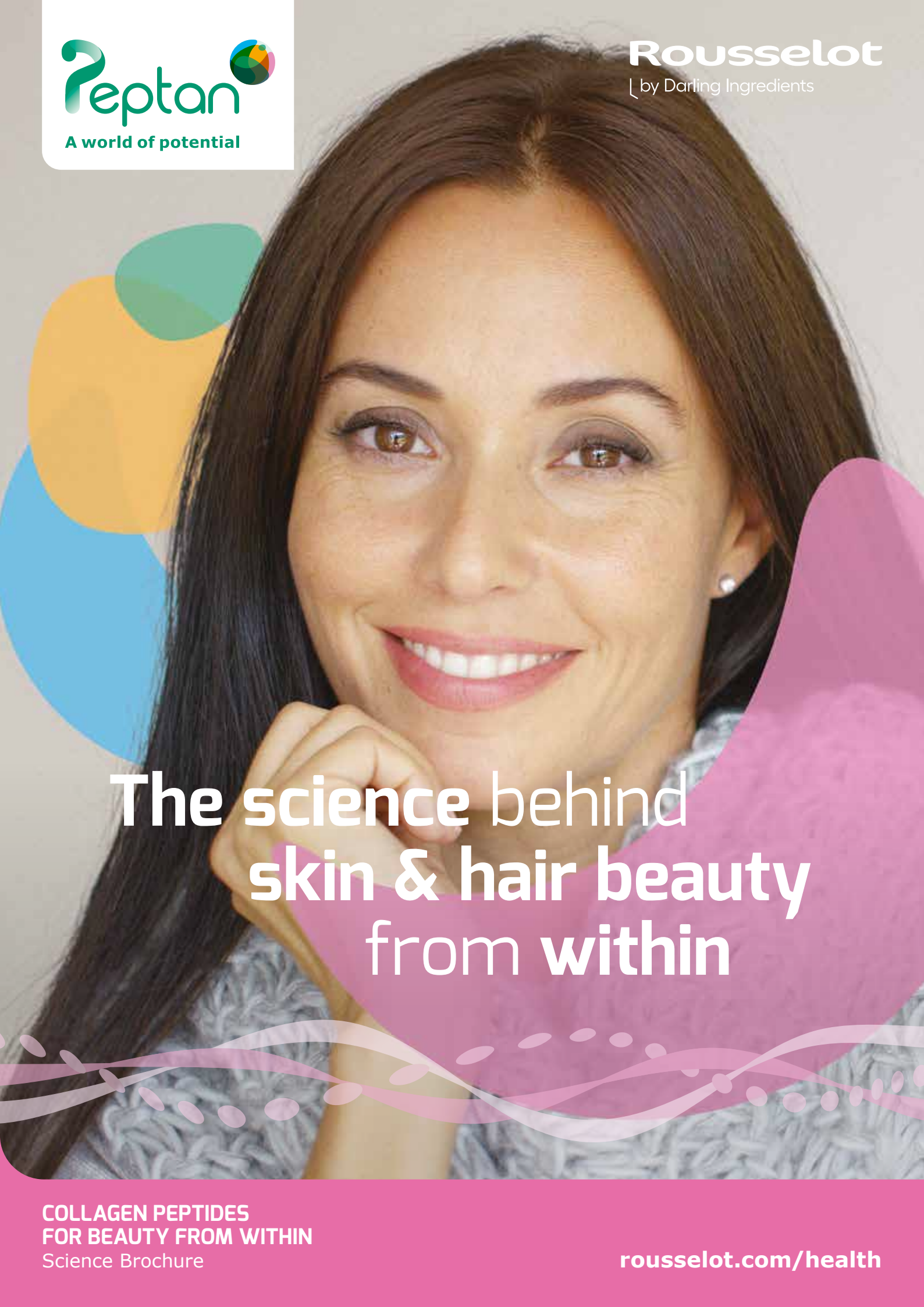




The science behind skin & hair beauty from within

A close-up photograph of two women smiling and embracing. The woman on the left is younger with dark hair, wearing a light pink top. The woman on the right is older with brown hair, wearing a grey top and a gold ring. They are both looking towards the camera with warm expressions.

Underpinned by
robust, innovative
research, Peptan®
bioactive collagen peptides
are an ingredient truly
backed by science.

THE SCIENCE BEHIND SKIN & HAIR BEAUTY BROUGHT TO YOU by Peptan COLLAGEN PEPTIDES

There has always been a link between beauty and health: beautiful skin quickly tells people around us that we're in good health - and, in fact, looking good can make us feel better physically and mentally. Healthy-looking skin, in short, is associated with attractiveness and confidence. This holistic well-being is one of Peptan's key pillars: we are here to help consumers look their best.

Collagen and beauty

Collagen, the body's most abundant protein, is crucial for our skin. It's responsible for its strength and flexibility (Box 1: Skin structure). Collagen also supports hair and nails, the skin's main appendages, even though they are not made of collagen.

Around our mid-twenties, collagen production in our skin diminishes, leading to well-known signs of aging: wrinkles, dry skin, and loss of elasticity [1]. And hair becomes thinner and weaker, which eventually can lead to hair loss [2].

What the science tells us

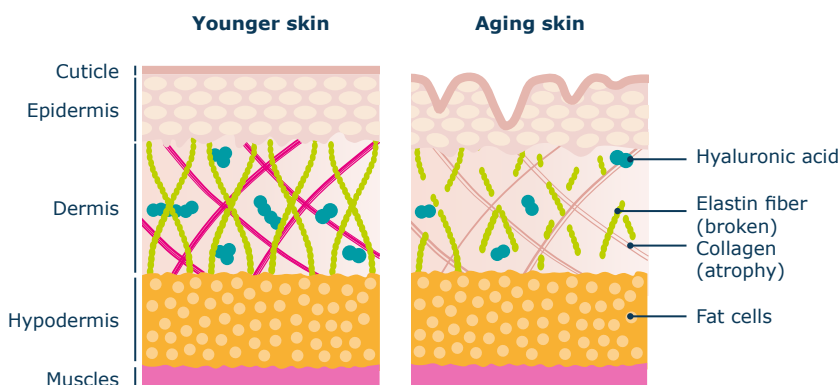
Rousselot's scientific research has shown that collagen peptides can delay the signs of aging and improve the appearance of skin and hair. More than 10 years of Rousselot studies demonstrate that oral intake of Peptan collagen peptides can help us achieve firmer skin and healthier looking hair.

The future of beauty

Our scientific portfolio is constantly growing with new findings, as we use the latest technologies to better understand collagen's role in promoting beauty from within.

Discover the latest insights into Peptan and beauty from within! (Box 2: Peptan science for Skin and Hair Beauty)

Skin structure as we age



As aging takes place, collagen's endogenous production decreases, causing thinner, drier and less elastic skin leading to wrinkles.

Daily oral collagen peptide supplementation can play a key role in delaying and diminishing the signs of aging.

Box 1: Skin structure

Summary of Referenced Studies

This table summarizes the collagen and beauty studies referenced in this document.

Topic	Author	Study type	Population	Country/Ethnicity	Dosage
Skin density	Asserin <i>et al.</i>	Randomized, placebo-controlled, double blind	99 women (40-65 years old)	France (Caucasian)	10g
Skin hydration	Asserin <i>et al.</i>	Randomized, placebo-controlled, double blind	33 women (40-59 years old)	Japan (Japanese)	10g
Skin density, skin elasticity, skin hydration and wrinkle reduction	Vleminckx <i>et al.</i>	Randomized, placebo-controlled, double blind	85 women (40-65 years old)	China (Chinese)	5 g
Skin elasticity and skin hydration	Kuninty* <i>et al.</i>	Randomized, placebo-controlled, double blind	40 women (35-48 years old)	Germany (Caucasian)	2.5g/5g/10g
Hair growth/loss	Pappelbaum <i>et al.</i>	<i>ex-vivo</i>	6 hair follicles of both men and women	Germany (Caucasian)	n/a

Box 2: Peptan science for Skin and Hair Beauty

* Rousselot clinical data

Peptan and the science behind skin beauty

Skin density

Our placebo-controlled studies have shown that **Peptan can increase skin firmness by improving skin density.**

The Asserin *et al.* scientific study on 99 Caucasian women (age 40-65) [3] has shown that ingestion of 10 g of Peptan F for 12 weeks significantly increased skin density compared to placebo (Figure 1a). Similar positive results were observed in the Vleminckx *et al.* study with 85 Chinese women (age 40-65) [4], where a significant improvement of skin density was observed after taking 5 g of Peptan P for 12 weeks (Figure 1b), compared to the placebo group.

+8%

Improvement in skin density

(on average, Peptan vs Placebo)^{3,4}

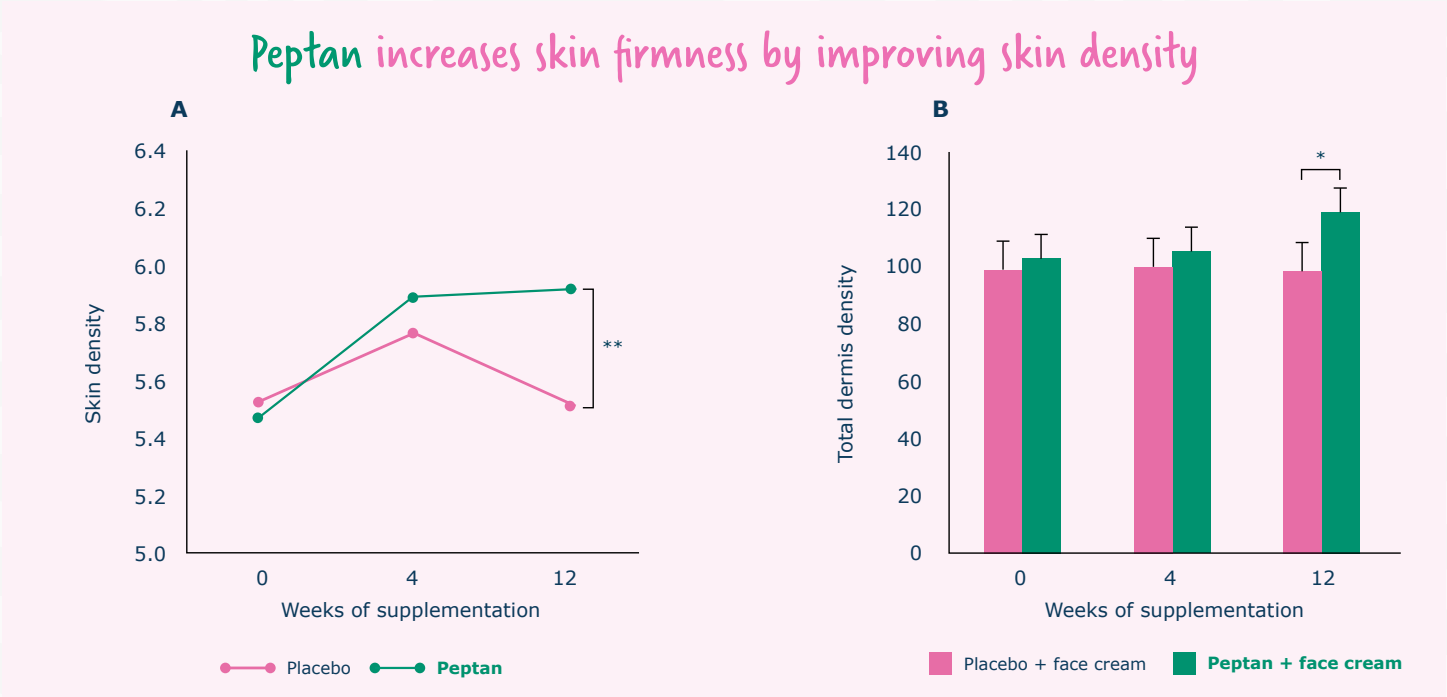


Figure 1. Effect of 12 weeks of Peptan supplementation on skin density. (A) 10 g Peptan F in Caucasian women using high frequency, real-time ultrasound; (B) 5 g Peptan P in East Asian women, measured by ultrasound scanning and subsequently quantified on a gray-scale (0-255).
* $p < 0,05$; ** $p < 0,01$ compared to placebo

Skin elasticity

Skin elasticity is vital for a healthy appearance, since the **loss of elasticity leads to sagging and wrinkling of the skin** [3]. In our studies, **Peptan positively impacted skin elasticity**. In the Vleminckx *et al.* study [4], an expert in dermatology assessed skin elasticity with clinical scoring (0-9) based on visual and tactile assessment (Figure 2a). The results demonstrate that after four weeks of oral supplementation of 5 g Peptan P, the skin elasticity of the participants significantly improved by 7% compared to placebo. This beneficial influence on skin elasticity was confirmed in the Kuninty *et al.* study in 40 Caucasian women (age 35-48) using gold standard elasticity-measuring technology after 12 weeks of supplementation with different Peptan F dosages [5]. Positive effects could already be observed with 2.5 g Peptan within 12 weeks. Oral intake of 5 to 10 g of Peptan F significantly elevated skin elasticity compared to placebo within 12 weeks (Figure 2b).

