

Amino Acid (Protein) Deficiency Signs: weak immune system, loss of antibody production, fatigue, stomach acid/alkaline imbalance, dizziness/nausea, water retention, and infertility.

Amino Acids are the "building Blocks" of the body. When protein is broken down by digestion the result is 22 known amino acids. Eight are essential (cannot be manufactured by the body) the rest are non-essential (can be manufactured by the body with proper nutrition). Sometimes the non-essential should still be supplemented to ensure an optimal available quantity.

Besides building cells and repairing tissue, amino acids form antibodies to combat invading bacteria & viruses; they are part of the enzyme & hormonal system; they build nucleoproteins (RNA & DNA); they carry oxygen throughout the body, and are part of all muscular activity.

Research from Dr. Steven Whiting of the Institute of Nutritional Science points out that an "All or None Law of Protein Utilization" is the rule of thumb. If ALL the amino acids are not present within a close 2 to 3 hour period protein assimilation will not work! Since most vegetarian sources of proteins are incomplete, they must carefully combine the timing and mix of their food intake to provide for complete coverage of ALL amino acids.

Even when all are present, the assimilation of ALL amino acids will be limited to the level of the lowest quantity amino acid. For example, if one amino acid is only present at the 60% level the assimilation of all amino acids will be limited to that 60% level.

Acetyl L-carnitine

Acetyl L-carnitine is a molecule composed of acetic acid and L-carnitine bound together. This amino acid, which is structurally similar to acetylcholine (a neurotransmitter in the brain responsible for memory and normal brain function), plays an important role in treating diseases like [Alzheimer's disease](#), senile depression, and [age-related memory defects](#). Many studies have shown that Acetyl L-carnitine can have the same benefits and effects of acetylcholine in stimulating brain cell production, in stabilizing cell membranes, and in acting as a powerful antioxidant to the brain.

One study of Alzheimer's sufferers showed that patients who took two grams of Acetyl L-carnitine daily for one year scored better on fourteen different tests than those who took the placebo. In another study of elderly patients with [mild memory deterioration](#), the patients demonstrated significant improvement in mental function after taking 1,500 mg of Acetyl L-carnitine on a daily basis. Another group of elderly patients suffering from [depression](#) also saw significant improvement when they took 500 mg of Acetyl L-carnitine three times daily.

Alanine

An important source of energy for muscle tissue, the brain and central nervous system; strengthens the immune system by producing antibodies; helps in the metabolism of sugars and organic acids.

Arginine

Arginine significantly contributes to insulin production, muscle metabolism, liver lipid metabolism, and is a component of collagen. It enhances the immune system, specifically by stimulating the thymus gland and the manufacture of T cells. This increase in T cell activity can be effective in fighting bacteria, viruses, cancer tumor cells, AIDS, [chronic fatigue](#), and other immune system related health challenges.

Arginine is a factor for maintaining the nitrogen balance in muscles; and can enhance the lean tissue to fat tissue body fat ratio; a great factor for weight management.

Arginine also neutralizes ammonia, which helps in liver detoxification and regeneration. As a component of collagen, it can assist with wound healing, skin problems, [arthritis](#), and connective tissue problems.

Asparagine

This amino acid is found mostly in meat sources, so vegetarians might need to consider supplementation. Asparagine balances the central nervous system and prevents excess nervousness/[anxiety](#) or excessive calmness/[depression](#).

Aspartic Acid

Aids in the expulsion of harmful ammonia from the circulatory system. When ammonia enters the circulatory system it acts as a highly toxic substance which can be harmful to the central nervous system and cause neural and brain disorders. Aspartic acid deficiency decreases cellular energy and may likely be a factor in [chronic fatigue](#).

Plants, especially sprouting seeds, are abundant in aspartic acid. |

Carnitine

Anyone concerned with decreasing body fat will want to assure their daily level of carnitine, because carnitine helps TRANSPORT FAT from fat cells to the mitochondria of muscle cells so it can be BURNED UP FOR ENERGY. It is hard to imagine how a weight loss program could ever be effective with a deficiency of carnitine.

Current levels of excessive body fat in the general population indicate a high level of carnitine deficiency. Interestingly, carnitine is not part of the "essential" nutrient group because the body manufactures it. But the manufacturing process requires adequate iron, Vitamin B1, B6, and C, and the amino acids lysine and methionine (neither of these amino acids are obtainable in sufficient amounts from vegetable sources). Carnitine deficiency will result if any of those nutrients are at inadequate levels, so supplementation is absolutely essential, especially for vegetarians.

Carnitine is great nutrient for [diabetes](#) prevention since poor fat metabolism is a causative factor for the development of diabetes. It is also great for [heart disease](#) prevention because it lowers triglycerides, improves organ muscle strength and enhances the antioxidant effectiveness of Vitamins C and E. Also, studies indicate that cardiac surgery damages to the heart can be reduced with carnitine treatments.

