

Collagen Benefits Skin and Joints, Study Confirms

Analysis by [Dr. Joseph Mercola](#)

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STORY AT-A-GLANCE

- › Collagen is the most common and abundant of your body's proteins; one of its primary purposes is to provide structural scaffolding for your various tissues to allow them to stretch while still maintaining tissue integrity
- › Collagen supplements allow for certain peptides to enter your bloodstream intact before they're broken down into their component parts in your digestive system, thereby benefiting connective tissues throughout your body
- › A peptide known as prolyl-hydroxyproline, in particular, which plays a role in skin health and repair, has been shown to enter the bloodstream intact
- › Oral collagen has been shown to increase skin elasticity, hydration and collagen density in the dermis of older women
- › Collagen may also help reduce joint pain, improve wound healing, improve blood pressure and reduce cardiovascular damage, improve glucose tolerance, strengthen bones and improve osteoporosis

This article was previously published July 15, 2019, and has been updated with new information.

Collagen is the most common and abundant of your body's proteins, which makes sense when you consider one of its primary purposes is to provide structural scaffolding for your various tissues to allow them to stretch while still maintaining tissue integrity.¹

Collagen makes up anywhere from 25%² to 30%³ of the total proteins in your body, and as much as 70% to 80% of the protein in your skin,⁴ in terms of dry weight.

It's found specifically in the connective tissues throughout your body,⁵ from your muscles, bones and tendons to your blood vessels and digestive system. As a compound of essential amino acids, there's only one way to get collagen: Your body can't produce it, so you must obtain it through your diet.

Historically, traditional diets provided ample collagen in the form of broth made from boiled chicken feet or beef bones. Today, few remember and value homemade bone broth as a key staple, which has led to an entire industry of collagen supplements.

While they certainly can be helpful, not all supplements are made alike. If you're looking to buy a collagen supplement it's important to know what to look for on the label before you bring that product home. In other words, it's a case of "buyer beware," as laboratory testing⁶ has revealed many popular collagen and bone broth products contain contaminants, from antibiotics and prescription drug metabolites to herbicides and insecticides.

Besides highlighting the hazards of nonorganic products, doubts have been raised as to whether collagen could really even benefit skin and connective tissue at all, as it was believed it likely would not be able to survive digestion. However, more recent research⁷ has provided a biological mechanism for how collagen works, showing certain peptides do in fact make it intact into the bloodstream. But before we get into that, let's review some of the basics.

Types of Collagen

While many different types of collagen have been scientifically identified, most of the collagen in your body falls into the following five categories:⁸

- **Type I⁹** – The most abundant type, Type 1 comprises 90% of the collagen found in your body, including your bones, tendons and organs. In supplements, Type I collagen may be derived from cows, pigs, chicken and/or fish

- **Type II¹⁰** – This is the primary component of cartilage. Type II collagen supplements are typically derived from poultry
- **Type III¹¹** – This is the fibrous protein found in bone, tendon, cartilage and connective tissues. Supplements containing Type 3 may be derived from cows, pigs, chicken and/or fish
- **Type IV** – This collagen is found in the connective tissues of epithelial cells
- **Type V** – This is the collagen found in your hair and nails

Types of Collagen Supplements

Collagen supplements can be either unhydrolyzed (undenatured) or hydrolyzed (denatured). Hydrolyzation refers to a processing technique that breaks the molecules down into smaller fragments, thereby enhancing intestinal absorption.¹² Since unhydrolyzed, natural collagen molecules are poorly absorbed due to their large size, most collagen products, whether topical or ingestible, are hydrolyzed.

However, as I'll discuss further below, the processing that most collagen supplements go through to become hydrolyzed may mean the end product has some byproducts in it you'd really rather not consume. This raises questions about which way to go: Should you buy the unhydrolyzed product and possibly not get the full benefits of the collagen, or opt for the hydrolyzed one, which may come with unwanted byproducts?