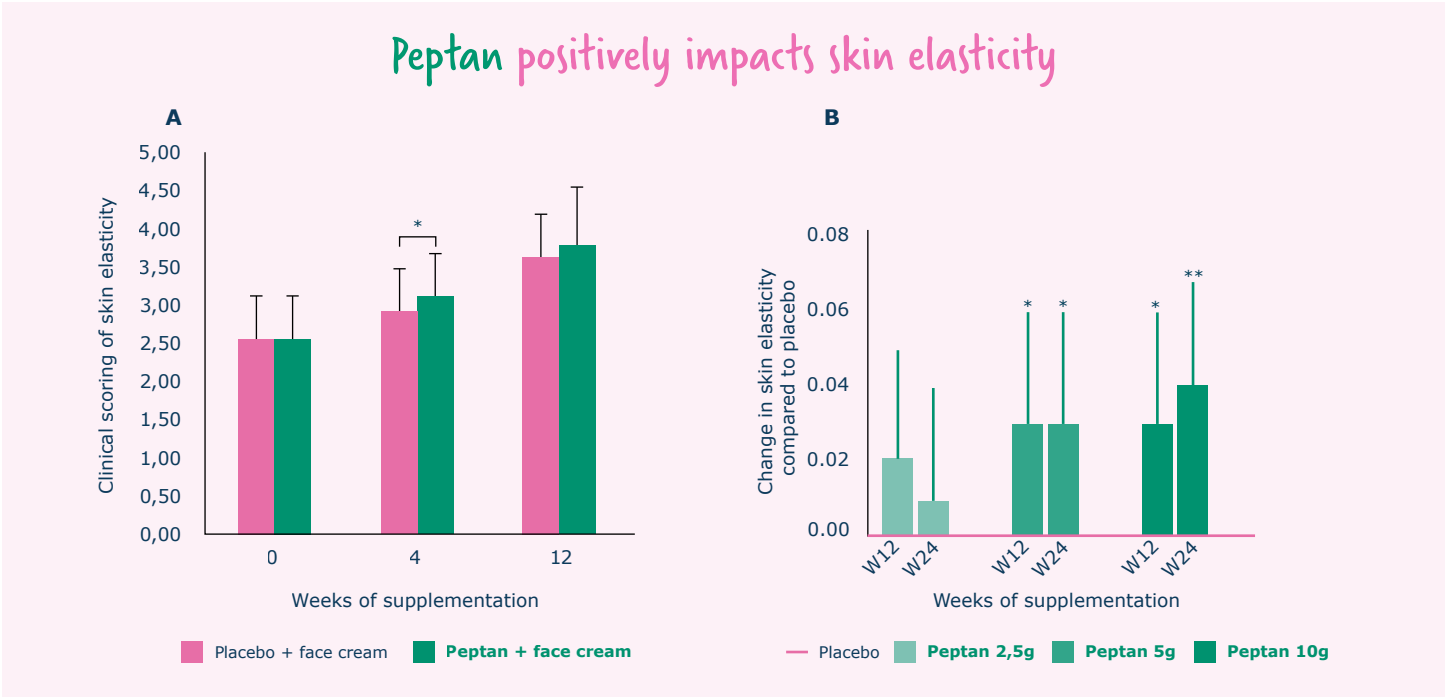


Figure 2. : (A) Clinical scoring of skin elasticity after four weeks of oral supplementation of 5 g Peptan P in East Asian women. (B) Changes in skin elasticity (mean and 95% CI) in Caucasian women under 48 years old, compared to placebo (pink line at Δ = 0) after 12 and 24 weeks of oral supplementation with Peptan F at different dosages. * $p < 0.05$, ** $p < 0.01$ compared to placebo at a given time point.

Skin hydration

For a natural glow, our skin needs enough hydration. Peptan has been observed to improve skin hydration levels. The study conducted by Asserin *et al.* [3] showed that a daily dose of 10 g Peptan P significantly improved skin hydration in 33 healthy Japanese women within 8 weeks compared to a placebo (Figure 3a). Additionally, supplementation with either Peptan P or Peptan F showed significantly enhanced skin hydration levels after 8 weeks when compared to baseline.

The Vleminckx *et al.* study performed on 85 Chinese women (age 40-65) shows that daily supplementation with only half the dose (5 g) of Peptan P was sufficient to increase skin hydration (Figure 3b; [4]). This study demonstrates a significant difference between the Peptan and placebo group after 12 weeks. Notably, the participants also used a face cream during the study period to standardize their facial care, highlighting the efficacy of Peptan in combination with routine

facial care and making these results valuable as they mimic real-life beauty routines.

The positive effects of Peptan supplementation on skin hydration were once again confirmed in the Kuninty *et al.* study [5]. The study showed that after 24 weeks, beneficial effects could be observed for lower dosages (2.5-5g) (Figure 3c), while in the placebo group skin hydration decreased over time. Taking 10 g of Peptan F significantly improved skin hydration already within 12 weeks compared to placebo.

+14%
enhanced
skin hydration
(Peptan vs Placebo)^{3,4}

Peptan improves skin hydration levels

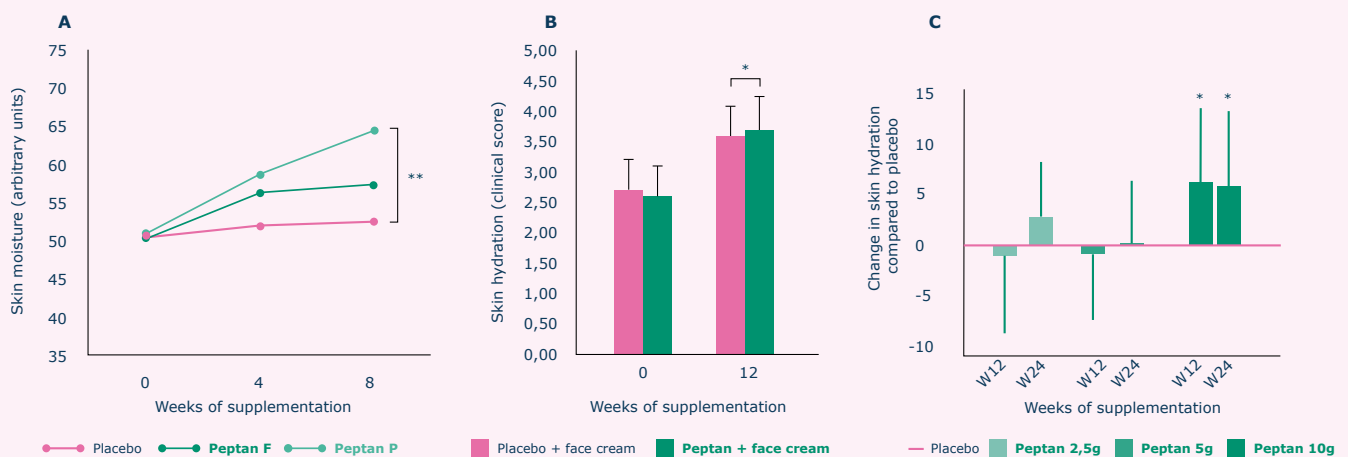


Figure 3. : Assessment of skin hydration (A) by conductivity in a Japanese population after supplementation with Peptan P or Peptan F; (B) clinical scoring by a dermatology expert in 40-65 years old East Asian women after supplementation with Peptan P. (C) Changes in skin hydration (mean and 95% CI) in women under 48 years old, compared to placebo (pink line at $\Delta = 0$) with Peptan F at different dosage. * $p < 0,05$; ** $p < 0,01$ denotes significant differences between Peptan and placebo group at a given time point.

Wrinkle reduction

We call them 'laugh lines', but many of us do not welcome those wrinkles around the eyes or mouth that are one of the most common physical signs of aging. Our research has revealed that Peptan can reduce wrinkle visibility in women [4].

In the placebo group, this significant effect was only observed after 12 weeks possibly due to properties of the face cream. This study shows that Peptan will

work faster against wrinkles than using a face cream alone.

Finally, adding to these findings and considering as shown above that Peptan can help improving skin hydration, density, and elasticity, it is concluded that overall wrinkle appearance can be diminished by Peptan supplementation.

Peptan reduces wrinkle visibility

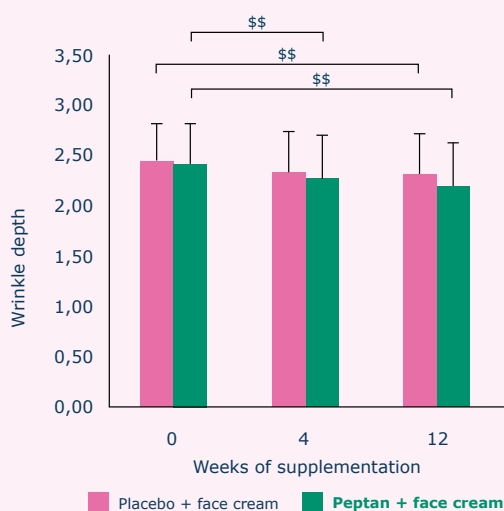


Figure 4. : Influence of Peptan on the appearance of wrinkles: a) depth of crow's feet wrinkles in East Asian women after supplementation with Peptan P. \$\$ $p < 0.05$ compared to baseline (Week 0)

Faster and
more visible
wrinkle reduction
effect

(Peptan vs face cream)⁴

Dosage & origin: which is the best choice?

Together, the studies mentioned above illustrate that Peptan can positively impact skin beauty and wrinkle visibility. Beneficial effects were obtained after supplementation with different dosages [5], but it's worth noting that the desired result might be reached faster with a higher daily dose. The demonstrated effects were observed independently of the Peptan raw material used and across populations with diverging ethnicities.



Peptan and the science behind hair beauty

We all know how our hair can influence our mood. A good hair day means looking and feeling good. But many people do not know that diminishing hair health does not just come with aging. Stress, hormones and even seasonal shifts can affect our hair and, consequently, cause hair loss. Hair care is essential for everyone.

Zooming in on hair

First, we need to take a closer look at our hair (Figure 5). Aside from the visible part on your scalp, hair also contains a second structure, called the hair follicle, located inside the skin. This hair follicle is a living mini-organ, containing hair follicle stem cells (HFSCs) responsible for the growth and structure of our hair. The presence of these HFSCs ensures that our hair keeps growing and renewing through the regulation of the hair cycle [6]. Disturbances in the growth cycle of these hair cells result in (age-induced) hair loss. If we want to keep our hair, we need to keep our stem cells alive.

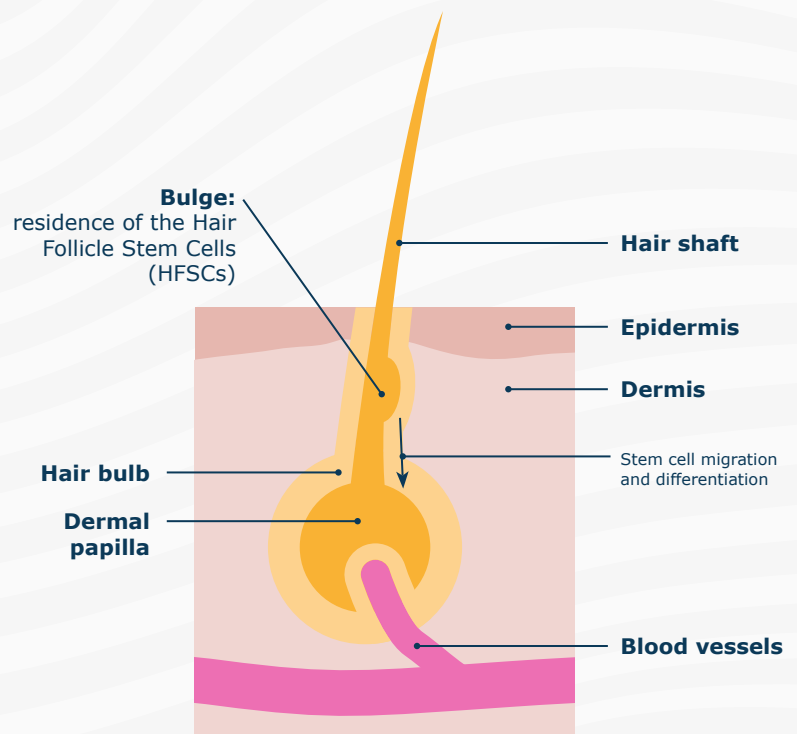


Figure 5. Schematic representation of a hair follicle.



Every day
can be a good
hair day!



**All Peptan studies
for Beauty have
been conducted in
compliance with
regulation (EC)
N1223/2009 with no
tests on animals**

**Glowing
skin & hair
start from
within!**

Growing beautiful hair from within

As hair follicles are situated in the skin, nurturing healthy hair starts from within. One promising solution is Peptan. The pioneering, *ex vivo* Pappelbaum *et al.* study on hair follicles, harvested from 6 people (men and women, age 27-59), revealed that *in vitro* digested Peptan B (mimicking the body's digestive process) increases the amount

of active stem cells (HFSCs) in the hair follicle (Figure 6a) and inhibits their death (Figure 6b) [7]. Since the aging process is linked to a decline of HFSCs, these findings suggest that **Peptan may play a positive role in addressing (age-induced) hair loss** by reinforcing the stem cells and, consequently, sustaining hair follicle health.

Peptan increases the number of hair follicle stem cells while reducing their death

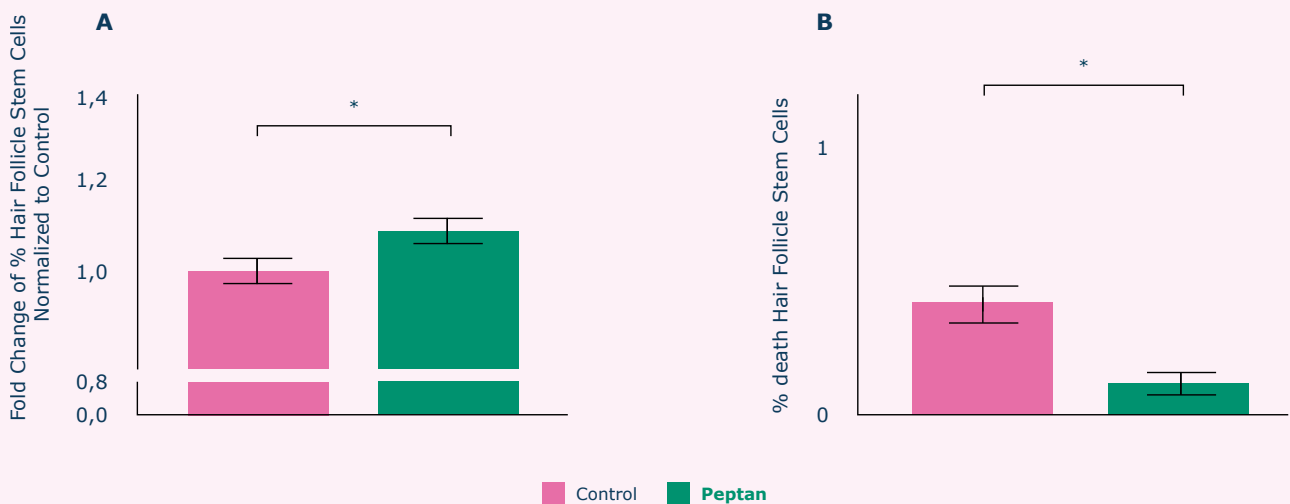


Figure 6. : Effect of Peptan B on A) presence and B) death of hair follicle stem cells: Hair follicles were harvested from 6 human donors and cultured *ex vivo* in the presence or absence of 0.01 mg/ml *in vitro* digested Peptan or blank. * $p < 0.05$.