Recent research has shown that at high doses (1,000- 3,000 mg. daily), carnitine acts as an agent to reduce blood triglycerides. Elevated triglycerides can lead to an increased risk of small vessel diseases, including poor circulation in the hands and feet as well as kidney problems.

Citrulline

Functions primarily in the liver. Like other amino acids, citrulline detoxifies ammonia is involved in the energy cycle, and enhances the immune system.

Cysteine and Cystine

These amino acids are structured very closely and convert into each other as needed. They are involved in collagen production for skin elasticity and texture, and for alpha-keratin for fingernails, toenails, and hair. In fact, hair and skin are made up of 10-14% Cystine. This makes supplemental cysteine great for burn and surgery recovery, it is also recommended in treating [rheumatoid arthritis](#).

Cysteine is a powerful free radical destroyer by itself, but works best when vitamin E and selenium are present. It helps detoxify and protect the body from radiation damage, so it is often used in conjunction with chemotherapy and radiation cancer treatments.

Cysteine is a precursor to the liver detoxifying and antioxidant amino acid [glutathione](#). This functionality provides an [anti-aging](#) effect on the body—even reducing the accumulation of [age spots](#). Another impressive function is the break down of mucus in the respiratory tract which can help in bronchitis, emphysema, and tuberculosis.

N-acetylcysteine is the best form of cysteine supplementation and has been proven more effective at increasing glutathione levels than supplements of glutathione itself, or supplements of just L-cysteine.

Caution: Cystinuria is a genetic disease where cystine kidney stones are formed. People with this disease should not take supplemental cysteine.

Dimethylglycine (DMG)

Participates in formation of [methionine](#), choline, DNA, and several neurotransmitters. DMG is good for the heart. It has been found to [lower blood cholesterol](#) and triglycerides, and help normalize [blood pressure](#) and [blood glucose](#).

Gamma-Aminobutyric Acid (GABA)

GABA functions in the central nervous system as a neurotransmitter; it occupies the nerve receptor sites for [anxiety](#) or stress related messages so that they are restrained from reaching the brain.

GABA can be taken as a tranquilizer to calm the body, but without the addiction that can come with usage of Valium™ or Librium™. GABA is also used for [epilepsy](#), hypertension, and [ADD-ADHD](#).

Balanced supplementation is important because too much GABA can increase anxiety, and cause numbness in the face and tingling in the fingers and toes.

Glutamic Acid

Glutamic Acid is the precursor of GABA but has somewhat the opposite function; it is an excitatory neurotransmitter. It is one of the few nutrients that crosses the blood-brain barrier and is the only means by which ammonia in the brain can be detoxified.

It is considered to be nature's "Brain food" by improving mental capacities; and is used in the treatment of [depression](#), [ADD and ADHD](#), fatigue and [chronic fatigue](#), alcoholism, [epilepsy](#), muscular dystrophy, mental retardation, and schizophrenia.

Glutamine

Glutamine readily passes the blood-brain barrier and increases the amount of glutamic acid and GABA; thereby enhancing normal nervous system function. As amino acids chemically change, ammonia is released. Glutamine plays a role in the removal of this toxic ammonia from the brain.

Because glutamine's role in the nervous system is so important, during times of stress, illness, or surgery up to one third of the muscle stores of glutamine are released for nervous system usage; causing extensive muscle deterioration and loss. The muscle glutamine release is much lower if glutamine levels are increased through supplemental L-glutamine.

Supplemental L-glutamine is also used therapeutically for [arthritis](#), autoimmune diseases, [developmental disabilities](#), [impotence](#), schizophrenia, and for tissue damage from cancer radiation treatments.

Caution: Supplemental glutamine should not be taken by anyone with a disproducts/productsindex that causes an accumulation of ammonia in the blood (kidney or liver problems, Reye's syndrome, etc.)

Glutathione

The liver produces glutathione from the amino acids cysteine, glutamic acid and glycine. Glutathione deficiency results in [early aging](#) and in the loss of coordination, balance, tremors, and [mental disorders](#).

Glutathione levels decline with age and if not corrected will accelerate the aging process; so supplementation is important. But the assimilation of supplemental oral glutathione is questionable. Instead it is best to supplement with cysteine, glutamic acid and glycine and have the body use those raw materials to manufacture needed glutathione.

Glycine

Glycine supplies additional creatine to muscles and is used to construct DNA and RNA. It functions in skin, connective tissues, the central nervous system and [prostate](#).

A proper level of cellular glycine produces more energy, but too much glycine can cause fatigue.

Histidine

Is found abundantly in red and white blood cells and is a component of the myelin sheaths that protect nerve cells. It is used in the treatment of [arthritis](#), allergies, and ulcers.

Histamine, a chemical that functions in the immune system, is derived from histidine. Besides functioning in the immune system, histamine aids in sexual arousal, functioning and pleasure. To form histamine, histidine requires vitamins B₃ and B₆.

