

# Amino Acids

**Amino acids** are the building blocks of **protein** . The body requires 20 different amino acids that act as these building blocks.

Non-essential amino acids are those that can be synthesized within the body, provided there is enough nitrogen, carbon, hydrogen, and oxygen available.



Essential amino acids are those that must be supplied by the diet, since the human body either cannot make them at all or cannot make them in sufficient quantity to meet its needs.

Under normal conditions, 11 of the amino acids are nonessential and 9 are essential.

Essential amino acids	Nonessential amino acids
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine
Phenylalanine	Glutamic acid
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

## Functions of Proteins

Proteins act as **enzymes** , **hormones** , and **antibodies** . They maintain fluid balance and the acid and alkaline balance. They transport oxygen, vitamins, and minerals to cells throughout the body. Structural proteins, such as collagen and keratin, are responsible for the formation of bones, teeth, hair, and the outer layer of skin, and they help maintain the structure of blood vessels and other tissues. In contrast, motor proteins use energy and convert it into some form of mechanical work (e.g., dividing cells, contracting muscle).

**Enzymes** are proteins that facilitate chemical reactions without being changed in the process.

**Hormones** (chemical messengers) are proteins that travel to one or more specific target tissues or organs, and many have important regulatory functions. Insulin, for example, plays a key role in regulating the amount of glucose in the blood.

The body manufactures **antibodies** (large protein molecules), which combat invading antigens. Antigens are usually foreign substances such as bacteria and viruses that have entered the body and could potentially be harmful. Antibodies defend the body from possible attack by these invaders by binding to the antigens and inactivating them.

## The 9 essential amino acids and their food sources

**Histidine:** Histidine is needed for growth and tissue repair. To protect nerve cells and to make red and white blood cells. It also detoxifies the body – by removing heavy metals and protects from radiation. It is also found to lower blood pressure. Histidine can be found in **rice, wheat and rye**.

**Isoleucine:** Isoleucine is important for blood sugar regulation, muscle development and repair, haemoglobin development, and energy regulation. Deficiencies of isoleucine result in possible dizziness, headaches, fatigue, depression, confusion and irritability. Isoleucine is found in **eggs, fish, lentils, poultry, beef, seeds, soy, wheat, almonds and dairy**.

**Leucine:** Leucine stimulates muscle protein synthesis and may be the major fuel involved in anabolic (tissue building) reactions. During times of starvation, stress, infection, or recovery from trauma, the body mobilizes leucine as a source for gluconeogenesis (the synthesis of blood sugar in the liver) to aid in the healing process. Insulin deficiency is known to result in poor utilization of leucine; therefore, individuals who suffer from glucose intolerance may require higher levels of leucine intake. Leucine is found in **cottage cheese, sesame seeds, peanuts, dry lentils, chicken, and fish**.

**Lysine:** Lysine deficiency can result in a deficiency in niacin (Vitamin B) and this can cause the disease pellagra. It is also beneficial in treating and preventing herpes and for cold sores. Lysine sources include **green beans, lentils, soybean, spinach and amaranth**.

**Methionine:** Methionine supplies sulphur and other compounds required by the body for normal metabolism and growth. It belongs to a group of compounds called lipotropics that help the liver process fats. It is found in **fish, whole grains, and dairy**.

**Phenylalanine:** Phenylalanine serves in the body as a precursor to the catecholamine family of hormones. These hormones include adrenaline and noradrenaline, which are activating substances in the central and peripheral nervous systems. Deficiencies are rare but can include slowed growth, lethargy, liver damage, weakness, oedema, and skin lesions. Food sources of phenylalanine are **dairy, almonds, avocados, lima beans, peanuts, and seeds**.

**Threonine:** Threonine is important for antibody production. It can be converted into glycine and serine. Deficiencies are rare but can result in skin disorders and weakness. Dietary sources of threonine include **dairy, beef, poultry, eggs, beans, nuts, and seeds**.

**Tryptophan:** tryptophan is a precursor for serotonin and melatonin. This amino acid is needed to maintain a balanced health mood and for promoting sleep. It is found in **oats, bananas, dried dates, milk, cottage cheese, meat, fish, turkey and peanuts**.

**Valine:** Valine is needed for muscle metabolism, tissue repair, and for the maintenance of proper nitrogen balance in the body. Valine is found in high concentration in the muscle tissue. It is also one of the three branched chain amino acids, which means that it can be used as an energy source by muscle tissue. It may be helpful in treating liver and gallbladder disorders, and it is good for correcting the type of severe amino acid deficiencies that can be caused by drug addiction. Dietary sources of valine include **dairy products, grain, meat, mushrooms, peanuts, and soy proteins**.

### Amino Acid Supplements

Although most of us obtain sufficient amounts of the essential amino acids in our diets there are conditions that require our bodies to need more than they are getting. In times of physical and emotional stress, illness, injury and surgery the body requires more amino acids than can be gained from food alone, especially when the diet is inadequate or low in proteins.

Many people are turning away from a meat based diet because of considerations for the environment, the animals, and their own health. In these situations it is important that people educate themselves on the best ways to obtain sufficient essential amino acids.