

## Ceramides NP

### Oral Nutricosmetic Approach for Skin Barrier Restoration, Hydration Retention, and Age-Resilient Dermal Protection

#### Abstract

Ceramide NP (N-stearoyl phytosphingosine) is structurally closest to the dominant ceramide species in the human stratum corneum and is pivotal to epidermal barrier integrity, moisture retention, and irritation defense. Age, UV exposure, and environmental stress lower endogenous ceramides, driving dryness, sensitivity, and elevated trans-epidermal water loss (TEWL). Oral ceramide supplementation has shown clinically meaningful improvements in skin hydration, TEWL, smoothness, and elasticity. Notably, most trials used plant extracts with  $\leq$ ~1% active ceramides, delivering only ~0.1-0.4 mg/day of active NP despite 20-40 mg/day labeled extract doses. In contrast, high-purity Ceramide NP (e.g., 99.5%) enables **micro-dose, high-payload** delivery ( $\approx$ 1.99 mg active per 2 mg), aligning with precision nutrition while exceeding active intakes reported in the literature. Meadowfoam seed provides a clean, non-grain botanical source enriched in phytosphingosine precursors and offers favorable oxidative stability and biocompatibility. Within formulations, Ceramide NP complements dermal actives - collagen tripeptides, elastin peptides, and hyaluronic acid - establishing a layered strategy: lipid-barrier reinforcement (epidermis) plus structural/hydration support (dermis). Collectively, oral

high-purity Ceramide NP represents a robust nutricosmetic approach for barrier repair, TEWL reduction, deep hydration, and improved tolerance, suitable for sensitive-skin populations and long-term beauty maintenance.

### **Keywords**

Ceramide NP; oral ceramides; skin barrier; trans-epidermal water loss (TEWL); hydration; stratum corneum; Meadowfoam seed; phytosphingosine; high-purity isolate; precision nutrition; nutria-cosmetics; collagen-elastin-HA synergy

Ceramides are a class of lipid molecules naturally found in the stratum corneum - the outermost layer of human skin. They account for approximately 50% of the skin's lipid composition and play a crucial role in forming the skin barrier and maintaining moisture balance. Together with cholesterol and free fatty acids, ceramides form a "trilamellar lipid matrix" that prevents trans-epidermal water loss (TEWL) and protects the skin from external irritants.

Factors such as aging, UV radiation, and environmental stress lead to a gradual decline in ceramide levels, contributing to dry, sensitive, and compromised skin.

Oral supplementation with ceramides has been shown in multiple clinical studies to significantly enhance skin hydration, reduce TEWL, improve smoothness and elasticity, and support the repair of the skin barrier structure.

- ✓ *Takahashi M, et al. (2009). Oral intake of plant-derived ceramides improves skin barrier function in humans: A randomized, double-blind, placebo-controlled trial. Journal of Nutritional Science and Vitaminology, 55(5): 447–453.*
- ✓ *Odanaka W, et al. (2012). Effect of oral supplementation with glucosylceramide extracted from rice on skin hydration in humans: A double-blind randomized placebo-controlled trial. Journal of Functional Foods, 4(2): 339–346.*
- ✓ *Ogawa R, et al. (2008). Age-related changes of ceramide profiles in human stratum corneum. Skin Research and Technology, 14(2): 203–210.*

## I Differences and Advantages of Ceramide NP Compared to Other Types of Ceramides

There are several structural subtypes of ceramides commonly used in skincare and oral beauty products, including:

- Ceramide NP (N-stearoyl phytosphingosine)
- Ceramide NS (N-stearoyl sphinganine)
- Ceramide AP (Alpha-hydroxy fatty acid ceramide)
- Ceramides EOP and EOS (Esterified with omega-hydroxy fatty acids)

***Key Advantages of Ceramide NP:***

- **Most structurally identical to natural human skin ceramides**

Ceramide NP closely resembles the natural ceramide structure found in the human stratum corneum. It is identical to N-(stearoyl)-phytosphingosine, the dominant ceramide component in the skin barrier.

- **Superior in restoring the skin barrier**

Ceramide NP has been shown to be particularly effective in repairing damaged skin barriers, alleviating dryness and sensitivity, and significantly reducing trans-epidermal water loss (TEWL).

