

**SOLUGEL<sup>®</sup>**  
collagen peptides



# **SOLUGEL<sup>®</sup> collagen peptides increase collagen synthesis and support skin elasticity, firmness, as well as skin hydration**

White paper of a preclinical & clinical study

Beauty from within & skin health

## Daily intake of SOLUGEL® benefits skin health & beauty

Preclinical trial conducted at Bionos Biotech SL, Hospital La Fe (Spain)

Clinical trial conducted by Cosderma Laboratories in cooperation with the Dermatology Unit at Hôpital Saint-André (France)

### INNER WELL-BEING DRIVES BEAUTY

In recent years, consumers have shown a growing interest in the holistic approach to health and beauty. Indeed, some of them are shifting their focus from the superficial use of topical products to products such as supplements and functional foods and beverages (which are also known as nutraceuticals) to enhance their appearance.

Nutraceuticals are products that combine nutrition and cosmetics to enhance the beauty and health of the skin, hair, and nails. They can come in the form of supplements, functional foods, or beverages containing ingredients that have beneficial effects on the skin or other tissues. Some examples of nutraceutical ingredients are antioxidants, vitamins,

amino acids, and collagen peptides. Nutraceuticals are based on the idea that beauty comes from within and that the quality of the skin or other tissues reflects the nutritional status of the body.

Nutraceuticals represent a growing trend in the global market. This is because consumers are becoming increasingly aware of the importance of nutrition for their well-being and appearance. The main drivers for this growth are the increasing demand for natural products, the rising awareness of the adverse effects of pollution and UV radiation on the skin, the aging population, and the growing popularity of product personalization and customization.

### MAINTENANCE OF COLLAGEN LEVEL IS ESSENTIAL IN HEALTHY SKIN

Skin appearance reflects health and general well-being. As our protective shield, our skin is subjected to constant pressure from external, environmental factors (such as sun and wind, etc.), but also from stress, which exacerbates the aging process. From age 30 onwards, the human skin begins to change and this is characterized by alterations to the dermal connective tissue.

**Collagen is the primary building block** of the connective tissue in the skin. In the dermis of human skin, collagen makes up more than 70% of the skin's dry weight. While the body is capable of making at least 28 different types of collagen, the **two types that are key to skin health and beauty are collagen type I and type III. Both of these types are present in SOLUGEL®.**

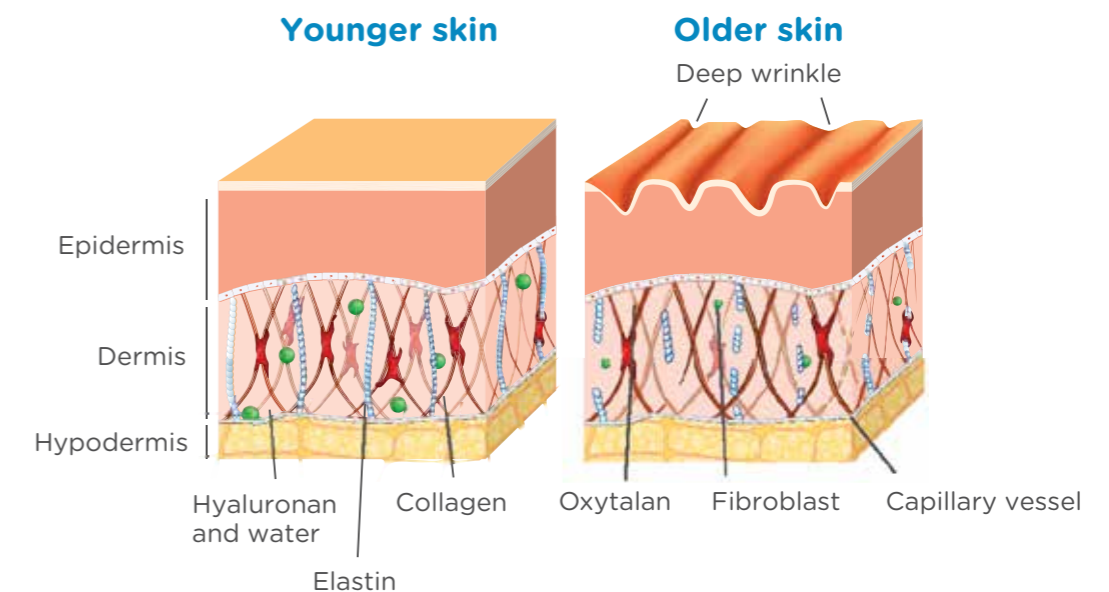
Consistent collagen levels are particularly important for the strength and elasticity of the skin. Changes in the amount and structure of collagen are responsible for the deterioration and aging of the skin. Hence, **healthy collagen levels are essential** for:

- Skin hydration
- Skin elasticity
- Skin firmness

Collagen is a structural protein that is created from precursor molecules that are formed in special cells in the dermis. These are known as fibroblasts and they also produce other structural elements, such as elastin and hyaluronic acid.