As hair does not contain collagen, this pioneering study demonstrates that Peptan's benefits may extend beyond the effects of collagen production. It's a clear indication that collagen peptides could support the HFSCs and keep them active and alive. This, in turn, could contribute to effective hair care and beauty.

Peptan
features
pioneering science
in hair beauty
research

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4. Vleminckx *et al.* Influence of collagen peptide supplementation on visible signs of skin and nail health and aging in an East Asian population: A double blind, randomized, placebo controlled trial, 2024 *Journal of Cosmetic Dermatology*, <https://doi.org/10.1111/jocd.16458>
5. Kuninty *et al.* Rousselot clinical data
6. Purba *et al.* Human epithelial hair follicle stem cells and their progeny: current state of knowledge, the widening gap in translational research and future challenges. *Bioessays.* 2014 May;36(5):513-25. Epub 2014 Mar 25. PMID: 24665045. doi: 10.1002/bies.201300166.
7. Pappelbaum *et al.* Revealing novel insights on how oral supplementation with collagen peptides may prevent hair loss: Lessons from the human hair follicle organ culture. *Journal of Functional Foods* 2024, 116, 106124. doi.org:10.1016/j.jff.2024.106124

Complete your product brand story with Peptan.

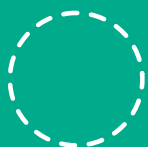
Complete your product brand story with Peptan. Rousselot is a world leader in trusted, science-backed collagen-based solutions. Many of our customers have engaged us in co-developing successful ingredient branding strategies. Selected customers benefit from our endorsement of their products, with access to the Peptan brand name and marketing materials.



Peptan collagen peptides are:

- An upcycled ingredient made from natural resources
- Of natural origin, available from fish, bovine, and porcine origin
- Kosher and Halal certified (on demand)
- Highly bioavailable
- Pure and neutral in sensory
- Backed by science
- World-class, safe products
- Convenient and easy to use
- Clean label, with no additives or e-numbers

Rousselot Health & Nutrition can help you with virtually any product requirement or innovation you have in mind, offering:



Transparency



Full traceability



High standards
of quality and safety

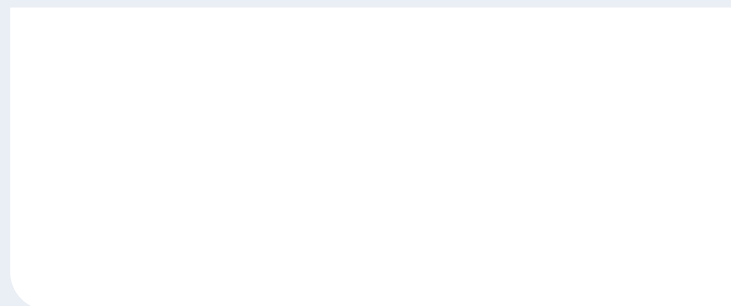


Committed to the
environment and
to our clients



Global support
and expert advice

Your Rousselot sales contact information



About Rousselot Health & Nutrition

At Rousselot's strategic segment dedicated to health and nutrition, we are committed to developing innovative ingredients answering today's demand for solutions offering proven efficacy, full safety, and premium quality. Our customers can rely on best-in-class products backed by trusted science, as well as on our expert support in formulation, product development, and regulatory advice. Our range of products includes Peptan®, the leading collagen peptide brand worldwide, Colartix®, ProTake® and Peptinex™ and offers "A world of potential for the consumer" for a healthier tomorrow.

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The science behind collagen for mobility

PEPTAN® FOR JOINT HEALTH

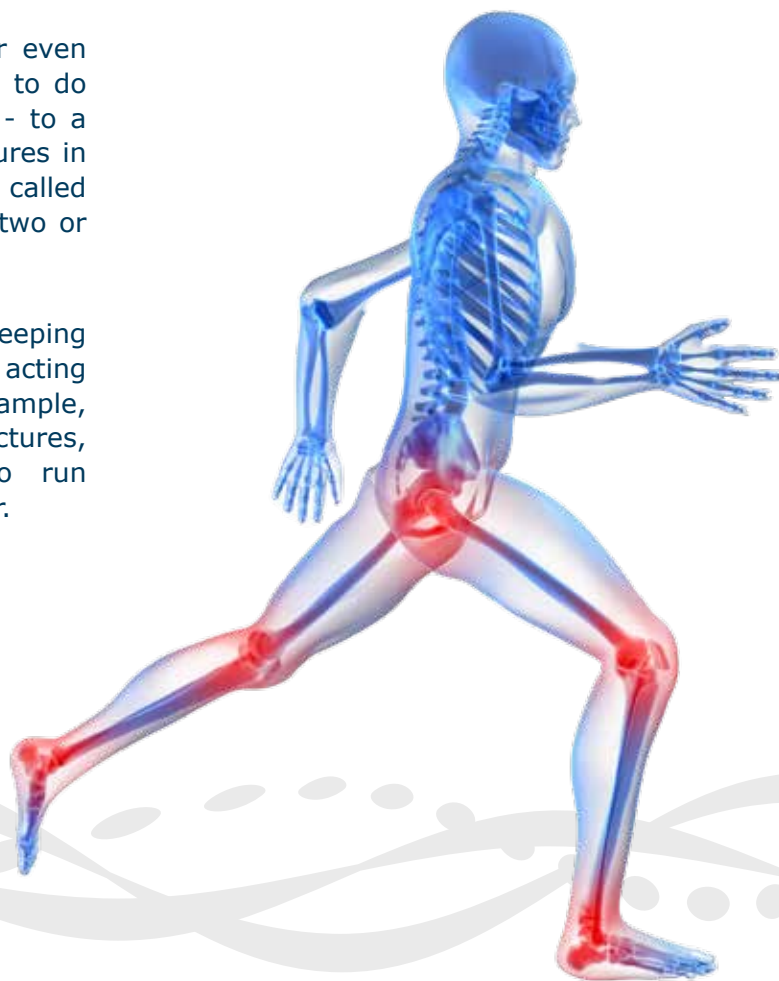


You've got the moves!

Running, cooking, walking the dog, or even reading a book: all the things we love to do require our body to move, bend, and - to a certain extent - be flexible. The structures in our body that make this possible are called joints, which define the area between two or more bones.

Joint cartilage protects our bones by keeping them from scraping against each other, acting as a cushion to minimize impact, for example, when we jump. In between those structures, (synovial) fluids help everything to run smoothly, like oil on a bicycle or in a car.

Peptan



Collagen is a major component of joints; it is responsible for our strength and flexibility. Over time, our body's collagen levels and quality diminish. Why? The balance between synthesis and breakdown of cartilage gets disturbed. This can lead to swelling, pain, stiffness, and bone friction, eventually causing osteoarthritis (OA) or 'wear-and-tear' disease.

TAKING THE LEAP WITH PEPTAN



In one scientific study ^[1], elderly women with mild joint discomfort reported a significant reduction of painful symptoms, like stiffness and pain, after oral intake of Peptan (8g/day) (Fig. 1). These positive effects also improved their mobility and joint function after three months (Fig. 2).

Peptan reduces joint discomfort

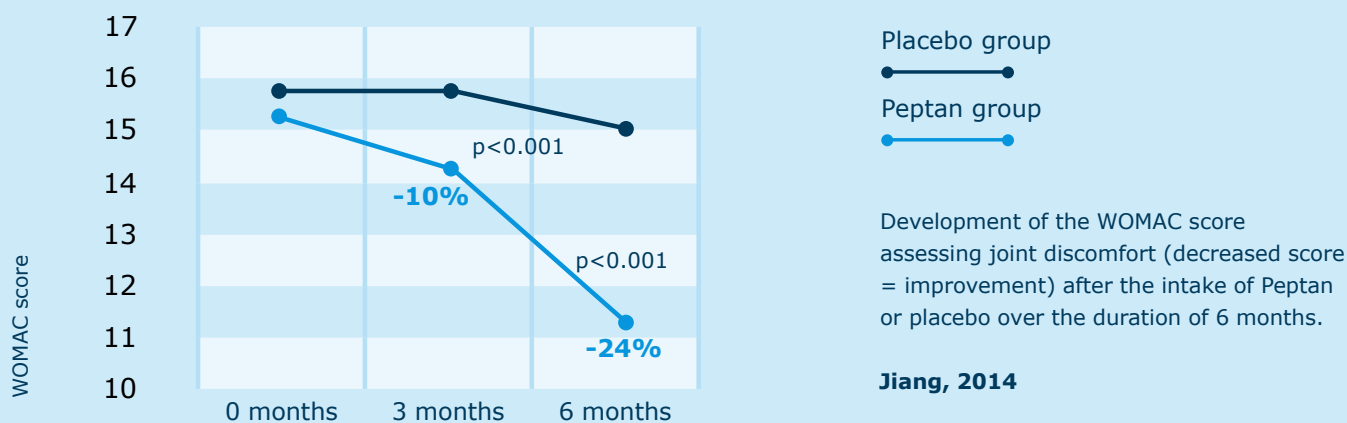


Figure 1: Symptom-relieving effects of Peptan

Peptan improves joint function

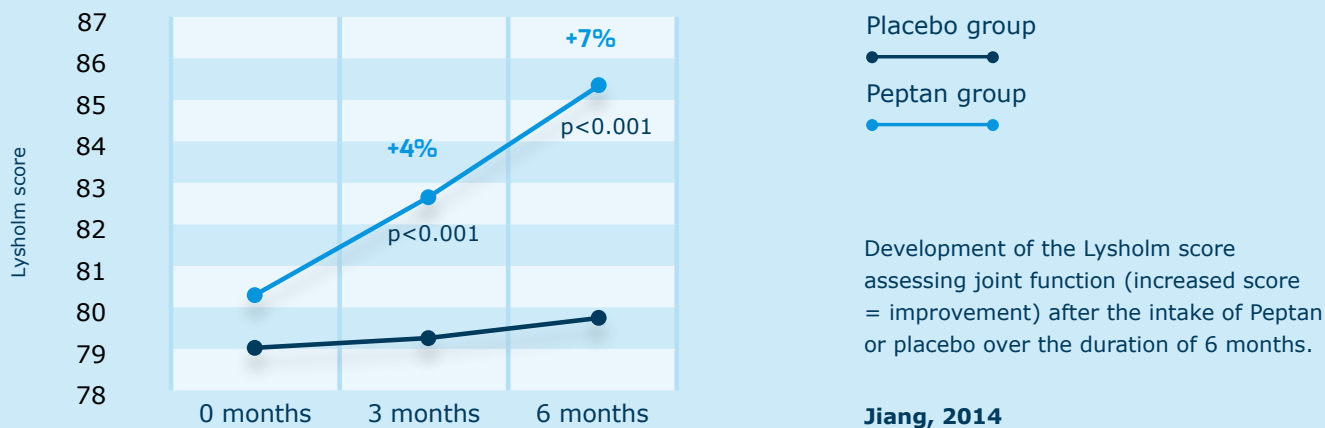


Figure 2: Peptan improves joint functionality

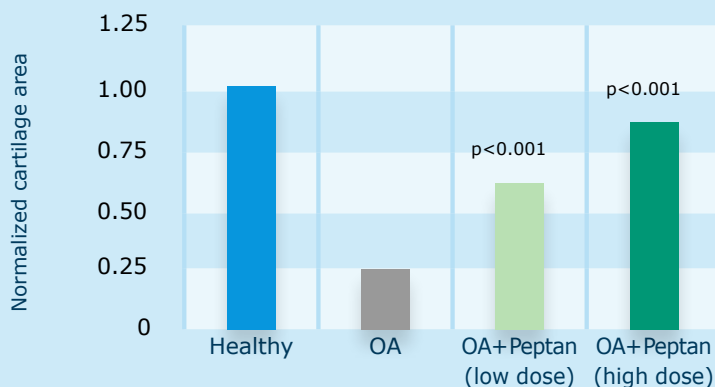
MAINTAINING CARTILAGE, STAYING ACTIVE



Our in vivo study ^[2] demonstrated that daily intake of Peptan before cartilage damage resulted in cartilage preservation (Fig. 3) and reduced inflammation (Fig. 4) in mice. In the study, the mice that were given Peptan before cartilage damage (green bar), had a higher cartilage area and lower levels of inflammation than the mice that did not take Peptan before cartilage damage (grey bar).

These results indicate that oral consumption of Peptan could have a positive effect on maintaining healthy cartilage.

