# NUTRICOSMETICS: ACTIVE INGREDIENTS AND CLINICAL BENEFITS BASED ON SCIENTIFIC EVIDENCE

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**Abstract**

Nutricosmetics are oral nutritional interventions designed to enhance skin health and aesthetics through internal biological mechanisms. The growing *beauty-from-within* trend has accelerated research on active compounds such as hydrolyzed collagen, oral hyaluronic acid, probiotics, and astaxanthin. This article synthesizes current scientific evidence by reviewing studies published between 2015 and 2025 retrieved from Scopus, PubMed, Web of Science, and ScienceDirect. Eight key publications, including meta-analyses, systematic reviews, and randomized controlled trials (RCTs), were evaluated to determine the clinical effectiveness of nutricosmetics on skin parameters. Hydrolyzed collagen demonstrates the strongest evidence base, with a meta-analysis of 26 RCTs (~1,721 participants) reporting significant improvements in skin hydration and elasticity. Oral hyaluronic acid likewise shows benefits in hydration, elasticity, and wrinkle reduction, supported by findings from seven RCTs. Probiotic supplementation exhibits clinical efficacy in acne management via modulation of the gut–skin axis, while astaxanthin offers potential improvements in hydration and photoprotection, although current data remain limited. Variability in dosing, formulations, and study duration contributes to heterogeneity across trials. Overall, nutricosmetics present promising complementary strategies for enhancing skin hydration, elasticity, and age- related parameters. Standardized methodologies and long-term clinical trials are required to strengthen evidence- based recommendations.

**Keywords**: Nutricosmetic, Hydrolyzed collagen, Oral hyaluronic acid, Clinical efficacy

## INTRODUCTION

Traditional skin care—such as topical creams, filler injections, and dermatological procedures—has long been the mainstay in maintaining aesthetics and delaying skin aging. However, non-invasive and "from within" approaches have gained popularity through the concept of nutricosmetics: oral nutritional interventions aimed at improving cosmetic aspects such as hydration, elasticity, and skin texture, as well as hair and nail health. This concept is in line with the "beauty-from-within" trend and increasing consumer demand for simpler and more practical alternatives to traditional cosmetic treatments.

Several active ingredients have been proposed as nutricosmetic candidates, including hydrolyzed collagen peptides, oral hyaluronic acid (HA), carotenoids such as astaxanthin, polyphenols, probiotics, and vitamins and minerals. Of these, collagen peptides have been the most studied—a recent meta-analysis of 26 randomized controlled trials (RCTs) with a total of 1,721 subjects reported that hydrolyzed collagen supplementation significantly improved skin hydration and elasticity compared to placebo. Sub analyses indicate that supplementation duration (especially ≥ 8 weeks) correlates with more consistent effects (Pu et al., 2023).

Data from individual RCTs support these findings: in two controlled clinical trials, oral collagen peptide supplementation accelerated skin hydration improvement and increased dermal collagen density while reducing collagen tissue fragmentation after several weeks of intervention (Asserin et al., 2015). This provides a mechanistic basis that oral collagen intake can strengthen the dermal structure and support extracellular matrix function, including glycosaminoglycan and hyaluronic acid production.

In addition to collagen, oral hyaluronic acid has also gained attention. A double-blind clinical trial of 129 women showed that oral HA consumption promoted increased skin hydration within 2–8 weeks, as well as improved epidermal thickness after 12 weeks (Gao et al., 2023). More recently, a 12-week study with HA matrix (containing HA, glycosaminoglycans, and collagen) showed significant improvement in parameters such as stratum corneum hydration, skin brightness, roughness, elasticity, and a reduction in wrinkles and scaliness compared to placebo (Montero-Vilchez et al., 2025).

Carotenoids have also been the focus of research; a meta-analysis of oral Astaxanthin supplementation showed improvements in skin moisture content and elasticity compared to placebo, although improvements in wrinkle depth were inconsistent (Zhou et al., 2021). The proposed biological mechanisms involve antioxidant activity and inhibition of extracellular matrix-degrading enzymes (e.g., MMP-1, MMP-12), which may protect collagen and elastin from

degradation due to oxidative stress and aging (Davinelli et al., 2018).

However, there are significant challenges in comprehensively assessing the benefits of nutricosmetics. Large variations in formulations (type of ingredients, dosage, combination of active substances), study duration, populations, and assessment methods make synthesizing the literature difficult. For example, heterogeneity in collagen sources and supplementation duration influenced results, as reported in a collagen meta-analysis sub analysis (Pu et al., 2023). Furthermore, although some studies show positive results, many studies have potential biases in randomization, outcome reporting, or funding support, so the generalization of findings must be handled with caution.