Collagen formation and breakdown take place in the dermis. Specific enzymes (matrix metalloproteinases) break down collagen while collagen renewal occurs continuously throughout our lives to repair and replace damaged tissue or to build new cellular structures.

As the skin ages, collagen becomes more and more fragmented. This is because enzyme breakdown becomes more active while collagen production by the fibroblasts decreases. As a result, the skin of an 80-year-old compromises broken collagen that is four times higher than the skin of a person aged 21-30.



## SOLUGEL® collagen peptides support the structure of the dermis and extracellular matrix in the skin

SOLUGEL® is made up of high-quality collagen peptides obtained by enzymatic hydrolysis. These peptides, which are obtained from natural sources, can be easily digested and absorbed by the human body. Bioactive collagen peptides can particularly be attracted to the fibroblasts, where they exert specific functions. Several studies on animal and human fibroblasts performed over the last decade have shown in vitro and in vivo evidence that collagen peptides trigger the body to make more of its own collagen by activating the fibroblasts. As fibroblasts are the most abundant collagen-forming cells, this study was based on fibroblasts and the molecules they express for skin antiaging.

### RESEARCH METHOD

Human dermal fibroblasts were treated with SOLUGEL® (0.01%) collagen peptides and this was followed by an analysis of the cells' collagen synthesis and collagen, elastin, and versican gene expression. Gene expressions of collagen, elastin, and versican were quantified by quantitative reverse transcription polymerase chain reaction (RT-qPCR). Collagen levels were analyzed by confocal scanning laser microscopy using immunostaining.

### PROVEN BEAUTY EFFECTS

#### Result 1: SOLUGEL® significantly increases the collagen synthesis in human dermal fibroblast

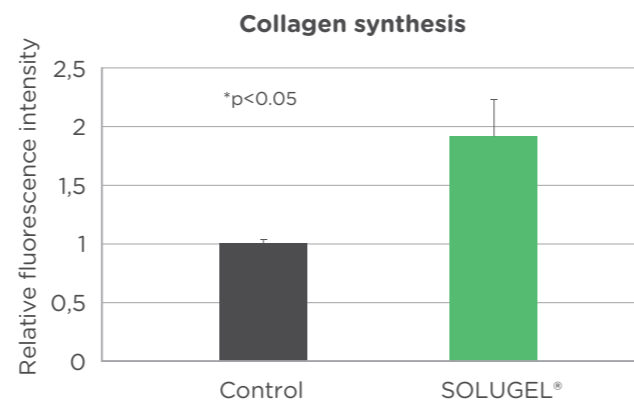
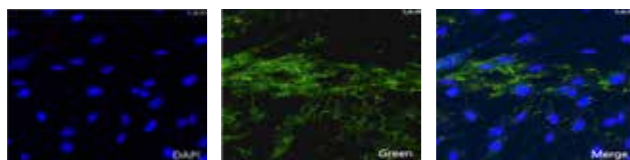
Representative confocal microscopy images showing dermal fibroblasts (blue) and collagen fibers (green).

Fibroblasts treated with SOLUGEL® synthesized more collagen fibers (see green spots)

