Arginine or L-Arginine

Arginine is a conditionally nonessential amino acid, meaning most of the time it can be manufactured by the human body, and does not need to be obtained directly through the diet. The biosynthetic pathway however does not produce sufficient arginine, and some must still be consumed through diet. Individuals who have poor nutrition or certain physical conditions may be advised to increase their intake of foods containing arginine. Arginine is found in a wide variety of foods, including:

- **Animal sources**: dairy products (e.g. cottage cheese, ricotta, milk, yogurt, whey protein drinks), beef, pork (e.g. bacon, ham), gelatin, poultry (e.g. chicken and turkey light meat), wild game (e.g. pheasant, quail), seafood (e.g. halibut, lobster, salmon, shrimp, snails, tuna)
- **Vegetable sources**: wheat germ and flour, buckwheat, granola, oatmeal. It occurs naturally in many nuts, legumes and seeds. Peanuts, nuts (coconut, pecans, cashews, walnuts, almonds, Brazil nuts, hazelnuts, pine-nuts), seeds (pumpkin, sesame, sunflower), chick peas, cooked soybeans, *Phalaris canariensis* (canary seed or ALPSTE). Some whole grains -- oats, barley, brown rice and buckwheat -- are rich in L-arginine, as are raisins.

So if you eat a lot of these foods, chances are you are already getting plenty of L-arginine. If not, a handful of trail mix might be your best bet.

Also, eating watermelon increases blood amino acid arginine concentration in humans. The nutrient in watermelon responsible for the increased plasma arginine level is called citrulline. On average, a gram of watermelon flesh contains 1.5 mg citrulline. Citrulline, an amino acid, is a precursor for the synthesis of arginine.

Ornithine is found in abundance in meats and fish, in dairy products
and eggs - in general it is found in all food sources rich in proteins. L-Ornithine is considered a non-essential amino acid and most people get enough without supplementation.

The pathways linking arginine, glutamine, and proline are bidirectional. Thus, the net utilization or production of these amino acids is highly dependent on cell type and developmental stage.

On a whole-body basis, synthesis of arginine occurs principally via the intestinal–renal axis, wherein epithelial cells of the small intestine, which produce citrulline primarily from glutamine and glutamate, collaborate with the proximal tubule cells of the kidney, which extract citrulline from the circulation and convert it to arginine, which is returned to the circulation. Consequently, impairment of small bowel or renal function can reduce endogenous arginine synthesis, thereby increasing the dietary requirement.

Synthesis of arginine from citrulline also occurs at a low level in many other cells, and cellular capacity for arginine synthesis can be markedly increased under circumstances that also induce iNOS. Thus, citrulline, a co-product of the NOS-catalyzed reaction, can be recycled to arginine in a pathway known as the citrulline-NO or arginine-citrulline pathway. This is demonstrated by the fact that in many cell types, citrulline can substitute for arginine to some degree in supporting NO synthesis. However, recycling is not quantitative because citrulline accumulates along with nitrate and nitrite, the stable end-products of NO, in NO-producing cells.

Function

Arginine plays an important role in cell division, the healing of wounds, removing ammonia from the body, immune function, and the release of hormones. Arginine taken in combination with proanthocyanidins or yohimbine has also been used as a treatment for erectile dysfunction.
The benefits and functions attributed to oral supplementation of L-arginine include:

- Precursor for the synthesis of nitric oxide (NO)
- Reduces healing time of injuries (particularly bone)
- Quickens repair time of damaged tissue
- Helps decrease blood pressure

The distributing basics of the moderate structure found in geometry, charge distribution and ability to form multiple H-bonds make arginine ideal for binding negatively charged groups. For this reason, arginine prefers to be on the outside of the proteins where it can interact with the polar environment. Incorporated in proteins, arginine can also be converted to citrulline by PAD enzymes. In addition, arginine can be methylated by protein methyltransferases.

Arginine is the immediate precursor of NO, urea, ornithine and agmatine; is necessary for the synthesis of creatine; and can also be used for the synthesis of polyamines (mainly through ornithine and to a lesser degree through agmatine), citrulline, and glutamate. As a precursor of nitric oxide, arginine may have a role in the treatment of some conditions where vasodilation is required. The presence of asymmetric dimethylarginine (ADMA), a close relative, inhibits the nitric oxide reaction; therefore, ADMA is considered a marker for vascular disease, just as L-arginine is considered a sign of a healthy

Potential medical uses

A low ratio of arginine to lysine may be of benefit in the treatment of herpes simplex virus.

Possible increased risk of death after supplementation following heart attack.

The Mayo Clinic web page on L-arginine reports that inhalation of L-arginine can increase lung inflammation and worsen asthma.
A clinical trial found that patients taking an L-arginine supplement following a heart attack did not improve in their vascular tone or their heart’s ability to pump. It is recommended that the supplement not be used by heart attack patients.

Arginine may stimulate the secretion of growth hormone and is used in growth hormone stimulation tests.

Sepsis

Cellular arginine biosynthetic capacity determined by activity of argininosuccinate synthetase (AS) is induced by the same mediators of septic response—endotoxin and cytokines—that induce nitric oxide synthase (NOS), the enzyme responsible for nitric oxide synthesis.

