Glycine

Pure powder form of the amino acid glycine

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Designs for Health's **Glycine Powder** offers the amino acid glycine in a pure powder form for flexible dosing and patient convenience. Glycine is a conditionally essential amino acid used for structural protein synthesis, detoxification pathways, neurotransmitter function, brain health, sleep support, and healthy blood sugar levels. It is the smallest amino acid, with a side chain consisting of just a single hydrogen atom. Although glycine is synthesized from serine in the human body, endogenous synthesis has been shown to fall far short of meeting the many biological and metabolic demands for this amino acid in healthy adults.[1] The need for supplemental glycine may be even greater during times of acute emotional or physiological stress, and among individuals recovering from physical trauma.

Glycine may be beneficial for:

- Detoxification
- Stimulating Phase II conjugation reactions
- Synthesis of glutathione, bile acids and detoxification
- Stimulating glycogen storage
- Muscle wasting
- Tissue repair
- Hypoglycemia
- Brain function
- Depression
- Anxiety
- Sleep

Structural and Transport Proteins

Glycine is a primary constituent of collagen, making up over one third of the total amino acids in this key structural component of blood vessels, skin, bones, cartilage, tendons, ligaments, and other connective tissue. A reaction between glycine and succinyl-CoA resulting in δ-aminolevulinic acid is the rate-limiting first step in the synthesis of the heme constituent of hemoglobin, myoglobin, and the cytochrome proteins.[2] Glycine is also required for nucleic acid synthesis. For these reasons, glycine supplementation may be beneficial for supporting protein synthesis, tissue repair, and wound healing.[3] In rat models of tendonitis, a high-glycine diet resulted in reduced inflammation and improved tissue repair, including higher concentrations of hydroxyproline and glycosaminoglycans.[4] Rats undergoing laparotomy who were supplemented with a 1% glycine diet (plus arginine) had greater overall nitrogen retention, higher ratios of type III/type I collagen, and more hydroxyproline than unsupplemented controls, mostly due to increased collagen synthesis in the wounds.[5] Mouse models of cancer cachexia indicate that glycine (injected subcutaneously) reduced loss of muscle and fat mass, and blunted increases in inflammatory markers. Similar improvements were not seen with isonitrogenous doses of alanine or citrulline, suggesting that the beneficial effects on tissue sparing are glycine-specific.[6]

Detoxification, Glutathione Synthesis, and Liver Function

Glycine is one of the amino acids that make up the glutathione tripeptide (a.k.a. gamma-glutamyl-cysteinyl-glycine). Reductions in glycine concentration from protein malnutrition, sepsis, or increased glycine oxidation due to diabetes or high glucagon levels may impair synthesis of adequate amounts of glutathione (GSH). Glycine availability is a determining factor in erythrocyte GSH synthesis in burn patients and children recovering from malnutrition; supplemental glycine improves hepatic GSH concentrations in protein-deficient rats.[7]

Oxidative stress associated with aging may be due in part to reduced glutathione synthesis. Compared with younger individuals, elderly individuals have markedly lower red blood cell concentrations of glycine (486.7 ± 28.3 versus 218.0 ± 23.7 μmol/L, respectively, according to one study).[8] Two weeks of supplementation with glycine and cysteine with no other changes to the habitual diet fully restored glutathione concentrations and rate of synthesis, and lowered levels of oxidative stress in elderly subjects.[8] In the elderly subjects, glycine supplementation restored glutathione levels to those of younger people (who were not supplemented).

Sustained hyperglycemia is another state associated with reduced glutathione levels. Compared with healthy controls, type-2 diabetics have lower erythrocyte concentrations of glycine (514.7 ± 33.1 vs. 403.2 ± 18.2 μmol/L, respectively), lower concentrations of GSH (6.75 ± 0.47 vs. 1.65 ± 0.16 μmol/g Hb, respectively), and lower GSH synthesis rates.[9] Results of two weeks of glycine and cysteine supplementation in diabetic subjects mirror those found in elderly subjects: GSH synthesis and concentrations increased significantly, with concomitant reductions in plasma oxidative stress.

