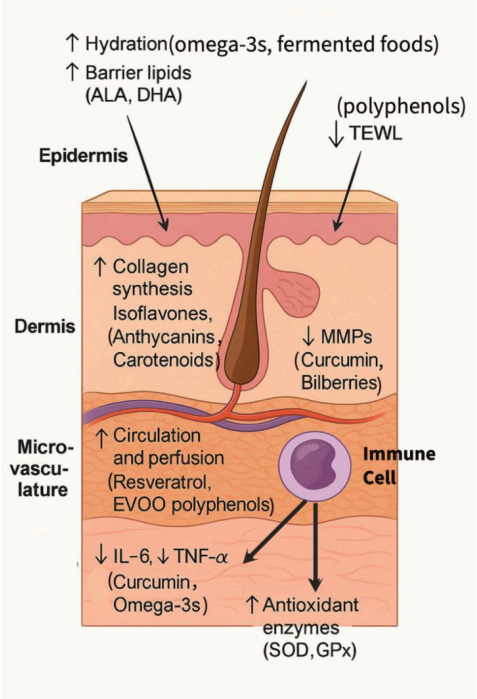

Figure 1. Skin Layer Diagram with Dietary Effects

Dietary compounds support skin health at multiple levels: omega-3s and fermented foods boost epidermal hydration and barrier lipids; polyphenols reduce TEWL. In the dermis, isoflavones and anthocyanins enhance collagen, while curcumin and bilberries inhibit MMPs. Resveratrol and EVOO improve circulation, and anti-inflammatory nutrients lower IL-6 and TNF-α while increasing antioxidant enzymes. Legend: (ALA) Alpha-linolenic acid; (DHA) Docosahexaenoic acid; (TEWL) Transepidermal Water Loss; (EVOO) Extra virgin olive oil; (MMPs) Matrix metalloproteinases (enzymes that degrade collagen); (IL-6) Interleukin-6 (inflammatory cytokine); (TNF-α) Tumor necrosis factor alpha (inflammatory cytokine); (SOD) Superoxide dismutase (antioxidant enzyme); (GPx) Glutathione peroxidase (antioxidant enzyme)[33]

mal water loss while increasing skin hydration and elasticity in clinical trials.[34]

NUTRITIONAL PHOTOPROTECTION

Traditional diets offer dietary photoprotection through systemic accumulation of antioxidants like lycopene, β-carotene, and lutein. These compounds absorb UV radiation, inhibit UV-induced MMP expression, and reduce erythema and DNA damage.[21,35] Anthocyanins from bilberries and purple sweet potatoes also support UV resistance by inhibiting tyrosinase and reducing oxidative pigment damage.[5,22]

ANTI-GLYCATION EFFECTS AND MICROBIOME SUPPORT

Low-glycemic, whole-food-based diets reduce advanced glycation end-product (AGE) accumulation, which otherwise binds RAGE receptors to trigger NF-κB–mediated inflammation and dermal matrix breakdown.[3] Foods like bitter melon and turmeric exhibit anti-glycation effects by lowering glucose and insulin spikes and modulating AGE-related oxidative stress.[8] Additionally, fermented foods in Blue Zone diets, such as yogurt, miso, and kimchi, enhance the gut-skin axis, supporting skin immunity, hydration, and microbial diversity.[30]

ACTIVATION OF AUTOPHAGY AND HORMETIC PATHWAYS

Polyphenols like EGCG in green tea (Okinawa) and resveratrol in grapes (Ikaria/Sardinia) activate autophagy through AMP-activated protein kinase-mammalian target of rapamycin (AMPK-mTOR) signaling and restore mitochondrial integrity, which declines with age.[11,20] These hormetic effects improve cellular turnover, reduce "inflammaging," and preserve dermal fibroblast viability.[36]

MICRONUTRIENT SYNERGY AND DERMAL GENE REGULATION

Vitamins A, C, D, and E, commonly found in traditional diets, regulate collagen biosynthesis, melanogenesis, wound healing, and UV resistance.[1] For example, fermented papaya preparations upregulate aquaporin-3 and downregulate oxidative stress markers like Cyclophilin A (CyPA), enhancing skin hydration and reducing pigmentation.[37]

DISCUSSION

The present review underscores the dermatologic relevance of traditional dietary patterns, especially those found in Okinawan, Nordic, and Mediterranean cultures, as potential modulators of skin aging and chronic dermatoses. Rich in polyphenols, omega-3 fatty acids, carotenoids, and fermented bioactives, these diets exert systemic effects that can protect against oxidative damage, inflammation, and collagen degradation, three central pathways in both intrinsic and extrinsic skin aging when compared to Westernized dietary patterns (Table 3).