Peptan prevents cartilage degradation

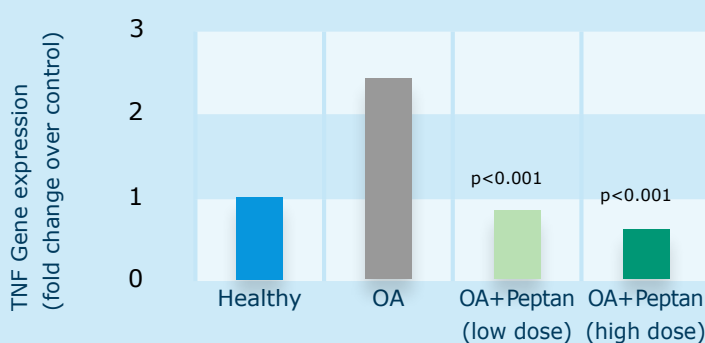


Osteoarthritis (OA) was induced by surgery in mice that received Peptan at two different dosages or a control twelve weeks after OA induction. Histology of the knee joints was performed and the area of the (tibia) cartilage was quantified and compared with healthy animals.

Dar et al., 2017

Figure 3: Oral intake of Peptan before joint damage preserves cartilage in mice

Peptan improves joint inflammation



Three weeks after OA induction the joint synovium was analyzed for the gene expression of inflammatory markers (TNF).

Dar et al., 2017

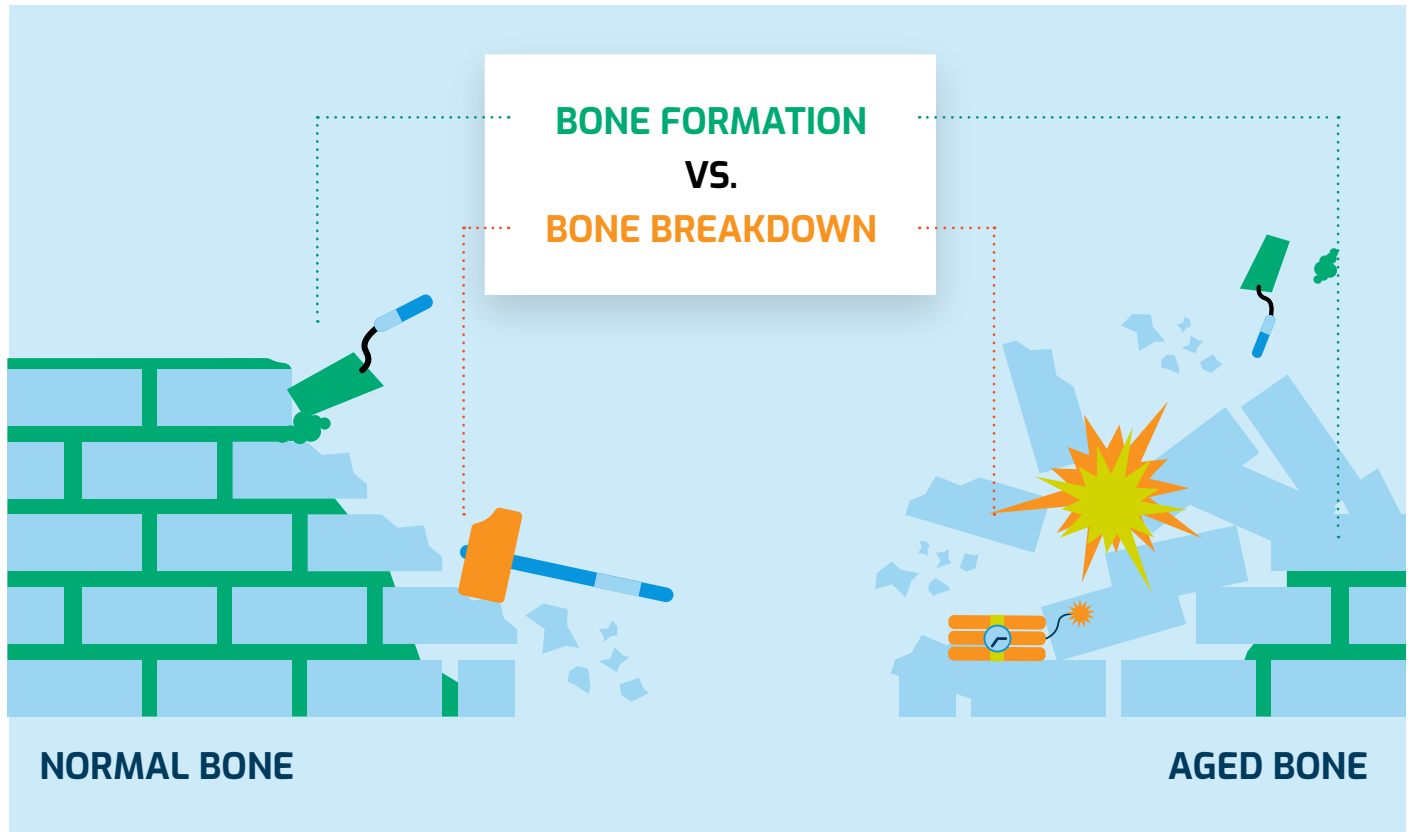
Figure 4: Peptan reduces inflammation in mice

PEPTAN FOR BONE SUPPORT



Bones, a balancing act

Whether we are 25 or 75, mobility is an important part of our lives. Looking after our bones is a vital part of this. Bones give our body the structure and strength we need to keep it moving ^[3]. Many people forget that bones are living tissues that are constantly renewed in carefully balanced processes of synthesis and breakdown, as shown in the image below:



Over time, the balance of our bone metabolism gets disturbed, and bone loss starts to take the upper hand. The amount and quality of collagen diminishes, which can lead to osteoporosis (OP).

OP causes bones to become weak and brittle, leading to discomfort and an increased risk of fracture. One of the main causes of OP is menopause, which explains why more women than men are affected by the disease.

Taking care of our body and bones is vital to staying active, healthy, and mobile as we age.

Peptan for bone support



Our scientific study with Peptan in a mouse model of post-menopausal osteoporosis showed that Peptan collagen peptides can protect against the mobility discomfort caused by collagen deterioration. For the mice in this study, Peptan reduced bone loss (Figure 1) and increased bone density (Figure 2) ^[4,5].

Most surprisingly, oral intake of Peptan, either before or after post-menopausal osteoporosis, resulted in bone breakdown levels similar to non-menopausal mice (healthy).

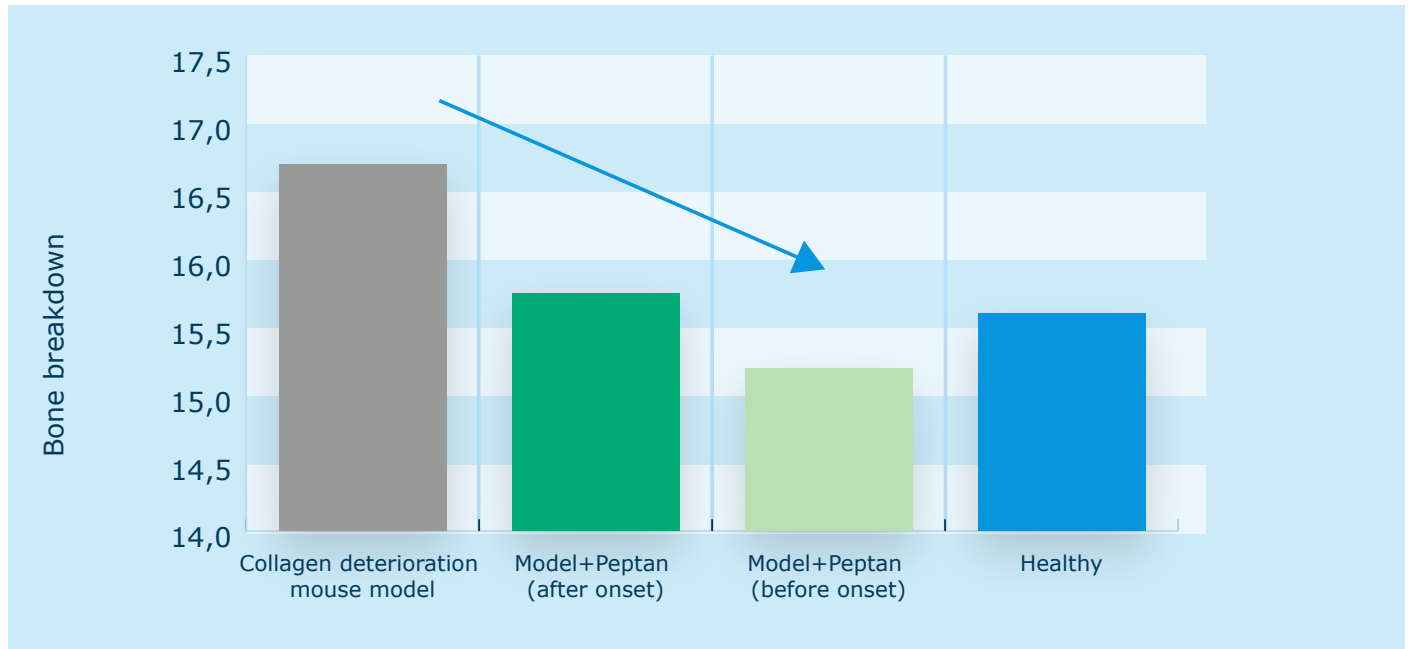


Figure 1: Influence of Peptan on bone breakdown in a post menopausal osteoporosis mouse model

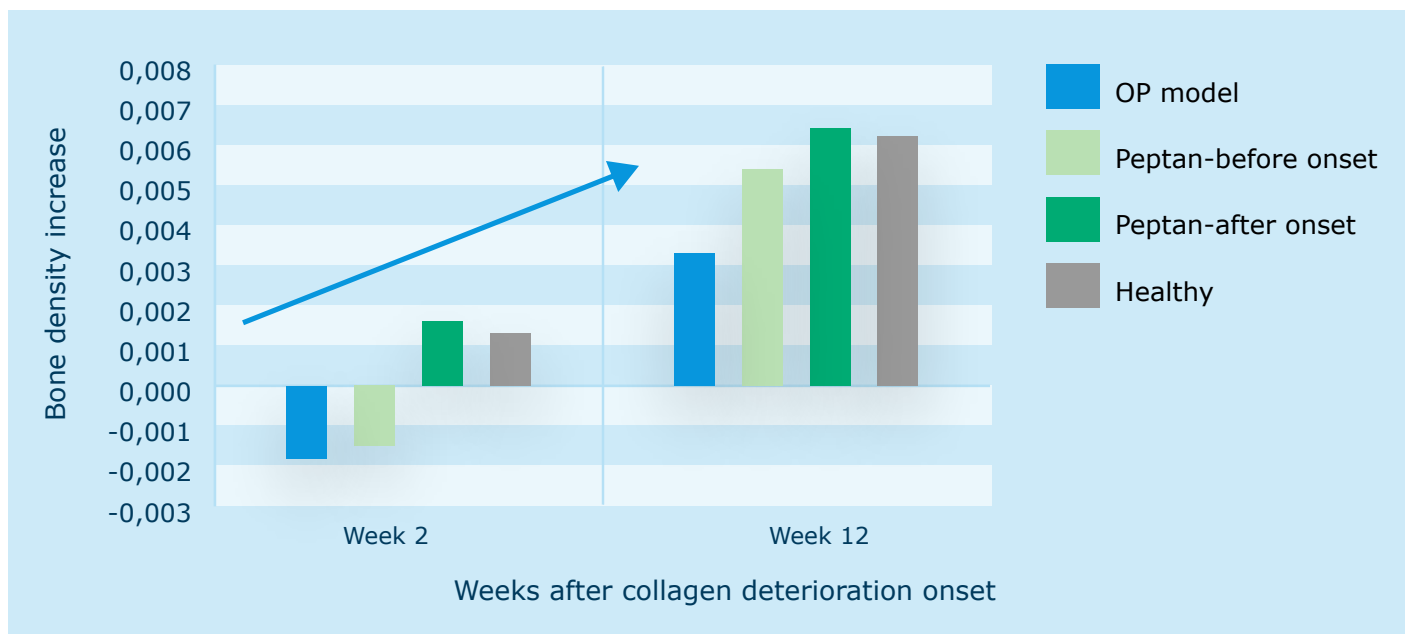


Figure 2: Influence of Peptan on bone density in a post menopausal osteoporosis mouse model

4. Guillerminet, F. et al., 2010, Hydrolyzed collagen improves bone metabolism and biomechanical parameters in ovariectomized mice: An in vitro and in vivo study. *Bone*, 46: 827-834

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Peptan stimulates the formation of bone



An in vitro study shows that Peptan collagen peptides have the potential to stimulate bone health (the balance between cell formation and breakdown) in mice even after digestion and absorption by the body ^[6].

These experiments used blood drawn from mice before and after ingesting Peptan to demonstrate that the digested and absorbed collagen peptides can stimulate the generation and growth of cells responsible for bone synthesis (osteoblasts, Fig. 3a), while simultaneously inhibiting the formation of cells that break down bones (osteoclasts, Fig. 3b).

