

**Dermial<sup>®</sup>:**  
**The first hyaluronic  
acid matrix ingredient  
for skin & beauty**

## Abstract

The beauty market is undergoing a transformation. With a heightened awareness of the link between inner wellbeing and outward appearance, there's a shift towards supporting skin health more holistically, and *from within*. This marks a new era where beauty intersects with nutrition - and nutricosmetics takes centre stage.

66.0% of consumers recognise the link between skin health and overall wellbeing.<sup>1</sup>

Introducing Dermial® - the first hyaluronic acid (HA) matrix ingredient for skin & beauty. Explore the benefits and science behind this first-of-its-kind ingredient, effective at a low dose of 60 mg/day, and uncover the opportunities it presents for brands that are looking to innovate in the nutricosmetics arena.

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## Discover Dermial®

Dermial® is a unique HA matrix ingredient that enables developers to unlock new formulations to support beauty-from-within. Extracted from rooster combs via a proprietary manufacturing process, it consists of three naturally-occurring components that work in synergy to maintain the health and nutrition of skin.



**Hyaluronic acid**

60-75%



**Glycosaminoglycans**

(like dermatan sulfate)



**Collagen**

## The background: Skin and ageing

Human skin has three layers - the epidermis, dermis and hypodermis - and each layer comprises a unique composition.

**1. Epidermis:** The epidermis is the outermost layer of the skin and is mainly composed of keratinocytes. Keratinocytes play an essential role in protection, as they form a tight barrier that prevents foreign substances from entering the body, while minimising the loss of moisture and heat.

**2. Dermis:** Considered the 'core' of the skin system, the dermis contains blood and lymph vessels, nerves and other structures like hair follicles and sweat glands. It is mainly made up of fibroblasts, which are embedded in the extracellular matrix (ECM). The dermis ECM is composed of a network of collagen fibres (70-80% of the skin dry weight), a high content of glycosaminoglycans (GAGs) - like hyaluronic acid (HA), dermatan sulfate and chondroitin sulfate - and elastic fibres known as elastin.<sup>2,3</sup> The collagen in the dermis delivers tensile strength to the skin, whereas elastin provides elasticity. GAGs have a structural role in the dermis ECM, where they help to maintain skin hydration, while also playing a role in cell signalling. This includes cell migration, proliferation and differentiation regulation.

**3. Hypodermis:** Beneath the dermis lies the hypodermis, which is composed mainly of loose connective and fatty tissues. The hypodermis provides insulation from the heat and cold.<sup>4</sup>

## Effects of ageing on skin

With age, there is a reduction in collagen fibres, GAG concentrations and elastic tissue (Figure 1), leading to a thinning of the epidermis and dermis layers of the skin. There is also a decrease in the quality and functionality of keratinocytes in the epidermis and fibroblasts in the dermis.<sup>5</sup>

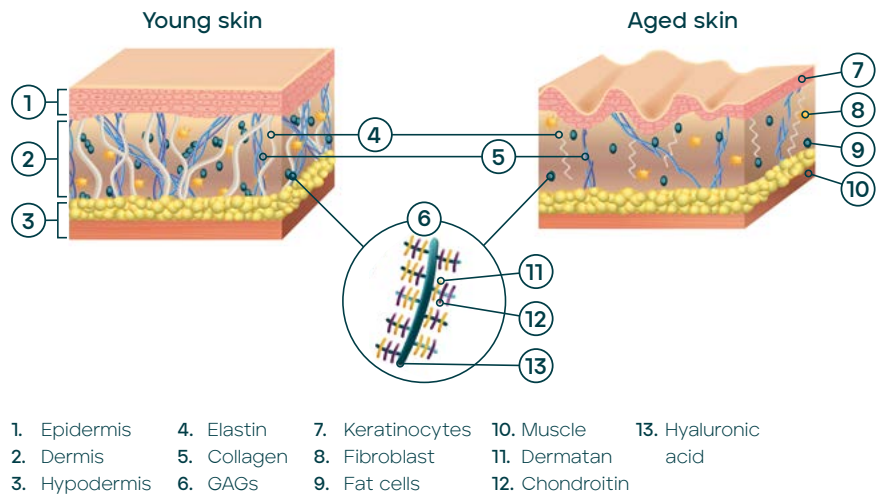
The reduction in volume and overall effectiveness of the skin's layers results in several changes:

**The skin loses some of its elasticity**

**It becomes drier**

**Thinner**

**Progressively fragile**



**Figure 1:** Changes to the skin structure with age.

## Nutricosmetics: The opportunity

To combat the effects of ageing on the skin, many consumers today – mostly women – adopt anti-ageing and regenerative products as part of their beauty regime. These products typically feature ingredients like collagen or HA (Figure 2). Edible beauty products provide nourishment from within and have the potential to facilitate a much more holistic and long-term approach to skin, hair and nail support.

