

# Collagen and Gelatin Are Crucial for Optimal Health

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by [Dr. Joseph Mercola](#)

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### Story-at-a-Glance

- Collagen accounts for about 30% of the total protein content in the human body and needs to be replaced. Red meat will not provide enough amino acids to allow you to build strong connective tissue
- Collagen provides structural scaffolding for your various tissues to allow them to stretch while still maintaining tissue integrity, and is crucial for repairing soft tissue, muscle and connective tissue. Gelatin is cooked collagen, which makes it more digestible and easier to absorb
- Many degenerative and inflammatory diseases can also be ameliorated by eating more gelatin-rich foods. 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
- Life extension studies have shown that restricting only tryptophan, or only cysteine, produces a greater life span extension than caloric restriction
- Collagen is rich in glycine, which can be helpful for all sorts of bleeding problems, including nosebleeds, excessive menstrual bleeding, bleeding ulcers, hemorrhoids and even stroke

Collagen accounts for about 30% of the total protein in your

body. One of its primary purposes is to provide structural support and strength to your tissues, such as skin, bones, tendons, ligaments and cartilage<sup>1,2,3</sup> by allowing them to stretch while still maintaining tissue integrity.

As such, collagen is crucial for repairing soft tissue, muscle and connective tissue. Connective tissues include tendons, ligaments, cartilage and fascia, which tend to get weaker and less elastic with age. Connective tissue injuries are also problematic since there's very little blood supply in connective tissue, which slows down recovery.

Nearly one-third of the amino acids in collagen is glycine. It is also high in proline, hydroxyproline and alanine, which are the building blocks for the matrix of connective tissue. Your body uses the amino acids in collagen to rehab stressed areas and places in your body where it's needed the most. Other lesser-known health benefits of collagen supplementation include:

- Deeper sleep due to its glycine content<sup>4</sup>
- Reduced joint pain and stiffness,<sup>5</sup> including osteoarthritis pain<sup>6</sup>
- Improved gut health and digestion, thanks to the presence of glycine<sup>7</sup>
- Improved blood pressure and reduced cardiovascular damage<sup>8</sup>
- Improved glucose tolerance<sup>9</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

## Important Differences Between Collagen and Red Meat

The chart below details the amino acid ratios of gelatin and collagen versus red meat (beef). As you can see, gelatin/collagen contain vastly more of the important amino acids to rebuild your connective tissue than beef. Since one-third of your body's protein is collagen, it makes no sense to eat only muscle meat, as it will not provide enough amino acids to allow you to build strong connective tissue.

Importantly, collagen contains higher amounts of specific amino acids with anti-inflammatory and other healing properties, while red meat is higher in amino acids that induce inflammation. I'll discuss these differences further below.

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

I believe it is still important to eat animal protein that is higher in branched chain amino acids to stimulate mTOR and muscle protein synthesis, but it is wise not to use this exclusively as the amino acids in red are relatively high in

animal protein and have been shown to negatively correlate with longevity.

Interestingly, collagen and gelatin are extraordinarily low in these amino acids. This is why I personally shoot to have about one-third of my protein as collagen or gelatin. I have cut down my egg and meat intake by 50% and replaced the protein with gelatin and collagen. One of the reasons I did this was based on the late Ray Peat's take on the importance of balancing these important amino acids.

Our ancestors never had access to gelatin or collagen products as food sources like we have today, so they typically obtained their collagen from eating the whole animal, including the connective tissue. Since most of us are not doing that today, it would seem important to integrate some collagen and gelatin into our diets.

## **Collagen Is Important for Degenerative Diseases**

According to Peat, who was a biologist<sup>10</sup> with a specialization in physiology,<sup>11</sup> collagen – especially the cooked form, which is gelatin – also helps protect your cells against stress. He points out that amino acids in their free state have many hormone-like functions.

For example, during stress, cysteine and tryptophan are released in large quantities, and these amino acids have antimetabolic effects. Other amino acids act as nerve-modifiers, triggering excitation or inhibition, while others, especially glycine, have cell-protective, anti-stress effects.

As such, many degenerative and inflammatory diseases can be ameliorated by eating more gelatin-rich foods. 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.

## **We've Followed a Flawed Paradigm**

Peat stressed that the conventional “lock and key” paradigm of endocrinology, which teaches that hormones signal cells that have suitable receptors for it, is flawed. Instead, his research brought him to the understanding that cellular responses were in fact dependent on the state of the cells, and that state is modified by nutrients, metabolites, hormones and neurotransmitters in its surroundings.

By fixating on a flawed paradigm, we've ended up with what Peat referred to as “monstrous distortion of the official dietary recommendations.” For example, most studies trying to determine the nutritional requirements for protein were done for the agricultural industry and were designed to identify the cheapest way to achieve maximum growth in the shortest time possible.

But maximizing growth doesn't mean you're also maximizing health and longevity. Quite the contrary. Polyunsaturated fats (PUFAs) like linoleic acid (LA), for example, produce rapid weight gain in young animals, which translates into rapid profits. But if we're looking for optimal human health, that's not what we want. And, indeed, there's overwhelming evidence showing excessive PUFA consumption is wrecking human health.

Similarly, amino acids in proteins were defined as “essential” based on their contribution of growth in animals, again ignoring factors such as longevity, brain development and optimal health.

According to Peat, what little research has been done in this area suggests the human requirement for tryptophan and cysteine is very low in adulthood. So, the high intake of red meat and virtually no consumption of connective tissues rich in collagen and gelatin is not doing your health any favors.