An argument can be made for unhydrolyzed products, as they will typically contain a wider spectrum of preserved amino acids, or peptides. On the other hand, hydrolyzed collagen is described as having greater bioavailability mainly because it has isolated, or broken-down, peptides. But unhydrolyzed collagen has these isolated peptides too – which can make it even more confusing if you're new to these terms.

To make it simpler, think of it this way: You need a good balance of amino acids like methionine and glycine – and when you isolate peptides, this balance is disrupted. Since your body breaks down the different collagen types through its own enzymatic

hydrolysis, it's helpful to know that unhydrolyzed collagen contains a wider range of amino acids.

This means you'll also get a more balanced ratio of complementary amino acids, and not just the isolated peptides you get with the hydrolyzed product. The argument here is nearly identical to the argument of whey protein concentrate versus isolate. Concentrates have a more natural profile, yet isolates are marketed as more bioavailable.

The thing is, with collagen, to isolate the peptides, the product must undergo harsh processing, which may negate some of its advertised benefits. This underscores why it's so important to learn everything you can about the product you're buying before you make the actual purchase. First, though, here is some information about how a collagen supplement might help you.

How Collagen Benefits Your Skin

As mentioned, there's been some debate as to whether collagen is able to survive digestion. Like collagen, many other foods contain amino acids, and if collagen is simply broken down into separate amino acids as it goes through the digestive process, why would it be specifically beneficial for ligaments, joints and skin, more so than any other amino acid-rich food?

As it turns out, hydrolyzed collagen does allow certain peptides to enter your bloodstream intact, before they're broken down into their component parts. Specifically, a peptide known as prolyl-hydroxyproline (Pro-Hyp), which plays a role in skin health and repair,^{13,14} has been shown to remain intact. As noted in a 2017 study¹⁵ published in the Journal of Agricultural and Food Chemistry:

"Previous studies have shown that the oral ingestion of collagen hydrolysate leads to elevated levels of collagen-derived peptides in the blood, but whether these peptides reach the skin remains unclear.

Here, we analyzed the plasma concentration of collagen-derived peptides after ingestion of high tripeptide containing collagen hydrolysate in humans.

We identified 17 types of collagen-derived peptides transiently, with a particular enrichment in Gly-Pro-Hyp ... Therefore, we propose that functional peptides can be transferred to the skin by dietary supplements of collagen."

Similarly, Caroline Brochard-Garnier, communication manager for Rousselot, a producer of gelatin and collagen products for the drug, food and nutritional markets, explained the mechanism of action to Nutraingredients.com in a March 2015 article:¹⁶

"When a collagen peptide preparation with optimized molecular weight and proven bioavailability is ingested, small collagen peptides are absorbed quickly into the blood stream.

The presence of these peptides in skin tissue, stimulate skin cells (fibroblasts) and activate multiple biochemical pathways which in turn leads to a response which is widely accepted:

Small collagen peptides are believed to act as a false signal of the destruction of collagen in the body, triggering the synthesis of new collagen fibers, which in turn increases skin suppleness and reduces the formation of wrinkles. In addition, the synthesis of hyaluronic acid is stimulated which leads to an increase in skin hydration."

Research Supporting the Use of Collagen for Skin Health

A number of studies have demonstrated collagen has beneficial effects on skin, helping mitigate age-related wrinkles, for example. Among them:

- A 2014 study¹⁷ in the journal *Skin Pharmacology and Physiology* found older women who took Type I collagen experienced "a statistically significant increase in skin elasticity," after eight weeks. They also observed improved skin hydration in

elderly women, although those results "did not reach a level of statistical significance."

- A 2015 study¹⁸ in the Journal of Medical Nutrition & Nutraceuticals found post-menopausal women given a collagen beverage experienced improvements in the look and feel of their skin.

