

The Benefits of Individual Amino Acids

By Gene Bruno, MS, MHS



Amino acids are organic compounds that function as the building blocks of proteins. Depending upon how they are combined, amino acids can form thousands of different proteins that perform thousands of important bodily functions. In addition, individual amino acids may serve other important functions for our health and well-being. This article will address human clinical research demonstrating certain amino acids individual use as dietary supplements.

Essential, Non-essential & Conditionally Essential

Essential amino acids are those aminos that cannot be made by the body, and must be obtained from dietary sources. The nine essential amino acids are: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine. Non-essential amino acids are those that bodies are capable of producing as long as we obtain sufficient essential amino acids; although non-essential aminos can also be obtained from the diet. The non-essential amino acids consist of: alanine, asparagine, aspartic acid and glutamic acid. Conditionally essential amino acids are those aminos that become essential in times of illness and stress. They include: arginine, cysteine, glutamine, tyrosine, glycine, ornithine, proline and serine.¹² In addition, there are a few other amino acids that do not fit neatly into any particular category (e.g., theanine, carnitine).

Note: Very specific doses of individual amino acids have been used in human clinical research to decipher likely benefits. This means that research may show that benefit X may occur at 1,000 mg, while 5,000 mg is needed for benefit Y. Furthermore, if research shows that 1,000 mg is required for a benefit, that same benefit shouldn't be

expected from 100 mg.

Alanine

Research suggests that during high-intensity exercise and strength training, 2.4-6.4 g beta-alanine daily improves some measures of physical performance (e.g. increases ventilatory threshold, time to onset of muscle fatigue, time to exhaustion and total work). A meta-analysis of 15 studies demonstrated that beta-alanine significantly improved exercise measures compared to placebo.³

Arginine

L-arginine is a precursor to nitric oxide, a vasodilator produced by the body to facilitate circulation.⁴ Consequently, supplementation has been shown to have benefit in heart failure (5.6-12.6 g/day)^{5,6}, increase oxygen transport during exercise and improve aerobic exercise (6 g/day)^{7,8}, improve exercise tolerance in stable angina pectoris (6 g/day)^{9,10}, improve sexual performance and function in men with erectile dysfunction (2.8-5 g/day)^{11,12} and increase circulating growth hormone levels in response to exercise (5-9 g/day, 30 minutes before exercise).¹³

Carnitine

L-carnitine supplementation has a variety of cardiovascular benefits, including exercise-induced stable angina (2 g/day)^{14,15}, congestive heart failure (2 g/day)^{16,17}, myocardial infarction, aka heart attack (2 g/day)¹⁸⁻²⁰, lipid levels and inflammatory markers in hemodialysis patients (750 mg-1 g/day)²¹⁻²³, oxidized LDL cholesterol levels in patients with type 2 diabetes (2 g/day)²⁴ and improvement in circulation and vascular inflammatory responses to a high-fat meal (2 g/day).²⁵ L-carnitine has also been shown to have benefit in reversing and preventing symptoms of hyperthyroidism (2-4 g/day)^{26,27}, and in reducing fatigue in the

elderly (2-4 g/day)^{28,29} and those with celiac disease (2 g/day).³⁰ Studies have also shown that supplementation with L-carnitine is capable of promoting greater weight loss than with diet and exercise alone (500 mg-3 g/day)³¹⁻³³, and improving various measures of exercise performance and recovery (2 g/day).³⁴⁻⁴¹

In addition, a form of carnitine known as acetyl-L-carnitine has been shown to improve memory and cognitive function in elderly subjects with mental decline, those with dementia, those with Alzheimer's disease and those with chronic alcoholism (2-3 g/day).⁴²⁻⁵² Acetyl-L-carnitine also offers improvement in diabetic neuropathy (2-3 g/day)^{53,54} and in elderly patients with depression (1-3 g/day).⁵⁵⁻⁵⁷

Cysteine

N-acetylcysteine (NAC) is a derivative of L-cysteine, and has effective mucolytic (i.e. mucus-reducing) properties. This has been shown in a number of studies, including with COPD patients and those with bronchitis (1200 mg/day).^{58,59} In addition, research in 262 subjects of both sexes demonstrated that NAC was effective in promoting cell-mediated immunity when used for six months (1200 mg/day).⁶⁰

Glutamine

L-glutamine supplementation is capable of increasing circulating growth hormone levels (2 g/day).⁶¹ There is other human research demonstrating that L-glutamine supplementation is effective in promoting immunomodulation, but the doses are 25 g or higher.