Among the most promising dietary components are anthocyanin-rich berries and purple sweet potatoes, which enhance antioxidant defenses and inhibit MMPs, thereby preserving the dermal extracellular matrix.[2,4] Fermented foods, such as papaya or soy products, have also demonstrated epigenetic and gene-modulating effects that may enhance collagen production, improve hydration, and reduce photoaging through upregulation of genes like aquaporin-3 (AQP-3) and suppression of inflammatory mediators (Table 4).[9,37]

The integration of traditional dietary principles into dermatologic practice represents a promising frontier in preventative and therapeutic skin care. Polyphenol-rich botanicals such as bilberries and sweet potatoes, cornerstone ingredients in Nordic and Okinawan diets, respectively, have demonstrated photoprotective, anti-inflammatory, and collagen-preserving effects that may complement conventional dermatologic regimens.[2,4] Clinical implementation could extend beyond general dietary recommendations to include structured nutritional counseling programs tailored to patients with inflammatory dermatoses, rosacea, atopic dermatitis, or photoaging concerns.[3,25]

Importantly, future approaches in dermatology may benefit from personalized nutrition models that consider individual variations in gut microbiota, flavonoid metabolism, and nutrient absorption. For instance, the conver-

Table 3. Comparative Dermatologic Benefits of Traditional Longevity Diets

Region	Signature Foods	Key Nutrients & Bioactives	Dermatologic Effects	Primary Mechanistic Pathways
Okinawa[1,4-6,8,9,11,23,24]	Purple sweet potatoes, seaweed, tofu, turmeric, green tea	Anthocyanins, curcumin, isoflavones, EGCG, β-carotene, selenium, polyphenols, fermented soy peptides	Anti-inflammatory, anti-glycation, photoprotective, enhances collagen & hydration	↓ NF-κB, ↓ MMP-1/9, ↑ antioxidant enzymes (SOD, GPx), ↓ AGEs, ↑ ERβ activation
Nordic[2,15-19,29]	Bilberries, lingonberries, oily fish, rye, fermented dairy	Omega-3s (EPA/DHA), anthocyanins, quercetin, betaine, choline, vitamin D, fermented probiotics	Barrier repair, UV protection, microbiome support, anti-wrinkle, vascular skin benefits	↓ IL-6/TNF-α, ↓ lipid peroxidation, ↑ nitric oxide, ↑ collagen synthesis, ↑ SC hydration
Ikaria/ Sardinia[1,15,18,20,24,27,31,35]	Extra virgin olive oil, legumes, grapes, citrus, yogurt	Oleuropein, carotenoids (lycopene, lutein), vitamin E, polyphenols, fermented peptides, squalene, flavonoids	Photoprotection, elasticity, MMP inhibition, antioxidant preservation of collagen & ECM	↓ MMPs, ↑ collagen/ elastin integrity, ↓ singlet oxygen, ↑ SIRT1, ↑ autophagy

Comparison of three traditional dietary patterns from longevity regions, Okinawa, Nordic countries, and Blue Zones (Ikaria/Sardinia), highlighting their signature foods, key bioactive nutrients, and associated dermatologic effects. Each diet contributes unique phytochemicals and micronutrients that support skin health through antioxidant, anti-inflammatory, and photoprotective mechanisms, offering culturally contextualized models for skin longevity.

