

Why Collagen Is a Proven Necessity

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STORY AT-A-GLANCE

- › Collagen is the most common and abundant of your body's proteins, accounting for about 30% of the total protein in your body. One of its primary purposes is to provide structural scaffolding to allow tissues to stretch and flex while maintaining tissue integrity
- › Collagen is found in your skin, connective tissues like tendons, ligaments, cartilage and fascia, your bones, organs, blood vessels, musculoskeletal system, hair and nails
- › The loss of collagen that occurs with age is the primary reason for wrinkles, dry sagging skin and lackluster hair. You can maintain a more youthful appearance by making sure you're getting plenty of collagen and/or gelatin in your diet
- › Collagen is also crucial for bone health and recovery from soft tissue injuries, and can help improve sleep, reduce joint pain, improve gut health, glucose tolerance and blood pressure, reduce cardiovascular damage, lower your risk of osteoporosis, and lower inflammation and oxidative damage
- › The primary amino acids in collagen – glycine, proline and hydroxyproline – make up the matrix of connective tissue. Beef contains very little of these amino acids, so eating only muscle meat will not provide enough amino acids to allow you to build strong connective tissue and maintain bone strength

Collagen is the most common and abundant of your body's proteins, accounting for about 30% of the total protein in your body. It's found in your skin, connective tissues like tendons, ligaments, cartilage and fascia, your bones, organs, blood vessels, musculoskeletal system and even your hair and nails. One of its primary purposes is to

provide structural scaffolding for tissues to allow them to stretch and flex while maintaining tissue integrity.

Collagen Helps Maintain a More Youthful Appearance

The loss of collagen that occurs with age is the primary reason for wrinkles, dry sagging skin and lackluster hair. When your collagen level is high, your skin will tend to be soft, smooth and firm, because the collagen allows skin cells to continuously repair and renew themselves.

By the time you reach your 60s, you have about half the collagen you did in your youth, and once you enter your 80s, you have about four times less, hence the radical changes in your skin.

If you're vegetarian or vegan, signs of skin aging may be more pronounced for the simple fact that you don't eat collagen-rich foods on a regular basis. Foods like fish, bone broth and organic, pastured chicken and eggs are all natural sources of collagen. Many vegetarians and vegans also shun collagen supplements because they're made from animal sources.

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. The good news is you can maintain a more youthful appearance by making sure you're getting plenty of collagen and/or gelatin in your diet.^{1,2,3}

Collagen Supports Optimal Health in Many Ways

The benefits of collagen certainly don't end there, though. Collagen is also crucial for bone health,^{4,5,6} and will dictate how well and how rapidly you'll recover from soft tissue injuries. Collagen can also help:

Improve your sleep⁷

Reduce joint pain and stiffness,⁸
including osteoarthritis pain⁹

Improve digestion¹⁰ and gut health by
keeping your gut lining healthy¹¹

Improve glucose tolerance¹²

Improve blood pressure¹³

Reduce cardiovascular damage¹⁴

It can also help lower your risk of osteoporosis (brittle bone). According to ABC15 Health Insider Dr. Shad Marvasti, adding 10 to 15 grams of collagen a day has been shown to improve bone health in as little as eight weeks.¹⁵

Thanks to its high glycine content, collagen also helps reduce inflammation and oxidative damage, which are hallmarks of most chronic diseases. The amino acid glycine, which makes up 28% of collagen, does this by inhibiting the consumption of nicotinamide adenine dinucleotide phosphate (NADPH), which acts as a reductive reservoir of electrons to recharge antioxidants once they become oxidized.

Collagen Is Required for Strong Connective Tissue and Bone

Connective tissues such as tendons, ligaments, cartilage and fascia also tend to get weaker and less elastic with age, making you more prone to injuries that can take a long time to heal.

Connective tissue injuries are also problematic because there's very little blood supply in connective tissue, which slows recovery. While a muscle injury is relatively easy to recover from, connective tissue requires collagen to heal, as glycine,¹⁶ proline and hydroxyproline¹⁷ are the raw materials that make up the matrix of connective tissue.

“ Beef contains very little of the amino acids required for connective tissue health. So, beef alone will not

allow you to build strong connective tissue and maintain bone strength.”

Interestingly, research suggests your body will selectively take collagen into the areas that are stressed and need it most. We discussed this in my 2018 [interview with Mark Sisson](#), a former elite endurance athlete.

As you can see in the chart below, beef contains very little of the amino acids required for connective tissue health. So, beef alone will not allow you to build strong connective tissue and maintain bone strength.

