

THE NINE

ESSENTIAL AMINO ACIDS

Compiled by

Campbell M Gold

(2009)

CMG Archives
<http://campbellmgold.com>

--()--

IMPORTANT

The health information contained herein is not meant as a substitute for advice from your physician, or other health professional. The following material is intended for general interest only; and it should not be used to diagnose, treat, or cure any condition whatever. If you are concerned about any health issue, symptom, or other indication, you should consult your regular physician, or other health professional. Consequently, the Author cannot accept responsibility for any individual who misuses the information contained in this material. Thus, the reader is solely responsible for all of the health information contained herein. However, every effort is made to ensure that the information in this material is accurate; but, the Author is not liable for any errors in content or presentation, which may appear herein.

--()--

Amino Acids

Amino Acids - are building blocks that make up proteins
Amino Acid - deficiency causes depression, fatigue, poor weight gain
Amino Acid - deficiency causes weakness of immune system
Amino Acid - sources - alfalfa, meat, fish, fowl, eggs, and dairy products

Essential Amino Acids

Amino Acid Histidine - removes heavy metals from the body
Amino Acid Histidine - helps protect nerves by maintaining the myelin sheath
Amino Acid Histidine - helps protect against radiation damage
Amino Acid Histidine - promotes the manufacture of both red and white blood cells
Amino Acid Histidine - has been used in the treatment of rheumatoid arthritis, poor sexual arousal
Amino Acid Histidine - has been used in the treatment of ulcers in the digestive tract
Amino Acid Histidine - has been used in the treatment of nausea during pregnancy
Amino Acid Histidine - is converted by the body into the neurotransmitter, histamine, which plays a role in smooth muscle function and the dilation and contraction of blood vessels

Amino Acid Isoleucine - helps to increase endurance
Amino Acid Isoleucine - helps to heal and repair muscle tissue
Amino Acid Isoleucine - helps clotting at the site of an injury

Amino Acid Leucine - works with the amino acids isoleucine and valine to repair muscles
Amino Acid Leucine - increases production of growth hormones
Amino Acid Leucine - works with the amino acids isoleucine and valine to regulate blood sugar, and provide the body with energy

Amino Acid Leucine - helps burn visceral fat, which is located in the deepest layers of the body and the least responsive to dieting and exercise

Amino Acid Lysine - has antiviral properties

Amino Acid Lysine - helps prevent outbreaks of herpes and cold sores

Amino Acid Lysine - is needed for hormone production

Amino Acid Lysine - helps with the maintenance of bones in both children and adults

Amino Acid Lysine - Lysine helps in the production of antibodies for a strong, healthy immune system

Amino Acid Methionine - helps the body process and eliminate fat

Amino Acid Methionine - contains sulphur, which is required for the production of the body's natural antioxidant, glutathione

Amino Acid Methionine - is needed to produce two other sulphur-containing amino acids, Cysteine (semi-essential) and Taurine (non-essential), which help the body eliminate toxins, build strong, healthy tissues, and promote cardiovascular health

Amino Acid Phenylalanine - is needed for normal functioning of the central nervous system

Amino Acid Phenylalanine - has been used to help control symptoms of depression and chronic pain

Amino Acid Phenylalanine - has been used to treat diseases linked to a malfunctioning central nervous system

Amino Acid Phenylalanine - is effective in treating brain disorders, because it is able to penetrate the blood-brain barrier

Amino Acid Threonine - helps normal growth by maintaining the proper protein balance

Amino Acid Threonine - supports cardiovascular, and liver functions

Amino Acid Threonine - supports central nervous, and immune system functions

Amino Acid Tryptophan - is needed for the manufacture of the neurotransmitter serotonin, which regulates mood and sleep patterns

Amino Acid Tryptophan - helps in the treatment of jet lag, depression, and binge eating

