

# Why Collagen Is Crucial for Bones and Skin

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

May 04, 2022

## 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 is part of the secret of why tendons have the tensile strength of wire ropes and why healthy bones are so hard yet not brittle. As minerals are incorporated into the collagen, it causes the collagen fibrils to contract. This stress generates a mineral-collagen composite material composed of high-tensile fibers with properties reminiscent of reinforced concrete
- › Loss of collagen is also one of the biggest contributors to visible signs of aging, such as wrinkles and dull or sagging skin. When your collagen level is high, your skin will tend to be soft, smooth and firm, because the collagen allows skin cells to repair and renew themselves continuously
- › Collagen is crucial for connective tissues such as tendons, ligaments, cartilage and fascia, and these too tend to get weaker and less elastic with age. Connective tissue requires very specific raw materials in order to heal, namely animal-based collagen such as gelatin and bone broth
- › Homemade bone broth using bones and connective tissue from grass fed, organically raised animals will produce the best result. If using a supplement, make sure it's made from grass fed organic animals, such as beef bones. Collagen supplements made from cattle hides can be problematic, even if organic and grass fed

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. While it's commonly known that a collagen-rich diet can help counteract signs of aging in your skin, it's also crucial for bone health,<sup>1,2,3</sup> and this is less widely known.

## Collagen's Role in Bone

Bone is created as collagen fibrils mineralize together with carbonated hydroxyapatite (calcium apatite). Combined, they form a hybrid material that is very strong yet flexible.

What's more, as other minerals (such as strontium- and calcium-based minerals) are deposited inside the collagen, it causes a reaction that triggers the collagen fibrils to contract. This stress generates a mineral-collagen composite material composed of high-tensile fibers with properties "reminiscent of ... reinforced concrete," to quote an April 2022 paper in the journal Science.<sup>4,5</sup>

In short, this explains why tendons have the tensile strength of wire ropes and why healthy bones are so hard yet not brittle. As explained by Phys.org, which reported the findings:<sup>6</sup>

*"A team at the Max Planck Institute of Colloids and Interfaces (MPICI) has discovered new properties of collagen: During the intercalation of minerals in collagen fibers, a contraction tension is generated that is hundreds of times stronger than muscle strength ...*

*This contraction of the fibers apparently occurs during mineral incorporation into the collagen, putting the mineral under enormous pressure, which increases the fracture strength of the composite ...*

*The strength of bones is based on the structural interplay of soft, organic collagen fibers and the hard, crystalline mineral particles embedded in them, thus a hybrid material. The collagen gives the mineral particles an active pre-stress.*

*Civil engineers use a comparable mechanism in pre-stressed concrete with the aid of high-strength steel and thus produce crack-resistant structural elements.*

*'It is also interesting from a medical or biological point of view to understand what happens in the process of mineralization in bones,' says Dr. Wolfgang Wagermaier, group leader at the MPICI. He adds, 'Many bone diseases are associated with changes in **mineral content** in bones and thus altered properties.'*

## Collagen Can Help Improve Your Skin

Loss of collagen is also one of the biggest contributors to visible signs of aging, such as wrinkles and dull or sagging skin. When your collagen level is high, your skin will tend to be soft, smooth and firm, because the collagen allows skin cells to repair and renew themselves continuously.

By the time you reach your 80s, you have about four times less collagen than you did in your youth, which brings about the skin issues. A collagen-rich diet can go a long way toward slowing down these visible signs of aging.<sup>7,8,9</sup> It also benefits your hair and nails.

That said, certain environmental and lifestyle factors can also have a negative impact on your collagen production, regardless of your age, making healthy, youthful skin hard to attain. Factors that can slow your body's ability to manufacture collagen include:

Hormone imbalances and thyroid dysfunction	Pollution and dust
Overwork	Hydrogenated cooking oils
Processed foods	Nutritional deficiencies
Fluoridated water	Radiation

Excessive sun exposure

Sugar

Stress

Poor liver or kidney function

If you're vegetarian, you may also have a more difficult time keeping up your collagen intake, because it's stored in animal bones. It's one of the reasons why bone broth is now considered a superfood.