Thus, although the potential of nutricosmetics is very attractive and supported by several clinical evidence, a critical review and systematic analysis considering methodological quality, dosage, duration, and interaction of active ingredients is needed. This article aims to provide an in-depth summary of the main active ingredients in nutricosmetics, evaluate clinical benefits based on RCTs and meta-analyses, and identify research gaps and recommendations for future studies to provide evidence-based guidelines for practitioners, researchers, and consumers.

## METHOD

This review followed the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020)** guidelines.

### a. Information Sources and Search Strategy

A systematic literature search was conducted using four major scientific databases, namely Scopus, PubMed, Web of Science, and ScienceDirect. The search period was set from January 2015 to January 2025 to ensure coverage of the latest scientific evidence on nutricosmetic active ingredients and their clinical benefits. The search strategy was designed to identify relevant articles, including randomized controlled trials (RCTs), observational studies, systematic reviews, and meta-analyses.

For example, the search strategy on Scopus used the following keyword combinations: ("nutricosmetic*" OR "oral cosmetic*" OR "beauty supplement" OR "collagen peptide" OR "hyaluronic acid" OR "carotenoid*" OR "probiotic*" OR "astaxanthin" OR "ceramide*" OR "polyphenol*") AND ("skin" OR "dermatology" OR "wrinkle*" OR "hydration" OR "elasticity" OR "photoaging").

The search was executed using Boolean operators, truncation, and phrase searching to ensure the sensitivity and specificity of the results. Similar strategies were adapted according to the characteristics of each database to obtain the most comprehensive and relevant literature.

### b. Eligibility Criteria

Inclusion criteria were established to ensure that the literature analyzed was highly relevant to the topic of nutricosmetics and their clinical benefits. Included articles comprise English-language studies published between January 2015 and January 2025 that focus on oral interventions containing active nutricosmetic ingredients such as collagen peptides, hyaluronic acid, carotenoids, probiotics, ceramides, polyphenols, vitamins, or combinations of these ingredients. Accepted study types included randomized clinical trials (RCTs), controlled trials, observational studies, systematic reviews, and meta-analyses evaluating clinical outcomes related to skin health or aesthetics, including hydration, elasticity, wrinkles, roughness, photoaging, or skin biomarker parameters.

Exclusion criteria include articles that only examine topical interventions or non-oral procedures, in vitro or animal studies without clinical translation data, non-scientific articles such as opinions or editorials, case reports, and studies that do not provide quantitative data or adequate methods for systematic assessment. Studies that did not mention the dose or composition of oral interventions were also excluded to maintain consistency in assessing the effectiveness of the formulation.

### c. Study Selection and Screening Process

All search results from the four databases were pooled and duplicates were removed using reference management software (e.g., Mendeley or Zotero). Two independent reviewers conducted a two-stage screening: first based on the title and abstract, then a full-text review to determine final eligibility according to the inclusion criteria. Disagreements were resolve through discussion or by involving a third reviewer. The selection process was carried out following the PRISMA 2020 guidelines to ensure transparency and replication of methods.

### d. PRISMA Flow Description

The study identification and selection process followed the four stages outlined in the PRISMA guidelines: identification, screening, eligibility, and inclusion. In the identification stage, all articles obtained from Scopus, PubMed, Web of Science, and ScienceDirect were combined and cleaned of duplicates. The screening stage was conducted on titles and abstracts to evaluate their relevance to the topic of nutricosmetics. Articles that met the initial criteria entered the full-text eligibility stage, where reviewers

assessed the suitability of the methods, characteristics of the intervention, and completeness of the report. Only studies that met all inclusion criteria entered the final stage and were included in the qualitative synthesis and, where possible, the quantitative synthesis.

## RESULTS AND DISCUSSION

A literature search of four major databases (Scopus, PubMed, Web of Science, and ScienceDirect) yielded many articles relevant to the topic of nutricosmetics for skin health. After data consolidation and duplication removal, the number of articles entering the title and abstract screening stage were substantially reduced. During the screening stage, most articles were excluded because they did not meet the scope of the study, such as topical interventions, animal, or in vitro studies, or did not clinically assess skin parameters. The remaining articles were then analyzed during the full- text assessment stage to evaluate methodological suitability and adequacy of intervention data. The results of the article search can be seen in Table 1.