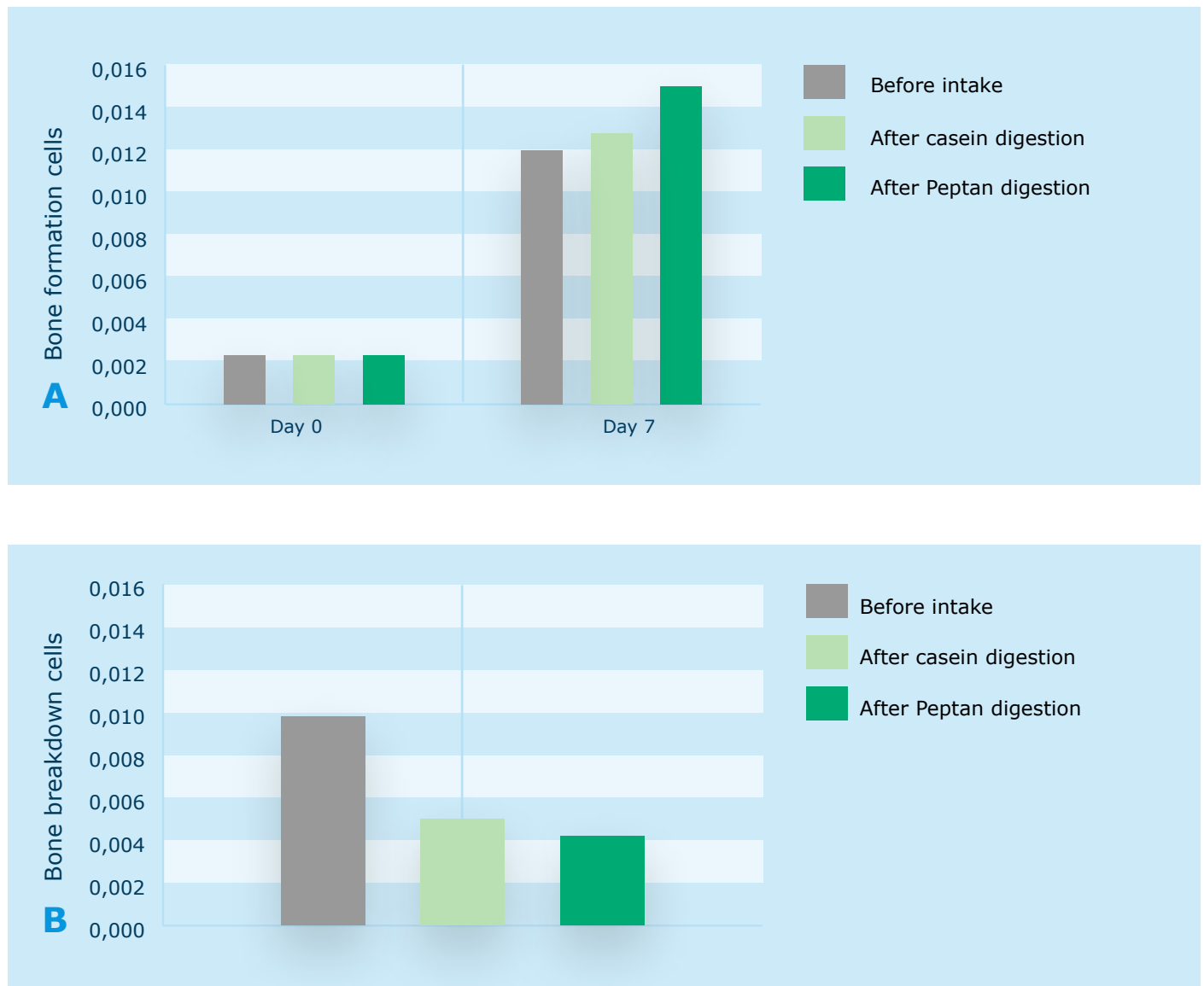


Figure 3: Influence of digested Peptan on the growth of bone metabolism cells in vitro.

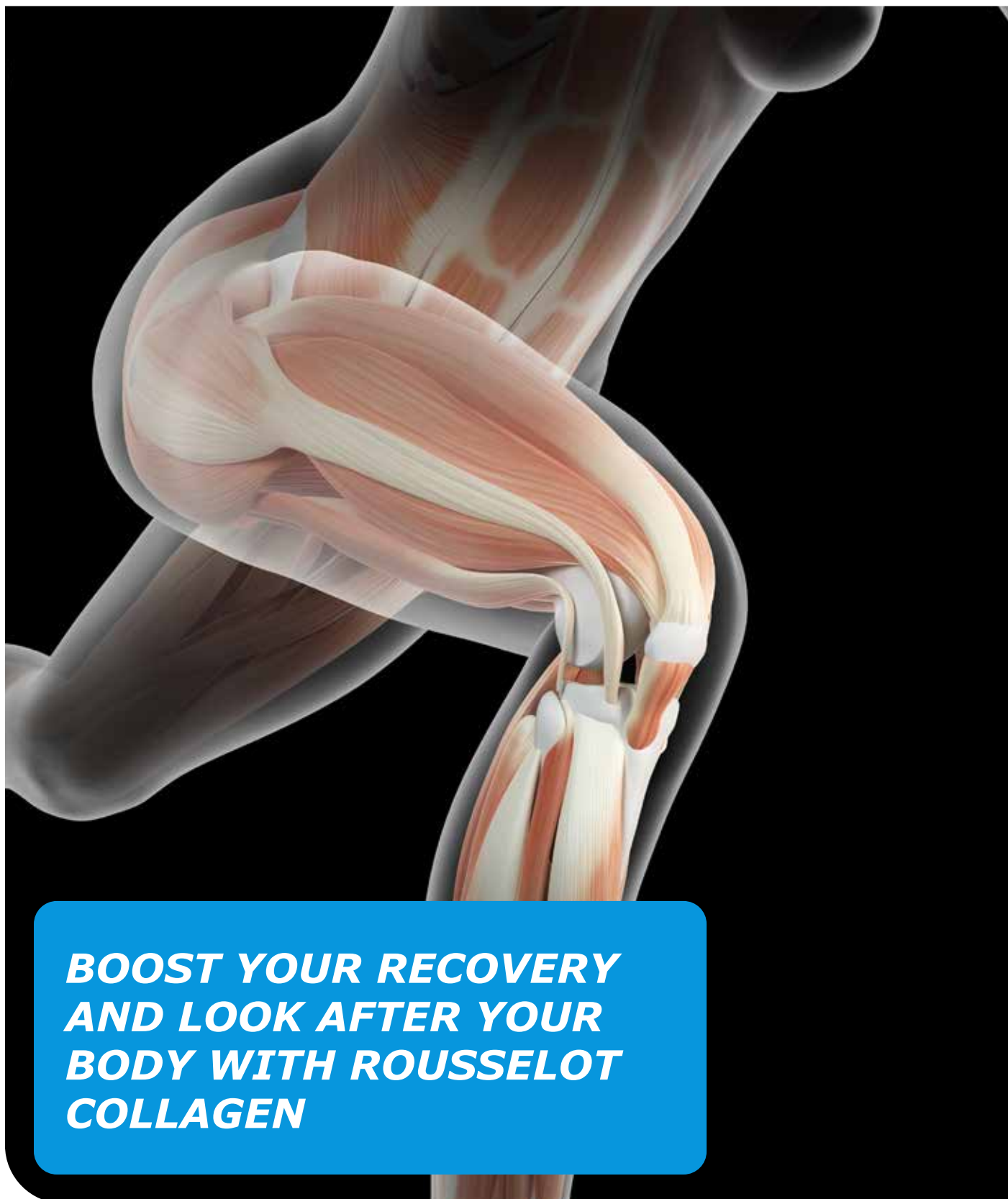
a) Growth of bone formation cells or osteoblasts.

b) Growth of bone breakdown cells or osteoclasts.

PEPTAN FOR MUSCLE HEALTH



As a protein, collagen contributes to the growth and maintenance of muscle mass.^[7] Furthermore, a study in young, healthy, and active males demonstrated that Peptan can stimulate a faster recovery from strenuous exercise and tends to decrease post-exercise muscle soreness as well ^[8].



**BOOST YOUR RECOVERY
AND LOOK AFTER YOUR
BODY WITH ROUSSELOT
COLLAGEN**

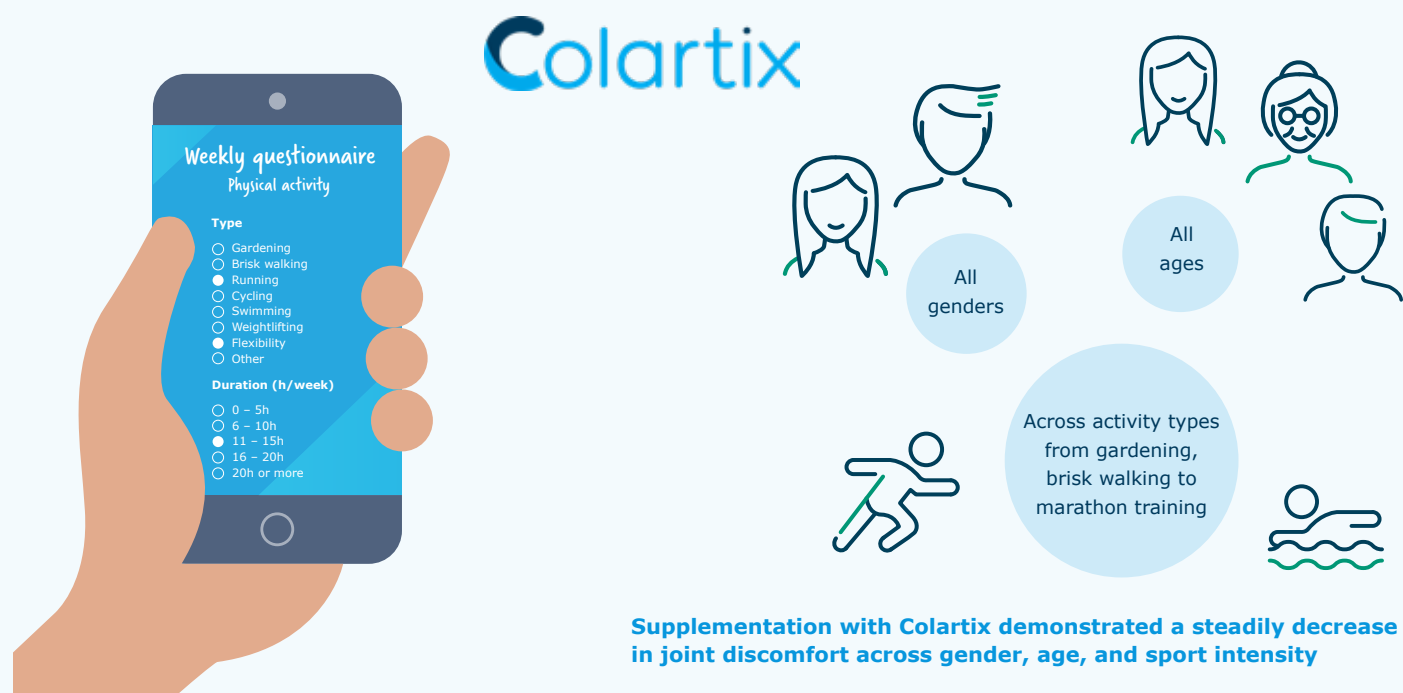
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COLARTIX® - COLLAGEN CARTILAGE MATRIX FOR JOINT CARE

Rousselot Health & Nutrition launches its collagen cartilage matrix - Colartix for joint care backed by consumer science.

In a recent placebo-controlled consumer study^[9] involving more than 200 consumers of different genders, all ages and across activity types from gardening, brisk walking to marathon training. A daily intake of 1g Colartix demonstrated a steadily decrease in joint discomfort across gender, age and sport intensity.

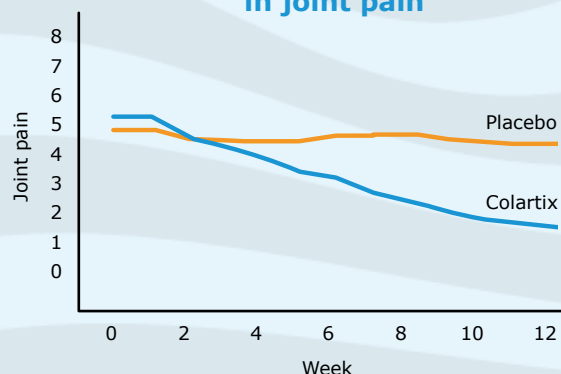


Changes in joint pain after exercise were assessed by the participants using a Visual Analog Scale (VAS)



Overall reduction in joint pain

Colartix supplemented group reported reduced joint pain after exercise, whilst in the placebo supplemented group joint pain remained steady over time.

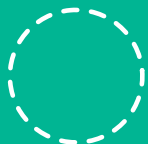


9. Newman, C. et al. 2022. The effect of a natural matrix of collagen types and chondroitin sulfate on joint discomfort in physically active adults: a real-life setting study. Submitted to publication.

Complete your product brand story with **Peptan** and **Colartix**.

Rousselot Health & Nutrition is a world leader in trusted, science-backed collagen-based solutions. Many of our customers have engaged us in co-developing successful ingredient branding strategies. Selected customers benefit from our endorsement of their products, with access to the Peptan and Colartix brand names and marketing materials.

Rousselot Health & Nutrition can help you with virtually any product requirement or innovation you have in mind, offering:



Transparency



Full traceability



High standards
of quality and safety



Committed to the
environment and
to our clients



Global support
and expert advice

Your Rousselot sales contact information



Rousselot Health & Nutrition

As Rousselot's strategic segment dedicated to health and nutrition, we are committed to developing innovative ingredients answering today's demand for solutions offering proven efficacy, full safety, and premium quality. Our customers can rely on best-in-class products, backed by trusted science as well as on our expert support in formulation, product development, and regulatory advice. Building on the success of our flagship brand Peptan, our collagen solutions offer a world of health benefits for a healthier tomorrow. Rousselot Health & Nutrition is one of three strategic markets served by Rousselot. Rousselot is Darling Ingredients' Health Brand.

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Rousselot
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The science behind collagen for sports nutrition and active lifestyle

UP YOUR GAME AND JOIN THE Peptan TEAM!



Picture yourself right after a very intense training session. What a nice feeling! Isn't it? However, your muscles are starting to feel a little sore. Can you feel them? And the day after, it only gets worse... After strenuous exercise our muscles experience some damage, causing us not only pain but also making it harder to reach the same intensity in the following trainings [1].

So, what if we could offer a solution?