## **Collagen for Life Extension and Disease Prevention**

According to Peat, life extension studies have shown that

“Restricting only tryptophan, or only cysteine, produces a greater extension of the life span than achieved in most of the studies of caloric restriction,” which is rather remarkable. In his archived article “Gelatin, Stress, Longevity,” Peat explained:<sup>12</sup>

*“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.*

*Histidine is another amino acid precursor to a mediator of inflammation, histamine; would the restriction of histidine in the diet have a longevity promoting effect, too?*

*It happens that gelatin is a protein which contains no tryptophan, and only small amounts of cysteine, methionine, and histidine. 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, as well as the muscles, or 'head-cheese' as well as pork chops, and chicken-foot soup as well as drumsticks), we assimilate a large amount of glycine and gelatin. This whole-animal balance of amino acids supports all sorts of biological process[es], including a balanced growth of children's tissues and organs.*

*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.*

*Some types of cell damage are prevented almost as well by alanine and proline as by glycine, so the use of gelatin, rather than glycine, is preferable ... Gelatin has been used successfully to treat diabetes for over 100 years. Glycine inhibits lipolysis ... and this in itself will make insulin more effective, and help to prevent hyperglycemia. (A gelatin-rich diet can also lower the serum triglycerides.)*

*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."*

## **Glycine for Bleeding, Stroke, Muscle Spasms and Pain**

In his article, Peat reviewed several conditions that can be successfully treated with glycine. For example, all sorts of bleeding problems, including nosebleeds, excessive menstrual bleeding, bleeding ulcers, hemorrhoids and even stroke may benefit from a gelatin-rich, and hence glycine-rich diet.

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. He also shared the effects of his personal experimentation with gelatin:<sup>13</sup>

*"For years I hadn't slept through a whole night without waking ... The first time I had several grams of gelatin just before bedtime, I slept without interruption for about 9 hours.*

*I mentioned this effect to some friends, and later they told me that friends and relatives of theirs had recovered from long-standing pain problems (arthritic and rheumatic and possibly neurological) in just a few days after taking 10 or 15 grams of gelatin each day.*

*For a long time, gelatin's therapeutic effect in arthritis was assumed to result from its use in repairing the cartilage or other connective tissues around joints, simply because those tissues contain so much collagen ...*

*Some of the consumed gelatin does get incorporated into the joint cartilage, but that is a slow process, and the relief of pain and inflammation is likely to be almost immediate, resembling the anti-inflammatory effect of cortisol or aspirin.*

*Inflammation produces fibrosis, because stress, hypoxia, and inadequate supply of glucose stimulate the fibroblasts to produce increased amounts of collagen. In lungs, kidneys, liver, and other tissues, glycine protects against fibrosis, the opposite of what the traditional view would suggest.*

*Since excess tryptophan is known to produce muscle pain, myositis, even muscular dystrophy, gelatin is an appropriate food for helping to correct those problems, simply because of its lack of tryptophan. (Again, the popular nutritional idea of amino acids as simply building blocks for tissues is exactly wrong – muscle protein can exacerbate muscle disease.)”*

According to Peat, any condition involving excess prolactin, serotonin and/or cortisol, including autism, postpartum and premenstrual problems, Cushing’s disease, diabetes, and impotence “should” benefit from a diet low in tryptophan.

*“In some of the older studies, therapeutic results improved when the daily gelatin was increased,” he noted. “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."*

## **What Is the Difference Between Gelatin and Collagen?**

While collagen and gelatin have the same basic amino acid composition, their properties differ due to differing manufacturing processes. Put simply, gelatin is basically cooked collagen,<sup>14</sup> which makes it more digestible and easier to absorb. This is particularly important if you have compromised digestion.

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.

## **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,<sup>15,16,17</sup> as they comprise 90% of the collagen in your body.<sup>18</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

## **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 or gelatin supplement, here are some general considerations to take into account when shopping around:

• **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>19,20</sup> chemicals like butylparaben, and various veterinary drugs,<sup>21,22</sup> including antibiotics.

To avoid contaminants, make sure your collagen supplement is certified “100% Organic” by the U.S. Department of Agriculture (USDA)<sup>23</sup> or, better yet, certified grass fed by the American Grassfed Association (AGA), which has the most rigorous standards. This also applies to gelatin, although it can be a bit more difficult to find, and if you do, it can run about \$50.

It appears that collagen and gelatin provide virtually identical protein profiles and biological benefits. Collagen has the benefit of being available in affordable organic choices. Gelatin can be used to improve the texture and satiety of foods. So, they both can improve your health; you just need to choose the one that works best for you.

•**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?

While my personal preference used to be grass fed organic collagen made from beef bones (not hide), I'm now leaning more toward powdered gelatin, as it's more easily digested.

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>24</sup>

And, to reiterate, eating muscle meat will not provide you with the important amino acids that are necessary for building collagen. Considering about one-third of the proteins in your

body are collagen, it makes sense to ensure you're getting enough collagen/gelatin.

## **Beware: Jell-O Contains No Gelatin**

In closing, do NOT make the mistake of using Jell-O brand<sup>25</sup> "gelatin" snacks. Remarkable as it may seem, the 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.<sup>26</sup> It can also cause digestive side effects.<sup>27</sup>

Jell-O powder<sup>28</sup> does contain gelatin, but sugar is the No. 1 ingredient, plus it contains food coloring and preservatives with questionable safety. What you want is a pure gelatin powder without sugar and other additives.

## **Sources and References**

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