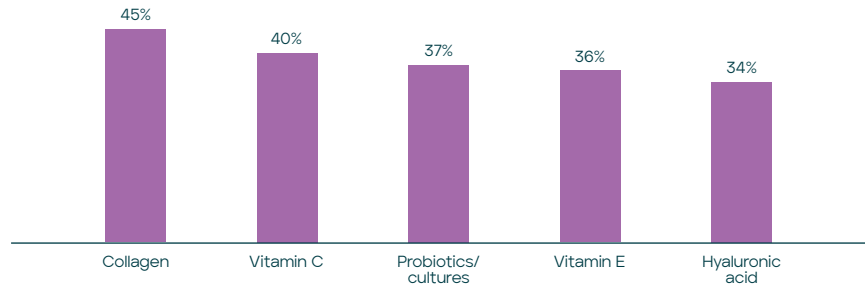


Figure 2: Top ingredients associated with skin health.<sup>1</sup>

## The modern nutricosmetic consumer

But it's not just older women fuelling demand for nutricosmetic supplements.

Historically, the skincare market has primarily catered to mature women. However, there has been a noticeable shift in the consumer demographic as younger generations and men become increasingly attracted to self-care products; broadening the segment's target audience.

Consumers of all ages and backgrounds want to feel good and view taking a proactive approach to skin, hair and nail maintenance as a part of this. This change has been fuelled by several global trends, such as greater health consciousness, holistic mindsets and desire to 'age well'.

But while each consumer in this space has unique requirements and tastes, one thing is clear – science is valued by all; making science-backed ingredients a key focus of formulation strategies.

1/3 of consumers research the efficacy of skincare ingredients before buying.<sup>6</sup>

## Target market

Ageing women focused on 'ageing well'

Consumers invested in self-care

Individuals seeking longer-term and proactive health solutions

## The power of 3

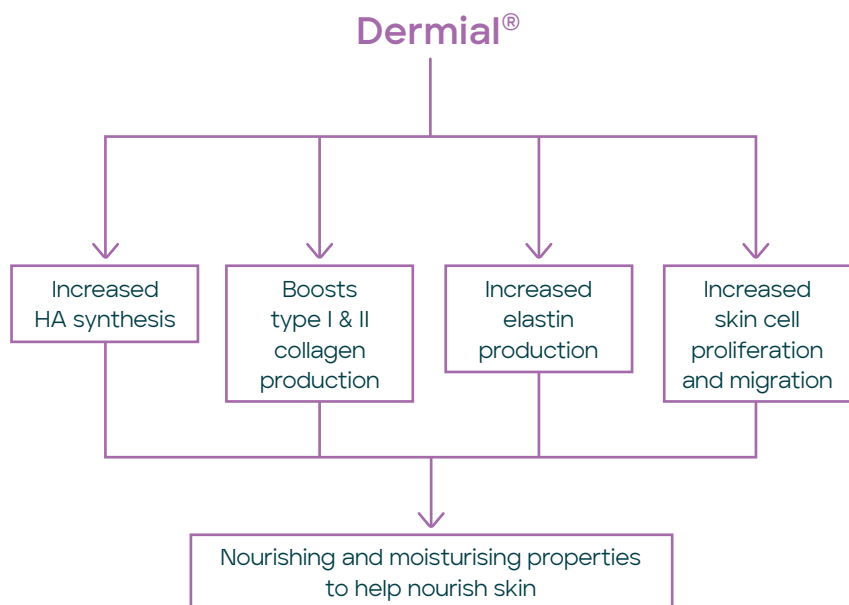
### Dermial®'s unique synergistic effect

HA and collagen ingredients have built up a strong reputation in the skin health – and wider beauty – markets. However, Dermial® is a HA solution with a difference. Comprising of a high concentration of HA plus other beneficial constituents, its novel composition brings powerful nourishing and moisturising properties to help maintain the health and nutrition of the skin.