Amino Acid	% Gelatin Collagen	% Beef
Glycine	28	1.6
Proline	17	1.0
Hydroxyproline	14	0.3
Alanine	11	1.3
Methionine	0.8	3.2
Histidine	0.8	2.1
Tryptophan	0.4	1.3
Cysteine	Trace	0.2

If you are only eating muscle meats without the connective tissue, you will get the amino acids in the right column, which simply does not provide your body with the amino acids it requires to build collagen. Admittedly, these missing amino acids are not essential so your body can make them, but it will waste loads of energy in doing that.

Bone Formation

Bone is created when 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.^{18,19}

This explains why tendons have the tensile strength of wire ropes and why healthy bones are so hard yet not brittle.²⁰ As with connective tissue, the key to strong and flexible bone is collagen, and if you're not trying to maintain a healthy intake, your bones will become increasingly brittle and less strong with age, ultimately resulting in osteoporosis.

Collagen for Life Extension and Disease Prevention

If you are getting the majority of your protein from muscle meats you will be getting high amounts of the amino acids that are in red, which are very low in collagen and gelatin. Why is this important? Because these are the very amino acids that, when consumed in excess, have been highly correlated with decreased longevity.

Your collagen intake may also impact your longevity and overall disease risk. As reported by the late Ray Peat, a biologist who specialized in bioenergetic medicine,²¹ life extension studies have shown that restricting tryptophan or cysteine alone produces greater life extension than calorie restriction, which is rather remarkable.

Referring to the chart above, you can see that beef contains more than three times the amount of tryptophan compared to collagen. Peat also argued that collagen, the cooked form (gelatin) in particular, has a long history of use for disease prevention. Modern medicine has simply chosen to overlook or forget all of that. In his archived article "Gelatin, Stress, Longevity," Peat explained:²²

"Both tryptophan and cysteine inhibit thyroid function and mitochondrial energy production, and have other effects that decrease the ability to withstand stress. Tryptophan is the precursor to serotonin, which causes inflammation, immunodepression, and generally the same changes seen in aging ...

[G]elatin is a protein which contains no tryptophan, and only small amounts of cysteine ... Using gelatin as a major dietary protein is an easy way to restrict the amino acids that are associated with many of the problems of aging ...

When cells are stressed, they form extra collagen, but they can also dissolve it, to allow for tissue remodeling and growth ... When collagen is broken down, it releases factors that promote wound healing and suppress tumor invasiveness.

Glycine itself is one of the factors promoting wound healing and tumor inhibition. It has a wide range of antitumor actions, including the inhibition of new blood vessel formation (angiogenesis), and it has shown protective activity in liver cancer and melanoma ...

When we eat animal proteins in the traditional ways (for example, eating fish head soup ... 'head-cheese' ... and chicken-foot soup ...), we assimilate a large amount of glycine and gelatin ...

When only the muscle meats are eaten, the amino acid balance entering our blood stream is the same as that produced by extreme stress, when cortisol excess causes our muscles to be broken down to provide energy and material for repair.

The formation of serotonin is increased by the excess tryptophan in muscle, and serotonin stimulates the formation of more cortisol, while the tryptophan itself, along with the excess muscle-derived cysteine, suppresses the thyroid function ...

The range of injuries produced by an excess of tryptophan and serotonin seems to be prevented or corrected by a generous supply of glycine. Fibrosis, free

radical damage, inflammation, cell death from ATP depletion or calcium overload, mitochondrial damage, diabetes, etc., can be prevented or alleviated by glycine ...

Since persistent lipolysis and insulin resistance, along with a generalized inflammatory state, are involved in a great variety of diseases, especially in the degenerative diseases, it's reasonable to consider using glycine/gelatin for almost any chronic problem."

Red meat, on the other hand, contains far higher levels of the antimetabolic amino acids cysteine and tryptophan, which you want less of if you struggle with degenerative and/or inflammatory conditions.

Glycine for Bleeding, Stroke and Muscle Spasms

In his article,²³ Peat also argues that a wide variety of bleeding conditions can be successfully treated with glycine, and hence a collagen- or gelatin-rich diet. These include everything from nosebleeds and excessive menstrual bleeding, to bleeding ulcers, hemorrhoids and even stroke.

According to Peat, glycine, taken shortly after a stroke, limits the damage and accelerates recovery. Glycine may also be protective in epilepsy, by stabilizing nerves and raising the amount of stimulation required to activate nerves. Glycine also has antispastic effects that can help alleviate muscle spasms associated with multiple sclerosis (MS).