Peptan collagen peptides are more than just another protein supplement. **Collagen is present everywhere in our body and is responsible for our body's strength, structure, and flexibility.** As one of the major components of our connective tissue, present in the skin, muscles, bones, joints, tendons, and ligaments, collagen is one of the most important proteins for athletes [2]. Performing sports, especially at high intensity, can damage the connective tissue affecting our performance. But no need to panic. Scientific studies have shown that **dietary collagen peptides can promote our own collagen production** [3, 4]. And there's more! As suggested by Rousselot's scientific studies explained below, **Peptan** could be linked to additional benefits, like **boosting recovery and enhancing performance.**

What
are you
waiting
for?

Ready, set,
Peptan!

Peptan accelerates recovery and performance

Boost up!

Peptan collagen peptides could reduce muscle soreness after intense exercise, as shown in a scientific, randomized, and controlled study [5]. 24 healthy, recreationally active males took a **daily dose of 2x10 g Peptan** or placebo, together with a drink rich in Vitamin C from 7 days before to 2 days after performing 150 drop jumps. 48 hours after exercise, participants were asked to rate their muscle soreness on a visual analog scale from 0 (no pain) to 200 mm (unbearable pain).





Volunteers who took Peptan scored their muscle soreness at 90.42 while the placebo group rated their soreness at 125.67, indicating that Peptan has a likely beneficial effect on muscle soreness 48 hours after exercise (Figure 1A).

Less muscle pain, great! But there's more.

This same study also suggests **accelerated muscle recovery during daily Peptan intake** as shown in Figure 1B. While in the control group muscle power decreased to approximately 80% 48h after the training, the **Peptan group retained approximately 90% of their muscle power**, indicating a faster recovery and showing a significant beneficial effect of Peptan compared to placebo.

Peptan reduces muscle soreness and accelerates recovery

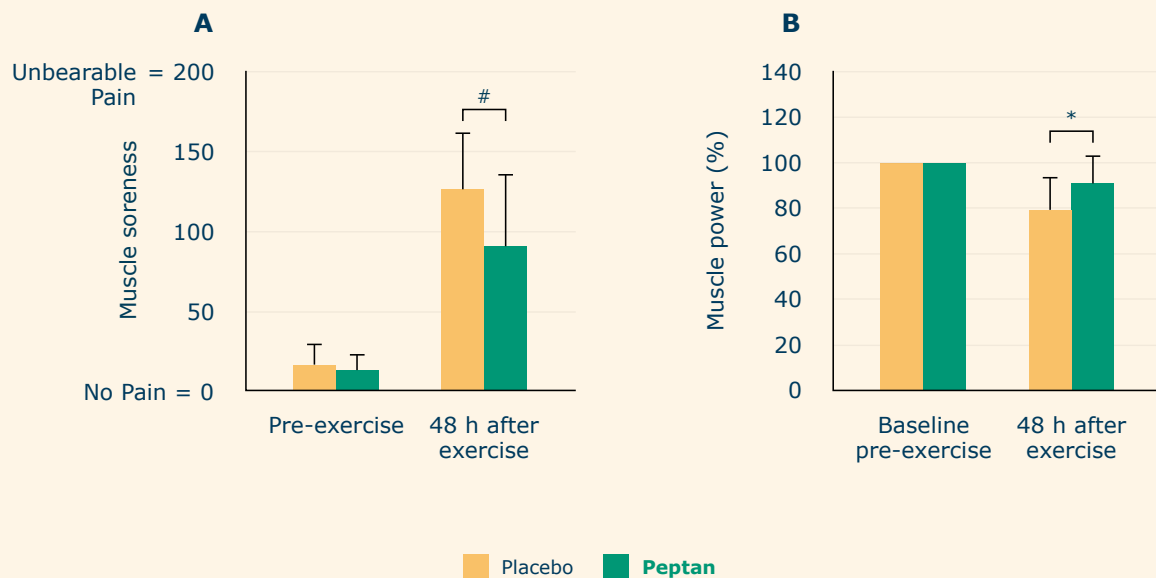
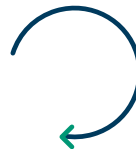
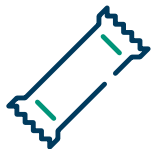


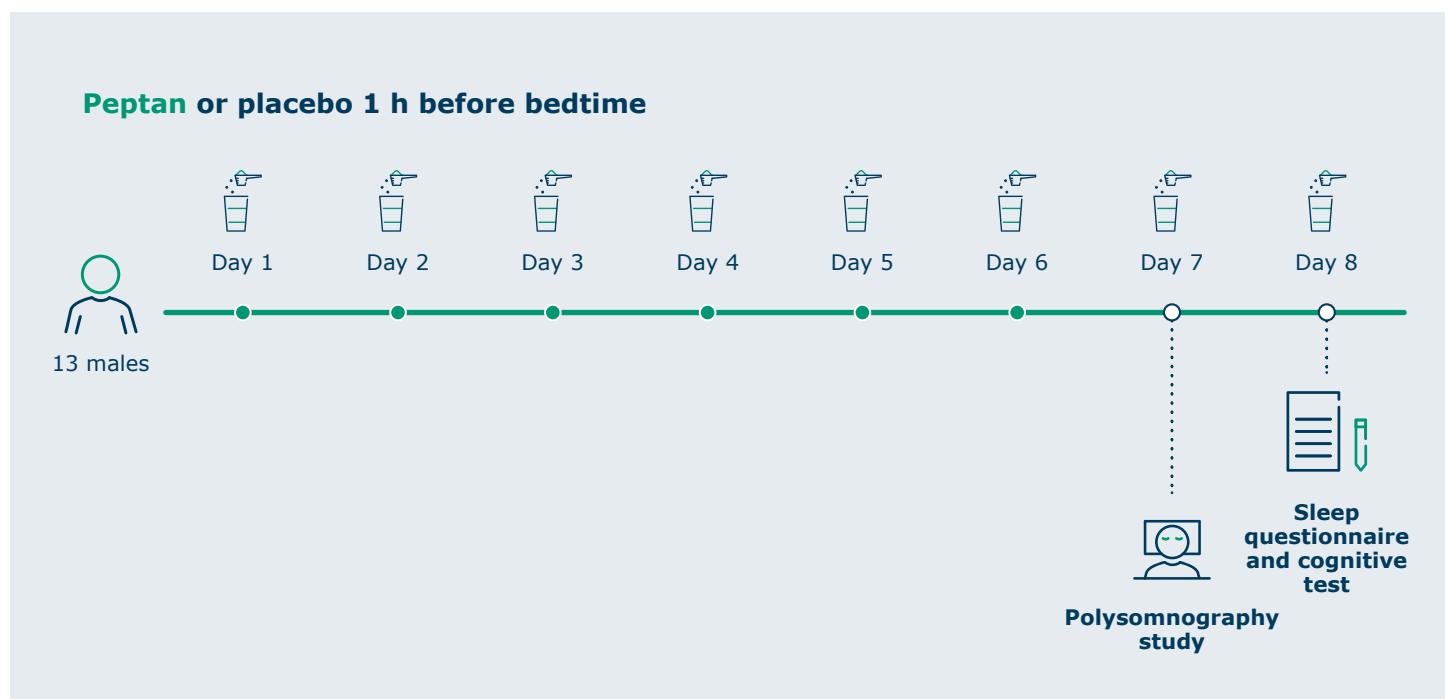
Figure 1. Effect of daily Peptan intake on A) Muscle soreness reported by the participants before, and 48 h after exercise on a visual analog scale, and B) Muscle power before and 48 h after exercise, expressed as a percentage of the muscle power seen before exercise (baseline).

Indicates that there is a likely beneficial effect of Peptan compared to the placebo group. * Indicates that there is a beneficial effect of Peptan compared to the placebo group, $p < 0.05$.

Eat-Sleep-Train-Repeat



Recovery is not only about muscles... sleep is essential to keep up with our performance. Every athlete knows that before an important event, a good night's sleep is crucial. However, impaired sleep is a frequent issue among athletes [6]. Yet again... **collagen peptides to the rescue! Rousselot is the first company** to show that **collagen supplementation can improve sleep quality**. Our latest findings from a pioneering study on sleep in an active population demonstrate that **daily supplementation with 15 g of Peptan** 60 minutes before bedtime for one week **enhanced the sleep quality of 13 males** (18-35 years old) with sleep complaints [7].



The randomized, placebo-controlled, crossover study showed a reduction in awakenings, as measured by polysomnography (Figure 2A), a technique that is considered the gold standard in sleep studies. This result was mirrored by the volunteers' subjective experience (Figure 2B) and might be explained by studies suggesting that **collagen peptides are rich in glycine, a nutrient also linked to improved sleep quality in athletes** [8]. What is more, **a good night's sleep is also essential for overnight bone, muscle, and skin regeneration**.

Peptan reduces the number of awakenings

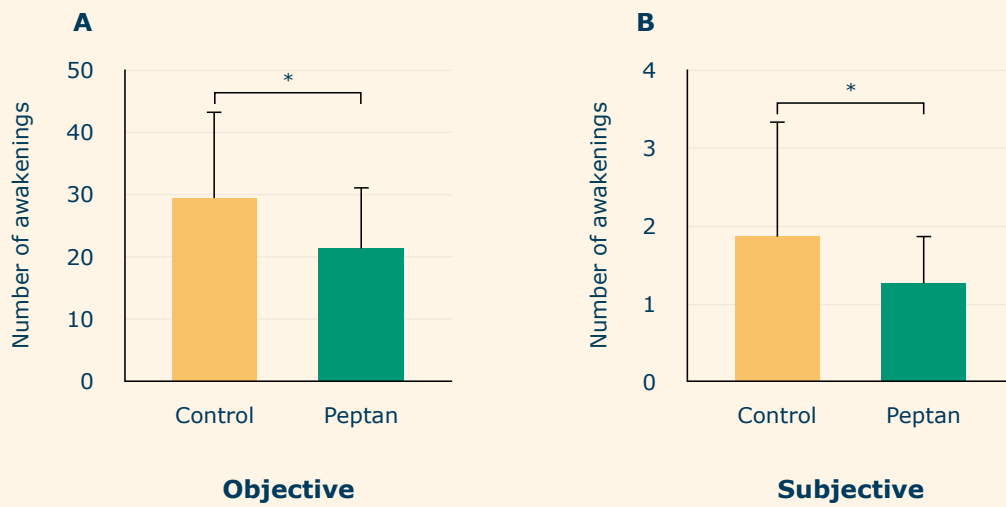


Figure 2. Total number of awakenings during the night, measured after 7 days of supplementation (A) objectively by polysomnography on the 7th night or B) subjectively by a validated questionnaire the morning of day 8.

* Indicates a significant difference between the two groups, $p < 0.05$.



Thinking about
your performance?
Don't lose sleep
over it and join the
Peptan Team!

An additional indication of an improved night's sleep was that participants in this study improved their scores in the baseline Stroop Color and Word test, a validated cognitive test measuring response time and accuracy to test if they could process two stimuli at the same time.

Participants are presented with a word (black letters on a white background) describing a color and asked to select the corresponding color by pressing the corresponding key (Figure 3A). **The morning after the sleep trial, participants consuming Peptan scored higher on the test, indicating they improved their response accuracy as a result of better sleep.**



Peptan increases response accuracy in the baseline Stroop cognitive test

All athletes responded in the same way and everyone benefitted from Peptan

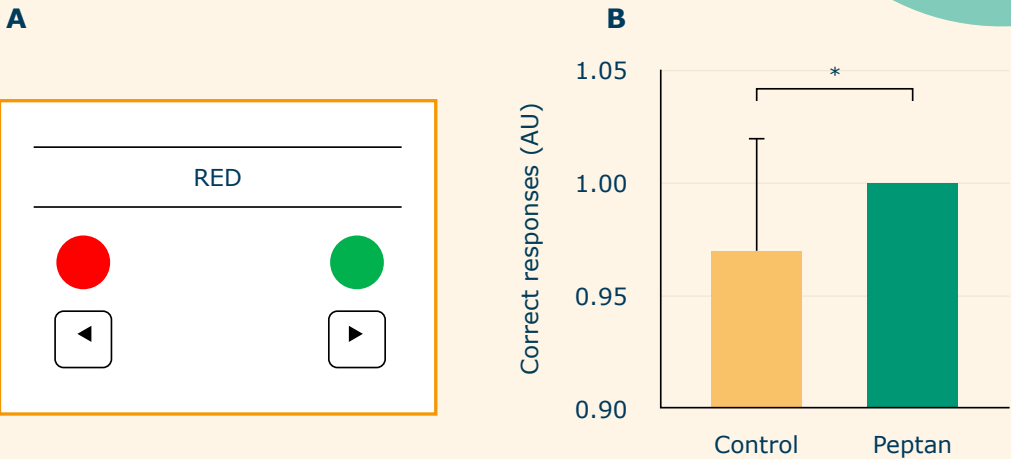


Figure 3. (A) Visualization of the baseline Stroop cognitive test. (B) Response accuracy, measured as the number of correct responses (arbitrary units) in the baseline Stroop test on the morning after the sleep trial. In the Peptan group, there was no variability in their scores.

Fueling victory: gut comfort in athletic performance

Strenuous exercise can cause gastrointestinal discomfort because it affects the intestinal barrier function. The tight junctions between intestinal cells that are meant to protect us, can open up due to intense training. This can result in elevated blood endotoxin levels, which causes inflammation, leading to **digestive issues and affecting sports performance** (Figure 4).