Amino Acid Tryptophan - helps in the treatment of obsessive-compulsive disorder

Amino Acid Tryptophan - helps in the treatment of some forms of vascular migraines, panic attacks (when taken with vitamin B-6), and chronic pain

Amino Acid Tryptophan - may help in cases of rheumatoid arthritis, and tardive dyskinesia (Involuntary writhing movements of the facial muscles and tongue caused by high doses of antipsychotic drugs over long periods of time)

Amino Acid Valine - helps with normal growth, tissue repair

Amino Acid Valine - helps to regulate blood sugar, and provide the body with energy

Semi-Essential Amino Acids

Amino Acid Cysteine - is found in beta-keratin, the main protein in nails, skin and hair

Amino Acid Cysteine - helps maintain a healthy, youthful appearance, by encouraging collagen production and skin elasticity

Amino Acid Tyrosine - helps regulate mood and stimulates the nervous system

Amino Acid Tyrosine - helps to speed up the metabolism

Amino Acid Tyrosine - helps in the treatment of conditions characterised by chronic fatigue

Non-Essential Amino Acids

Amino Acid Alanine - helps to convert the simple sugar glucose into energy

Amino Acid Alanine - helps to eliminate excess toxins from the liver

Amino Acid Alanine - helps protect cells from being damaged during intense aerobic activity, when the body cannibalises muscle protein to help produce energy

Amino Acid Arginine (L-arginine) - is needed to keep the liver healthy

Amino Acid Arginine (L-arginine) - is needed to keep skin, joints, and muscles healthy

Amino Acid Arginine (L-arginine) - helps strengthen the body's immune system

Amino Acid Arginine (L-arginine) - regulates hormones, and blood sugar
Amino Acid Arginine (L-arginine) - promotes male fertility
Amino Acid Arginine (L-arginine) - may improve circulation, and heart disease
Amino Acid Arginine (L-arginine) - may help in cases of impotence

Amino Acid Asparagine - is required for normal functioning

Amino Acid Aspartic Acid (L-aspartate) - help promote a robust metabolism
Amino Acid Aspartic Acid (L-aspartate) - is used to treat fatigue and depression

Amino Acid Carnitine (L-carnitine) - helps carry fatty acids into the mitochondria in cells so that they
can convert these acids to energy
Amino Acid Carnitine (L-carnitine) - supplementation can help heart function

Amino Acid Carnosine (L-carnosine) is thought to be a powerful anti-aging supplement

Amino Acid Citrulline - promotes healthier skin and immune functions
Amino Acid Citrulline - is part of the Urea Cycle, and assists in converting ammonia to urea in the
liver, which offers protection against damage promotes healthy liver function

Amino Acid Cystine - is a sulphur-containing amino acid that helps form healthy skin, hair, bones, and
connective tissue
Amino Acid Cystine - is needed to make glutathione, one of the natural antioxidants that fights free-
radical damage (glutathione detoxifies the liver)

Amino Acid Gamma-aminobutyric acid (GABA) - helps promote normal brain function by helping to
block stress-related messages from reaching
receptor sites in the central nervous system

Amino Acid Gamma-aminobutyric acid (GABA) - helps reduce feelings of anxiousness, and may be
helpful for treatment of disorders linked to emotional
stress, including reduced sex drive, and
hypertension

Amino Acid Glutamic Acid - is an excitatory neurotransmitter that increases the firing of neurons in the
central nervous system

Amino Acid Glutamic Acid - is a major excitatory neurotransmitter in the brain, and spinal cord

Amino Acid Glutamine - helps build and maintain muscles
Amino Acid Glutamine - helps remove toxic ammonia from the liver
Amino Acid Glutamine - helps maintain a healthy central nervous system

Amino Acid Glutathione peroxidase - is the body's most abundant natural antioxidant
Amino Acid Glutathione peroxidase - protects vision, and boosts immune system
Amino Acid Glutathione peroxidase - helps to turn carbohydrates into energy
Amino Acid Glutathione peroxidase - prevents the build-up of oxidized fats that may contribute to
atherosclerosis