The effects, safety and mechanism of action of Dermial® have been analysed across four pre-clinical studies<sup>7-11</sup> and one clinical study<sup>12</sup>, including its:

- Benefits for ageing skin, including effects on hydration and wrinkles
- 'Glow' effect on skin
- Efficacy compared to pure HA
- Absorption in the body

### Skin health benefits



**Figure 3:** Through its actions, Dermial® has various benefits for skin health.

# The science behind **Dermial®**

Dermial® is the result of **15+ years**  
of development and research.

## 1. Clinical study: Efficacy and safety of Dermial®<sup>12</sup>

### Objective

To investigate the clinical efficacy and safety of a daily oral supplement containing 60 mg Dermial® on signs of skin ageing in healthy women.

### Methods

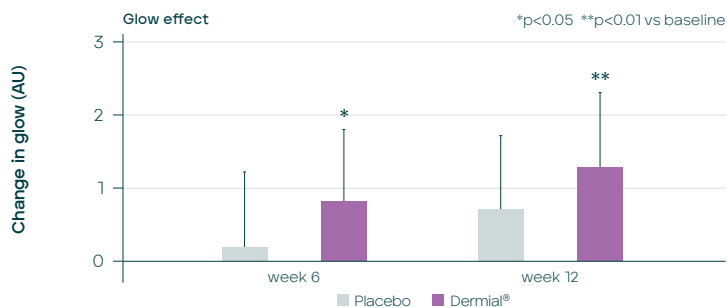
The prospective, randomised, double-blind, placebo-controlled study recruited 60 healthy women (aged between 35-65 years) and split them into two groups: one received 60 mg Dermial® daily for 12 weeks, while the other was given a placebo. The efficacy of the supplement was assessed by evaluating changes in hydration, skin glow, transepidermal water loss (TEWL), friction, T<sup>s</sup> (skin temperature), pH, erythema index (redness of skin) and elasticity, as well as wrinkle and scaliness (dryness) at baseline, measured at 6 weeks and 12 weeks. The overall satisfaction of the participants was also evaluated after completing the study.



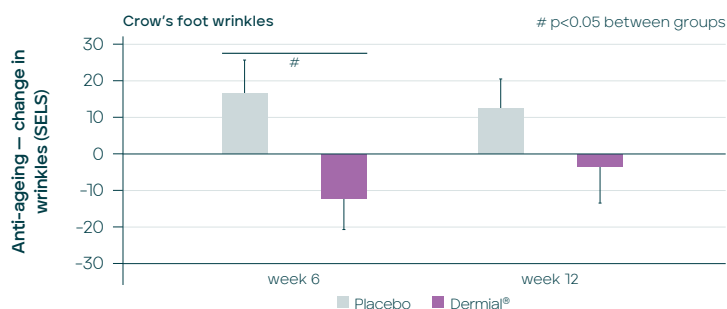
## Results

After 6 weeks, hydration, skin glow, T<sup>a</sup>, erythema index and scaliness (dryness) were significantly improved in the supplemented group versus baseline, and there were no differences detected in the placebo group (except for T<sup>a</sup>). At 12 weeks, the same effects were observed. Highlights included significant increase in hydration of the stratum corneum in Dermial®-treated subjects (13.1% and 12.1% at 6 and 12 weeks respectively), whereas no differences vs baseline were detected in the placebo group. The facial glow in the treatment group also showed a statistically significant increase of 20% and 33.4% at 6 and 12 weeks respectively, whereas no differences vs baseline were detected in the placebo group. Moreover, after 6 weeks, the placebo group demonstrated 26.5% increase in wrinkles, whereas there was no change in the supplemented women, highlighting that 60 mg/d Dermial® had a significant effect on wrinkles.

Global satisfaction evaluation demonstrated that 69% of participants receiving the Dermial® supplement were 'very satisfied' or 'satisfied' and none were dissatisfied. However, in the placebo group, only 42% of participants indicated that they were 'very satisfied' or 'satisfied' and 25% of said they were 'very dissatisfied' or 'dissatisfied'. No treatment-related adverse events were reported.