When it comes to skin health, it's important to realize that topically applied collagen cannot cross into deeper skin layers, so most collagen-containing skin creams are likely a waste of money. To really make a difference, you need to tackle the problem from the inside-out, making sure you're getting enough collagen, either through collagen-rich foods or a supplement.

## Collagen for Soft Tissue Injury and Repair

Collagen is, of course, also crucial for connective tissues such as tendons, ligaments, cartilage and fascia, and these too tend to get weaker and less elastic with age. Connective tissue injuries are also problematic due to the fact that there's very little blood supply in connective tissue, which slows down recovery.

**“ Collagen is high in amino acids such as glycine, proline and hydroxyproline, which are the building blocks for the matrix of connective tissue. Your body automatically takes collagen into stressed areas and places where it's needed the most. ”**

While a muscle injury is fairly easy to fix and recover from, connective tissue requires very specific raw materials in order to heal, namely animal-based collagen such as gelatin and bone broth.

Collagen is high in amino acids such as glycine,<sup>10</sup> proline and hydroxyproline, which are the building blocks for the matrix of connective tissue. Interestingly, your body automatically takes collagen into stressed areas and places where it's needed the most.

On a side note, collagen will not count toward your daily protein intake, because it's very low in branched-chain amino acids (such as leucine, isoleucine and valine, found in meat), which are the primary amino acids that stimulate muscle anabolism and muscle building.

## Other Health Benefits of Collagen

Health benefits provided by collagen supplementation, aside from what I've already mentioned, include:

---

Deeper sleep and serotonin release due to its glycine content<sup>11</sup>

---

Reduced joint pain and stiffness,<sup>12</sup> including osteoarthritis pain<sup>13</sup>

---

Improved gut health and digestion, thanks to the presence of glycine<sup>14</sup>

---

Improved blood pressure and reduced cardiovascular damage<sup>15</sup>

---

Improved glucose tolerance<sup>16</sup>

---

Reduced inflammation and oxidative damage, as glycine inhibits the consumption of nicotinamide adenine dinucleotide phosphate (NADPH). NADPH is used as a reductive reservoir of electrons to recharge antioxidants once they become oxidized

---

## Types of Collagen

While 28 different types of collagen have been scientifically identified, most supplements will contain one or more of just three of these, which are known simply

as:<sup>17,18,19</sup>

- Type 1 – collagen found in skin/hide, tendon, scales and bones of cows, pigs, chicken and fish
- Type 2 – formed in cartilage and typically derived from poultry
- Type 3 – fibrous protein found in bone, tendon, cartilage and connective tissues of cows, pigs, chicken and fish

Types 1, 2 and 3 comprise 90% of the collagen in your body.<sup>20</sup> As for the difference between collagen and gelatin: Collagen is the raw material; gelatin is what you get when you cook the collagen.<sup>21</sup>

## Choose Your Collagen Source Wisely

Historically, traditional diets provided ample collagen in the form of broth made from boiled chicken feet or beef bones. These are by far your best alternatives. If you decide to use a collagen supplement, it's important to know what to look for. Here are some general questions to ask when shopping around:

- **Has it been hydrolyzed?** – Collagen supplements can be either unhydrolyzed (undenatured) or hydrolyzed (denatured). In their natural, unhydrolyzed state, collagen molecules are poorly absorbed due to their large size. Hydrolyzation refers to a processing technique that breaks the molecules down into smaller fragments, thereby enhancing intestinal absorption.

For this reason, most collagen products are hydrolyzed. However, the processing that most collagen supplements undergo to become hydrolyzed can also result in questionable byproducts that are best avoided. I review some of these problems in the video above.

- **Is it organic and/or grass fed certified?** – Laboratory testing has revealed many popular collagen and bone broth products contain potentially hazardous contaminants typically associated with concentrated animal feeding operations

(CAFOs), such as heavy metals,<sup>22,23</sup> chemicals like butylparaben, and various veterinary drugs,<sup>24,25</sup> including antibiotics.