Amino Acid Glycine - helps create muscle tissue and convert glucose into energy
Amino Acid Glycine - essential to maintaining a healthy central nervous system
Amino Acid Glycine - essential to maintaining a healthy digestive system
Amino Acid Glycine - may provide protection via antioxidants from some types of cancer

Amino Acid Ornithine - helps build muscle and reduce body fat, especially when combined with the
amino acids arginine and carnitine

Amino Acid Ornithine - is needed for the formation of citrulline, proline, and glutamic acid - three
amino acids that help to supply energy to all the body's cells

Amino Acid Proline - is needed for the production of collagen and cartilage
Amino Acid Proline - keeps muscles and joints flexible
Amino Acid Proline - helps reduce sagging/wrinkling that accompany UV exposure, and skin aging

Amino Acid Serine - needed for overall good health - physical and mental
Amino Acid Serine - needed for the proper functioning of the brain and central nervous system

Amino Acid Taurine - helps regulate the nervous system and the muscles
Amino Acid Taurine - helps to keep the brain and heart healthy

Amino Acid Threonine - promotes normal growth by helping to maintain the proper protein balance in the body
Amino Acid Threonine - supports cardiovascular, and liver function
Amino Acid Threonine - supports central nervous, and immune system function

--()--

Dosage

This is where it gets subjective - there is a wealth of divergent opinion regarding supplement dosage, especially for the treatment of disease. In the final analysis it is up to the individual, in consultation with their health professional, as to what dosage is recommended.

See the chapter, "*Example Applications of Supplements*", for some examples of application.

--()--

Amino Acids - General Overview

Some practitioners recommend and prescribe Amino Acid supplementation. However, all the essential amino acids should be readily obtained from the individual's diet; and only if special circumstances require, should Amino Acid therapy be considered.

What are Amino Acids?

Amino acids are the "building blocks", or chemical units, that make up protein. There are nine essential amino acids, namely: Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine; and their best sources are meat, fish, fowl, eggs, and dairy products.

Alfalfa is also a good source for the nine essential amino acids.

In addition, Cysteine and Tyrosine, sometimes classified as Non-essential Amino Acids, are now considered "semi-essential", because if they are present in the diet (meat, milk, fish, poultry, and legumes are good sources), the body can use them in place of the two essential amino acids, Methionine and Phenylalanine, to make protein.

The nonessential amino acids are: Alanine, Arginine, Asparagine, Aspartic Acid, Carnitine, Carnosine, Citrulline, Cystine, Gamma-aminobutyric acid (GABA), Glutamic Acid, Glutamine, Glutathione, Glycine, Ornithine, Proline, Serine, Taurine, and Threonine.

--()--

Net Protein Utilization

Foods that lack essential amino acids are poor sources of protein equivalents - this is because the body tends to *deaminate the amino acids obtained, and convert proteins into fats and carbohydrates. Consequently, a balance of essential amino acids is necessary for a high degree of net protein utilization, which is the mass ratio of amino acids converted to proteins, to amino acids supplied.

*(**deaminate, deamination** - is the process by which amino acids are broken down when too much protein has been taken in.)

Complete proteins

Complete proteins contain a balanced set of essential amino acids for the human organism. With animal sources such as meat, poultry, eggs, fish, milk, and cheese providing all of the essential amino acids.

Complete proteins are also found in some plant sources such as quinoa, buckwheat, hempseed, and amaranth. Soybeans are considered by some authorities to be a source of complete protein; however, this is contested.

The net protein utilization is seriously affected by the *limiting amino acid* content (the essential amino acid found in the smallest quantity in the foodstuff), and also affected by the salvage of essential amino acids in the body.

