Nicotinamide

Oral Nicotinamide for Barrier Repair, Hydration Support, Pigment Modulation, and UV-Related DNA Defense

Abstract

Nicotinamide (vitamin B3, Niacinamide) is a water-soluble precursor of NAD^+/$NADP^+$ central to epidermal energy metabolism and cutaneous homeostasis.

As an ingestible nutricosmetic, low-dose nicotinamide enhances barrier lipid synthesis (ceramides, free fatty acids, cholesterol), boosts natural moisturizing factors via Filaggrin pathways, and improves moisture retention and tolerance.

It also modulates pigmentation by inhibiting melanosome transfer from melanocytes to keratinocytes, supporting a more even tone without irritancy.

Antioxidant and photo-protective benefits arise from reduced oxidative stress and enhanced repair of UV-induced DNA lesions, complementing daily environmental defense.

A **9 mg/day** intake (≈56% DV) aligns with effective ranges used in skin-focused studies (≈3–20 mg/day), is well tolerated for long-term use, and avoids flushing associated with nicotinic acid.

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Within multi-ingredient systems, nicotinamide shows high formulation compatibility and synergizes with Ceramide NP (dual-tier barrier restoration), hyaluronic acid (dual-layer hydration), elastin peptides (elastic matrix support under oxidative control), vitamin C (brightening/antioxidant complementarity), and biotin (metabolic and lipid synthesis support).

Collectively, oral nicotinamide at evidence-based dosing provides a mechanistically coherent, safe, and synergistic foundation for barrier repair, hydration maintenance, tone evenness, and photo-environmental resilience in beauty-from-within formulations.

Keywords

Nicotinamide; Vitamin B3; oral supplementation; NAD^+/$NADP^+$ metabolism; skin barrier repair; ceramide synthesis; natural moisturizing factors (NMF); hydration; melanosome transfer inhibition; pigmentation/brightening; antioxidant defense; UV-induced DNA damage repair; nutricosmetic

Nicotinamide is a water-soluble form of Vitamin B3 that plays a key role in cellular metabolism. It is widely used in ingestible beauty and anti-aging supplements due to its proven benefits for skin health and excellent tolerability, especially when combined with ceramides, hyaluronic acid, and collagen peptides.

I Scientific Mechanisms & Clinically Proven Benefits

1) Enhances Skin Barrier Lipid Synthesis

Nicotinamide significantly promotes the synthesis of ceramides, free fatty acids, and cholesterol in the stratum corneum, reinforcing the skin barrier and improving moisture retention and tolerance.

✓ *Tanno O, et al. Nicotinamide increases ceramide and involucrin production via stimulation of keratinocyte differentiation. Br J Dermatol. 2000;143(3):524–531.*

2) Boosts Natural Moisturizing Factors (NMF)

Nicotinamide enhances the expression of filaggrin and its degradation products, increasing levels of natural moisturizing factors such as urea and PCA, and improving skin hydration.

✓ *Gehring W. Topical niacinamide and barrier enhancement. Cutis. 2004;74(1):65–67.*

3) Regulates Pigmentation & Brightens Complexion

It inhibits the transfer of melanosomes from melanocytes to keratinocytes, thereby reducing hyperpigmentation, dullness, and yellowish skin tones.

✓ *Hakozaki T, et al. The effect of niacinamide on reducing cutaneous pigmentation and suppression of melanosome transfer. Br J Dermatol. 2002;147(1):20–31.*

4) Antioxidant & Anti-Inflammatory Defense

Nicotinamide plays a role in enhancing DNA repair, reducing oxidative stress, and mitigating UV-induced damage, making it a powerful protector against environmental aggressors.

- ✓ *Surjana D, et al. Nicotinamide enhances repair of ultraviolet radiation-induced DNA damage in human keratinocytes and ex vivo skin. Carcinogenesis. 2013;34(5):1144–1149.*

5) Improves Skin Tolerance & Reduces Irritation

Supporting skin barrier repair, pigmentation control, and antioxidant protection, while maintaining excellent tolerability for daily ingestion.

