

# Glycine to Increase Longevity and Decrease Depression

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › Glycine has been shown to extend lifespan in animal studies and mitigate chronic disease and disability, thereby increasing healthspan
- › Glycine has anticancer effects, reduces insulin and alleviates neuroinflammation; it may also protect against depression and is essential for collagen synthesis
- › To gain all of glycine's healing potential, doses of 10 to 20 grams a day may be optimal
- › You need at least 12 grams of glycine daily for optimal collagen turnover, plus another 3 grams per day to form glutathione
- › Excess methionine from eating animal products without the connective tissues decreases longevity, but adding glycine will reduce the methionine/glycine ratio to counter the negative side effects of excess methionine
- › Glycine has neurotransmitter qualities, improves depression and is also useful for improving sleep quality by helping relaxation at night by being very similar to the neurotransmitter GABA

Glycine, a nonessential amino acid, meaning your body can make it, but most of us as we age are simply unable to make enough of it, especially if our dietary intake is low because we are not eating enough connective tissue and collagen in our diet.

New research is emerging showing glycine is a powerful longevity enhancer, one that's not only inexpensive but also has a pleasant, slightly sweet flavor. In fact, glycine is

sometimes used as a sugar substitute, and I personally take 1 teaspoon with each of my two meals and before bedtime for its health-enhancing qualities.

Research shows glycine extends lifespan in worms, mice and rats while improving health in models of age-related disease.<sup>1</sup> If there were any doubt about its importance, consider that collagen — the most abundant protein in your body<sup>2</sup> — is made mostly of glycine. It's also a precursor to glutathione, a powerful antioxidant that declines with age.

As noted by Siim Land, author of "Metabolic Autophagy," in the video above,<sup>3</sup> however, there are two glycine benefits that appear key to its actions as a veritable fountain of youth — inducing autophagy and mimicking the longevity benefits of methionine restriction.<sup>4</sup>

## How Glycine May Influence Aging

Glycine is a receptor for the enzyme glycine N-methyltransferase (GNMT), which plays a role in methionine clearance, according to a review published in Ageing Research Reviews.<sup>5</sup> Glycine is the acceptor for GNMT, an enzyme responsible for methionine clearance. GNMT converts glycine to sarcosine, "an autophagy-inducing metabolite."<sup>6</sup>

Further, in mice deficient in GNMT, levels of free methionine may be seven-fold higher, while S-adenosyl-L-methionine may increase by 35-fold.<sup>7</sup> This matters, as methionine is involved in cancer cell growth and metabolism, while methionine restriction inhibits cancer cell growth.<sup>8</sup>

Methionine restriction has been shown to improve longevity, extending lifespan in mice while lowering levels of insulin, glucose and insulin-like growth factor 1. Limiting methionine also yields a host of additional antiaging benefits in mice, like reducing liver damage after exposure to dangerous amounts of acetaminophen and reducing overall frailty.<sup>9</sup>

"Since a low level of methionine signifies a low nutrient state, methionine restriction is thought to act as a caloric restriction mimetic," the Ageing Research Reviews report

explains.<sup>10</sup> Glycine, in turn, the researchers noted, "may prolong life by serving as a methionine restriction mimetic."<sup>11</sup> It does this because it lowers the methionine/glycine ratio which may be more important than the absolute level of methionine consumption.

## **You Need Glycine for Collagen Synthesis**

Indeed, in a study on mice using data from the National Institute on Aging's Interventions Testing Program, a team of scientists revealed that feeding a diet with 8% glycine increased lifespan significantly, by 4% to 6%, in males and females, while offering additional benefits like reduced risk of dying from lung cancer.<sup>12</sup>

Some animal studies have shown up to a 28.4% median increase in lifespan when eating a diet containing 8% or 12% glycine.<sup>13</sup> There are also direct antiaging effects via collagen synthesis. Land explains:<sup>14</sup>

*"Glycine also has a very important role in antiaging directly by helping to reduce wrinkles, and collagen synthesis. Glycine makes up every third amino acid in collagen, which is why there is such a large requirement of glycine for optimal collagen turnover.*

*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 is the most abundant protein in the human body, making up approximately 30% of all your protein by mass. It 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 ... up 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

Also significant is glycine's potential to mitigate chronic disease and disability, thereby increasing healthspan throughout your body. Glycine receptors exist in the central nervous system, for instance, which means glycine acts as a neurotransmitter.<sup>15</sup> The Ageing Research Reviews study compiled multiple examples of glycine's ability to fight age-related disease in animals, including:<sup>16</sup>

Suppressed tumor growth in mice with melanoma <sup>17</sup>	Decreased fasting glucose, insulin, triglyceride and insulin-like growth factor 1 in male rats <sup>18</sup>
Preserved muscle mass and reduced inflammatory markers in mice with cancer cachexia <sup>19</sup>	Improved endothelial function in older rats <sup>20</sup>
Even intermittently restricting methionine leads to benefits like improved glucose homeostasis, reduced obesity and protection against fatty liver	Reduced weight gain and improved bone mineral density in a mouse model designed to mimic postmenopausal bone loss <sup>21</sup>
Protected against cardiac hypertrophy <sup>22</sup>	Alleviated neuroinflammation and protected against cognitive deficits in mice with neurodegeneration <sup>23</sup>