Table 4. Dermatologic Targets and Dietary Modulators

Dermatologic Target	Affected by	Dietary Components That Modulate
Collagen breakdown (MMPs)[7,8,24,26,27,32]	UV, inflammation	Polyphenols (curcumin, anthocyanins)
Skin hydration (AQP-3 levels)[14,15,37]	Aging, dehydration	Fermented foods (FPP, yogurt)
Pigmentation[8-10,21,24]	Oxidative stress, tyrosinase activity	Seaweed, carotenoids, fermented polyphenols
Glycation (AGEs)[1,8,23,38]	High-sugar diet, metabolic aging	Bitter melon, turmeric, legumes

Common dermatologic aging processes, such as collagen degradation, dehydration, pigmentation changes, and glycation, can be influenced by specific dietary components found in traditional whole-food diets.

sion of isoflavone glycosides to their bioactive aglycone forms is heavily influenced by gut microbiota composition, which can vary across ethnic and regional populations.[9] Such variability underscores the need for culturally sensitive, precision-based dietary recommendations when translating traditional food practices from Okinawa, Ikaria, or the Nordic regions into dermatologic care.

Emerging evidence from nutrigenomics and skin epigenetics further supports this approach. Dietary bioactives such as anthocyanins, resveratrol, and carotenoids are known to influence gene expression involved in oxidative stress, collagen degradation, and skin inflammation.[22,37] These compounds interact with pathways such as NF-κB, Nrf2, and AP-1, modulating inflammatory cytokines and protecting against UV-induced damage. As research evolves, such nutrient-driven gene modulation may enable clinicians to tailor nutritional interventions to prolong not only systemic healthspan but also "skinspan," the duration of optimal skin function across the lifespan.

Comparative analysis of traditional Okinawan, Nordic, and Mediterranean diets underscores the central role of antioxidant- and polyphenol-rich whole foods, fermented products, and healthy fats in skin longevity. Unlike Western dietary patterns, these diets confer protection against inflammaging, glycation, and photoaging, with the strongest evidence seen in population-based, clinical, and mechanistic studies. Future research should continue to directly compare these dietary models for skin-specific outcomes in diverse populations. Interdisciplinary collaboration between dermatologists, dietitians, and molecular researchers will be essential to translating these insights into clinical tools that advance skin longevity and resilience.

LIMITATIONS AND CONSIDERATIONS FOR APPLICATION

While this review highlights the potential dermatologic benefits of traditional diets, there are important limitations to consider when translating these findings into practice. Dietary habits are deeply influenced by cultural preferences, socioeconomic status, and access to traditional foods, which may limit the feasibility of adopting these dietary patterns in diverse populations. Much of the supporting evidence is derived from observational studies, which are subject to confounding variables and cannot establish direct causality. Additionally, population differences in genetics, microbiome composition, and food preparation methods may affect individual responses to dietary interventions. Future research should prioritize randomized controlled trials, culturally tailored interventions, and mechanistic studies to clarify the precise impact of traditional diets on skin health across varied settings.

ACKNOWLEDGMENT

The authors gratefully acknowledge the valuable insights and contributions of dietitians, researchers, dermatologists, and public health professionals whose work in nutritional science and skin health significantly informed this review.

CONFLICTS OF INTEREST

The authors declare no financial, professional, or personal conflicts of interest that could influence or be perceived to influence the content of this work.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Submitted: May 08, 2025 PDT. Accepted: May 11, 2025 PDT. Published: July 31, 2025 PDT.

REFERENCES

1. Assaf S, Kelly O. Nutritional Dermatology: Optimizing Dietary Choices for Skin Health. *Nutrients*. 2024;17(1):60. doi:10.3390/nu17010060

2. Vaneková Z, Rollinger JM. Bilberries: Curative and Miraculous – A Review on Bioactive Constituents and Clinical Research. *Front Pharmacol*. 2022;13:909914. doi:10.3389/fphar.2022.909914

3. Afvari S, Beck TC, Kazlouskaya M, et al. Diet, sleep, and exercise in inflammatory skin diseases. *Our Dermatol Online*. 2023;14(4):430-435. doi:10.7241/ourd.20234.21

4. Chiang MC, Liu YC, Chen BY, et al. Purple Sweet Potato Powder Containing Anthocyanin Mitigates High-Fat-Diet-Induced Dry Eye Disease. *IJMS*. 2023;24(8):6983. doi:10.3390/ijms24086983

5. Li A, Xiao R, He S, et al. Research Advances of Purple Sweet Potato Anthocyanins: Extraction, Identification, Stability, Bioactivity, Application, and Biotransformation. *Molecules*. 2019;24(21):3816. doi:10.3390/molecules24213816

