



# Collagen supplements: do they work?

## A science based review

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There is a strong interest in collagen supplements as recent basic and clinical scientific advancements have accumulated evidence for the essential role of collagen in the health of connective tissues such as joints, skin dermis, ligaments, tendons, and blood vessels. Collagen holds great promise as a key ingredient applicable to a wide spectrum of consumers, from the young adult to the middle aged on through the senior population. The focus of an older population is on optimal aging and mitigating degenerative processes, while younger consumers are interested in preventing sport-related injuries to maintain an active lifestyle. Despite its great potential, the consumer and marketers are confused about scientific distinction of collagen ingredients. This review provides a science-based comparison of collagen ingredients based upon their molecular nature and composition, which strongly affects their bioavailability, biological properties, and clinical efficacy.

### COLLAGEN INGREDIENTS ARE NOT CREATED EQUAL

Although many collagen supplements are available, collagen as an ingredient can be classified into several groups depending upon its type (I or II) that are associated with its sources and upon manufacturing processes, i.e., hydrolysis that reduces its molecular weight (MW).

First, collagen type I is found in ingredients such as Fortigel® and NEM® derived from porcine skin/bovine hide (a.k.a., gelatin) and eggshell membrane, respectively. Fish-derived collagen also provides type I. In contrast, BioCell Collagen® and UC (Undenatured collagen)-II® are made from chicken sternal cartilage and contain type II. Second, as undenatured or unhydrolyzed collagen is hardly soluble with poor absorption, a manufacturing process is used to hydrolyze collagen into smaller (poly)peptides enhancing bioavailability. BioCell Collagen® and Fortigel® belong to this hydrolyzed collagen category whereas UC-II® has unhydrolyzed/undenatured collagen.

Another layer of distinction is whether a collagen ingredient has a substantial amount of glycosaminoglycan (GAG) molecules such as hyaluronic acid (HA) and chondroitin sulfate. Among collagen ingredients, BioCell Collagen® appears to be the only science-backed ingredient that naturally contains a substantial amount of GAGs together with collagen. This difference is critical because both collagen and GAGs are required for healthy structure and function of joint, skin, and other connective tissues.

### SCIENCE-BASED COMPARISON

#### BioCell Collagen®, a holistic approach

BioCell Collagen® is a naturally-occurring matrix containing hydrolyzed collagen type II (65 percent), low molecular weight HA (10 percent) and chondroitin sulfate (20 percent), and offers a comprehensive support for joint, skin, and connective tissue health. Its safety and efficacy has been strongly substantiated by four human clinical trials.

The size of hydrolyzed collagen is smallest at 1.5 to 2.5 kDa among collagen ingredients and its human bioavailability study showed that HA concentration in human blood increased as much as 60-fold. Its daily dose, 2 grams for joint and 1 gram for skin benefit doses, is much lower than the typical 10 grams for hydrolyzed collagen type I.

It is noted that a hydrolysis process for BioCell Collagen® makes the constituent molecules not only more bioavailable, but also creates an intriguing biological activity such as stimulation of the cartilage-forming chondrocytes to produce de novo collagen type II. This suggests that BioCell Collagen® has cartilage regenerative potential. Furthermore, its ingestion leads to the appearance of collagen-specific peptides including Pro-Hyp. This dipeptide was shown to stimulate HA synthesis from human synovium cells and dermal fibroblasts, and to alleviate the degradation of cartilage and the programmed death of the chondrocytes. These potential tissue regenerative effects have not been reported for UC-II®, NEM®, or fish collagen.

Another unique feature of BioCell Collagen® is its inhibition of the hyaluronidase enzyme that degrades HA. As HA degradation is implicated in joint deterioration and skin aging, this ingredient seems to provide an additional support for maintaining the integrity and amount of HA.





### Hydrolyzed type I collagens

Human clinical trial showed that hydrolyzed collagen type I supported joint health and skin aesthetics endogenously, when consumed orally. However, its MW is higher than that of BioCell Collagen® and its daily dose is 5 to 10 times higher. In addition, GAGs lacks in this ingredient, making it an incomplete approach to healthy aging problems that involve the loss of both collagen and GAGs.

### Undenatured collagen-II

UC-II demonstrated that it might reduce joint discomfort via a mechanism different from hydrolyzed collagen ingredients that may stimulate tissue regeneration. Immune tolerance is proposed for its principal mechanism, but more details remain to be shown to verify its role in joint health. Also, UC-II does not provide GAGs and the current scientific evidence demonstrates its potential health benefit is isolated to joint only.

### NEM® or fish skin collagen

A clinical trial on eggshell membrane showed its limited effect in managing joint discomfort. The shortcoming seems to be associated with its substantially lower content of collagen (type I, 12 to 18 percent) and negligible amount of GAGs (<1 percent). More studies on human bioavailability and mechanisms of action need to be performed.

### CONCLUSION

The molecular composition and hydrolysis process affects both bioavailability and clinical outcome of a dietary ingredient. Review of scientific data from basic and clinical research suggests that BioCell Collagen® stands out as a most comprehensive collagen ingredient, which provides a holistic approach to joint, skin, and connective tissue health.

### REFERENCES AND NOTES

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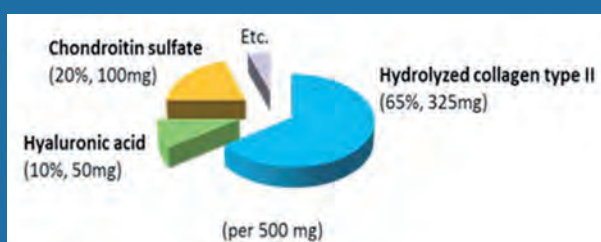


Figure 1. BioCell Collagen®: a cartilage collagen.

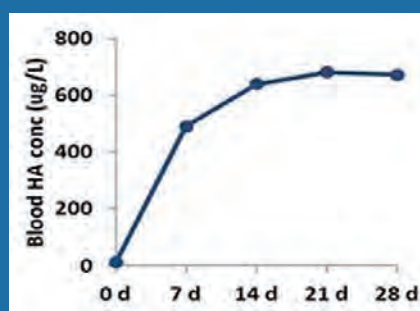


Figure 2. HA bioavailability in human.

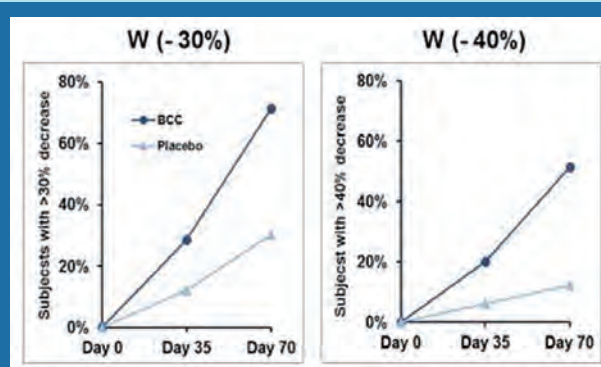


Figure 3. Improvement of joint discomfort.

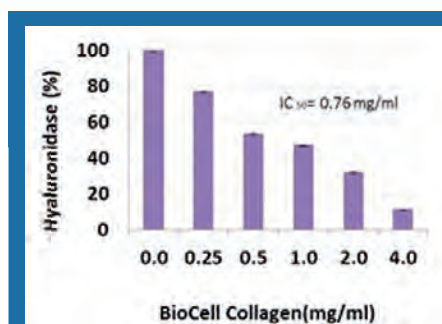


Figure 4. Inhibition of hyaluronidase.