Table 1. Results of the Systematic Review

| No | Reference | Year | Design | n | Intervention | Dose | Duration | Outcomes |
|---|---|---|---|---|---|---|---|---|
| 1 | Pu SY et al. | 2023 | Systematic review & meta-analysis (26 RCTs) | ≈1721 (total) | Hydrolyzed collagen (various sources) | 1–10 g/day (varies) | 2–12 weeks (various) | Improved skin hydration and elasticity (meta-analysis) |
| 2 | Montero-Vilchez T. et al. | 2025 | Randomized double-blind placebo-controlled trial | ≈60 | Hyaluronic Acid Matrix (HAm) | 60 mg/day (product Dermial®) | 12 weeks | Increased brightness, hydration, smoothness, reduced roughness vs placebo |
| 3 | Eguren C. et al. | 2024 | Randomized clinical trial | ≈74 | Probiotic (Lacticaseibacillus rhamnosus CECT 30031 + Arthrospira platensis) | As per study product (capsule) | 12 weeks | Improvement in Acne Global Severity Scale vs placebo (p=0.03) |
| 4 | Tjiu JW et al. | 2025 | Systematic review & meta-analysis (oral probiotics in acne) | various RCTs | Oral probiotics (various strains) | varies | varies | Potential modest reduction in acne severity (meta-analysis) |
| 5 | Ng et al., | 2021 | Review (astaxanthin) | various RCTs | Astaxanthin (typically 4–12 mg/day) | 4–12 mg/day | 6–12 weeks typical | Improved skin hydration, texture, photoprotection in several RCTs |
| 6 | Evans M. et al. | 2020 | Randomized, triple-blind, placebo-controlled trial | various (fish-derived collagen study) | Fish-derived hydrolyzed collagen (VWC) | as per protocol | varies (study-specific) | Improved skin hydration and elasticity in aging population |
| 7 | Amin P. et al. | 2025 | Systematic review & meta-analysis (oral HA) | 7 RCTs identified | Oral Hyaluronic Acid (various formulations) | varies | varies | Meta-analysis suggests improvements in hydration/elasticity/ wrinkle depth |
| 8 | Myung SK et al. | 2025 | Meta-analysis (collagen supplements) | 23 RCTs | Collagen supplements | varies | varies | Improved hydration, elasticity, and wrinkles |

This study identified eight major publications representing the most widely researched types of oral nutricosmetic interventions, namely hydrolyzed collagen, oral hyaluronic acid, probiotics, astaxanthin, and combinations of other active ingredients that have been evaluated in clinical trials and systematic reviews. Overall, the evidence gathered shows consistent benefits for skin parameters such as hydration, elasticity, texture, and signs of aging, although with a level of methodological heterogeneity that needs to be considered.

### a. Hydrolyzed Collagen

Two large meta-analyses provide the strongest evidence regarding the effectiveness of oral collagen. A study by Pu (2023) involved 26 RCTs with a total of 1,721 participants and concluded that collagen supplementation (1–10 g/day, for 2–12 weeks) significantly improved skin hydration and elasticity compared to placebo, although there was heterogeneity between studies regarding collagen sources and product formulations (Pu et al., 2023). These findings are reinforced by a recent meta-analysis by Myung & Park (2025) analyzing 23 RCTs and reporting consistent improvements in hydration, elasticity, and wrinkle depth (Myung & Park, 2025).

High-quality interventional evidence is also seen in an RCT study by Evans et al. (2020) using hydrolyzed fish collagen (VWC), which showed improvements in

hydration and elasticity in an adult population experiencing skin aging (Evans et al., 2021).

Collectively, the evidence supports the ability of oral collagen to improve skin structural parameters through increased extracellular matrix density and fibroblast stimulation, as described in several mechanistic studies.

**e. Oral Hyaluronic Acid (Oral HA)**

Two primary sources evaluated the benefits of oral HA. Montero-Vilchez et al. (2025) reported through an RCT (≈60 participants) that consuming 60 mg/day of Hyaluronic Acid Matrix (Dermial®) for 12 weeks significantly improved skin brightness, hydration, softness, and reduced roughness compared to placebo (Montero-Vilchez et al., 2025). These findings are consistent with a meta-analysis by Amin P. et al. (2025) that identified 7 RCTs and reported significant improvements in hydration, elasticity, and wrinkle depth, although the number of clinical trials remains limited and formulations vary greatly between products (Amin et al., 2025).

**f. Oral Probiotics**

Probiotic interventions for skin health show promising results, particularly in acne conditions. An RCT study by Eguren et al. (2024) using a combination of Lacticaseibacillus rhamnosus CECT 30031 and Arthrospira platensis for 12 weeks showed a significant reduction in the Acne Global Severity Scale compared to placebo ($p = 0.03$) (Eguren et al., 2024). A systematic review and meta-analysis by Tjiu & Lu (2025) also noted a potential mild to moderate reduction in acne severity, although heterogeneity in strains, doses, and intervention duration hindered the generalization of results (Tjiu & Lu, 2025).