#### Control



#### SOLUGEL®

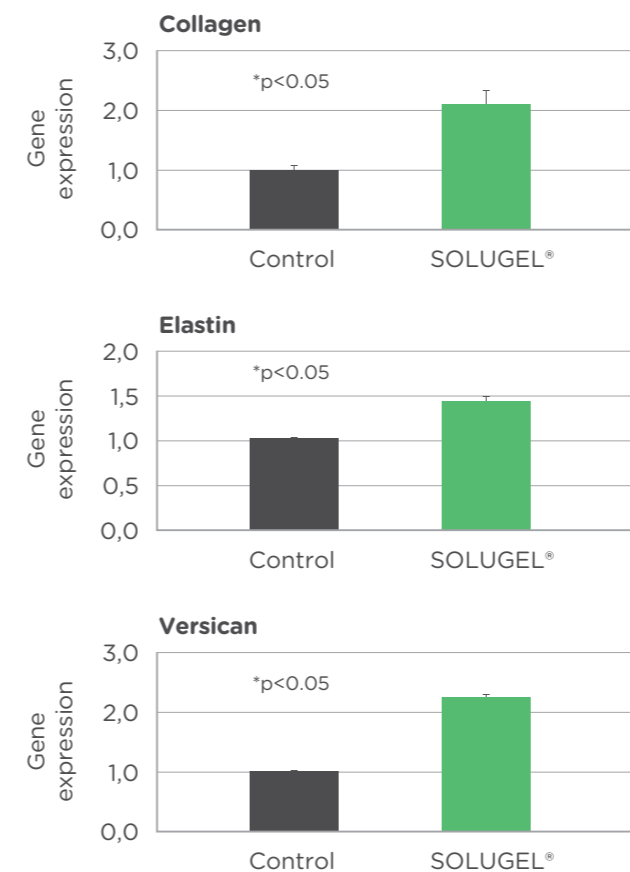


The bar graph shows the mean fluorescence intensity of collagen fibers obtained from the confocal microscopy after treatment of normal human dermal fibroblasts with SOLUGEL® collagen peptides at 0.01% for 24 hours compared to the untreated control.

#### Result 2: SOLUGEL® improves the collagen, elastin & versican genetic expression levels by human fibroblasts.

Bar graphs showing the expression results of collagen (COL1), elastin (ELN), and versican (VCAN) after treating normal human dermal fibroblasts for 24 hours with SOLUGEL® collagen peptides at 0.01% compared to the untreated control.

It has been scientifically proven that SOLUGEL® significantly increases collagen, elastin and versican gene expressions in human dermal fibroblasts by 1.5-2 times.



### CONCLUSION

These data provide scientific, cell-based evidence regarding the beneficial effects of SOLUGEL® collagen peptides on skin-firming and skin-aging properties. SOLUGEL® collagen peptides support collagen synthesis and the expression of collagen, elastin, and versican genes in cultured human dermal fibroblasts. **This suggests that SOLUGEL® collagen peptides support the structure of the dermis and extracellular matrix in the skin.**

Dierckx S, et al. Collagen peptides affect collagen synthesis and the expression of collagen, elastin, and versican genes in cultured human dermal fibroblasts. Front Med Sec Dermatol. Volume 11 - 2024. <https://doi.org/10.3389/fmed.2024.1397517>.



## SOLUGEL® collagen peptides have a positive effect on skin properties

### RESEARCH METHOD

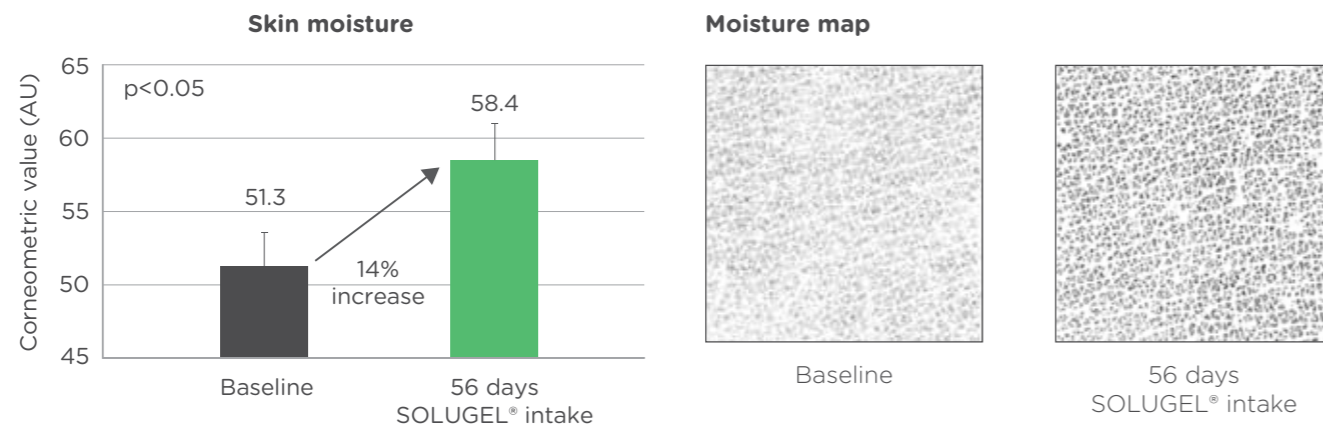
A double-blind study on women aged between 35 and 55 years was undertaken to investigate the positive effect of the oral intake of SOLUGEL® collagen peptides on skin properties both before and after a treatment period that lasted 56 days. A total of 54 women were randomly selected according to strict inclusion criteria and their skin properties were closely monitored. The group was divided in two: the placebo group was comprised of 28 women, while the SOLUGEL® group was comprised of 26 women. During the study, 5-10 g/day of SOLUGEL® collagen peptides powder was dissolved in a liquid and ingested.