**Figure 4:** Increase in skin 'glow' following Dermial® supplementation. The 'glow' effect was evaluated using a skin brightness assessment (Skin-Glossometer GL 200, W0-W6-W12).



**Figure 5:** Assessment of crow's foot wrinkle (on right side) periorcular area. The wrinkles were evaluated using a Visioscan® VC 20plus (W0-W6-W12).

## Conclusion:

A daily oral supplementation featuring Dermial® at a dose of 60 mg is safe and supports the homeostasis, appearance and integrity of ageing skin.

## 2. In vitro: Nourishing, anti-ageing and antioxidant capacity of Dermial®<sup>11</sup>

### Objective

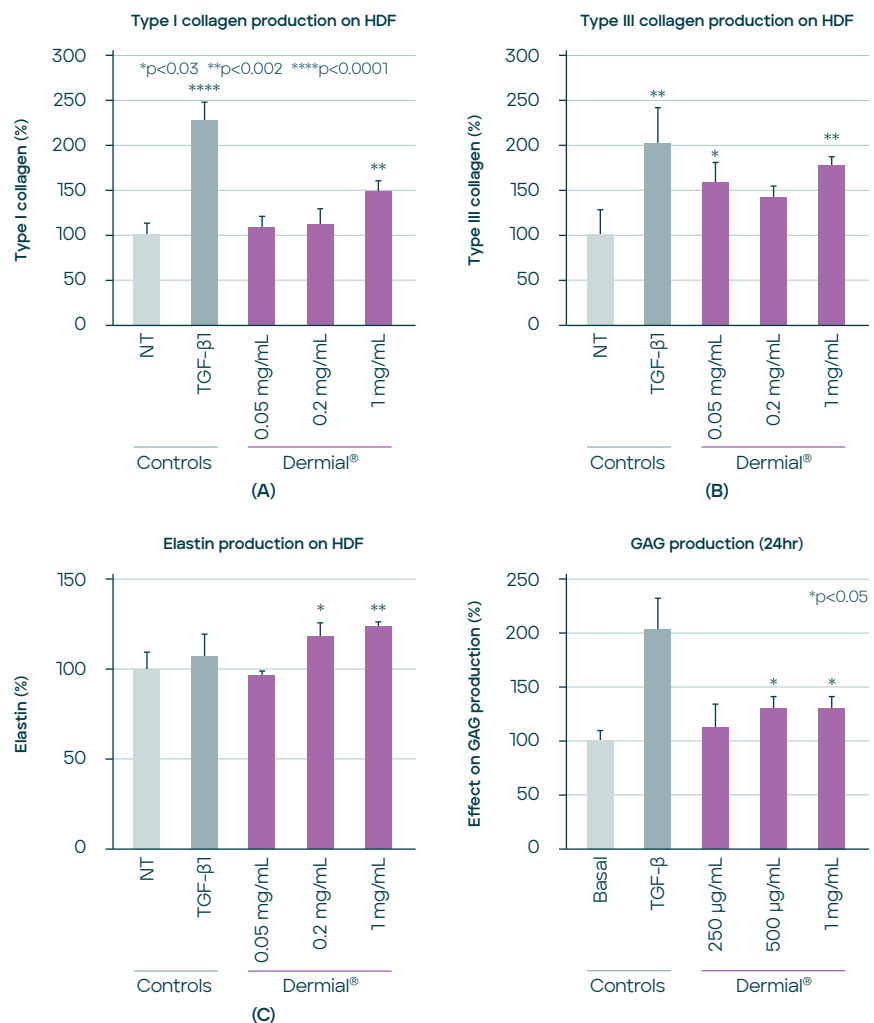
To assess the nourishing, anti-ageing and antioxidant properties of Dermial®.

### Methods

The HA matrix (Dermial®) was isolated and purified from rooster comb and characterised physiochemically and molecularly. The molecule's regenerative, anti-ageing and antioxidant potential was assessed in two dermis skin cells – Human Dermal Fibroblasts (HDF) and in Human Epidermal Keratinocytes (HEK).