Conditions involving excess prolactin, serotonin and/or cortisol, such as autism, postpartum and premenstrual problems, Cushing's disease, diabetes and impotence, may also benefit.

"In some of the older studies, therapeutic results improved when the daily gelatin was increased," he notes. "Since 30 grams of glycine was commonly used for treating muscular dystrophy and myasthenia gravis, a daily intake of

100 grams of gelatin wouldn't seem unreasonable, and some people find that quantities in that range help to decrease fatigue ...

For adults, a large part of that could be in the form of gelatin. If a person eats a large serving of meat, it's probably helpful to have 5 or 10 grams of gelatin at approximately the same time, so that the amino acids enter the blood stream in balance."

Make Sure You Are Getting Some Collagen or Glycine

Importantly, while glycine, proline, hydroxyproline and alanine all have anti-inflammatory and other healing properties, the primary amino acids in red meat tend to induce and/or promote inflammation (listed in red in the chart above).

For that reason, I cut my egg and meat intake by 50% and replaced the protein with gelatin and collagen instead. Overall, I aim to have about one-third of my protein as collagen or gelatin.

As a general suggestion, a good maintenance dose is about 20 grams of collagen per day. If you're trying to address a soft tissue injury, you may want to increase that to 40 grams a day. You can also help prevent the breakdown of collagen by eating antioxidant-rich foods and avoiding cigarette smoke, pollution,²⁴ excessive alcohol consumption and sugary foods.²⁵ Vitamin C-rich foods also aid in collagen production.

Collagen Types

While 29 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:^{26,27,28}

- **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 found in your body.²⁹ Collagen supplements typically come in one of two forms: unhydrolyzed (undenatured) or hydrolyzed (denatured) collagen. 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.

Collagen Vs. Gelatin

As for the difference between collagen and gelatin: Collagen is the raw material and gelatin is what you get when you cook the collagen.³⁰ While collagen and gelatin have the same basic amino acid composition, gelatin is more digestible and easier to absorb, which is important if your digestion is in any way compromised.

Collagen is made from animal bones, skins, tendons and other connective tissues. The collagen is extracted through an acid or alkali treatment followed by purification and does not involve heat. Since the molecular structure is larger, collagen does not dissolve in water.

When collagen is heated, the molecular bonds break down, giving you gelatin hydrolysate or hydrolyzed gelatin (other terms to describe gelatin include collagen hydrolysate or collagen peptides). Since the peptide chains are shorter, gelatin can be dissolved in water, where it forms a thick gel.

In terms of health benefits, these differences are likely minimal, because when collagen is ingested, it gets broken down in your gastrointestinal tract into shorter peptides that are the same as gelatin.

Since only free amino acids can enter your bloodstream, collagen and gelatin have essentially identical systemic effects, as their basic composition is the same. That said, gelatin may be preferable if you have ulcers or other GI problems.

Collagen Sources – The Good, the Bad and the Ugly

The ideal source of collagen/gelatin is homemade broth made from boiled organic chicken feet or beef bones. (Gelatin is the thickened layer that forms on top.) This also tends to be the most cost effective.

As far as supplements go, my preference is powdered gelatin, followed by collagen products made from beef bone broth rather than hide. When made from cattle hide, even organic certification becomes questionable, because hides, organic or not, are scraps from the leather tannery industry that have undergone intense processing with harsh chemicals.

Whether you choose gelatin or collagen, make sure it's certified "100% Organic" by the U.S. Department of Agriculture (USDA)³¹ or, better yet, certified grass fed by the American Grassfed Association (AGA), which has the most rigorous standards.

Nonorganic collagen supplements are best avoided, as most are made from animal parts derived from animals raised in concentrated animal feeding operations (CAFOs), and may contain unwanted contaminants, including heavy metals,³² chemicals and drugs,^{33,34} including antibiotics.

Also, do not use JELL-O brand³⁵ "gelatin" snacks, as ready-to-eat JELL-O cups contain no gelatin whatsoever. Instead, they're using carrageenan, which can induce inflammation and contribute to a wide variety of chronic diseases.³⁶ It can also cause digestive side effects.³⁷

JELL-O powder³⁸ does contain gelatin, as it contains food coloring and preservatives with questionable safety. What you want is a pure gelatin powder without sugar and other additives.

If you cannot afford a high-quality collagen or gelatin supplement, you could consider taking pure glycine instead. It's available in powder form and tends to be very affordable and is easy to take, as it has a mildly sweet flavor. That said, alanine and proline have many of the same benefits as glycine, including protection against cell damage, so using gelatin rather than pure glycine is preferable.³⁹

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