6. Laveriano-Santos EP, López-Yerena A, Jaime-Rodríguez C, et al. Sweet Potato Is Not Simply an Abundant Food Crop: A Comprehensive Review of Its Phytochemical Constituents, Biological Activities, and the Effects of Processing. *Antioxidants*. 2022;11(9):1648. doi:10.3390/antiox11091648

7. Sung B, Prasad S, Yadav VR, Aggarwal BB. Cancer Cell Signaling Pathways Targeted by Spice-Derived Nutraceuticals. *Nutrition and Cancer*. 2012;64(2):173-197. doi:10.1080/01635581.2012.630551

8. Vollono L, Falconi M, Gaziano R, et al. Potential of Curcumin in Skin Disorders. *Nutrients*. 2019;11(9):2169. doi:10.3390/nu11092169

9. Nagino T, Kano M, Masuoka N, et al. Intake of a fermented soymilk beverage containing moderate levels of isoflavone aglycones enhances bioavailability of isoflavones in healthy premenopausal Japanese women: a double-blind, placebo-controlled, single-dose, crossover trial. *Bioscience of Microbiota, Food and Health*. 2016;35(1):9-17. doi:10.12938/bmfh.2015-011

10. Heo SJ, Ko SC, Cha SH, et al. Effect of phlorotannins isolated from Ecklonia cava on melanogenesis and their protective effect against photo-oxidative stress induced by UV-B radiation. *Toxicology in Vitro*. 2009;23(6):1123-1130. doi:10.1016/j.tiv.2009.05.013

11. Brimson JM, Prasanth MI, Malar DS, et al. Role of Herbal Teas in Regulating Cellular Homeostasis and Autophagy and Their Implications in Regulating Overall Health. *Nutrients*. 2021;13(7):2162. doi:10.3390/nu13072162

12. Wasilewski R, Ubara EO, Klonizakis M. Assessing the effects of a short-term green tea intervention in skin microvascular function and oxygen tension in older and younger adults. *Microvascular Research*. 2016;107:65-71. doi:10.1016/j.mvr.2016.05.001

13. Geng R, Kang SG, Huang K, Tong T. Boosting the Photoaged Skin: The Potential Role of Dietary Components. *Nutrients*. 2021;13(5):1691. doi:10.3390/nu13051691

14. Khayatan D, Nouri K, Momtaz S, et al. Plant-Derived Fermented Products: An Interesting Concept for Human Health. *Current Developments in Nutrition*. 2024;8(5):102162. doi:10.1016/j.cdnut.2024.102162

15. Saleem GN, Gu R, Qu H, et al. Therapeutic potential of popular fermented dairy products and its benefits on human health. *Front Nutr*. 2024;11:1328620. doi:10.3389/fnut.2024.1328620

16. Sharma A, Lee HJ. Anti-Inflammatory Activity of Bilberry (Vaccinium myrtillus L.). *CIMB*. 2022;44(10):4570-4583. doi:10.3390/cimb44100313

17. Pärnänen P, Niikko S, Lähteenmäki H, et al. Lingonberry (Vaccinium vitis-idaea L.) Fruit Phenolic Bioactivities—A Review of In Vitro and In Vivo Human Studies. *Microorganisms*. 2024;12(9):1850. doi:10.3390/microorganisms12091850

18. Krznarić Ž, Karas I, Ljubas Kelečić D, Vranešić Bender D. The Mediterranean and Nordic Diet: A Review of Differences and Similarities of Two Sustainable, Health-Promoting Dietary Patterns. *Front Nutr*. 2021;8:683678. doi:10.3389/fnut.2021.683678

19. Rogerson D, McNeill S, Könönen H, Klonizakis M. Encouraging effects of a short-term, adapted Nordic diet intervention on skin microvascular function and skin oxygen tension in younger and older adults. *Nutrition*. 2018;49:96-101. doi:10.1016/j.nut.2017.11.001

20. Capurso C, Bellanti F, Lo Buglio A, Vendemiale G. The Mediterranean Diet Slows Down the Progression of Aging and Helps to Prevent the Onset of Frailty: A Narrative Review. *Nutrients*. 2019;12(1):35. doi:10.3390/nu12010035

21. Darvin ME, Sterry W, Lademann J, Vergou T. The Role of Carotenoids in Human Skin. *Molecules*. 2011;16(12):10491-10506. doi:10.3390/molecules161210491