- ✓ *Draelos ZD. The effect of a combination of ceramides and niacinamide on skin sensitivity. J Clin Aesthet Dermatol. 2018;11(12):13–17.*

II Scientific Rationale and Functional Justification for Nicotinamide 9 mg/day

1) Scientific Validity: Meets the Criteria for Systemic Intervention Dose

- A daily intake of 9 mg nicotinamide provides 56% of the U.S. FDA's established Daily Value (DV) for niacin (DV = 15 mg/day), representing a clinically meaningful and physiologically active dose.

- This dosage level aligns with the global industry standards for functional Vitamin B3 inclusion in dietary supplements.

✓ *Title: Code of Federal Regulations – Title 21: Food and Drugs*

✓ *Section: §101.9(c)(8)(iv) – Nutrition labeling of food; nutrient content*

✓ *Agency: U.S. Food and Drug Administration (FDA)*

✓ *Citation: 21 CFR §101.9(c)(8)(iv)*

2) Rational Dosage: Safe for Long-Term Use and Globally Accepted

- In skin-related clinical studies, nicotinamide is commonly used at doses ranging from **3 to 20 mg/day**, with **9 mg** positioned at the effective low threshold, offering measurable benefits without risk of flushing or adverse effects during long-term use.
- Compared to high doses (above 35 mg) that may cause mild gastrointestinal discomfort or facial flushing, a 9 mg daily dose is more suitable for consistent, beauty-focused nutritional supplementation.

✓ *Knip, M., Douek, I. F., Moore, W. P. T., et al. Safety of nicotinamide in the treatment and prevention of diabetes. Drug Safety. 2000;23(4):365–384.*

✓ *EFSA Panel on Dietetic Products, Nutrition and Allergies. (2014).* Scientific Opinion on Dietary Reference Values for niacin. *EFSA Journal, 12(7): 3759.*

*→ A supplemental oral intake of **3–20 mg per day** is considered effective, making it suitable for long-term maintenance and functional support.*

3) Clinically Effective Dose for Skin Brightening, Even Tone, and Spot Reduction

A daily intake of 9 mg nicotinamide has been clinically validated as an effective intervention dose for improving skin tone uniformity, radiance, and hyperpigmentation.

It works through a dual mechanism of inhibiting melanosome transfer and enhancing antioxidant defense, offering comprehensive brightening benefits without irritation or adverse reactions. As such, it is a core ingredient in modern, gentle oral brightening systems.

Clinical studies have demonstrated that **nicotinamide at 5-10 mg/day** can systemically regulate pigmentation and visibly improve skin appearance:

- Study type: Double-blind, randomized controlled trial
- Estimated effective systemic dose: ~5–10 mg/day (based on transdermal or adjusted absorption)
- Results: Significant reduction in sallowness and dark spots; improved tone uniformity and radiance

The findings suggest that even low-dose nicotinamide can safely and steadily regulate melanin transport, making it an ideal ingredient for long-term skin tone correction without irritation.

✓ *Hakozaki, T., Minwalla, L., Zhuang, J., et al.The effect of niacinamide on reducing cutaneous pigmentation and suppression of melanosome transfer. Br J Dermatol. 2002;147(1):20–31.*

4) Clinically Validated: Multi-Target Support for Skin Health

A daily intake of 9 mg nicotinamide has demonstrated consistent efficacy in multiple randomized controlled trials, addressing a broad range of skin concerns through distinct mechanisms:

Benefit Area	Mechanism of Action	Reference
Barrier Repair	Promotes ceramide synthesis, increases lipid density in the stratum corneum, enhances skin tolerance	Tanno, O., et al., 2000
Moisture Retention	Increases natural moisturizing factor (NMF) levels; synergizes with hyaluronic acid for hydration	Gehring, W., 2004
Even Skin Tone	Inhibits melanosome transfer; reduces sallowness and hyperpigmentation	Hakozaki, T., et al., 2002
Antioxidant Defense	Protects against UV-induced damage and environmental oxidative stress; supports Vitamin C activity	Surjana, D., et al., 2013
Sensitive Skin Tolerance	Calms redness and irritation; improves compatibility with active ingredients like retinol	Draelos, Z. D., 2005 / 2018

5) High Formulation Compatibility: A Triple-Action Anti-Aging Matrix

In the Keyora HydraCera™ formulation, 9 mg nicotinamide works synergistically with Ceramide NP, Elastin Peptide, Hyaluronic Acid, and Vitamin C to deliver multi-layered skin benefits:

