

# Amino Acid Synergy



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Amino acids play central roles both as building blocks of proteins and as intermediates in metabolism. They are called "amino acids" because they all contain an amino group (NH<sub>2</sub>) and a carboxyl group (COOH), which is acidic. Your body is about 20 percent protein by weight. The 20 amino acids that are found within proteins convey a vast array of chemical versatility. The precise amino acid content, and the sequence of those amino acids, of a specific protein determines the biological activity of the protein. Proteins not only catalyze all (or most) of the reactions in living cells, they control virtually all cellular processes.

Humans can produce 10 of the 20 amino acids. The others must be supplied in food. Failure to obtain enough of even 1 of the 10 essential amino acids, those that we cannot make, results in degradation of the body's proteins, including muscle. Unlike fat and starch, the human body does not store excess amino acids for later use so amino acids must be consumed every day.

The 10 amino acids that we can produce are alanine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine and tyrosine. Tyrosine is produced from phenylalanine, so if the diet is deficient in phenylalanine, tyrosine will be required as well.

The essential amino acids are arginine (required for the young, but not necessarily for adults), histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. These amino acids are required in the diet.

Alpha-ketoglutarate is the keto acid produced by deamination of glutamate. It is a key intermediate in the Krebs cycle, coming after isocitrate and before succinyl CoA. Anaplerotic reactions, or supplementation, can replenish this cycle, increasing energy and stamina. Alpha-ketoglutarate is one of the most important nitrogen transporters in metabolic pathways. The amino groups of amino acids are attached to it by transamination and carried to the liver where the urea cycle takes place.

Alpha-ketoglutarate is transaminated, along with glutamine, to form the excitatory neurotransmitter glutamate. Glutamate can then be decarboxylated, via glutamic acid decarboxylase, requiring vitamin B6 (in the form of pyridoxal-5-phosphate, known as P5P) into the inhibitory neurotransmitter GABA. Adequate P5P was included in this formula to facilitate such conversions efficiently.

Arginine is a complex amino acid that is often found at the active (or catalytic) site in proteins and enzymes due to its amine-containing side chain. Arginine plays an important role in cell division, the healing of wounds, removing ammonia from the body, immune function, release of hormones and the production of nitric oxide.

Histidine is the direct precursor of histamine and is needed to help grow and repair body tissues and to maintain the myelin sheaths that protect nerve cells. It also helps manufacture red and white blood cells and helps to protect the body from heavy metal toxicity. Histamine also stimulates the secretion of the digestive enzyme, gastrin.

Isoleucine belongs to a special group of amino acids called branched-chain amino acids (BCAAs), which are needed to help maintain and repair muscle tissue. Leucine and valine are the other two branched-chain amino acids. Isoleucine is needed for hemoglobin formation and also helps to maintain regular energy levels. Isoleucine is also important for stabilizing and regulating blood sugar and energy levels.

Leucine is also a member of the branched-chain amino acid family along with valine and isoleucine. The branched-chain amino acids (BCAAs) are found in proteins of all life forms. Leucine ties glycine for the position of second most common amino acid found in proteins. Leucine is necessary for the optimal growth of infants and for proper nitrogen balance in adults.

Lysine is an essential amino acid which is a major building block for all protein and is needed for proper growth and bone development in children. Lysine helps the body absorb and conserve calcium and it plays an important role in the formation of collagen. The lysine in this formula may help prevent some common viral outbreaks, such as cold sores caused by herpes viruses.

Methionine is an important amino acid that helps to initiate translation of messenger RNA by being the first amino acid incorporated into the N-terminal position of all proteins. Methionine supplies sulfur and other compounds required by the body for normal metabolism, detoxification and growth. Methionine reacts with adenosine triphosphate to form S-adenosyl methionine. S-adenosyl methionine is the principal methyl donor in the body and contributes to the synthesis of many important substances, including epinephrine and choline.

## Supplement Facts

Serving Size 4 capsules

Servings Per Container 30

Amount Per Serving		% Daily Value
Vitamin B6 (as Pyridoxal-5-Phosphate)	14 mg	700%
L-Histidine	338 mg	*
L-Leucine	338 mg	*
Alpha-Ketoglutarate	300 mg	*
L-Arginine	300 mg	*
L-Lysine	300 mg	*
L-Phenylalanine	300 mg	*
L-Valine	300 mg	*
L-Isoleucine	270 mg	*
L-Methionine	270 mg	*
L-Threonine	270 mg	*

\*Daily Value not established.