According to the authors, "This study shows that the oral nutritional supplement consisting of hydrolyzed collagen, hyaluronic acid and essential vitamins and minerals, leads to a significant improvement in wrinkle depth. It is also able to induce noticeable improvement in elasticity and hydration of the skin." They also highlighted the results of previous research:

"Three studies from Japan in particular have demonstrated a clear effect. The benefits of daily ingestion of hydrolyzed collagen (10 g) on skin hydration of 20 healthy Japanese women compared to the placebo group (19 volunteers) were evaluated by Sumida et al.

In comparison with the placebo group, gradual improvement of water absorption capacity was observed through 60 days in volunteers who ingested collagen peptides. Matsumoto et al. presented results of a trial also suggesting that a daily ingestion of collagen peptides improve skin hydration.

The authors reported subjective improvement of the skin condition of woman's volunteers after ingestion of fish collagen peptides for 6 weeks. The percentage of positive response between the subjects was very high.

This study was followed by a double-blind placebo-controlled study by the same research group on healthy women volunteers aged 25-45. In this study 2.5, 5 and 10 g of fish collagen peptide were administered and compared to the placebo.

The hydration of the stratum corneum was measured at baseline and after 4 weeks. A significant difference was observed in subjects older than 30 years between the treated group (5 g and 10 g) and placebo."

- More recently, a systematic review¹⁹ published in January 2019 – which analyzed 11 studies using either collagen hydrolysate or a collagen tripeptide supplement at dosages ranging between 2.5 grams and 10 grams per day for eight to 24 weeks – concluded, "Preliminary results are promising for the short and long-term use of oral collagen supplements for wound healing and skin aging."

Specifically, oral collagen was found to "increase skin elasticity, hydration and dermal collagen density."

Other Health Benefits of Collagen

Collagen has also been shown to impart other valuable health benefits, including but not limited to the following:

- Reducing joint pain and stiffness²⁰
- Improving wound healing^{21,22}
- Improving blood pressure and reducing cardiovascular damage²³
- Improving glucose tolerance²⁴
- Strengthening bones^{25,26} and improving osteoporosis²⁷

Some of the benefits of collagen may also be attributable to the glycine it contains. While collagen contains 20 amino acids, glycine is one of the three predominant ones.²⁸ Glycine (and collagen, being a source of glycine) inhibits the consumption of NADPH, thereby lowering inflammation and oxidative damage in your body.

NADPH, or reduced nicotinamide adenine dinucleotide phosphate, is used as a reductive reservoir of electrons to recharge antioxidants once they become oxidized. NADPH is also necessary to make your steroid hormones and fats.

Glycine supplementation may also be beneficial for the prevention and/or treatment of metabolic syndrome, complications from diabetes, cardiac hypertrophy, and alcoholic and nonalcoholic liver disorders.

Collagen Versus Gelatin

Gelatin²⁹ is a staple in paleo-based diets. The difference between collagen and gelatin is that collagen is the raw material, and gelatin is what you get when you cook the collagen.³⁰

If you've ever made homemade bone broth, you'll find it forms a layer of gelatin at the top when it cools. That's the collagen from the bones and cartilage that has turned into gelatin, a formidable superfood.

In fact, making your own bone broth from the bones of organic grass fed or pastured animals is one of the best (and most inexpensive) ways to get healthy collagen into your diet.

On the other hand, hydrolyzed collagen (also called collagen hydrolysate) requires more intensive processing and cannot be produced at home. This processing is also one of its most significant drawbacks.

You likely will never find an organic hydrolyzed collagen on the market, because it is often a byproduct from the leather industry. When you see a product is made from hides, it is best to ask questions about how that collagen is removed from the hides. Many tanneries use sulfuric acid and chromium salts during processing.

Hydrolyzed collagen and gelatin are similar but not identical. While both products contain the same amino acids, they have different chemical properties and therefore differ in how you can use them. For example:

Both gelatin and hydrolyzed collagen have gut-healing properties (which is why they're a staple in the GAPS diet), aiding digestion, reducing inflammation and restoring your gut lining,³¹ although hydrolyzed collagen tends to be more easily digested.