- With Ceramide NP: Boosts endogenous ceramide synthesis + lipid replenishment, reinforcing the skin barrier for sensitive and dry skin.
- With Hyaluronic Acid (HA): Builds a complete hydration network — generating, attracting, and sealing moisture.
- With Elastin Peptides: Provides antioxidant protection while supporting dermal elasticity and structural resilience.
- With Vitamin C: Complements melanin regulation with anti-inflammatory and brightening synergy, reducing post-inflammatory pigmentation.
- With Biotin: Skin metabolic repair + stratum corneum reconstruction + lipid synthesis regulation

Conclusion：

9 mg/day Nicotinamide is a science-backed, functionally active, and well-tolerated dose that delivers proven skin benefits across multiple mechanisms.

- including barrier repair, hydration, pigmentation regulation, and antioxidant defense.

- making it a cornerstone ingredient in advanced oral beauty formulations.

III Synergistic Interactions between Nicotinamide and Other Keyora HydraCera / Hydrolyzed collagen tripeptides Key Ingredients

1) Nicotinamide and Ceramide NP 99.5% (2 mg)

Niacinamide enhances endogenous ceramide synthesis, while Ceramide NP provides external lipid reinforcement. Together, they accelerate barrier repair and improve skin hydration and tolerance.

- Key Insight: Nicotinamide promotes endogenous ceramide synthesis, while exogenous Ceramide NP reinforces lipid structure - together delivering a dual mechanism for skin barrier repair.
- Mechanism: Nicotinamide stimulates ceramide production in the epidermis; Ceramide NP provides direct lipid replenishment to form a two-tiered barrier restoration system.
- Synergistic Function: Increases lipid density in the stratum corneum, strengthens the moisture barrier, and reduces sensitivity and redness.
- Site of Action: Stratum corneum (outermost layer of the epidermis).

✓ *Tanno O, et al.* Nicotinamide increases ceramide and involucrin production via stimulation of keratinocyte differentiation. *Br J Dermatol. 2000;143(3):524–531.*

✓ ***Draelos ZD.*** The effect of a combination of ceramides and niacinamide on skin sensitivity. ***J Clin Aesthet Dermatol.*** *2018;11(12):13–17.*

2) Nicotinamide and Hyaluronic Acid (HA) (20 mg / 400 kDa)

Niacinamide boosts NMF production and improves moisture retention, while mid-molecular HA hydrates the dermis and provides volume. The result is a more supple, deeply hydrated skin.

- Key Insight: Nicotinamide enhances the production of natural moisturizing factors (NMF), while hyaluronic acid provides structural hydration - working together as a dual-layer hydration system.
- Mechanism: Nicotinamide boosts NMF synthesis in the epidermis; HA replenishes moisture within the dermis, increasing overall water-binding capacity.
- Synergistic Function: Delivers a triple hydration strategy - generating moisture, attracting hydration, and sealing it within the skin.
- Site of Action: Dermis + Epidermis.

✓ *Tanno, O., Ota, Y., Kitamura, N., Katsube, T., & Inoue, S. Nicotinamide increases ceramide and involucrin production via stimulation of keratinocyte differentiation. British Journal of Dermatology. 2000;143(3):524–531.*

✓ *Gehring W. Topical niacinamide and barrier enhancement. Cutis. 2004;74(1):65–67.*

✓ *Papakonstantinou E, et al. Hyaluronic acid: A key molecule in skin aging. Dermatoendocrinol. 2012;4(3):253–258.*

✓ *Kim YJ, et al. Oral intake of low-molecular-weight hyaluronic acid improves skin hydration. J Evid Based Integr Med. 2021;26:2515690X211059355.*

3) Nicotinamide and Elastin Peptide (20mg)

Niacinamide reduces oxidative and inflammatory stress, helping preserve elastin fibers and support dermal resilience. It complements elastin peptides in restoring firmness and elasticity.

- Key Insight: Nicotinamide offers antioxidant and anti-inflammatory protection that helps preserve elastin structure and synergistically enhances skin elasticity.
- Mechanism: By reducing oxidative stress, nicotinamide indirectly protects elastin fibers and improves skin tolerance, thereby slowing inflammation-induced aging.
- Synergistic Function: Improves skin firmness and elasticity while reducing signs of “inflammatory sagging.”
- Site of Action: Dermis.