This evidence supports the gut–skin axis concept, where probiotics modulate systemic inflammation, oxidative stress, and barrier function, indirectly improving skin condition.

**g. Astaxanthin**

A review by Ng et al. (2021) summarizing several RCTs showed that astaxanthin consumption (4–12 mg/day for 6–12 weeks) improved skin hydration, texture, and provided photoprotective effects (Ng et al., 2021). Although most studies were small, the results were relatively consistent, supported by astaxanthin's strong antioxidant mechanism that protects skin cells from UV radiation damage and oxidative stress.

A systematic analysis of scientific evidence shows that a few nutricosmetic active ingredients, particularly hydrolyzed collagen, and oral hyaluronic acid, have demonstrated consistent clinical effects on skin parameters related to aging, hydration, and elasticity. A meta-analysis of 26 randomized controlled trials (RCTs) reported that hydrolyzed collagen

supplementation significantly improved skin hydration and elasticity compared to placebo (with a significant effect on the overall test, $p < 0.00001$) after a minimum of 8 weeks of use, despite heterogeneity in formulations and doses among the studies analyzed.

The proposed mechanisms are related to increased endogenous collagen synthesis, dermal hydration, and glycosaminoglycan production, including hyaluronic acid, as well as decreased collagen tissue fragmentation, which is a sign of intrinsic aging. Individual clinical studies support these findings, showing increased dermal collagen density and decreased tissue fragmentation after oral collagen supplementation for 4–12 weeks. Additional evidence suggests that collagen peptides derived from hydrolyzed collagen can circulate in the bloodstream and reach the dermis, providing amino acid substrates for endogenous collagen, elastin, and hyaluronic acid synthesis (Jadach et al., 2024).

Beyond collagen, RCT evidence on oral hyaluronic acid supports its potential to improve skin hydration, elasticity, and brightness after 2–12 weeks of use. A recent meta-analysis covering several RCTs found significant improvements in hydration, elasticity, and wrinkle depth after HA supplementation compared to placebo, although results related to TEWL, and skin firmness did not always reach statistical significance and heterogeneity existed between studies. Individual clinical trials also reported improvements in dermal hydration, skin tone, and epidermal thickness after oral HA consumption across various skin types.

Oral probiotic interventions show more specific results in certain clinical conditions, such as acne. An RCT reported that the combination of Lacticaseibacillus rhamnosus CECT 30031 and Arthrospira platensis significantly reduced the number of non-inflammatory lesions and increased acne severity scores compared to placebo in 12 weeks. Review evidence also supports the role of probiotics in reducing inflammation and improving skin barrier function through gut–skin axis modulation, although strain characteristics, dosage, and duration have not been standardized (Sutema et al., 2025).

The effects of astaxanthin on skin hydration and photoprotection have also been reported through several small RCTs, although meta-analytic evidence is weaker, and some reviews state the need for stronger data. Because astaxanthin has strong antioxidant activity that can protect dermal collagen against oxidative stress, these preliminary findings remain promising despite the

need for large-scale studies and more systematic reporting of doses.

The strongest evidence currently remains with hydrolyzed collagen and oral hyaluronic acid, which have moderate to strong RCT data. Common limitations in this field include dose variation, inconsistent commercial product formulations, relatively small sample sizes in some clinical trial, and observation durations generally less than 6 months. For clinical implementation, this approach should be viewed as a complementary therapy rather than a substitute for topical skin care or UV protection and should be tailored to the patient's clinical profile, including skin condition, outcome expectations, and tolerance to supplements. Balanced nutrition, UV protection, and topical skin care remain fundamental in anti-aging strategies. Evidence also suggests that combinations of active ingredients, such as collagen plus vitamin C or HA, may produce synergistic effects; however, more RCTs systematically evaluating these component interactions are needed for strong clinical recommendations (Lin et al., 2024).

## CONCLUSION

Based on all available evidence, hydrolyzed collagen has the highest level of consistency and strength of evidence, followed by oral hyaluronic acid, probiotics, and astaxanthin. However, the heterogeneity of study designs, differences in commercial product formulations, and variations in dosage remain challenges in establishing precise clinical recommendations. Most RCTs had a duration of 8–12 weeks, so long-term effects still require further research.

This review indicates that nutricosmetics have the potential to provide real clinical benefits in terms of hydration, elasticity, texture, and signs of skin aging, but mechanistic understanding and formulation optimization still need to be improved through clinical trials with more uniform designs, longer durations, and more standardized reporting of results.

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