The researchers measured the hydration and moisture levels of the upper layer of the epidermis using the Corneometer® on the cheek and via a quantitative Moisture Map analysis on the forearm. Furthermore, the Moisture Map technique was used for representative images. The biomechanical properties, such as elasticity and firmness of the skin, were assessed by Cutometer® measurements on the temple.

The clinical scoring of the effect on elasticity, moisture, and smoothness of the facial skin was performed by the dermatologist using a 10-point review scale (from 0 to 9), where 0 = not elastic, not hydrated, while 9 = very elastic, very hydrated.

### PROVEN BEAUTY EFFECTS

#### Result 1: Daily SOLUGEL® intake results in an improved skin hydration



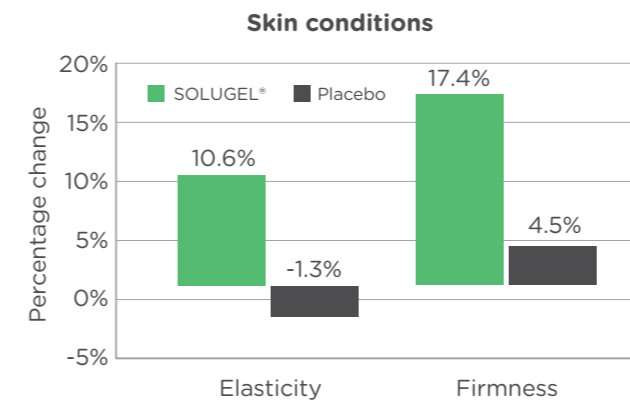
The study showed that the daily oral intake of 5-10 g SOLUGEL® significantly improved the skin hydration of the cheek after 56 days. The results, measured by a Corneometer®, **demonstrated an increase in the moisture level of up to 14%**. Moreover, the visual effect of the Moisture Map is clear evidence of the **improved skin hydration as a result of the daily SOLUGEL® oral intake** – not only on the temple area but also on the forearm. The darker the image, the more hydrated is the skin.

In addition to these results, self-assessment questionnaires completed during the study showed that volunteers taking 5-10 g/day of SOLUGEL® demonstrated a good perception of the product's efficacy in terms of skin hydration.

#### Result 2: Skin firmness and elasticity significantly increased after a daily intake of SOLUGEL®

The situation at baseline and after 56 days of intake of 10 g/day of SOLUGEL® were compared to evaluate the collagen peptide supplementation effect. The skin firmness and skin elasticity were significantly improved after 56 days of collagen peptide supplementation compared to baseline.

The percentage of change from baseline after 56 days of supplementation is shown in the figure.

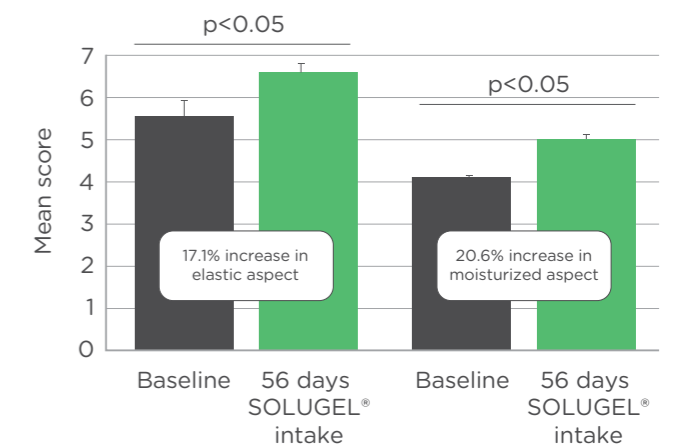


#### Result 3: SOLUGEL® intake improves the elasticity and the moisturizing aspect of the skin

The clinical scoring consisted of a visual and tactile assessment of the cutaneous state at the level of the face, before and after the intake of 10 g/day of SOLUGEL® collagen peptides, to determine its efficacy.

Overall, the skin showed positive responses in both elasticity aspects. The skin's elasticity increased by 17%, and its moisturized aspect improved by 20.6%, as clinically evaluated by a dermatologist.