**Other Ingredients:** Microcrystalline cellulose, vegetable stearate, rice flour.

Phenylalanine is an essential amino acid that plays a key role in the biosynthesis of other amino acids and various neurotransmitters.

Threonine is an alcohol-containing essential amino acid that is an important component in the formation of protein, collagen, elastin and tooth enamel. It is also important for the production of neurotransmitters and the health of the nervous system.

Valine is a branched-chain amino acid (BCAA) that is closely related to leucine and isoleucine both in structure and function. Valine is a constituent of fibrous protein in the body and has been found useful in muscle health and the improvement of mental and emotional disorders, insomnia and nervousness. Valine may also help treat malnutrition associated with drug addiction.

\*Tryptophan was not included in Amino Acid Synergy in order to give the health care practitioner the ability to use this supplement regardless of the patient's serotonin-related status and to allow the practitioner to add tryptophan (or *5-HTP Synergy* or *5-HTP Supreme*) on a case-by-case basis.

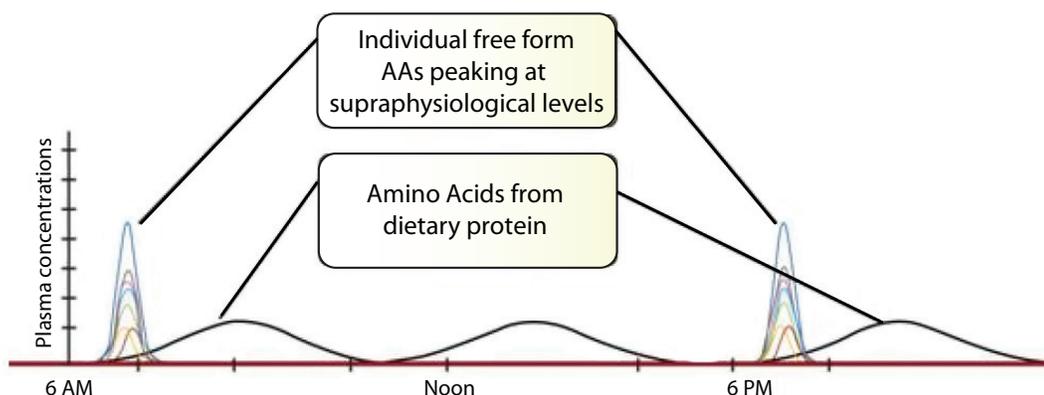
#### Amino Acid Synergy may benefit:

- Individuals whose diets are insufficient in quality protein
- Athletes that require additional amino acids to maintain or achieve greater lean body mass
- Patients who are cachexic from chronic illness or GI malabsorption
- Individuals who are in catabolic states due to stress or illness
- Those recovering from surgery or tissue trauma
- People wanting better quality hair and nails
- Patients who have been found to have confirmed amino acid deficiencies on metabolic testing

#### How to Take

- 2 capsules, twice daily (4 capsules) will deliver 3 grams of free-form essential amino acids and is the suggested dose for standard applications.
- More aggressive dosing can be used in cases where a significant addition of muscle mass is desired or in confirmed amino acid deficiency states.
- Deficiency of free-form amino acids can be suggested on the Designs for Health Metabolic Profiles when organic acids related to energy metabolism (i.e., Krebs cycle intermediates) are low (please contact Designs for Health for more information). Specific amino acid testing is also available via blood-spot and serum testing from Genova Diagnostics-Metamatrix Clinical Labs.

#### Novel Effects of Supplementation with Free-Form Essential Amino Acids versus Dietary Protein Ingestion Alone:



#### Representation of Daily Plasma Amino Acid Levels

Schematic approximations are shown for plasma concentrations of essential amino acids from three meals of dietary protein compared with twice daily oral dosing with 5 grams of a free-form essential amino mixture. Although the supplement supplies only a fraction of total daily intake, the immediate delivery to absorptive mechanisms without need for protein digestion means that assimilation is rapid. Each amino acid (represented by individual lines) is delivered to the tissues at mild supraphysiologic concentrations, allowing greater saturation of multiple biosynthetic and energetic processes.

Source: Lord RS and Bralley JA, Laboratory Evaluations in Functional and Integrative Medicine, Metamatrix Press (2007).

#### General References:

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