

Glycine Reverses Aging in Cells

Analysis by Dr. Joseph Mercola • October 02, 2023

STORY AT-A-GLANCE

- Collagen is one-third of the protein in your body and 28% of it is made up of the amino acid glycine. One study estimates most people are about 10 grams short of what their bodies need for all metabolic uses on a daily basis
- Mounting research suggests glycine may play an important role in the aging process. It's been shown to extend lifespan in worms, mice and rats, and improve health in mammalian models of age-related disease
- Glycine is a precursor to glutathione, a powerful endogenous antioxidant that declines with age, and the lack of glutathione in older adults may be an element that drives the oxidative stress and mitochondrial dysfunction that lead to age-related degeneration
- Glycine also acts as a neurotransmitter and may play an important role in depression, neuroinflammation, neurodegeneration and cognitive decline
- Glycine may even be responsible for the epigenetic regulation that drives the aging process. Regulation of the aging process in your mitochondria appears to be ruled by two genes that regulate glycine production in the mitochondria. Adding glycine to the culture medium of fibroblast cells taken from 97-year old people restored the cells' respiratory function, which suggests that glycine treatment can reverse the age-associated respiration defects in human fibroblasts

Collagen — which provides structural support and strength to your tissues — accounts for about 30% of the total protein in your body. Twenty-eight percent of collagen, in turn, is made up of the amino acid glycine.

Glycine, proline and hydroxyproline are the raw materials for connective tissue, but the benefits of glycine go far beyond connective tissue health. In fact, mounting research suggests glycine may play an important role in the aging process.

While your body does make glycine, endogenous production decreases with age. If you only eat red meat, and rarely or never consume foods made with collagen-rich connective tissue, you're likely not getting enough from your diet either. The chart below details the amino acid ratios of gelatin/collagen versus red meat (beef). As you can see, gelatin/collagen contains vastly more glycine than beef.

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

Glycine Has Many Antiaging Benefits

Glycine has been shown to extend lifespan in worms, mice and rats, and to improve health in mammalian models of age-related disease. In some animal studies, eating a diet containing 8% to 12% glycine increased the median lifespan by as much as 28.4%.

As explained by Siim Land, author of "Metabolic Autophagy: Practice Intermittent Fasting and Resistance Training to Build Muscle and Promote Longevity," in the video [YouTube, Siim Land, Glycine Longevity Benefits Are Amazing – New Study Confirms April 5, 2023](#) (14:46), glycine induces autophagy (a "self-eating" process in which your body digests damaged cells) and mimics the longevity benefits of methionine restriction. Both of these effects are related to an enzyme called glycine N-methyltransferase (GNMT).

Glycine is a receptor for GNMT, and the GNMT converts glycine to sarcosine, a metabolite that induces autophagy. GNMT also plays a role in methionine clearance. Methionine is involved in cancer cell growth and metabolism, and restricting methionine has been shown to:

- Inhibit cancer cell growth
- Extend lifespan
- Lower levels of insulin, glucose and insulin-like growth factor 1 (IGF-1)
- Reduce liver damage after exposure to dangerous amounts of acetaminophen
- Reduce frailty

Even intermittently restricting methionine leads to benefits like improved glucose homeostasis, reduced obesity and protection against fatty liver disease. Glycine is also a precursor to glutathione, a powerful endogenous antioxidant that declines with age.

The lack of glutathione in older adults may be an element that drives the oxidative stress and mitochondrial dysfunction that leads to age-related degeneration. Glycine also acts as a neurotransmitter and may play an important role in depression. It's also been shown to alleviate neuroinflammation and protect against cognitive deficits in mice with neurodegeneration.

Glycine Reverses Aging in Human Cells

According to previous research,¹⁵ glycine may even be responsible for the epigenetic regulation that drives the aging process as a whole. As reported by Science Daily in 2015,¹⁶ contrary to popular belief, the aging process in your mitochondria may not be controlled by DNA mutations after all, but rather by epigenetic regulation.

This epigenetic regulation appears to be ruled by two genes (CGAT and SHMT2) that regulate glycine production in the mitochondria. By altering the regulation of these genes, the researchers were able to either induce defects or restore mitochondrial function in human fibroblast cell lines.

Remarkably, simply adding glycine to the culture medium of fibroblast cells taken from 97-year-old people restored the cells' respiratory function, which "suggests that glycine treatment can reverse the age-associated respiration defects in the elderly human fibroblasts." As such, glycine supplementation could potentially give the elderly "a new lease on life."

"According to one study, most people are about 10 grams short of what their bodies need for all metabolic uses on a daily basis."

Glycine Is Required in Daily Collagen Turnover

Making up 28% of your body's collagen, glycine is, of course, also required for optimal collagen synthesis. As explained by Land in the featured video¹⁷:

"Glycine also has a very important role in antiaging directly by helping to reduce wrinkles, and collagen synthesis ... The less collagen or glycine you consume, the slower your collagen turnover is."

Slow collagen turnover increases the damage that occurs to your collagen, such as glycation and oxidation, and reduces collagen deposition into tissues.

Collagen ... makes up your hair, teeth, skin, nails, organs, arteries, cartilage, bones, tendons and ligaments. Collagen is literally the glue that holds you together. So, making sure that you preserve your collagen is very important for slowing down aging, especially when it comes to wrinkles.

Starting at the age of 20 you lose just under 10% of your skin's collagen content every decade. So, by the time you're 75 years old you would have lost 50% of your skin's collagen content ...

[U]p until very recently it was thought that the collagen turnover was very slow, and it only happened over the course of many years — over the entire lifespan. However, recently it was shown that collagen turnover happens every day and is part of your daily protein turnover."