Protein Source	Limiting Amino Acid
Wheat	Lysine
Rice	Lysine
Legumes	Tryptophan
Maize	Lysine and Tryptophan
Pulses	Methionine (or Cysteine)
Egg, Chicken	none; the reference for absorbable protein

It is therefore a good idea to mix foodstuffs that have different weaknesses in their essential amino acid distributions, and thus limit loss through deamination, and to increase overall net protein utilization.

--()--

Essential Amino Acids (Nine)

- **Histidine** - promotes growth and the repairing of body tissues.
- **Isoleucine** - necessary for protein synthesis, and is found in all foods that contain complete protein (meat, poultry, fish, eggs, milk, and dairy products, etc). Deficiency of Isoleucine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.
- **Leucine** - found in milk, meat, and other high protein foods. It is needed for protein synthesis, and a well functioning immune system. Deficiency of leucine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.
- **Lysine** - found in cheese, fish, and legumes. It is necessary for protein synthesis, and is integral to the production of Carnitine, which in turn is essential to the oxidation of fatty acids in the body. Lysine is the limiting amino acid in wheat.
- **Methionine** - its primary function is to facilitate fat and protein metabolism; the body also uses it to manufacture Cysteine, another amino acid. Methionine is the limiting amino acid in legumes and other vegetables.
- **Phenylalanine** - the body uses phenylalanine to produce tyrosine, a nonessential amino acid, and three important hormones (Epinephrine, Norepinephrine and Thyroxine) as well as melanin (brown skin pigment). Phenylalanine uses the same active transport channel as tryptophan to cross the blood-brain barrier; and, in large quantities, it interferes with the production of the brain neurotransmitter, Serotonin.

- **Threonine** - plays a major role in the synthesis of purines, which in turn break down uric acid, which is a by-product of protein digestion. Threonine is also necessary to bodily processes requiring Glycine, a non essential amino acid.
- **Tryptophan** - Tryptophan is a precursor of Niacin (Vitamin B3), and of Serotonin, the brain neurotransmitter that regulates appetite, pain, mood, and sleep. Because of Tryptophan's mood-elevating, sleep-inducing capabilities, it is prescribed as both a sleeping agent and an antidepressant.
- **Valine** - necessary in the growth and maintenance of body tissues (found in fibrous animal proteins). Deficiency of Valine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.

--()--

Semi-essential Amino Acids (Two)

- **Cysteine** - Once considered a non-essential amino acid, Cysteine has been re-classified as semi-essential. This is because if there is a deficiency of Methionine (an essential amino acid) in the diet, the body can use Cysteine in place of Methionine to synthesize protein.

Good sources of Cysteine include meat, fish, fowl, soybeans, oats, and wheat. Food manufacturers use Cysteine as an antioxidant to protect the Vitamin C content of processed foods. Also, bakers mix Cysteine into dough to speed kneading. Cystine, on the other hand, is used as a dough strengthener as well as a dietary supplement.

Additionally, two molecules of Cysteine can bond, forming Cystine, another amino acid

- **Tyrosine** - originally classified as a non essential amino acid, tyrosine is now considered semi-essential by most nutritionists, because if the body gets a sufficient amount, it can be used in place of phenylalanine to synthesize protein. Milk, meat, fish and legumes are good sources of tyrosine. The brain uses tyrosine to manufacture Norepinephrine, an "upper" that boosts mental alertness. (Norepinephrine, also known as noradrenaline, is both a hormone and a neurotransmitter.)

--()--

Non-essential Amino Acids (Eighteen)

These amino acids are called "nonessential", or "dispensable", because the human organism can synthesize as much of them as it needs. There are many non-essential amino acids, including: Alanine, Arginine, Asparagine, Aspartic Acid, Carnitine, Carnosine, Citrulline, Cystine, Gamma-aminobutyric acid (GABA), Glutamic Acid, Glutamine, Glutathione, Glycine, Ornithine, Proline, Serine, Taurine, and Threonine.

End

--()--

<http://campbellmgold.com>

13012009/2