#### Clinical scoring evaluated by a dermatologist



#### The self-assessment of the efficacy perceived by the subjects and product evaluation

At the end of the study (which lasted 56 days), the subjects completed a self-assessment questionnaire to measure their perception of the skin improvement. Overall, all of the products were well accepted. **More than one-half of the volunteers taking SOLUGEL® demonstrated a better perception of the product efficacy in terms of skin hydration, firmness of the skin, appearance of the skin, as well as overall improvement of the state and aspect of the skin.**

### CONCLUSION

A double-blind clinical study carried out at the Cosderma Institute in France over a period of 56 days **proved the positive effects of the oral intake of 5-10 g/day SOLUGEL® collagen peptides on skin antiaging**. The clinical trial was funded by PB Leiner and conducted by a research team at Les Laboratoires Cosderma (Bordeaux, France), in cooperation with the Dermatology Unit at Hôpital Saint-André (Bordeaux, France) and in accordance with the regulatory requirements (International Conference on Harmonization [ICH] and Good Clinical Practices [GCP]).

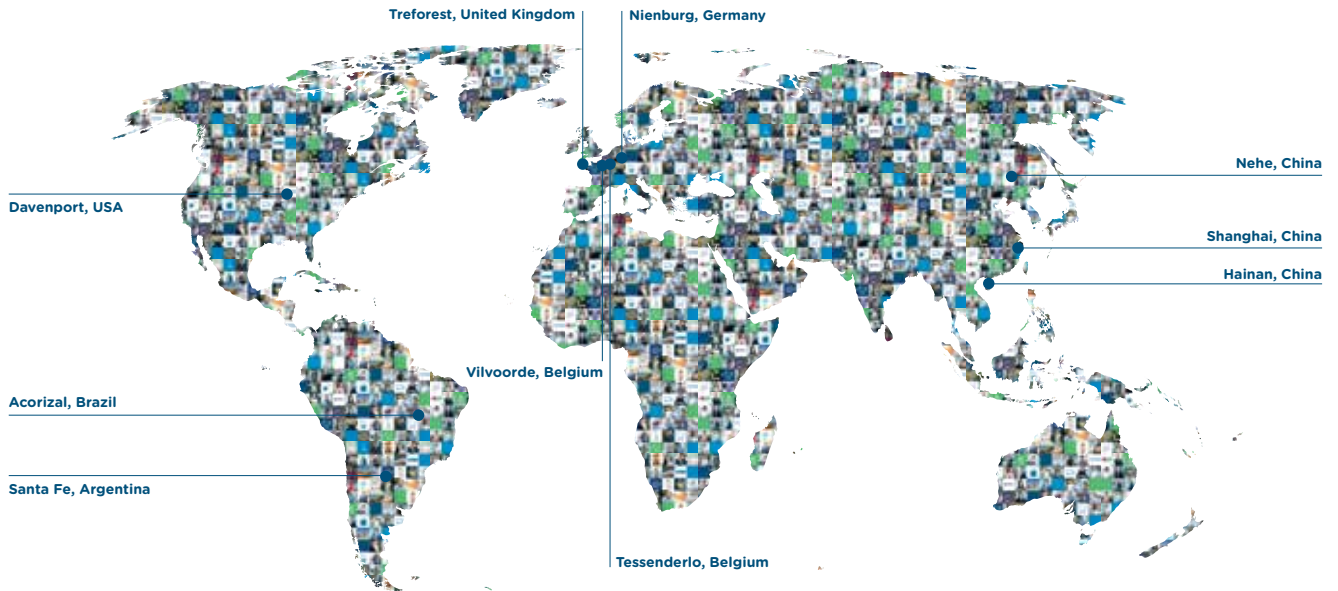
### SOLUGEL® COLLAGEN PEPTIDES

SOLUGEL® is a brand of clinically proven collagen peptides that provides solutions for a wide range of health benefits for the target consumers. These highly bioactive peptides are obtained from natural collagen-rich sources, using state-of-the-art technology and resulting in premium quality that can be easily incorporated into many different applications.

PB Leiner's knowledgeable and approachable team is ready to help you develop on-trend products tailored.



## Here for you, around the world - Global gelatin and collagen solutions manufacturer



Over 100 years of craftsmanship

### PB Leiner

PB Leiner is one of the world's leading gelatin and collagen producers with production sites in Asia, Europe, North America, and South America. PB Leiner's SOLUGEL® is composed of high-quality bio-active collagen peptides obtained from natural animal sources, which include halal, kosher, pasture-raised, and certified grass-fed products. As a highly digestible pure protein free of sugar, fat, cholesterol and carbohydrates with a range of potential health benefits, SOLUGEL® is the clear ingredient choice for food and beverage products and supplements.

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