Glycine Protects Against Age-Related Disease

Glycine also helps mitigate chronic disease and disability, thereby increasing your health span. As reported in a 2023 scientific review, glycine has been shown to:

- Suppress tumor growth in mice with melanoma
- Decrease fasting glucose, insulin, triglyceride and IGF-1 in male rats
- Preserve muscle mass and reduce inflammatory markers in mice with cancer cachexia²¹
- Improve endothelial function in older rats
- Reduce weight gain and improve bone mineral density in a mouse model designed to mimic postmenopausal bone loss
- Protect against cardiac hypertrophy
- Alleviate neuroinflammation and protect against cognitive deficits in mice with neurodegeneration

Human trials also confirm that glycine is protective against a range of chronic diseases. As noted by Land:

"The benefits of glycine generally have to do with improving the blood sugar levels, fasting insulin levels, triglycerides, even lowering the demand for sleep, improving brain function and health, helping with just overall aspects of vitality."

Other Health Benefits of Glycine

Other health benefits of glycine include:

- Improved sleep
- 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
- Reduced stress
- Improved wound healing
- Improved gut health

In his article "Gelatin, Stress, Longevity,"³⁰ the late biologist, Ray Peat, reviewed a long list of health conditions that can be prevented or alleviated by glycine supplementation and/or increased consumption of collagen or gelatin. These include:

- Fibrosis
- Most bleeding problems, including nosebleeds, excessive menstrual bleeding, bleeding ulcers, hemorrhoids and stroke. According to Peat, glycine, taken shortly after a stroke, limits the damage and accelerates recovery
- Epilepsy, by stabilizing nerves and raising the amount of stimulation required to activate nerves
- Multiple sclerosis (MS), thanks to its antispastic effects

- Any condition involving excess prolactin, serotonin and/or cortisol, including autism, postpartum and premenstrual problems, Cushing's disease, diabetes, and impotence
- Fatigue
- Muscular dystrophy and myasthenia gravis
- Metabolic disorders
- Nonalcoholic fatty liver disease (NAFLD)
- Schizophrenia

How to Optimize Your Glycine Intake

When it comes to optimizing your glycine intake, you have several basic options:

1. Eat more collagen or gelatin-rich foods, as glycine makes up nearly one-third of collagen and gelatin. Examples include homemade bone broth made with bones and connective tissue from grass fed, organically raised animals, and chicken broth made from organic chicken feet. The claws are particularly rich in collagen. Indirectly, animal foods such as seafood, red meat, poultry and dairy products will also raise your glycine level, as these foods contain taurine, which increases glycine.
2. Take a high-quality collagen or gelatin supplement.
3. Take a glycine supplement. Pure glycine is available in powder form and tends to be very affordable and easy to take, as it has a mildly sweet flavor.

Considering its many health benefits, making sure you get enough glycine in your diet can go a long way toward improving your health and life span. There's no established daily requirement or upper limit of glycine currently, so it's hard to make specific recommendations.

That said, doses of 3 to 5 grams have been shown to improve sleep. One study estimated that most people are about 10 grams short of what their bodies need for all metabolic uses on a daily basis, and in a study of people with metabolic syndrome, 15 grams of glycine a day for three months reduced oxidative stress and improved systolic blood pressure. That should give you an approximate idea.

Sources and References

- 1 [Bone 2010 Mar;46\(3\):827-3](#)
- 2 [PLoS One 2014 Jun 13;9\(6\):e99920](#)
- 3 [J Agric Food Chem. 2010 Jan 27;58\(2\):835-41](#)
- 4 [Molecular Cell Biology, 4th Edition, Section 22.3. 2000](#)
- 5 [Amino Acids 2018 Jan;50\(1\):29-38](#)
- 6 [Ageing Research Reviews March 31, 2023, Highlights](#)
- 7 [Ageing Research Reviews March 31, 2023, Table 1](#)
- 8, 9, 10 [Ageing Research Reviews March 31, 2023](#)
- 11, 18 [Ageing Research Reviews March 31, 2023, Table 2](#)
- 12 [Ageing Research Reviews March 31, 2023, Intro](#)
- 13 [Medical News Today April 4, 2023](#)
- 14, 25 [Journal of Neuroinflammation October 15, 2020; 17, Article number 303](#)
- 15 [Scientific Reports 2015; 5 Article number 10434](#)
- 16 [Science Daily May 26, 2015](#)
- 17 [YouTube, Siim Land, Glycine Longevity Benefits Are Amazing – New Study Confirms April 5, 2023, 5:49, 7:31](#)
- 19 [Carcinogenesis, Volume 20, Issue 5, May 1999, Pages 793–798](#)
- 20 [The FASEB Journal April 1, 2011](#)
- 21 [Clinical Nutrition June 2014, Volume 33, Issue 3, Pages 448-458](#)
- 22 [Canadian Journal of Physiology and Pharmacology March 4, 2015; 93\(6\)](#)
- 23 [Amino Acids 2016; 48: 791–800](#)
- 24 [Biochemical Pharmacology January 1, 2017; 123: 40-51](#)
- 26 [J Pharmacol Sci 2012; 118: 145 – 148 \(PDF\)](#)
- 27, 28, 30, 31 [RayPeat.com Gelatin Stress and Longevity](#)
- 29 [Am J Physiol 1982 February;242\(2\):G85-8](#)
- 32, 33 [Nutrients June 2019, 11\(6\): 1356](#)
- 34, 37 [Examine Glycine](#)
- 35 [TheHealthBenefitsOf.com 10 Chicken Feet Health Benefits](#)
- 36 [Anxiety Medication, Taurine](#)
- 38 [J Biosci December 2009; 34\(6\): 853-872](#)
- 39 [Supplements Self Decode Glycine](#)
- 40 [Canadian Journal of Physiology and Pharmacology June 17, 2013](#)