To avoid contaminants, make sure your collagen supplement is certified “100% Organic” by the U.S. Department of Agriculture (USDA)<sup>26</sup> or, better yet, certified grass fed by the American Grassfed Association (AGA), which has the most rigorous standards. This also applies to gelatin, commonly used in cooking and baking.

- **What raw materials is it made from?** – Nonorganic collagen is almost universally made from hydrolyzed cattle hides, not beef bones. When made from cattle hide, even organic certification becomes questionable, because hides, organic or not, are still scraps from the leather tannery industry and have undergone intense processing with harsh chemicals.

Raw, newly skinned hides arrive to the tannery on large pallets, where they can remain to rot for weeks before being processed. Even though they’re salted, they’re not entirely preserved and the stench is overwhelming. The tannery process itself typically involves an acid bath and processing with harsh chemicals such as sulfuric acid or chromium salts.

Hides with scars and imperfections are discarded once they’ve gone through this processing, and these castoffs are what are used to make bovine hide-based collagen supplements. The already processed scraps then undergo additional processing to dissolve the hide and release the collagen peptides. So, while the raw hide may have come from an organically raised, grass fed cow, after all that chemical processing, just how organic is the final product?

My personal preference is to use a less denatured (unhydrolyzed) grass fed organic collagen supplement made from beef bones (not hide). Unhydrolyzed products tend to have a more balanced amino acid profile, and grass fed beef bones will avoid most contaminants.

That said, I still believe the natural approach is best. Making homemade bone broth using bones and connective tissue from grass fed, organically raised animals isn't very complicated and will produce the best results. If you prefer chicken broth, consider using organic chicken feet. The claws are particularly rich in collagen.<sup>27</sup>

## Sources and References

---

- <sup>1</sup> Bone 2010 Mar;46(3):827-3
- <sup>2</sup> PLoS One 2014 Jun 13;9(6):e99920
- <sup>3</sup> J Agric Food Chem. 2010 Jan 27;58(2):835-41
- <sup>4</sup> Science April 7, 2022; 376(6589): 188-192
- <sup>5</sup> National Natural Science Foundation of China, Chinese Scholars and Cooperators Achieved Progress in Bioprocessing-inspired Fabrication
- <sup>6</sup> Phys.org April 8, 2022
- <sup>7</sup> Skin Pharmacology and Physiology 2014; 27: 47-55 (PDF)
- <sup>8</sup> Journal of Medical Nutrition & Nutraceuticals 2015; 4(1): 47-53
- <sup>9</sup> J Drugs Dermatol. 2019 Jan 1;18(1):9-16
- <sup>10</sup> Amino Acids January 2018;50(1):29-38
- <sup>11</sup> J Pharmacol Sci 2012; 118: 145 – 148 (PDF)
- <sup>12</sup> Curr Med Res Opin. 2008 May;24(5):1485-96
- <sup>13</sup> Curr Med Res Opin. 2006 November; 22(11):2221-32
- <sup>14</sup> Am J Physiol 1982 February;242(2):G85-8
- <sup>15</sup> J Med Food. 2010 Apr;13(2):399-405
- <sup>16</sup> J Med Food. 2016 Sep;19(9):836-43
- <sup>17</sup> Nutraingredients.com March 19, 2015
- <sup>18</sup> Charlotte's Book, Collagen Supplements
- <sup>19</sup> Amino-collagen.com, Types of Collagen
- <sup>20</sup> Woundresearch.com, A Review of Collagen and Collagen-Based Wound Dressings
- <sup>21</sup> Paleo Leap, Collagen Versus Gelatin
- <sup>22</sup> Rodale's Organic Life May 19, 2017
- <sup>23</sup> ConsumerLab, October 4, 2019
- <sup>24</sup> Consumer Wellness Center October 5, 2017
- <sup>25</sup> Bonebroth.news October 5, 2017
- <sup>26</sup> USDA.gov, USDA Organic
- <sup>27</sup> T Health, 10 Chicken Feet Health Benefits August 6, 2015