Introduction to Collagen

Collagen Overview

Product Category
KoACT®
KollaGenII-xs™
Naticol®
Instagen™

COLLAGEN OVERVIEW

WHAT IS COLLAGEN?

Collagen is the main structural protein of our body. It is the most abundant protein, composing from 25% to 35% of our body protein content. Collagen consists of three chains each of 100,000 daltons. When being hydrolyzed, collagens are cut short into smaller molecular weight (MW) of varying sizes, which are called peptides or collagen peptides. Collagen contains specific amino acids such as Glycine, Proline, Arginine, Hydroxyproline, and Hydroxylysine. As the main component of connective tissue, it is mostly found in fibrous tissues such as tendons, ligaments and skin, and is also abundant in corneas, cartilage, bones, blood vessels, the gut, and intervertebral discs.

FUNCTIONS OF COLLAGEN

Collagen has been used extensively in the medical, food and cosmetics applications. Collagen has great tensile strength, and is the main component of fascia, cartilage, ligaments, tendons, bone and skin. Along with soft keratin, it is responsible for skin strength and elasticity. Its degradation leads to wrinkles that accompany aging. It strengthens blood
vessels and plays a role in tissue development. Recently, in the nutritional field, collagen has been a hot new ingredient with applications in bone health, joint health and cosmeceutics (beauty within).

**TYPES OF COLLAGEN**

Collagen is one of the long, fibrous structural proteins whose functions are quite different from those of globular proteins, such as enzymes. Tough bundles of collagen, called collagen fibers are a major component of the extracellular matrix that supports most tissues and gives cells structure from the outside, but collagen is also found inside certain cells. More than 28 types of collagen have been identified, three of them are the most common.

**COLLAGEN I**
- Most abundant collagen of the human body (90%)
- Present in scar tissue, repair healing tissue
- Found in tendons, myofibrils and the organic part of bone
- Contains hydroxyproline and hydroxylysine.

**COLLAGEN II**
- Basis for articular cartilage and hyaline cartilage
- Makes up 50% of all protein in cartilage and 85% of collagen of articular cartilage
- Contains hydroxyproline and hydroxylysine.

**COLLAGEN III**
- Fibrillar collagen, found in extensible connective tissues such as skin, lung and vascular system, associated with type I collagen.
- Contains hydroxyproline and hydroxylysine.

The different types of collagen can support unique functions throughout the body. This technical paper will review the collagen best suited for the body’s needs from head to toe.

**COLLAGEN FOR BONE**

Bone is living, growing tissue. It undergoes continuous remodeling during one’s lifetime, with constant formation of new bones and resorption of old bones.

The balance between bone formation and bone loss changes after peak bone mass is reached. More bone is lost than the new bone is formed. Usually, men and women have same bone lose speed in mid-life. However, women can lose up to 20 percent or more of their bone in the five to seven years after menopause.

Osteoporosis is a disease known by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures, especially of the hip, spine and wrist. The osteoporosis patient can fracture a bone from a minor fall, or from a sneeze or even spontaneously in serious cases. Today in the U.S., over 10 million individuals are estimated as osteoporosis patients and almost 34 million more are estimated to have low bone density. While osteoporosis is often thought of as an older person’s disease, it can strike at any age.
KoACT®
COLLAGEN FOR BONE

It is known that, in human bone, calcium builds bone density and collagen builds the framework for calcium to attach. Collagen plays an essential role on improving bone flexibility. Thus, even the strongest bones can crack or break without collagen. Although the body produces collagen naturally, its production diminishes as we age. Supplements for people with osteoporosis have always been focused on calcium and vitamin D, since calcium increases bone mineral density and vitamin D facilitates the absorption of calcium. However, recent concerns over too much calcium have the medical community reconsidering the amount and the role of calcium supplementation.

As a patented collagen and calcium combination, KoACT has been designed to improve bone strength by addressing the bone organic matrix. KoACT was awarded three US patents for its unique composition as well as its application in improving bone mineral density and bone strength. It goes beyond calcium supplementation and other general bone supplements by providing calcium and bone collagen at the same time.

KOACT RESEARCH

Animal tests showed that KoACT dose-dependently increased Femur Bone Strength and Bone Mineral Density in an osteoporosis animal model. (Figure 1).

**FIGURE 1.** Animal Study: Effect of KoACT on Bone Mineral Density After 8 Weeks of Intake
**HUMAN CLINICAL TRIAL**

A human clinical trial has been conducted at Florida State University with Dr. Bahram H. Arjmandi, PhD, RD who is the Margaret A. Sitton Professor and Chair of the Department of Nutrition, Food, and Exercise Sciences at FSU. Dr. Arjmandi is widely published in peer-reviewed journals, and a worldwide expert in bone health.