Leucine, Isoleucine, & Valine

Leucine, isoleucine and valine are collectively referred to as the branched-chain amino acids (BCAAs). BCAAs have also been shown to significantly reduce the breakdown of skeletal muscle in normal and exercising volunteers⁶²⁻⁶⁷, decrease muscle soreness and muscle fatigue occurring for a few days after exercise^{68,69}, and decrease lactic acid levels during exercise (1.3-5.7 g/day).⁷⁰⁻⁷³

Lysine

L-lysine has been shown to reduce recurrences of herpes simplex labialis infections (i.e. cold sores), and reduce their severity and healing time (1-3 g/day).⁷⁴⁻⁷⁸ In addition, when L-lysine is supplemented along with calcium, it enhances calcium absorption and reduced calcium excretion, suggesting a potential usefulness of L-lysine supple-

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ments for both preventive and therapeutic interventions in osteoporosis (400-800 mg/day).⁷⁹

Methionine

Supplementation with 2.5 g methionine every four hours for four doses is effective in treating acetaminophen poisoning if given within 10 hours of acetaminophen ingestion.⁸⁰

Ornithine (with Arginine)

When L-ornithine is supplemented with L-arginine, the combination is effective in promoting increases in serum growth

hormone in association with exercise. This was seen in studies using 1 g of each daily^{81,82}, as well as a study using 6 g ornithine and 4.4 g arginine.⁸³

Phenylalanine

Note: Phenylalanine exists as two enantiomers, D-phenylalanine and L-phenylalanine. Though some studies used D-phenylalanine, the D- form is only commercially available as DL-phenylalanine, a mix providing 50 percent D- and 50 percent L-phenylalanine.

Supplementation with L-phenylalanine in combination with UVA exposure or

applying L-phenylalanine topically in combination with UVA exposure, was shown to be effective for treating vitiligo in adults and children (3-8 g/day).⁸⁴⁻⁸⁸ The DL-phenylalanine (DLPA) has been shown to have antidepressant effects in depressed patients (200 mg/day).⁸⁹⁻⁹² D-phenylalanine has reduced chronic pain in patients with different types of chronic pain, using 1-4 g/day.⁹³⁻⁹⁷ With DLPA, this would translate to 2-8 g/day.

Serine

A form of serine known as phosphatidylserine (PS) has been shown in several studies to improve attention, arousal, verbal fluency and memory in aging people with age-related memory impairment (100-300 mg/day).⁹⁸⁻¹⁰² PS is also effective at increasing cognitive function, global improvement rating scales, and improve behavioral rating scales in patients with Alzheimer's disease (300 mg/day).¹⁰³⁻¹⁰⁸

Theanine

L-theanine significantly increases brain activity in the alpha frequency band, and improve mental alertness while promoting relaxation.^{109,110} L-theanine has also been shown to induce feelings of tranquility in subjects¹¹¹ and have a direct anti-stress effect via the inhibition of cortical neuron excitation (50-200 mg).¹¹²

Tryptophan

L-tryptophan is converted in the body to 5-hydroxytryptophan (5-HTP), and then ultimately into the neurotransmitter serotonin, which has multiple effects. This has been demonstrated in studies in which supplementation resulted in inducing sleep when taken before bedtime (1 g)^{113,114}, reducing PMS symptoms (2-6 g/day)¹¹⁵⁻¹¹⁷, treating depression with or without the use of other antidepressant agents (2-4 g/day)¹¹⁸⁻¹²² and treating seasonal affective disorder (4-6 g/day).¹²³

For a full list of references, visit www.vitaminretailer.com.

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