Glutathione is the body's master antioxidant and is also a critical compound for enabling healthy detoxification processes in the liver. Beyond glycine's role as a constituent of glutathione, however, glycine itself plays a role in phase II biotransformation and conjugation of xenobiotics and endogenously produced toxins.[10,11] Impaired glycine conjugation may result in a buildup of compounds that adversely affect mitochondrial function, and impaired mitochondrial dysfunction is associated with a host of metabolic and neurological impairments.[12]

Glycine may be especially supportive of liver health after alcohol-induced damage and other forms of liver injury.[13] Compared to control rats on a standard diet, those on a glycine-enriched diet experienced 30% faster recovery in aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels. After one week post-ethanol-induced damage, hepatic steatosis was reduced significantly more in the glycine group than in the controls, and the glycine group also had significantly diminished numbers of infiltrating leukocytes and necrotic cells compared to controls.[14] Liver injury due to ischemia/reperfusion (I/R), partial resection, or transplant may also be reduced by oral glycine supplementation. Studies in rats that underwent partial liver resection with I/R injury show that oral glycine supplementation led to significant improvements in survival rate and recovery rate of the remnant liver weight compared to untreated rats.[15] Study authors concluded that glycine may be clinically beneficial to the prognosis of patients with liver resection, and it has also been shown to be cytoprotective for other tissues, including the kidneys and small intestine.[15-18]

An additional role for glycine in healthy liver function is its conjugation with bile acids in order to form the active, amphipathic bile salts necessary for the emulsification of dietary fats and the formation of micelles to facilitate digestion and absorption of fats and fat-soluble nutrients.[3,19]

Supplement Facts

Serving Size 3 grams (approx. 1/2 teaspoon)
Servings Per Container 60

Amount Per Serving	% Daily Value
Glycine 3 g	*

*Daily Value not established.

MADE WITH NON-GMO INGREDIENTS

Function as an inhibitory neurotransmitter

Glycine is a well-known inhibitory neurotransmitter and is often included in combination products to combat stress and anxiety. The binding of glycine to its neuronal receptor results in an influx of chloride ions, leading to membrane hyperpolarization and inhibition of the response to excitatory neurotransmitters.[17] Alterations in glycine receptor genes have been implicated in the pathology of autism, generalized epilepsy, and amyotrophic lateral sclerosis (ALS), while autoantibodies against subunits of the glycine receptor have been found in patients with progressive encephalomyelitis, including rigidity and myoclonus.[20]

Owing to its inhibitory function, glycine may be helpful for improving sleep quality, which, in itself, may be beneficial for supporting healthy moods and responses to psychological stress. In a randomized crossover study, a single bolus of glycine (3 g) given one hour before bed to subjects who regularly experienced unsatisfactory sleep but were otherwise healthy resulted in subjective and objective improvements of sleep parameters. Compared to placebo, glycine supplementation led to improved subjective assessments of difficulty in getting to sleep, the time it took to fall asleep, and overall sleep efficiency (time in bed versus time actually asleep). Direct measurements showed that compared to placebo, glycine reduced sleep onset latency and the onset of slow wave sleep. Latency to rapid eye movement (REM) sleep remained unchanged, as did the total sleep architecture—the ratios of time spent in each sleep stage. Nevertheless, assessments of daytime sleepiness, cognitive function and reaction time the day after glycine ingestion showed that glycine supplementation slightly improved these parameters compared to placebo.[21] Other studies support the role of glycine in improving sleep quality as well as "liveliness and peppiness," and "clear-headedness" upon awakening.[22] Additionally, daytime ingestion of glycine does not lead to acute sleepiness, so individuals taking glycine for other reasons should not be at risk for this potentiality.

Glycine is required along with glutamate in order to open ion channels on neuronal N-methyl-d-aspartate (NMDA) receptors.[23] Glycine supplementation and increasing brain glycine levels may be instrumental in improving treatment-resistant schizophrenia, particularly in patients with low baseline serum glycine levels. Randomized, placebo-controlled, crossover studies show that glycine supplementation added to prior antipsychotic treatment results in significant reductions in negative symptoms, with improvements in depressive and cognitive symptoms.[24-26] Other calming and inhibitory effects of glycine in the central nervous system include reversing hyperactivity and schizophrenia-like psychosis induced by phencyclidine (PCP).[27]

How to Use:

- As a dietary supplement take 3 grams (approx. 1/2 teaspoon) with water or any other beverage per day, or as directed by a health care practitioner.
- Glycine powder can be used post-workout for recovery/glycogen resynthesis, especially for those following a low carb diet who prefer to avoid post-workout carbohydrates.

For a list of references cited in this document, please visit:

http://catalog.designsforhealth.com/assets/itemresources/GlycineReferences.pdf