The malate salt of arginine can also be used during the treatment of alcoholic hepatitis and advanced cirrhosis.

L-arginine is an amino acid that has numerous functions in the body. It helps the body get rid of ammonia (a waste product), is used to make compounds in the body such as creatine, L-glutamate, and L-proline, and can be converted to glucose and glycogen if needed.

L-arginine is used to make the nitric oxide, a compound in the body that relaxes blood vessels. Preliminary studies have found that L-arginine may help with conditions that improve when blood vessels are relaxed (called vasodilation), such as atherosclerosis, erectile dysfunction, and intermittent claudication.

L-arginine is also involved in protein formation. In larger amounts, L-arginine stimulates the release of hormones growth hormone and prolactin.

Heart disease
In the body, L-arginine is used to make nitric oxide, which reduces blood vessel stiffness, increases blood flow, and improves blood vessel function.

However, L-arginine should not be used following a heart attack. An study sponsored by the National Institutes of Health examining the use of L-arginine after a heart attack was terminated early after six patients died, a disproportionate number. There were no deaths in the patients who did not receive L-arginine.

The study researchers speculate that L-arginine may aggravate the effects of cardiac shock. The results were published in the *Journal of the American Medical Association.*

**Erectile Dysfunction**

L-arginine has been used for erectile dysfunction. Like the drug sildenafil citrate (Viagra), L-arginine is thought to enhance the action of nitric oxide, which relaxes muscles surrounding blood vessels supplying the penis. As a result, blood vessels in the penis dilate, increasing blood flow, which helps maintain an erection. The difference in how they work is that Viagra blocks an enzyme called PDE5 which destroys nitric oxide and L-arginine is used to make nitric oxide.

In one study, 50 men with erectile dysfunction took either 5 grams of L-arginine per day or a placebo. After six weeks, more men in the L-arginine group had an improvement compared to those taking the placebo.

Unlike Viagra, L-arginine must be taken daily.

**Wound healing**
L-arginine’s possible activity in wound repair may be due to its role in the formation of L-proline, an important amino acid that is essential for the synthesis of collagen.

Other Conditions

L-arginine is also used for high blood pressure, migraines, sexual dysfunction in women, intermittent claudication, and interstitial cystitis.

Some people have a medical condition, hyperargininemia, in which the body is already producing more L-arginine than it needs.

Severe burns, infections, and injuries can deplete the body’s supply of arginine. Under these conditions, L-arginine becomes essential and it is necessary to ensure proper intake to meet the increased demands.

L-arginine is also essential for children with rare genetic disorders that impair the formation of L-arginine.

Side Effects of L-Arginine

Any drug or supplement can cause side effects. L-arginine is no exception.

L-arginine affects the way your body handles waste, so it can have adverse effects on the organs involved in waste disposal. Some liver and kidney problems can be exacerbated by L-arginine. Using L-arginine can also lead to problems of potassium balance and dehydration, as well as stomach cramps, nausea and other digestive discomfort.

There can also be some circulatory side effects associated with L-arginine. People recovering from heart attacks should not take it. There is a possibility that, because it dilates blood vessels, it increases the risk of excessive bleeding. Hemophiliacs and people on blood
thinners should probably steer clear. So should people who are taking gingko biloba, another herbal supplement that can heighten the risk of bleeding. Sometimes L-arginine can make problems of low blood pressure more severe. People with sickle cell disease may find that their symptoms get worse.

You would think that, because L-arginine production can be hindered by dialysis, it would be a natural choice to recommend L-arginine supplements to diabetics. However, there is some evidence that the amino acid actually raises blood sugar. Once again, the workings of chemicals in the body are incredibly complicated.

One of the most severe potential side effects of L-arginine is anaphylaxis. That is a very severe allergic reaction that can result in shock and potentially even death. In an anaphylactic reaction, you may experience sudden chills, sweating, tremors, hives, vomiting, and diarrhea, shortness of breath and light-headedness or fainting -- all at once. It is not pleasant. If you have any allergies, do not take L-arginine before being tested for an allergy to it.

L-arginine may lower blood pressure because it is involved in the formation of nitric oxide. It may also result in indigestion, nausea, and headache.

L-arginine should not be used following a heart attack. If you have a history of heart disease, consult your doctor before taking L-arginine.

Higher doses of arginine can increase stomach acid, so it may worsen heartburn, ulcers, or digestive upset caused by medications. Arginine appears to increase stomach acid by stimulating the production of gastrin, a hormone that increases stomach acid.

L-arginine may also alter potassium levels, especially in people with liver disease. People with kidney disease and those who take ACE inhibitors or potassium sparing diuretics should not use supplemental L-arginine unless they are under professional supervision. It may also
alter the levels of other chemicals and electrolytes in the body, such as chloride, sodium, and phosphate.

Arginine may increase blood sugar levels, so it should not be used by people with diabetes unless under a doctor’s supervision.

Side effects of L-arginine (when taken in high dosage and for long term) are thickening and coarsening of skin.