**RESEARCH RESULTS**

In this double-blind, placebo controlled human study, it was shown that, KoACT significantly improved Bone Biomarkers for bone growth, resulting in significantly decreased bone BMD loss as compared to calcium after one year of intake*. The combination of calcium and collagen makes KoACT the best bone product of choice.  

* Manuscript available upon request.

**CONCLUSION**

The human results are consistent with the pre-clinical animal data showing a bone forming effect of KoACT that is not observed in the calcium group. KoACT benefits bone health by both increasing bone synthesis and reducing bone resorption, shifting the bone metabolism to a more youthful level. These bone biomarker changes observed in this double-blind, placebo controlled study suggest KoACT, a natural nutraceutical product, brings all desirable characteristics to bone health management. This is a significant step forward in providing a solution to bone health beyond traditional calcium products. (Table 1)

**TABLE 1. Major Drugs and Supplements**

<table>
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<tr>
<th>CATEGORY</th>
<th>MECHANISM</th>
<th>MAJOR PROBLEMS</th>
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<tbody>
<tr>
<td></td>
<td>Bone Formation</td>
<td>Bone Resorption</td>
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| DRUGS     | Bi-Phosphates (Fosamax) | ↓→↓ | 1) Risk of osteonecrosis of the jaw  
2) Risk of atypical femoral fracture for long term user |
|           | Anabolic Drug (rhPTH)   | ↑→↑ | 1) Higher dosage leads to the development of bone cancer in animals.  
2) Needs injection |
| SUPPLEMENT| Calcium (†Vitamin D, †Vitamin K) | ↓→↓ | 1) Constipation |
|           | KoACT®        | ↑→↓ | 1) Constipation |
Collagen accounts for about two thirds of the dry weight of an adult’s articular cartilage (David, 2002). As a hydrated soft tissue, articular cartilage is composed of negatively charged proteoglycans fixed within a collagen matrix, whose primary function is to provide low friction and wear in the synovial joints (Baeurle 2009). The chondroitin sulfate, also known as sulfated glycosaminoglycan (GAG) is usually found attached to proteins as part of a proteoglycan. Therefore the GAG is a very important structural component of cartilage and provides much of its resistance to compression (Baeurle 2009).

As we age, the body’s ability to make collagen protein slows down so there is insufficient new collagen to make skin, joints, and other parts of the body. Collagen fibers lose their moist texture and become rigid. Much of this damage is caused by free radicals: unstable molecules created when the body uses oxygen.

Collagen Type II is the major component of hyaline joint cartilage. It consists of 70% protein and 30% to 45% naturally occurring mucopolysaccharide (carbohydrates). The mucopolysaccharide consists of glucosamine, chondroitin, and hyaluronic acid, the makeup of synovial fluid and amino sugars required to make collagen type II cells.

Studies have shown that hydrolyzed collagen can be absorbed and preferably accumulates in joint cartilage (Oesser, 1999). Furthermore, collagen signals the cartilage-building cells to make new cartilage components (Oesser, 2003). Collagen therefore may provide additional benefits to joint health.

Osteoarthritis is the most common form of arthritis affecting more than 40 million Americans. Extensive research has shown that Type II collagen is lost progressively in osteoarthritis patients (Hollander, 1994; Dodge, 1991; Dodge, 1989). One of every 3 Americans over the age of 60 suffers from joint problems. It is a natural wear and tear of our joint cartilage. As we age, the body’s ability to make the protein Type II Collagen slows down. This is the protein needed to maintain healthy cartilage tissues.

KOLLAGEN II-XS™
ADVANCED COLLAGEN FOR JOINT HEALTH
Patented KollaGenII-xs is the result of more than a quarter of a century of collagen food supplement research. It is composed of 70% collagen type II protein and 30% to 45% naturally occurring mucopolysaccharides containing hyaluronic acid, chondroitin, and glucosamine, which are all essential compounds for joint health. KollaGenII-xs has a higher molecular weight for optimum absorption. It is cold water soluble and ideally suited for use in food/beverages, cosmetics, dietary supplements and sports nutrition.
**CLINICALLY PROVEN EFFECTIVE**

Human (30 day) clinical trial was conducted by Morton Scientific Group, Cambridge, Ontario, Canada. The study results showed that KollaGenII-xs when taken at a dosage of 375mg-500mg twice per day appears to benefit joint inflammation, secondary mobility and other tertiary effects. KollaGen Il-xs™ taken at a dosage of 1500 mg-2500 mg daily significantly reduced pain and inflammatory response (Lopes, 2016).

The study also showed a normalizing of saliva pH levels which is often indicative of a reduction in inflammation. (Figure 2)

Consequently, KollaGenII-xs offers the complete building blocks for cartilage and a unique advantage as a nutritional supplement product for joint health.