## Results

The study demonstrated that Dermial® is composed of 67% HA, with an average molecular weight of 1.3 MDa; 12% sulphated glycosaminoglycans (including dermatan sulphate and chondroitin sulphate); 17% protein (including collagen at 10.4%); and water. The *in vitro* studies performed in HDF and HEK cells showed that Dermial® induced cell proliferation and migration, increased the synthesis of collagen I and III, elastin and glycosaminoglycans (GAGs), and had an effect against oxidative stress. These cellular and molecular mechanisms, which are typically altered in ageing skin, suggest that Dermial® exhibits nourishing, anti-ageing and antioxidant properties. This demonstrates that the ingredient could have the potential to improve the hydration, elasticity, firmness and dermal density of skin.



**Figure 6:** Dermial® stimulation of extracellular matrix protein (collagen and elastin) production in HDF. Mean percentage production of (A) type I collagen, (B) type III collagen and (C) elastin versus non-treated cells (NT).

## Conclusion:

**Dermial® may have several potential benefits for skin health by stimulating skin cell migration and proliferation, inducing the synthesis of collagen, elastin and GAGs, and supporting against oxidative stress.**

### 3. In vitro: Efficacy of Dermial® compared to pure HA<sup>9</sup>

#### Objective

Determine the comparative *in vitro* effects of Dermial® versus pure HA from extraction (HA-E) and fermentation origins (HA-F).

#### Methods

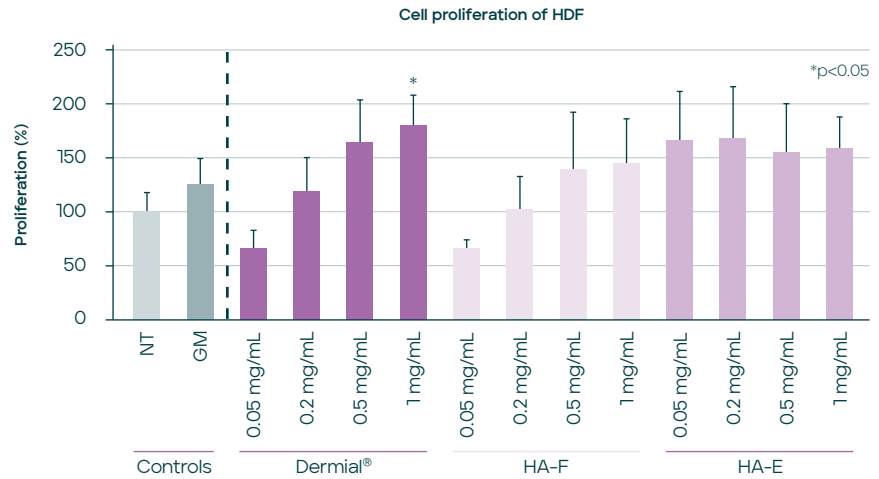
The effectiveness of the HA ingredients in promoting cell proliferation was evaluated in Human Dermal Fibroblasts (HDF) and in Human Epidermal Keratinocytes (HEK) using the method bromodeoxyuridine (BrdU) incorporation, detected via the Enzyme-Linked Immunosorbent Assay (ELISA). Effect of the HA ingredients on cell migration was assessed in HDF and in HEK using the Oris™ Cell Migration Assay. Inductive capacity on extracellular matrix (ECM) protein synthesis was evaluated using ELISA.

## Results

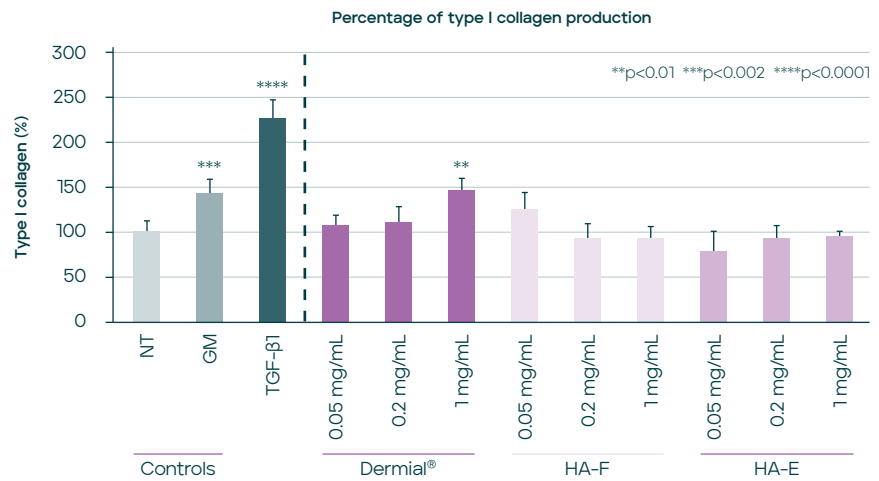
The rate of cell proliferation was significantly higher in HDF treated with Dermial® versus untreated HDF. A dose-dependent response was observed in the Dermial® group, reaching a proliferation rate of 1.81 ( $\pm$  27) times at the highest concentration tested (1 mg/mL) in comparison to HA-E and HA-F treated HDF. Dermial® also demonstrated significant capacity to induce HEK cell proliferation, increasing HEK proliferation at a rate of 85–95% at Dermial® concentrations of 25 and 50  $\mu$ g/mL. HA-E and HA-F showed similar effects, with significant increases on HEK cell proliferation (88% increase at 50  $\mu$ g/mL HA-F and 100% at 25  $\mu$ g/mL of HA-E).