Pregnant and nursing women and children should not use supplemental L-arginine, as its safety has not been established.

People with genital herpes should not take L-arginine because it may aggravate their symptoms.

Possible Drug Interactions

L-arginine may counteract the benefits of lysine to treat herpes.

NSAIDS (non-steroidal anti-inflammatory) or other drugs that are hard on the stomach should not be combined with L-arginine.

Drugs that alter potassium levels in the body, such as ACE inhibitors and potassium sparing diuretics should not be combined with L-arginine.

L-arginine helps the body get rid of waste and synthesize proteins. Certain conditions such as severe burns, sepsis, jaundice, protein deficiencies and malnutrition can affect your ability to produce L-arginine. So can dialysis. People who do not have enough L-arginine may have symptoms such as constipation, alopecia (hair loss) and skin problems. Their wounds may heal slowly, and fat may have built up in their livers.

Some effects of L-arginine depend on the method in which the body is exposed to the chemical. L-arginine can be administered as a
nutritional supplement, inhaled or injected and, of course, you get some of it through the foods you eat.

When it's administered as a medicine, L-arginine is a *vasodilator* -- that is, it dilates the blood vessels, allowing more blood to pass through at once. That has the effect of lowering blood pressure and, in some cases, helping the body negotiate the arterial blockages that can come with conditions such as atherosclerosis.

**Benefits of L-arginine**

First, it may treat disorders of urea production and waste removal. Some chemical imbalances cause the body to accumulate waste products. Depending on the chemicals involved, L-arginine can restore the balance.

L-arginine may also reduce symptoms of angina (chest pain) and coronary disease. L-arginine may be a good treatment for some heart patients. The supplement may also improve blood flow. For certain patients, L-arginine can help reduce blood pressure. People with blood clots, especially in the legs, may find some relief from supplemental L-arginine.

If you find yourself with an open wound, L-arginine may be a good alternative. People with severe burns, malnutrition and certain wasting diseases may heal more slowly, raising the risk of infection and other complications. L-arginine is promising as a treatment in these cases.

L-arginine regulates growth. Erratic or excessive growth may be a symptom of an L-arginine deficiency. It may also reduce migraine pain. More research is needed, but L-arginine may work well in combination with other pain drugs such as ibuprofen.

Lastly, it may improve sexual function. There is some evidence that L-arginine can help with the function of body parts that rely on dilated blood vessels. That includes the sexual organs. L-arginine
cannot treat cases of erectile dysfunction that are not related to blood flow.

One final note: Beware of herbal supplements promising L-arginine. Herbal supplements are not subject to the same FDA regulations as prescription pharmaceuticals are. Among other things, this means that in two identical-looking pills from the same bottle, the dosage may vary. You may not always be able to predict the effects of the supplement -- even from day to day.

L-arginine may boost the activity of certain hormones, including human growth hormone. But that's a big maybe. The ways in which L-arginine interacts with hormones are numerous and complicated. Estrogen may boost its activity; progesterone may suppress it.

There is a possibility that L-arginine can actually assist with human growth before birth. There has not yet been enough studies to determine it conclusively, but it's possible that one day pregnant women will take supplements of L-arginine to aid in fetal growth, especially in cases of preeclampsia (a potentially dangerous condition in which the mother suffers high blood pressure during pregnancy). Low birth weight is a major risk factor for infant mortality and numerous other health problems.

One interesting use of L-arginine is not so much to foster growth as to prevent wasting. In people with chronic wasting diseases such as HIV/AIDS, L-arginine seems to have the ability to help the body hang on to its muscle mass. Plummeting body weight can be a risk for numerous other conditions, and muscle loss can also mean a loss of independence. So L-arginine may help such patients’ quality of life.

**L-Arginine is essential to several systems in the body. Among its many roles, L-Arginine:**

- Is a precursor of nitric oxide (NO)
- Promotes circulation resulting in improved blood flow
• Stimulates the release of growth hormone
• Improves immune function
• Reduces healing time of injuries
• Plays a role in the formation of bone and tendons
• Increases muscle mass, while reducing body fat
• Supports male fertility, improving sperm production and motility
• Reduces risk of blood clots and stroke
• Supports normal blood pressure
• Improves vascular function for patients with angina
• Helps recovery after heart attack
• Helps prevent and treat cardiovascular disease
• Helps reduce growth of cancerous tumors

Timing and contraindications

L-Arginine users say they can achieve a pro-sexual effect by taking it 45 minutes before sex. There are few reported side effects. The most notable is:

• People with herpes - L-Arginine may increase the severity of outbreaks, but some reports indicate that it may also enhance your immune function enough so you are less likely to get herpes outbreaks.

L-Arginine is an excellent supplement for anyone wanting to increase his or her sexual arousal, improve performance, and overall health. The huge advantage this natural and safe supplement has over Viagra is that men and women can take it.

While L-Arginine is an inexpensive way to supplement your dietary arginine and increase nitric oxide production, an even more effective supplement is OKG (Ornithine ketoglutarate). OKG not only is slowly converted to arginine in the body, but is also metabolized to other health promoting amino acids.