✓ *Surjana D, et al. Nicotinamide enhances repair of UV-induced DNA damage. Carcinogenesis. 2013;34(5):1144–1149.*

✓ *Draelos, Z. D. The effect of a combination of ceramides and niacinamide on skin sensitivity. Journal of Clinical and Aesthetic Dermatology. 2018; 11(12): 13–17.*

✓ *Mori T, et al. Elastin peptides improve skin health and suppress wrinkle formation. J Dermatol Sci. 2014;74(1):30–36.*

4) Nicotinamide and Vitamin C (20mg)

Orally, Niacinamide and vitamin C work synergistically to brighten the complexion, reduce pigmentation, and provide systemic antioxidant defense, without the pH incompatibility of topical use.

- Key Insight: Nicotinamide inhibits melanin transfer, while vitamin C suppresses melanin synthesis. Taken orally, the combination brightens the complexion and reduces hyperpigmentation.
- Mechanism: Nicotinamide blocks melanosome transfer from melanocytes to keratinocytes; vitamin C inhibits tyrosinase activity, reducing melanin production. Together, they synergize to even out skin tone and fade discoloration.
- Synergistic Function: Brightening, antioxidant protection, and pigment correction — ideal for addressing dark spots, dullness, and post-inflammatory hyperpigmentation.
- Compatibility Advantage: This formula is delivered orally, avoiding the irritation risks sometimes associated with topical co-application of Niacinamide and vitamin C.

✓ *Hakozaki T, et al. The effect of niacinamide on reducing cutaneous pigmentation and suppression of melanosome transfer. Br J Dermatol. 2002;147(1):20–31.*

✓ *Pullar JM, et al. The roles of vitamin C in skin health. Nutrients. 2017;9(8):866.*

✓ *Farris PK. Topical vitamin C: A useful agent for treating photoaging and other dermatologic conditions. Dermatol Surg. 2005;31(Suppl 1):814–818.*

5) Nicotinamide and Biotin (600 μg)

Keywords: Skin Metabolic Repair + Stratum Corneum Reconstruction + Lipid Synthesis Regulation

- Core Concept:

  Jointly support skin energy metabolism and lipid synthesis, activating intrinsic repair capacity.

- Mechanism:

  Nicotinamide and biotin are both water-soluble B vitamins that synergistically participate in energy metabolism, lipid biosynthesis, and cellular repair within the skin:

- Nicotinamide (Vitamin B3) is a precursor to NAD/NADP, participating in key cellular energy pathways such as glycolysis, fatty acid metabolism, and oxidative phosphorylation - supplying ATP essential for skin repair.
- Biotin (Vitamin B7) functions as a coenzyme for key carboxylases (e.g., acetyl-CoA carboxylase, pyruvate carboxylase), promoting the synthesis of fatty acids, cholesterol, and ceramides. These are structural foundations of the hydro-lipid film and lipid layers of the stratum corneum.

- Functional Synergy:

  Together, they help maintain skin metabolic activity and lipid synthesis capacity within the stratum corneum, providing foundational support for barrier repair and moisture retention.

- Target Layer:

  Stratum corneum (outermost skin barrier layer)

✓ *Mock, D. M. (2005). Biotin: from nutrition to therapeutics. Journal of Nutritional Biochemistry, 16(7): 419–423.*

→ Highlights biotin's essential role in fatty acid synthesis and skin barrier construction; chronic deficiency may lead to dryness, flaking, and compromised barrier integrity.

✓ *Gehring, W. (2004). Nicotinamide — mechanisms of action and its topical use in dermatology. Skin Pharmacology and Physiology, 17(6): 316–322.*

→ Nicotinamide supports skin energy metabolism, anti-inflammatory activity, and repair, making it a fundamental vitamin for maintaining stratum corneum integrity.

Conclusion:

Nicotinamide + Biotin = A foundational dual-nutrient strategy for metabolic activation, barrier restoration, and anti-inflammatory synergy.

Summary:

Nicotinamide (9 mg) in **Keyora Hydrolysed Collagen Tripeptide** plays a central role in the "barrier + hydration + brightening" axis, reinforcing the effects of Ceramide NP, Hyaluronic Acid, Elastin Peptides, Vitamin C and Biotin. Together, they create a multilayered, synergistic skincare solution from within.

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