Dermial®, HA-E and HA-F also induced migration of HDF, demonstrating significant increases equal to, or greater than, 50%. However, only Dermial® had a significant stimulatory effect on HEK migration, with an increase of 102.77% ( $\pm$  40.86) at 200  $\mu$ g/mL.

In addition, Dermial® had a significant effect on the production of type I collagen, increasing production by 48.04% ( $\pm$  11.49%) at a concentration of 1 mg/mL. Dermial® and HA-F had a substantial effect on the production of type III collagen (with increases of 77% following 1mg/mL Dermial® and 89–118% at 50  $\mu$ g/mL and 1 mg/mL HA-F). All HA ingredients significantly increased the production of elastin (between 17–38%). Only Dermial® demonstrated a considerable effect on the production of the three proteins tested.



**Figure 7:** Cell proliferation of HDF at 24h, including non-treated HDF (NT) and HDF treated with Dermal®, HA-E or HA-F.



**Figure 8:** Percentage of type I collagen production after 72h following HDF treatment with Dermal®, HA-E or HA-F.

## Conclusion:

Dermial® demonstrated superior effects compared to pure HA (either from extraction or fermentation origin) on HDF cell proliferation, HEK cell migration and in the stimulation of type I collagen production. This suggests that it may bring enhanced nourishing properties to the dermis and epidermis of the skin, as well as helping to stimulate the synthesis of ECM proteins, thereby supporting the maintenance and functionality of the dermis.

## 4. In vitro: Intestinal absorption of Dermial®<sup>8,11</sup>

### Objective

To determine the intestinal absorption of Dermial® using an everted gut sac model.

### Methods

Male OFA-strain rats weighing approximately 200 g were used. Three parts of the intestine were studied. The duodenum: first part of the small intestine, located between the stomach and the jejunum. Food is combined with stomach acids and then enters the duodenum, where it is mixed with bile and digestive juices from the pancreas. The jejunum: a portion of the intestine that extends from the duodenum to the ileum to form the small intestine (although there is no morphological line of distinction between the jejunum and the ileum). The ileum: the last part of the small intestine, located between the jejunum and the large intestine.

The amount of absorbed Dermial® was analysed following the technique described by Farndale et al. (1982) for glycosaminoglycan determination. This technique is based on measuring the absorbance of a glycosaminoglycan and dye complex at 535 Nm.

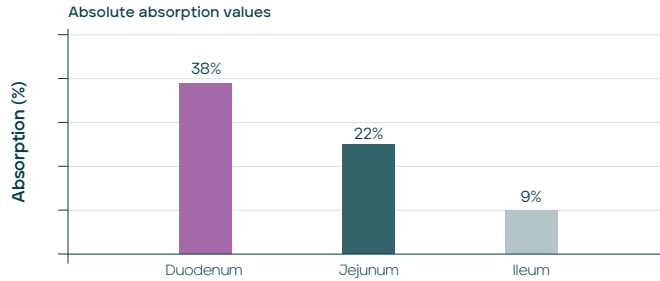
Importantly, the absorption-assay model measured intestinal absorption under conditions that are more similar to human physiological conditions, and therefore closer to real conditions than in vitro cell models.

Torrent A et al. Anti-inflammatory activity and absorption of a natural rooster comb extract. *Osteoarthritis and Cartilage*, 2010, vol. 78, pg. S266-S267.