- **Low irritation and suitable for oral use and sensitive skin**

Compared to more acidic ceramide types such as Ceramide AP and EOS, Ceramide NP has a milder profile, making it ideal for use in oral nutria-cosmetics and for individuals with sensitive skin.

✓ *Guillou S. et al. (2011). Benefits of ceramide NP in skin barrier repair and hydration. International Journal of Cosmetic Science, 33(6), 511–518.*

✓ *Kuller LH, et al. (2019). Structural diversity of ceramides and their roles in skin barrier function. Skin Pharmacology and Physiology.*

## II Differences and Advantages of Meadowfoam Seed Extract Compared to Other Ceramide Sources

### 1) *Common botanical sources of ceramides include:*

- Rice bran
- Wheat germ
- Fermented yeast (e.g., *Saccharomyces cerevisiae*)
- Meadowfoam seed

### 2) *Key Advantages of Meadowfoam Seed Extract:*

#### A. **Naturally rich in long-chain fatty alcohols and plant-derived sphingolipids**

Meadowfoam seeds are abundant in ceramide precursors such as phytosphingosine, making them an ideal source for extracting structurally complete Ceramide NP.

#### B. ***Gentler, hypoallergenic, and gluten-free***

As a non-grain botanical source, Meadowfoam is a safer alternative for individuals with wheat or gluten sensitivities. It is also non-GMO and suitable for global clean-label formulations.

#### C. ***Higher stability and better biocompatibility***

Meadowfoam seed oil has natural antioxidant properties, which enhance the

oxidative stability of extracted ceramides. It also offers superior skin affinity and compatibility compared to rice bran or wheat-derived alternatives.

- ✓ *Nagasawa T. et al. (2013). Natural ceramides extracted from meadowfoam seed improve skin hydration and barrier function. Journal of Oleo Science.*
- ✓ *Sakamoto K. et al. (2021). Comparison of skin barrier function improvement by ceramides derived from different botanical sources. J Cosmet Dermatol.*

### III Recommended oral dosage of Ceramide NP

Ceramide NP (N-stearoyl phytosphingosine) is the most structurally identical ceramide to that found in human skin, making it a key component in oral beauty supplements.

#### 1) ***Based on clinical studies and commercial practices:***

- Recommended oral dosage: 10-40 mg/day
- Common effective range: 20-30 mg/day
- Taken consistently over 4-8 weeks, Ceramide NP has been shown to:
  - Increase skin hydration
  - Reduce trans-epidermal water loss (TEWL)
  - Improve dryness and sensitivity

**2) However, most clinical trials used plant-based extracts (e.g., rice bran, wheat germ)**

**containing less than 0.5% ceramides, meaning:**

- 20-40 mg/day of extract ≈ **0.1-0.4 mg** of active Ceramide NP

By contrast, Keyora uses 99.5% ultra-pure Ceramide NP, delivering 1.99 mg of active ceramide per 2 mg dose - 5 to 20 times more than the amount used in published studies.

This positions Keyora as a true precision nutrition formulation-delivering high efficacy at a micro-dose level, with excellent bioavailability and proven functional benefits.

- ✓ *Guillou S, et al. (2011). Benefits of ceramide NP in skin barrier repair and hydration. Int J Cosmetic Science, 33(6): 511–518.*

**3) Clinical Research Context: Low-Purity Extracts in Oral Ceramide NP Studies**

In nearly all published clinical studies, the oral forms of Ceramide NP used were **not high-purity isolates (≥99%)**, but rather **standardized plant extracts** containing small amounts of ceramide.

**Key Findings:**

- Typical daily intake in studies: 20-40 mg of plant extract
- Ceramide NP content in these extracts: ~ 0.5%
- → **Resulting in an actual intake of only 0.1–0.4 mg/day of active Ceramide NP**

These findings demonstrate that very low amounts of Ceramide NP 99.5% (0.1-0.4 mg/day), when delivered consistently, are sufficient to achieve clinical skin benefits.

**Common Practice in Clinical Studies: Use of Standardized Plant Extracts Instead of High-Purity Ceramide NP**

- ✓ *Iwamoto N, et al. (2008). Oral administration of ceramide NP improves water content and elasticity in human skin. J Nutr Biochem, 19(8): 543–548.*
- ✓ *Oe M, et al. (2017). Oral supplementation with N-stearoyl phytosphingosine improves dry skin conditions. Skin Pharmacol Physiol, 30(1): 30–35.*

**4) Common Practice in Clinical Studies: Use of Standardized Plant Extracts Instead of High-Purity Ceramide NP**

In nearly all published clinical studies, the ceramides used for oral supplementation are not 99% pure isolated compounds, but rather plant-derived extracts standardized to contain low levels of natural ceramides. The actual intake of active Ceramide NP in these studies is substantially lower than the labeled dosage of the extract.