**COLLAGEN FOR BEAUTY WITHIN**

**COLLAGEN’S ROLE IN SKIN**

The youthful qualities of the skin will deteriorate rapidly, unless action is taken to support your skin’s intrinsic defense system. The process of skin aging is both intrinsic and extrinsic. Intrinsic aging is due to genetic and hormonal processes. Extrinsic aging is caused by external factors such as smoking, UV radiation and pollution. Extrinsic and intrinsic aging reduce the number and the quality of collagen fibers. They also reduce the skin’s elasticity and uniformity.

Collagen I is the most abundant collagen of the human body. It plays a positive role in skin beauty, for it is widely present in skin (75-80%). Type I collagen plays an essential role in maintaining skin tone, suppleness and elasticity. However, collagen synthesis in human body reduces at a rate of 1.5% per year after the age of 25. Its levels may have fallen by as much as 30% by the age of 45. The external effects of such process are the appearance of wrinkles, fine lines, and dry skin.
Naticol®
COLLAGEN FOR BEAUTY FROM WITHIN

Naticol is a natural source of Type I collagen peptides. It is produced from 100% fish skin and scales through a validated and safe process in Europe. It is bioavailable, allowing the body to circulate necessary amino acids used in collagen fibril synthesis and other connective tissues. Studies on Naticol and fish collagen peptides supplementation suggest health benefits related to skin hydration, antioxidant and anti-aging.

CONSUMER PANEL STUDY

Just Research (Tokyo) conducted a study that evaluated the acceptance of Naticol by women taking part in the study. Collagen peptides are regulated by FOSHU (food for specified health use) in Japan. In this mature market for dietary supplements and nutricosmetics, Japanese consumers are one of the most demanding customers in terms of food ingredient organoleptic and bioactive properties.

According to the consumers, the oral intake of 10g Naticol/day may improve skin appearance after only 2 weeks. (Figure 3)

At 10g/day, the improvements for joint parameters are highly significant, although lower dosage would provide similar relief at a smaller scale. (Figure 4)

A new study currently completed by the Center of Clinical Pharmacology Applied to Dermatology (CPCAD Nice, France) further supports that even a lower dosage of 5g/day Naticol can reverse skin aging.

CONCLUSION

Collagen from fish is traditionally more desirable among consumers, especially in Asian countries like Japan, where collagen is one of most popular functional food ingredients. Consumers view fish collagen as a better source of material, with higher mineral content, superior absorption, and a greener image vs. collagen from bovine. Naticol provides consumers with a high quality, research based ingredient for beauty within products.

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat cure or prevent any disease.
FORMULATING WITH COLLAGEN

Challenges existing when formulating with collagen. Often it is difficult to dissolve and can sometimes provide an off color, odor or taste. It is dependent on the source of collagen and how it has been derived. Dose can also play a factor. As the awareness and consumer demand for collagen increases, product offering will diversify beyond the tablet and pill format. This may provide a challenge to formulators.

INSTANGEN™
INSTANT COLD WATER DISPENSABILITY

Instangen is designed for customers interested in using collagen in beverages and need an instant cold water dispensability. This product is not only water soluble, but provides instantized dispersion and solubalization. Products include a fish and bovine collagen type I/III in either a powder or granular form. All the products are near tasteless and odorless. They are designed for better absorption for either topical or ingested products. The competitive advantage of these products is that they are highly soluble making it suitable for new delivery forms such as powder mix, meal replacement, functional power mix, liquids and chews.

AIDP Collagen Product Portfolio

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<thead>
<tr>
<th>PRODUCT</th>
<th>FUNCTION</th>
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</tr>
</thead>
<tbody>
<tr>
<td>KoACT®</td>
<td>Bone health</td>
<td>Collagen I, Calcium</td>
<td>Bovine</td>
</tr>
<tr>
<td>Naticol®</td>
<td>Skin health</td>
<td>Collagen I, III</td>
<td>Fish</td>
</tr>
<tr>
<td>Porcine Collagen</td>
<td>Skin health</td>
<td>Collagen I, III</td>
<td>Porcine</td>
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<tr>
<td>Bovine Collagen</td>
<td>Skin health</td>
<td>Collagen I, III</td>
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<tr>
<td>KollaGen II-xs™</td>
<td>Joint Health</td>
<td>Collagen II</td>
<td>Chicken</td>
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REFERENCES


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PROVIDING SOLUTIONS FROM HEAD TO TOE

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BONE STRENGTH
Improves bone strength over calcium

Naticol®
BEAUTY FROM WITHIN
Fish collagen, improves skin appearance

KollaGenII-xs®
JOINT HEALTH
Relieves joint pain in 30 days

Instagen™
BEVERAGE GRADE
Instantly dissolving collagen

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