Since hydrolyzed collagen has been broken down into smaller components, it can dissolve in both cold and hot liquids, whereas gelatin will only dissolve in hot liquid. And, since hydrolyzed collagen will not gel, it cannot be used as a substitute for gelatin in dishes like puddings and sauces.

Beware: Some Collagen Supplements May Be Contaminated

Sometimes testing shows that certain collagen supplements may be contaminated with heavy metals or other ingredients that are byproducts of making the products.³² They also may be tainted with glyphosate³³ due to the foodstuffs fed to animals in concentrated animal feeding operations (CAFOs).

In one example showing the extent of contamination in some products, Organic Consumers Association looked at 28 of the top-selling collagen supplements on Amazon. They found:³⁴

- 64% tested positive for measurable levels of arsenic
- 37% tested positive for measurable levels of lead
- 34% tested positive for trace levels of mercury
- 17% tested positive for measurable levels of cadmium

As noted by Root Cause Medical Clinics, you might even get a dose of something else if you choose a nonorganic product:³⁵

"Tests of collagen supplements that were non-organic revealed the presence of contaminants that included: antibiotics, drugs and endocrine disruptors that will affect hormone function and increase your cancer risk."

So, to avoid contaminants, you'd be wise to read labels thoroughly to make sure that what you choose is 100% organic.

While other research shows that heavy-metal contamination is likely below the maximum allowed in a product,³⁶ the take-home message, in my view, is that if you're

going to use a poultry-based collagen supplement, make sure it's certified "100% Organic" by the U.S. Department of Agriculture,³⁷ the only organic label that relates to food.

Factory farmed animal products are problematic for many reasons, such as accelerating antibiotic resistance, poor conditions for the animals, and because the farms contribute to severe environmental pollution. If you do not consume CAFO meats, you probably would not want to consume CAFO collagen and bone broth products either.

All things considered, my personal preference is to use a less denatured (unhydrolyzed) organic collagen supplement, as it has a more balanced amino acid profile or, better yet, simply make homemade bone broth using bones and connective tissue from grass fed, organically raised animals. It's the most natural approach of all and is, in my view, the best way to get the full range of benefits without the potential drawbacks.

Other Safe Ways to Boost Your Collagen

You may not even need a collagen supplement if you provide your body with the needed precursors. In fact, some experts recommend increasing consumption of collagen building blocks rather than collagen protein itself. Here are a number of ways to boost your collagen level without having to resort to a supplement:

Making and consuming homemade bone broth, made from organic, pasture-raised poultry or grass fed and finished bovine bones and cartilage. Chicken feet are excellent for this, as chicken claws are particularly rich in collagen³⁸

Red light therapy, aka low-level laser light therapy or photobiomodulation, has been shown to increase collagen growth to reduce wrinkles and improve skin elasticity³⁹

Ginseng, which has antioxidant and anti-inflammatory properties, has been found to increase collagen in the bloodstream and may have antiaging benefits⁴⁰

Aloe vera, taken orally as an aloe vera gel powder, nearly doubled collagen

production and increased hyaluronic acid levels by 1.5 times in one study,⁴¹ significantly reducing wrinkles in women aged 40 and over

Hyaluronic acid, an important compound for collagen in the skin, can be found in bone broth, organ meats and root vegetables,⁴² or taken as a supplement. Hyaluronic acid has been shown to improve skin moisture and suppleness and reduce wrinkles when added to the diet⁴³

Vitamin C, for example, plays an important role in collagen synthesis,⁴⁴ so, without vitamin C, your body's natural collagen production will be impacted. Fruits and vegetables rich in vitamin C include kiwi, oranges and other citrus fruits, tomatoes, bell peppers and broccoli

Antioxidants, which protect against damaging free radicals, enhance the effectiveness of existing collagen. Berries such as blueberries, blackberries and raspberries are good sources

Garlic contains sulfur, a necessary component for collagen production,⁴⁵ as well as lipoic acid, which helps rebuild damaged collagen fibers⁴⁶

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