Caution: Histidine levels that are too high may lead to stress and psychological disorders like [anxiety](#) and schizophrenia. Individuals with [manic \(bipolar\) depression](#) should not take supplemental histidine unless prescribed by their health care provider.

Isoleucine

One of three branched-chain amino acids (the others are leucine and valine) that enhance energy, increase endurance, and aid in muscle tissue recovery and repair. This group also lowers elevated blood sugar levels and increases growth hormone production. Supplemental isoleucine should always be combined with leucine and valine at a respective milligram ratio of 1:2:2.

Caution: Megadosing causes symptoms of hypoglycemia, pellagra, and may result in excessive levels of ammonia in the body.

Leucine

One of three branched-chain amino acids (the others are isoleucine and valine) that enhance energy, increase endurance, and aid in muscle tissue recovery and repair. This group also lowers elevated blood sugar levels and increases growth hormone production. Supplemental leucine should always be combined with isoleucine and valine at a respective milligram ratio of 2:1:2.

Caution: Megadosing causes symptoms of hypoglycemia, pellagra, and may result in excessive levels of ammonia in the body.

Lysine

Lysine is especially needed for adequate absorption of calcium and bone development in children. It aids in the production of antibodies, hormones & enzymes. Recent studies have shown that Lysine may be effective against herpes by improving the balance of nutrients that reduce viral growth.

A deficiency may result in tiredness, inability to concentrate, irritability, bloodshot eyes, retarded growth, hair loss, anemia & [reproductive problems](#).

Methionine

This amino acid is a principle supplier of sulfur, which inactivates free radicals. Adequate methionine prevents disorders of the hair, skin and nails; helps [lower cholesterol levels](#) by increasing the liver's production of lecithin; reduces liver fat and protects the kidneys.

Methionine is a natural chelating agent for heavy metals and helps detoxify the body of these metals. It regulates the formation of ammonia and creates ammonia-free urine which reduces bladder irritation. It also influences hair follicles and prevents brittle hair.

Ornithine

Ornithine participates in the release of growth hormone, which then prompts the metabolism of excess body fat. This process is enhanced by the presence of arginine and carnitine.

Caution: Children, pregnant or nursing women, or anyone with a history of schizophrenia should only use supplemental L-ornithine under the direction of a physician.

Phenylalanine

Used by the brain to produce dopamine and norepinephrine, chemicals that promote alertness, elevate mood, decrease pain, aid in memory and learning, and reduce hunger and appetite.

Caution: Phenylalanine should not be supplemented by individuals with [anxiety attacks](#), [diabetes](#), pigmented melanoma (skin cancer), [high blood pressure](#), or if pregnant.

Proline

Is obtained primarily from meat and aids in maintaining collagen (skin protein). Proline deficiency will cause an uncared-for vegetarian to have early signs of [skin aging](#). Proline also strengthens joints, tendons, connective tissue, and cartilage.

Serine

A storage source of glucose by the liver and muscles; helps strengthen the immune system by providing antibodies; synthesizes fatty acid sheath around nerve fibers.

Taurine

Helps stabilize the excitability of membranes which is very important in the control of [epileptic seizures](#). Taurine and sulfur are considered to be factors necessary for the control of many biochemical changes that take place in the [aging process](#); aids in the clearing of free radical wastes. A deficiency of zinc and taurine may impair vision.

It is used therapeutically for people with [hypertension](#), [atherosclerosis](#), edema, [cardiac arrhythmias](#), [anxiety](#), [epilepsy](#), hyperactivity, seizures, breast cancer, Down syndrome, muscular dystrophy.

Taurine is in eggs, fish, meat, and milk, but not in vegetable proteins. It can be synthesized from cysteine and methionine as long as sufficient quantities of vitamin B₆ are present.

Threonine

Is an important constituent of collagen, elastin, and enamel protein; helps prevent fat build-up in the liver; helps the digestive and intestinal tracts function more smoothly; assists metabolism and assimilation.

Tryptophan

A natural relaxant, helps alleviate insomnia by inducing normal sleep; reduces [anxiety](#) and [depression](#); helps in the treatment of migraine headaches; helps the immune system; helps reduce the risk of artery and heart spasms; works with lysine in reducing [cholesterol](#) levels.

Tyrosine

Promotes the healthy functioning of the thyroid, adrenal and pituitary glands. Suppresses the appetite and helps to reduce body fat. Research indicates tyrosine may help [chronic fatigue](#), narcolepsy, [anxiety](#), [depression](#), allergies, headaches, and [Parkinson's disease](#).

Valine

One of three branched-chain amino acids (the others are leucine and isoleucine) that enhance energy, increase endurance, and aid in muscle tissue recovery and repair. This group also lowers elevated blood sugar levels and increases growth hormone production. Supplemental valine should always be combined with isoleucine and leucine at a respective milligram ratio of 2:1:2.

Caution: Megadosing can cause hallucinations and tingling skin.