Schematic representation of a healthy vs. an inflamed intestinal barrier

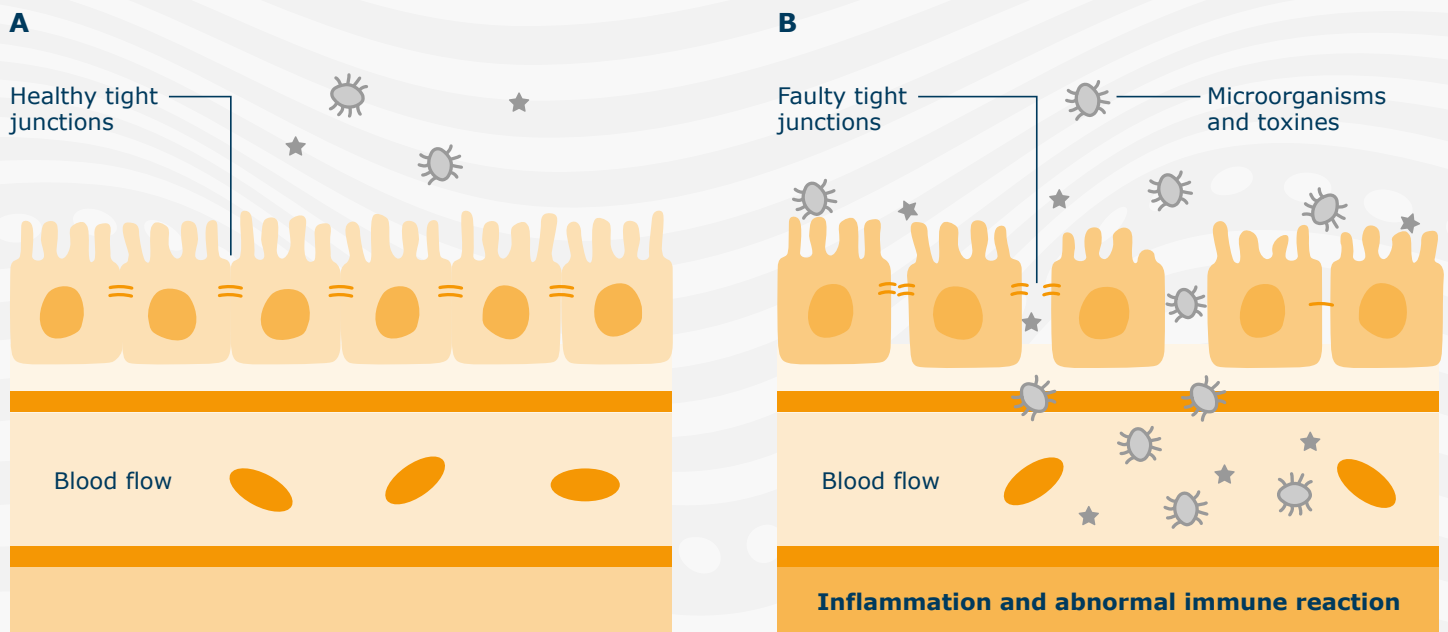


Figure 4. (A) Healthy intestinal barrier, (B) disturbed intestinal barrier. Strenuous exercise can perturb tight junctions between intestinal cells and increase intestinal permeability to microorganisms and toxins, potentially leading to digestive issues.

Rousselot showed that supplementation with **10 g of Peptan** collagen peptides 7 days prior to, and 45 min before a 70 min run, could lessen the increase of blood endotoxin levels, a known cause of inflammation, two hours after exercising [9].

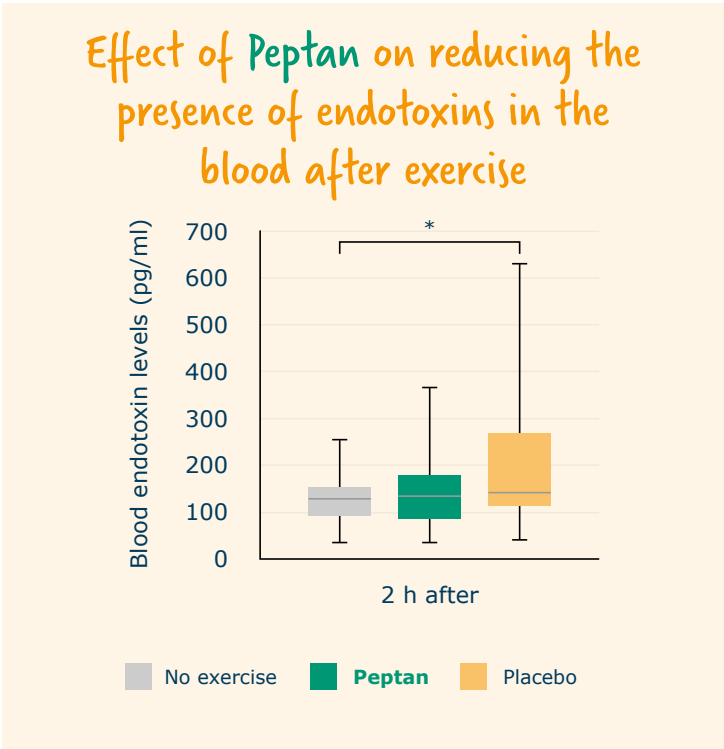
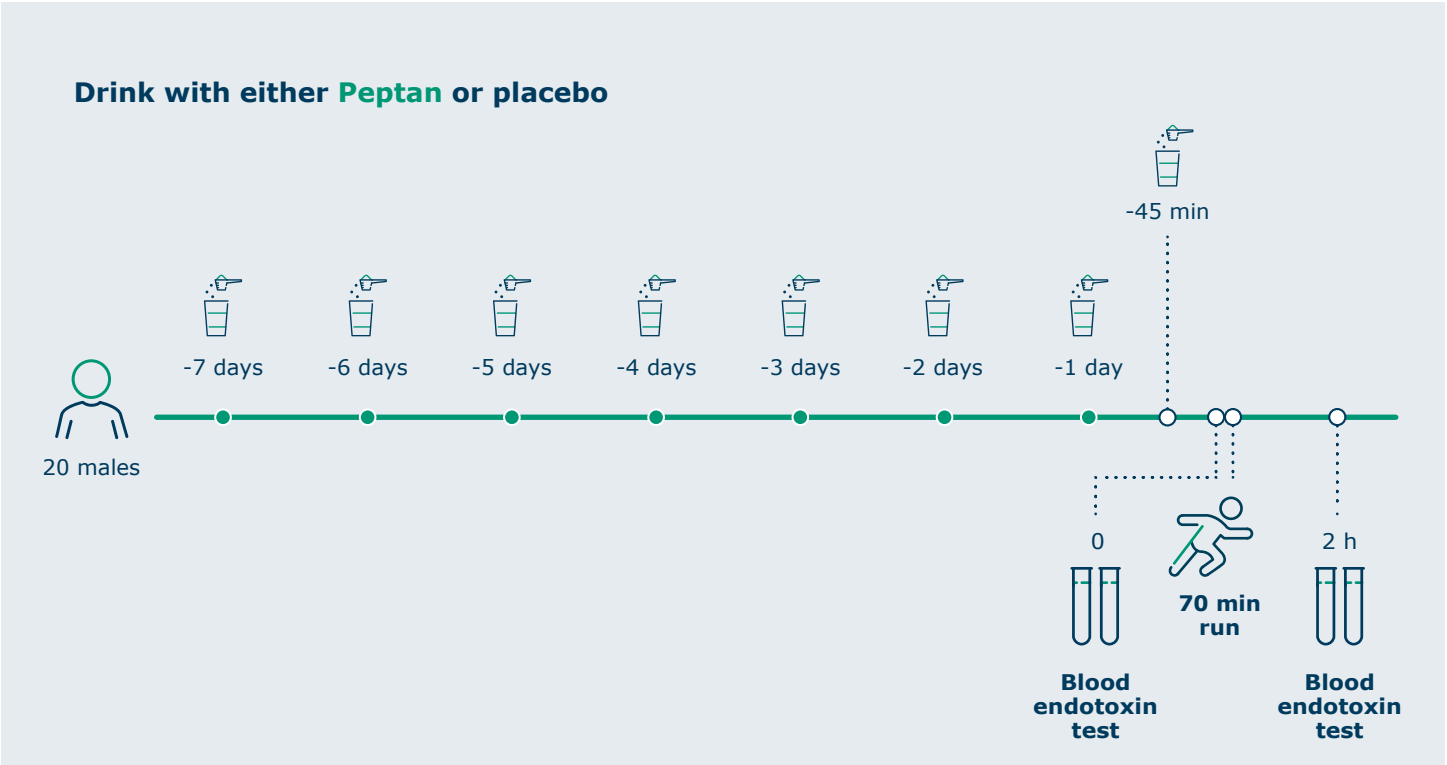


Figure 5 shows the results of this randomized, placebo-controlled, crossover study performed in 20 healthy, recreationally active sporters. When taking Peptan, no difference in blood endotoxin levels was observed before or after exercise, contrary to the significantly elevated levels when drinking flavored water. This suggests that **collagen peptides might be able to support intestinal barrier function thereby reducing the presence of endotoxins in the blood.**

As mentioned above, very intense sports performance is often associated with gastrointestinal symptoms. Although it is known that this discomfort can be intensified by some sports supplements used to promote performance, our study shows that symptoms reported in the Peptan group were comparable to the control (flavored water) [9]. These findings indicate that **Peptan impact on the gut during strenuous exercise is comparable to flavored water.**

Figure 5. Blood endotoxin levels measured with no exercise or two hours post-exercise, having ingested Peptan or placebo. Blood endotoxin levels were not significantly different between the non-exercise group and the Peptan group 2 hours after exercise.
* Indicates a significant difference between the two groups, $p \leq 0.05$.

Sporty and mobile lifestyle for all

Over time, the balance between synthesis and breakdown of cartilage gets disturbed. This can lead to joint pain, stiffness, and reduced mobility.

In a scientific, randomized, placebo-controlled study [10], **elderly women with mild joint discomfort reported a significant reduction of painful symptoms, like stiffness and pain, after oral intake of Peptan (8 g/day)** (Figure 6). These positive effects also improved their mobility and joint function within three months (Figure 7).



Peptan reduces joint discomfort

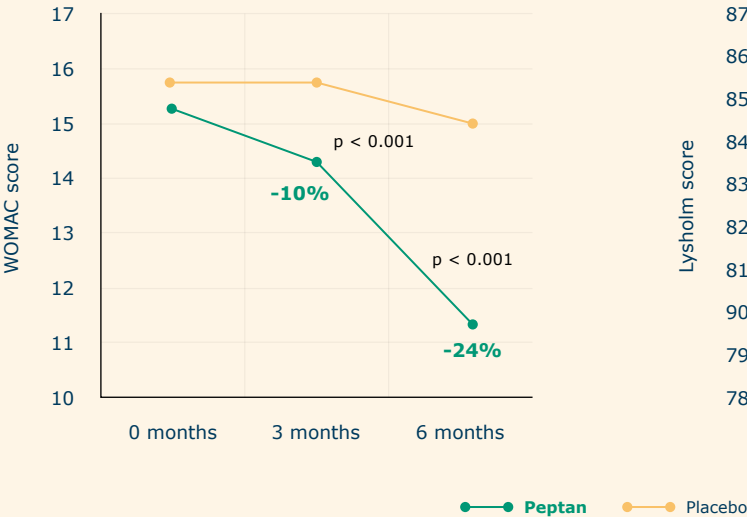


Figure 6. Symptom-relieving effects of Peptan: development of the WOMAC score assessing joint function discomfort (decreased score = improvement) after the intake of Peptan or placebo over the duration of 6 months (Jiangm 2014).

Peptan improves joint function

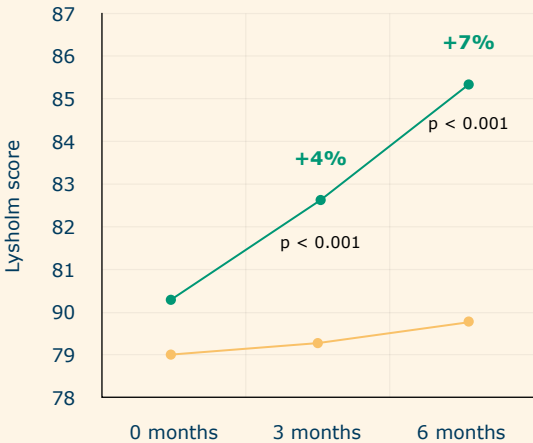


Figure 7. Peptan improves joint functionality: development of the Lysholm score assessing joint function (increased score = improvement) after the intake of Peptan or placebo over the duration of 6 months (Jiangm 2014).



More than just another protein

Looking after our bones is key to enjoying an active life whether you are 25 or 75. Bones are living tissues that are constantly renewed in a carefully balanced process of synthesis and breakdown.

Peptan stimulates bone formation cells more than casein. A study performed in mice bone cells shows that the potential for Peptan to improve bone health (balance between cell formation and breakdown) is the result of its collagen peptide composition rather than mere proteins [11].

These *in vitro* experiments demonstrate that the digested and absorbed **collagen peptides stimulate the formation of cells responsible for bone synthesis** (Figure 8A) more than casein (milk protein), **while simultaneously inhibiting the formation of cells that break down bones** (Figure 8B).