Human trials confirm what the animal models suggest – that glycine is protective against a range of chronic diseases. In a study of 60 people with metabolic syndrome,

15 grams of glycine a day for three months had reduced oxidative stress and improved systolic blood pressure.<sup>24</sup>

In older adults, limited availability of glycine and cysteine may lead to decreased synthesis of glutathione — composed of the three amino acids cysteine, glycine and glutamic acid — such that glutathione deficiency is widespread in this population.<sup>25</sup> The lack of glutathione, perhaps driven by limited glycine, in older adults may be a key element driving the oxidative stress and mitochondrial dysfunction that lead to age-related degeneration. Land notes:<sup>26</sup>

*"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.*

*... a lot of the longevity benefits come from the methane restriction and the autophagy stimulation that pretty much helps to clean out the cells from the dysfunctional components as well as boosting glutathione levels, which just enables the body to function with less inflammation and oxidative stress, which is very crucial for aging and it also pretty much buffers against the methionine toxicity."*

## **Glycine With NAC Supports Mitochondrial Health**

Researchers at Baylor College of Medicine also looked into supplementation with a combination of glycine and N-acetylcysteine (NAC), two glutathione precursors known as GlyNAC when taken together.

They had previously shown that young mice deficient in glutathione had mitochondrial dysfunction, and supplementing with GlyNAC in older mice not only improved glutathione deficiency but also mitochondrial impairment, oxidative stress and insulin resistance.<sup>27</sup>

Additional previous research they conducted in HIV patients<sup>28</sup> found GlyNAC supplementation improved "deficits associated with premature aging" in this

population.<sup>29</sup> This included improvements to oxidative stress, mitochondrial dysfunction, inflammation, endothelial dysfunction, insulin resistance, genotoxicity, strength and cognition.<sup>30</sup>

A subsequent pilot trial in older humans found similar results, with GlyNAC supplementation for 24 weeks correcting glutathione deficiency and improving multiple measures of health, including:<sup>31</sup>

Mitochondrial dysfunction	Oxidative stress	Inflammation
Endothelial dysfunction	Insulin resistance	Genomic damage
Cognition	Strength	Gait speed
Exercise capacity	Body fat levels	Waist circumference

Further, GlyNAC supplementation improved four of nine hallmarks of aging associated with most age-related disorders — mitochondrial dysfunction, inflammation, insulin resistance and genomic damage.<sup>32</sup> Glycine, the team noted, is an important methyl-group donor. "Methyl groups are abundant in DNA and are important components of multiple cellular reactions. Glycine is also important for normal brain function."<sup>33</sup>

In addition to supporting brain function,<sup>34</sup> supplemental glycine may be useful for the "prevention and control of atherosclerosis, heart failure, angiogenesis associated with cancer or retinal disorders and a range of inflammation-driven syndromes, including metabolic syndrome."<sup>35</sup>

## Glycine's Link to Depression

As a major neurotransmitter,<sup>36</sup> glycine's role in brain health is receiving increasing attention. The results of a 15-year study conducted by University of Florida researchers also suggest it may be involved in depression. The finding relates to a receptor called GPR158. When suppressed in mice, stress-induced depression is less likely.

When they determined the structure of GPR158, they realized it's an amino acid receptor — for glycine. "We were barking up the completely wrong tree before we saw the structure," study author Kirill Martemyanov told Medical News Today. "We said, 'Wow, that's an amino acid receptor. There are only 20, so we screened them right away and only one fit perfectly ... it was glycine.'"<sup>37</sup>

After learning that GPR158 binds to glycine and acts as a metabotropic glycine receptor, they named it mGlyR.<sup>38</sup> The team explained in the journal *Science*:<sup>39</sup>

*"Glycine signals through mGlyR to inhibit production of the second messenger adenosine 3',5'-monophosphate. We further show that glycine, but not taurine, acts through mGlyR to regulate neuronal excitability in cortical neurons. These results identify a major neuromodulatory system involved in mediating metabotropic effects of glycine, with implications for understanding cognition and affective states."*

Glycine is also useful for improving sleep quality.<sup>40</sup> "It can help to relax at night by being very similar to GABA," Land says. "... It's beneficial for ... reducing the time it takes to fall asleep. People who ingested 3 grams of glycine within one hour before bedtime saw an improvement in subjective sleep quality, fell asleep faster and were less sleepy during the day."<sup>41</sup>

## How Much Glycine Is Enough?

To gain all of glycine's healing potential, doses of 10, 15, or 20 grams a day may be necessary. Land suggests you need at least 12 grams of glycine daily for optimal collagen turnover, plus another 3 grams per day to form glutathione and other compounds:<sup>42</sup>

*"Your body only makes 3 grams of glycine per day, and if you only consume around 2 to 3 grams of glycine from foods then it means that almost all of us are in a 10-gram glycine deficit every day," he says.*

*"... I think most people would benefit for at least 5 to 10 grams of glycine a day, which is, uh kind of a moderate amount ... if you are eating a lot of muscle meat ... or you're just interested in getting more of the benefits of glycine then you can take even up to 20 grams a day."*

In addition to supplements, collagen is an outstanding source of glycine. 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 boost your collagen intake by making homemade bone broth using bones and connective tissue from grass fed, organically raised animals.

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