22. Correia P, Araújo P, Ribeiro C, et al. Anthocyanin-Related Pigments: Natural Allies for Skin Health Maintenance and Protection. *Antioxidants*. 2021;10(7):1038. doi:10.3390/antiox10071038

23. Willcox DC, Willcox BJ, Todoriki H, Suzuki M. The Okinawan Diet: Health Implications of a Low-Calorie, Nutrient-Dense, Antioxidant-Rich Dietary Pattern Low in Glycemic Load. *Journal of the American College of Nutrition*. 2009;28(sup4):500S-516S. doi:10.1080/07315724.2009.10718117

24. Sun M, Deng Y, Cao X, et al. Effects of Natural Polyphenols on Skin and Hair Health: A Review. *Molecules*. 2022;27(22):7832. doi:10.3390/molecules27227832

25. Katta R, Desai SP. Diet and dermatology: the role of dietary intervention in skin disease. *J Clin Aesthet Dermatol*. 2014;7(7):46-51.

26. Diaconeasa Z, Ştirbu I, Xiao J, et al. Anthocyanins, Vibrant Color Pigments, and Their Role in Skin Cancer Prevention. *Biomedicines*. 2020;8(9):336. doi:10.3390/biomedicines8090336

27. Ratz-Łyko A, Arct J, Majewski S, Pytkowska K. Influence of Polyphenols on the Physiological Processes in the Skin. *Phytotherapy Research*. 2015;29(4):509-517. doi:10.1002/ptr.5289

28. Nikolakopoulou Z, Nteliopoulos G, Michael-Titus AT, Parkinson EK. Omega-3 polyunsaturated fatty acids selectively inhibit growth in neoplastic oral keratinocytes by differentially activating ERK1/2. *Carcinogenesis*. 2013;34(12):2716-2725. doi:10.1093/carcin/bgt257

29. Hesselink A, Winkvist A, Lindahl B, et al. Healthy Nordic diet and associations with plasma concentrations of metabolites in the choline oxidation pathway: a cross-sectional study from Northern Sweden. *Nutr J*. 2023;22(1):26. doi:10.1186/s12937-023-00853-w

30. Gul S, Durante-Mangoni E. Unraveling the Puzzle: Health Benefits of Probiotics—A Comprehensive Review. *JCM*. 2024;13(5):1436. doi:10.3390/jcm13051436

31. Buettner D, Skemp S. Blue Zones: Lessons From the World's Longest Lived. *American Journal of Lifestyle Medicine*. 2016;10(5):318-321. doi:10.1177/1559827616637066

32. Sajadimajd S, Bahramsoltani R, Iranpanah A, et al. Advances on Natural Polyphenols as Anticancer Agents for Skin Cancer. *Pharmacological Research*. 2020;151:104584. doi:10.1016/j.phrs.2019.104584

33. Parga A. Skin Diagram Figure (Traditional Diets and Skin Longevity: Okinawan, Nordic, and Blue Zone Insights). Zenodo. doi:10.5281/zenodo.15369149

34. Choi SY, Hong JY, Ko EJ, et al. Protective effects of fermented honeybush (*Cyclopia intermedia*) extract (HU-018) against skin aging: a randomized, double-blinded, placebo-controlled study. *Journal of Cosmetic and Laser Therapy*. 2018;20(5):313-318. doi:10.1080/14764172.2017.1418512

35. Cao C, Xiao Z, Wu Y, Ge C. Diet and Skin Aging—From the Perspective of Food Nutrition. *Nutrients*. 2020;12(3):870. doi:10.3390/nu12030870

36. Baylis D, Bartlett DB, Patel HP, Roberts HC. Understanding how we age: insights into inflammaging. *Longev Healthspan*. 2013;2(1):8. doi:10.1186/2046-2395-2-8

37. Bertuccelli G, Zerbinati N, Marcellino M, et al. Effect of a quality-controlled fermented nutraceutical on skin aging markers: An antioxidant-control, double-blind study. *Experimental and Therapeutic Medicine*. 2016;11(3):909-916. doi:10.3892/etm.2016.3011

38. Basch E, Gabardi S, Ulbricht C. Bitter melon (Momordica charantia): A review of efficacy and safety. *American Journal of Health-System Pharmacy*. 2003;60(4):356-359. doi:10.1093/ajhp/60.4.356