Peptan stimulates bone formation cells and inhibits bone breakdown cells more than other proteins

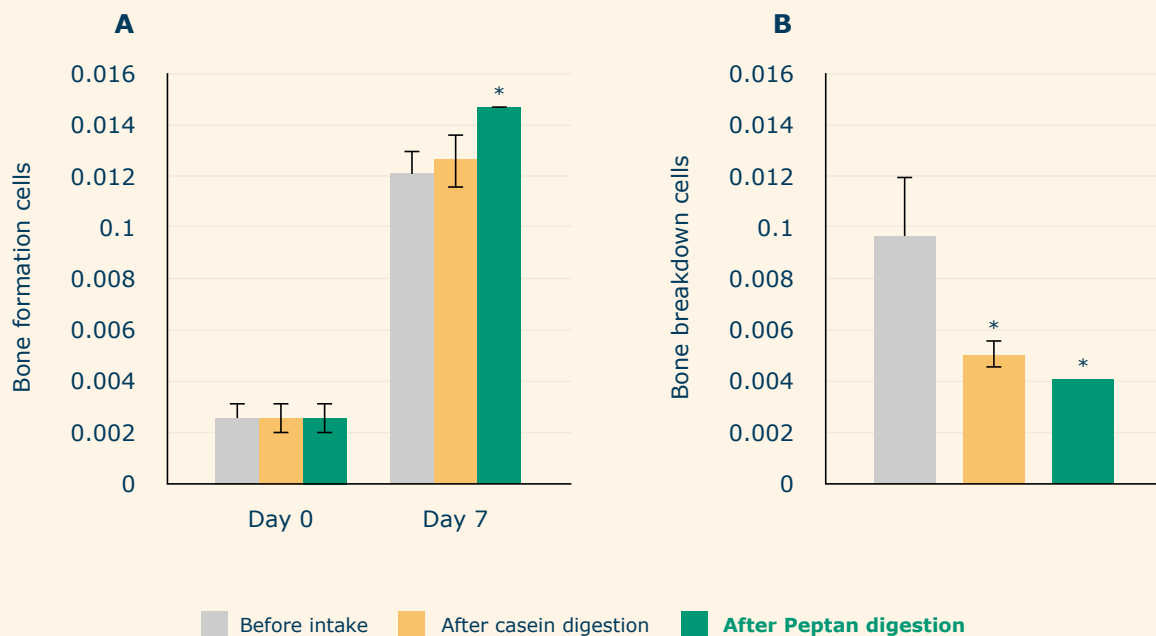
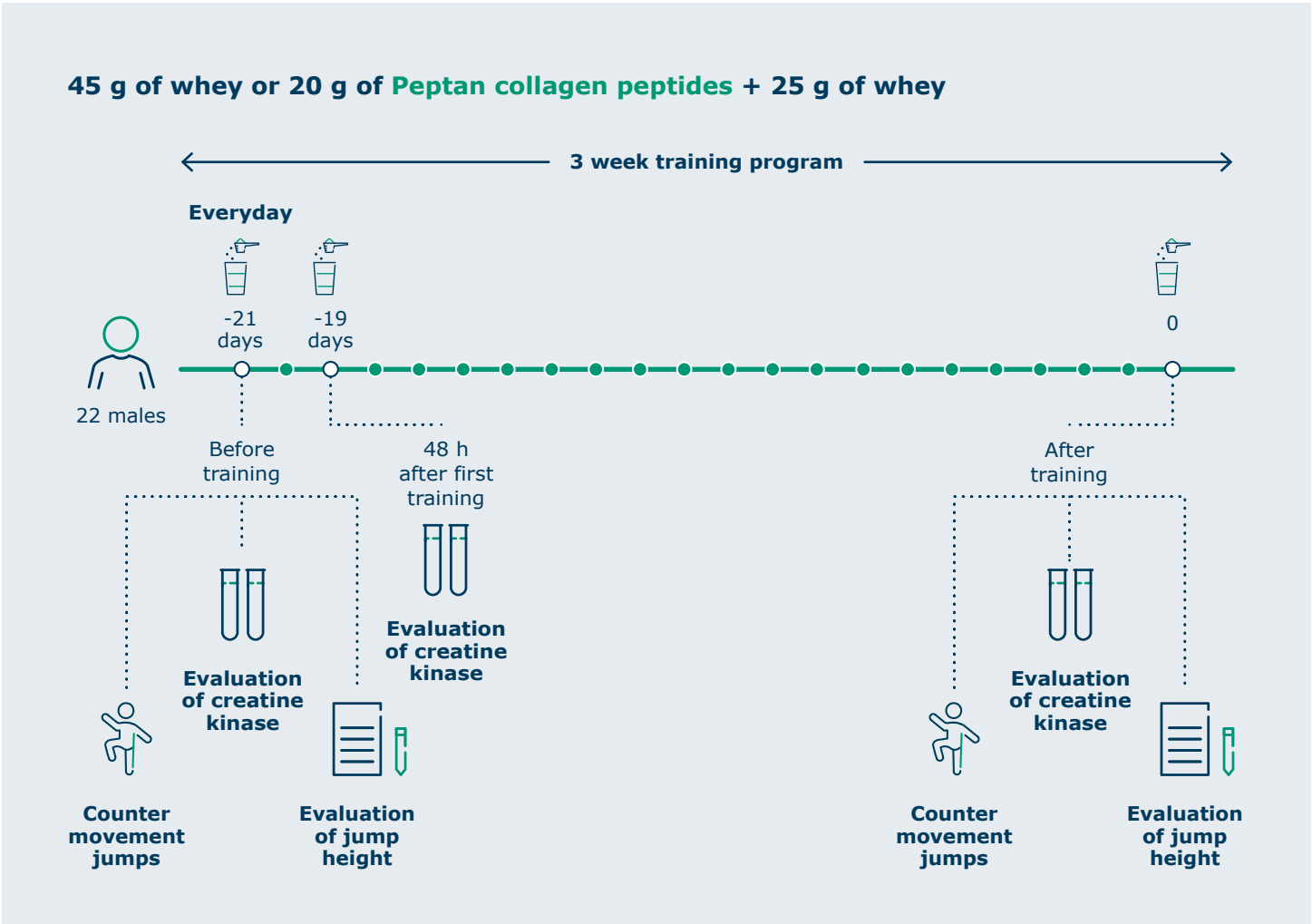


Figure 8. Influence of digested Peptan on the growth of bone metabolism cells in vitro. (A) Growth of bone formation cells or osteoblasts, (B) growth of bone breakdown cells or osteoclasts.

Collagen and whey: friends with benefits

Protein supplement usage among athletes, both professional and recreational, is a well-established practice with whey protein being by far the most popular choice. While 45 g consumption of whey protein is currently recognized as the gold standard, blending diverse protein sources might enable to target different components of the musculoskeletal system. Since **collagen peptides are known for their beneficial effects on mobility and recovery after exercise**, why not **merge the established advantages of collagen peptides with whey**?

In a double-blind, randomized, parallel-group study, the impact of daily consumption of **20 g of Peptan** and 25 g of whey was compared to the prevailing standard of 45 g/day of whey. In twenty-two healthy, active men, performance was evaluated by measuring the jump height of counter movement jumps before and after a 3-week training program combined with supplementation of either whey (W) or whey with Peptan collagen peptides (WP).



Both W and WP groups showed similar results as depicted in Figure 9A. Levels of creatine kinase, a marker for muscle damage, were elevated 48 h after the first training but fully recovered after completion of the training program in both groups (Figure 9B). This study indicates that **substituting 44.4% of the daily recommended protein dose for Peptan leads to similar results for both exercise performance and recovery after strenuous exercise [12].**

Since ingestion of dietary supplements can instigate digestive issues, mixing protein sources, such as whey and collagen, could potentially present an effective alternative. Taylor et al. already demonstrated that daily **ingestion of collagen peptides did not alter exercise-induced gastro-intestinal symptoms [9]**. By doing so, athletes may stand to **reap the benefits of both proteins while potentially mitigating digestive discomfort.**

Substituting half of the whey supplement with Peptan yields the same results on recovery and performance

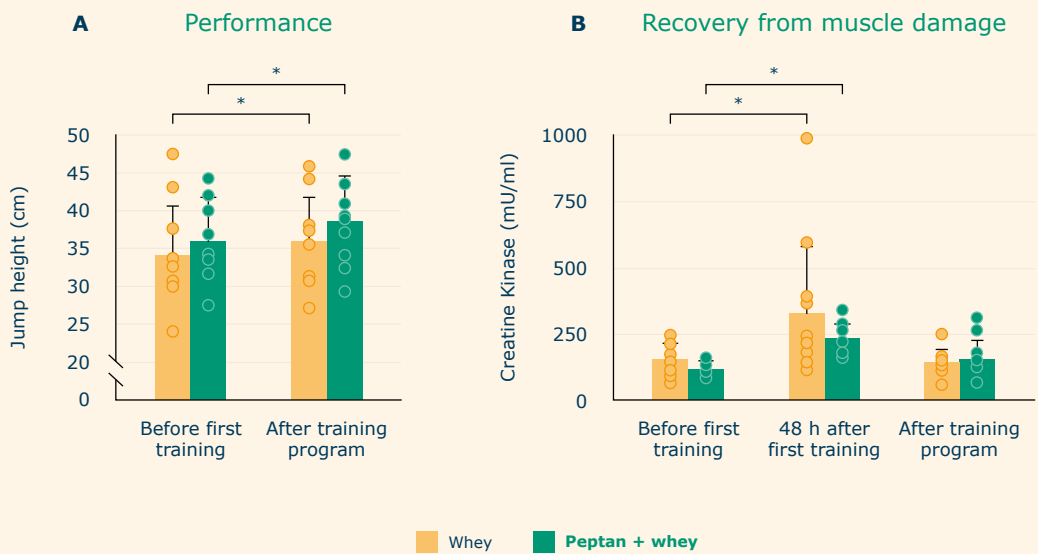


Figure 9. Evaluation of the impact of daily consumption of a whey protein supplement (45 g) or a whey (25 g) + collagen peptides (20 g) supplement on performance (A), evaluated by measuring jump height of counter movement jumps, and recovery (B), assessed by levels of creatine kinase, a marker of muscle damage, after extensive training in 22 healthy, active men.
* $p < 0.05$ compared to baseline (before first training).



HEALTHY JOINTS, HEALTHY LIFE

In a real-life study, 201 healthy and physically active adults (18 to 72 years old) recorded their joint pain scores for 12 weeks in a mobile application while keeping their daily habits and taking 1 g per day of either Colartix or placebo [13]. The evolution of joint pain scores (scale of 1 (no pain) to 10 (unimaginable and unspeakable pain)) during the study is shown in Figure 10.

While the average score at the beginning of the study was 5, **Colartix was able to significantly reduce joint discomfort throughout the supplementation period** down to an average score of 2 at the end of the 12 weeks supplementation period.

The reduction of joint discomfort was felt regardless of age, gender, or activity intensity. The placebo group did not report a significant reduction. More importantly, **in the Colartix group, the reported joint pain levels were still significantly lower than in the placebo group 4 weeks after supplementation had stopped.** However, joint pain scores gradually increase again after stopping supplementation highlighting the importance of daily, sustained, supplementation.

**For more information
visit Colartix**



Next to finding a balance between training and rest, athletes need to take good care of their bodies. Performing sports, especially at a high level, can cause damage, particularly to the joints. With this in mind, **Rousselot developed COLARTIX®, a dietary supplement derived from hydrolyzed cartilage matrix and composed of collagen peptides and naturally present chondroitin sulfate.**

Supplementation with Colartix demonstrated a steadily decrease in joint discomfort across gender, age, and sport intensity

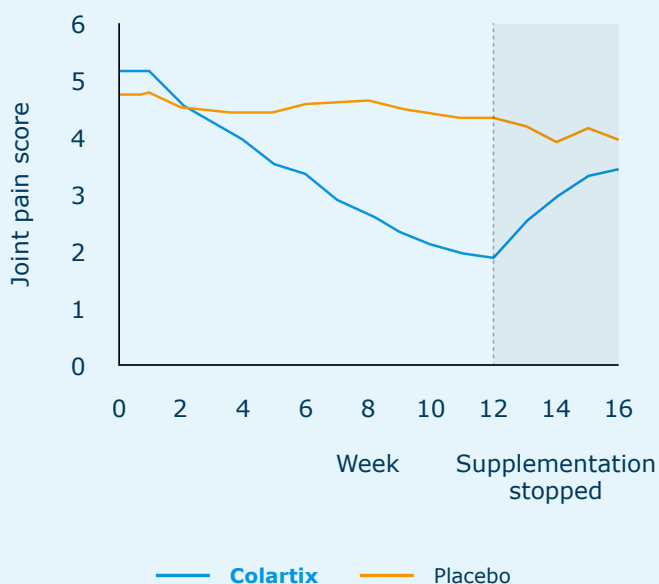


Figure 10. Joint pain score reduced from very distressing to discomfort after 12 weeks of supplementation with Colartix. 4 weeks after supplementation stopped, pain discomfort in the Colartix group was still significantly lower than in the placebo group.

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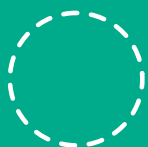
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Complete your product brand story with **Peptan** and **Colartix**

Peptan collagen peptides are:

- An upcycled ingredient made from natural resources
- Of natural origin, available from fish, bovine, and porcine origin
- Kosher and Halal certified (on demand)
- Highly bioavailable
- Pure and neutral in sensory
- Backed by science
- World-class, safe products
- Convenient and easy to use
- Clean label, with no additives or e-numbers

Rousselot Health & Nutrition can help you with virtually any product requirement or innovation you have in mind, offering:



Transparency



Full traceability



High standards
of quality and safety

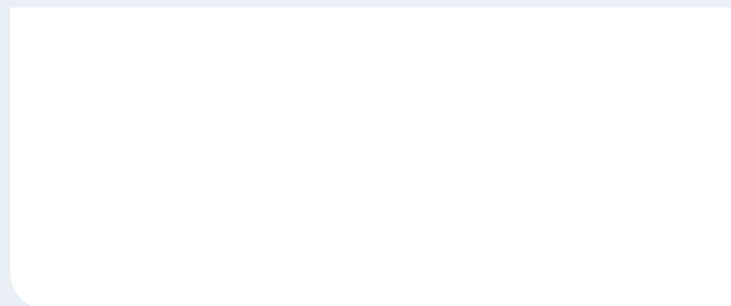


Committed to the
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Rousselot Health & Nutrition

As Rousselot's strategic segment dedicated to health and nutrition, we are committed to developing innovative ingredients answering today's demand for solutions offering proven efficacy, full safety, and premium quality. Our customers can rely on best-in-class products, backed by trusted science as well as on our expert support in formulation, product development, and regulatory advice. Building on the success of our flagship brand Peptan, our collagen solutions offer a world of health benefits for a healthier tomorrow. Rousselot Health & Nutrition is one of three strategic markets served by Rousselot. Rousselot is Darling Ingredients' Health Brand.

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