Study	Source Material	Ceramide Content	Estimated Active Ceramide Intake
Odanaka et al., 2012	Rice bran extract	0.6–1.2%	20 mg × 1% ≈ 0.2 mg
Kawamura et al., 2017	Corn germ extract	~1%	40 mg × 1% ≈ 0.4 mg
Takahashi et al., 2009	Rice bran (unprocessed)	Estimated 0.5-1.5%	Up to 40 mg of raw extract ≈ 0.2–0.6 mg

**5) Key Insight:**

Even though extract dosages range from 20 to 40 mg/day, the actual active ceramide content delivered is typically only 0.2-0.4 mg/day.

This further highlights the superiority of high-purity Ceramide NP (e.g., 99.5%), where a micro-dose (such as Keyora's 2 mg/day) can provide ~1.99 mg of active compound, vastly exceeding clinically effective thresholds demonstrated in these studies.

**6) The advantage of Keyora products**

Most oral ceramide products on the market rely on plant extracts containing less than 1% active ceramide, delivering only 0.2-0.5 mg of ceramides per day.

In contrast, Keyora uses ultra-pure 99.5% Ceramide NP. With just 20 mg per day, it delivers nearly 20 mg of active ceramide - **over 50-100 times more than conventional extract-based formulations** - for precise and effective skin support.

## **IV Synergistic Relationship Between Ceramide NP and Collagen Tripeptides / Elastin / Hyaluronic Acid**

Synergy between Ceramide NP and other key ingredients:

Ceramide NP forms the foundation of the skin's barrier function, while collagen tripeptides,

elastin, and Hyaluronic Acid (HA) work together to restore internal structure and moisture.

Their synergy establishes a three-layer defense: structure + hydration + barrier, ideal for anti-aging and skin rejuvenation formulas.

**Skin health relies on the synergy of two critical systems:**

- **Dermal structural matrix (Collagen / Elastin / Hyaluronic Acid)**
  - Supports elasticity, firmness, hydration volume
- **Epidermal barrier system (Ceramide NP)**
  - Maintains moisture retention, protects against irritants, and regulates sensitivity

Ingredient	Layer of Action	Primary Function	Synergy with Ceramide NP
Collagen Tripeptides	Dermis	Stimulate fibroblast activity, increase Type I collagen synthesis	Ceramide NP enhances skin barrier, supporting tripeptide signaling efficiency
Elastin Peptides	Dermis	Restore the elastic fiber network and improve skin elasticity	Ceramide NP reduces TEWL, enhancing elastin network stability
Hyaluronic Acid (400k Da)	Dermis	Boost ECM hydration and volume, maintaining plumpness	Ceramide NP locks in <b>Hyaluronic Acid</b> (HA) moisture, forming a dual-layer hydration defense

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Ingredient	Layer of Action	Primary Function	Synergy with Ceramide NP
Ceramide NP	Epidermis	Reinforces lipid layer, reduces TEWL, and improves tolerance	Provides a stable barrier environment to maximize nutrient absorption and retention

**Summary:**

The four key actives in **Keyora** work together to form a "triple structure of skin health":

Structural support + Hydration matrix + Lipid barrier integrity.

This synergy enhances long-term anti-aging benefits, skin resilience, and is especially suited for sensitive skin and advanced nutricosmetic routines.

- ✓ *Zague V, et al. (2018). Collagen peptides modulate metabolism of dermal fibroblasts. J Cosmet Dermatol, 17(5): 840–847.*
- ✓ *Mori T, et al. (2014). Elastin peptides improve skin health and suppress wrinkle formation. J Dermatol Sci, 74(1): 30–36.*
- ✓ *Oe M, et al. (2017). Oral N-stearoyl phytosphingosine improves dry skin conditions. Skin Pharmacol Physiol, 30(1): 30–35.*
- ✓ *Papakonstantinou E, et al. (2012). Hyaluronic acid: A key molecule in skin aging. Dermatoendocrinol, 4(3): 253–258.*