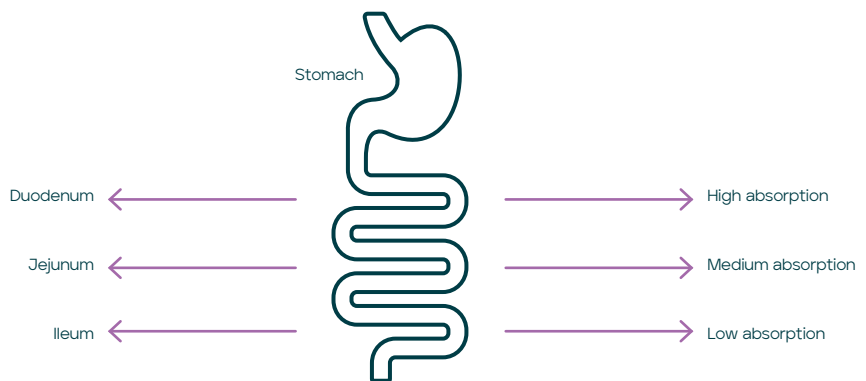
Galvez-Martin P et al. A novel hyaluronic acid matrix ingredient with regenerative, anti-ageing and antioxidant capacity. *Int J Mol Sci.*, 2023, vol. 24, pg. 4774.

## Results

Absolute absorption values were obtained for each portion of intestine. Dermial® was absorbed in the intestine – mainly in the duodenum, where the highest percentage of absorption was observed. The jejunum and ileum also showed absorption activity.



**Figure 9:** Absolute absorption values. NB: These absolute values are approximate and should not be understood to be exact due to the variability of the method.



**Figure 10:** Levels of absorption throughout the intestine.

## Conclusion:

The study confirmed that Dermial® is absorbed through the intestinal mucous membrane, with the highest levels of absorption occurring in the duodenum.



## 5. In vitro: Anti-inflammatory effects of Dermial®<sup>8</sup>

### Objective

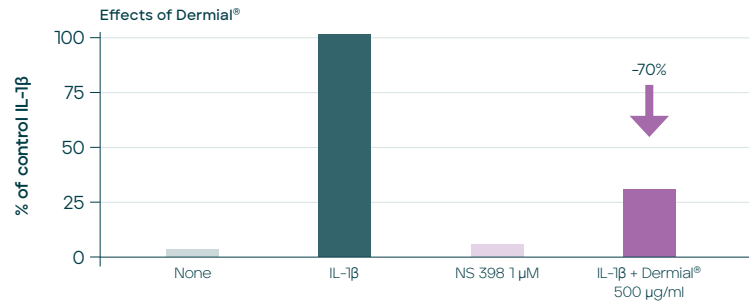
To study the effects of Dermial® on the synthesis of cell-catabolism mediators – prostaglandin E2 (PGE2) and metalloproteinase 1 (MMP-1) – in cases of inflammation (Interleukin-1 $\beta$ , IL-1 $\beta$ ).

### Methods

The effect on inflammation was determined by using HDF stimulated with IL-1 $\beta$  and co-treated with three concentrations of Dermial® (5, 50 and 500  $\mu$ g/ml). Levels of Prostaglandin E2 (PGE2) and metalloprotease-1 (MMP-1) were determined by automated enzyme immunoassay (EIA). The compound NS 398 at 1  $\mu$ M was used as a positive control of cyclooxygenase-2 (Cox-2) inhibition in this assay.

## Results

The study showed that Dermial® significantly reduced PGE2 levels in fibroblast cells cultured under conditions similar to those of inflammation. Furthermore, it showed a tendency to lower MMP-1 levels.



**Figure 11:** Effects of Dermial® on PGE2 synthesis in inflammation-induced human dermal fibroblasts (IL-1β).

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## Conclusion:

**These results indicate that Dermial® may have anti-inflammatory effects.**

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Bioiberica is a global life science company with more than 45 years' experience in the research, production and commercialisation of molecules of high biological and therapeutic value for the pharmaceutical, nutraceutical and food industries. With a portfolio of scientifically-backed ingredients inspired by the latest consumer trends, Bioiberica Human Health serves the mobility, digestive health and skin & beauty markets.

**Dermial®**  
Hyaluronic acid matrix ingredient

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with Bioiberica's science-backed Dermial®  
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