

Amino acid

Amino acids are organic compounds containing the basic amino groups (-NH₂) and carboxyl groups (-COOH). The ingredients present in proteins are amino acids. Both peptides and proteins are long chains of amino acids. Altogether, there are twenty amino acids, which are involved in the construction of proteins.

List of 20 Amino acids with the chemical formula

Alanine	C ₃ H ₇ NO ₂	Leucine	C ₆ H ₁₃ NO ₂
Aspartic Acid	C ₄ H ₇ NO ₄	Lysine	C ₆ H ₁₄ N ₂ O ₂
Asparagine	C ₄ H ₈ N ₂ O ₃	Methionine	C ₅ H ₁₁ NO ₂ S
Arginine	C ₆ H ₁₄ N ₄ O ₂	Proline	C ₅ H ₉ NO ₂
Cytosine	C ₄ H ₅ N ₃ O	Phenylalanine	C ₉ H ₁₁ NO ₂
Cysteine	C ₃ H ₇ NO ₂ S	Serine	C ₃ H ₇ NO ₃
Glycine	C ₂ H ₅ NO ₂	Tyrosine	C ₉ H ₁₁ NO ₃
Glutamine	C ₅ H ₁₀ N ₂ O ₃	Threonine	C ₄ H ₉ NO ₃
Histidine	C ₆ H ₉ N ₃ O ₂	Tryptophan	C ₁₁ H ₁₂ N ₂ O ₂
Isoleucine	C ₆ H ₁₃ NO ₂	Valine	C ₅ H ₁₁ NO ₂

General properties of Amino acids

- They have a very high melting and boiling point.
- Amino acids are white crystalline solid substances.
- In taste, few Amino acids are sweet, tasteless, and bitter.
- Most of the amino acids are soluble in water and are insoluble in organic solvents.

Essential and Non-essential Amino acids

Out of 20 amino acids, our body can easily synthesize a few on its own, which are called non-essential amino acids. These include alanine, asparagine, arginine, aspartic acid, glutamic acid, cysteine, glutamine, proline, glycine, serine, and tyrosine.

Apart from these, there are other nine amino acids, which are very much essential as they cannot be synthesized by our body. They are called essential amino acids, and they include isoleucine, histidine, lysine, leucine, phenylalanine, tryptophan, methionine, threonine, and valine.

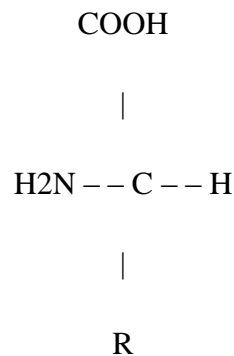
Sources of Amino acids

Amino acids play an important role in performing several biological and chemical functions in different parts of our body, including building and repairing the tissues, the formation and function of enzymes, food digestion, the transportation of molecules, etc. Our body can synthesize only certain amino acids and the rest of the amino acids which are called essential amino acids should be supplied through protein-rich foods in our daily diet.

Foods rich in amino acids include plant-based products like broccoli, beans, beetroots, pumpkin, cabbage, nuts, dry fruits, chia seeds, oats, peas, carrots, cucumber, green leafy vegetables, onions, soybeans, whole grain, peanuts legumes, lentils, etc. Fruits rich in amino acids are apples, bananas, berries, figs, grapes, melons, oranges, papaya, pineapple, and pomegranates. Other animal products include dairy products, eggs, seafood, chicken, meat, pork etc.

Structure of Amino acids

The general structure of Amino acids is $\text{H}_2\text{NCH(R)COOH}$, and it can be written as:

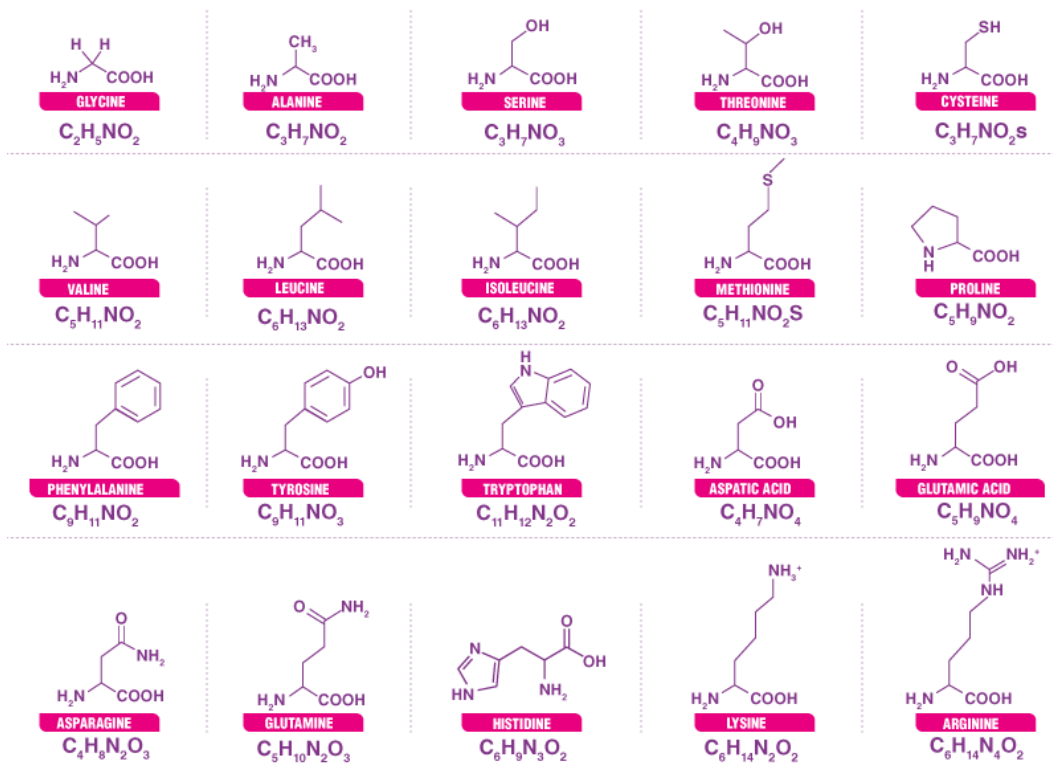


There are 20 naturally occurring amino acids and all have common structural features – an amino group ($-\text{NH}_3^+$), a carboxylate ($-\text{COO}^-$) group and a hydrogen-bonded to the same carbon atom. They differ from each other in their side-chain called the R group. Each amino acid has 4 different groups attached to α - carbon.

These 4 groups are:

- -
 - Amino group,
 - COOH ,
 - Hydrogen atom,
 - Sidechain (R).

Structure of 20 Amino acids with their chemical formula



Functions of Amino acids

Functions of Essential Amino acids

- Phenylalanine helps in maintaining a healthy nervous system and in boosting memory power.
- Valine acts as an important component in promoting muscle growth.
- Threonine helps in promoting the functions of the immune system.
- Tryptophan is involved in the production of vitamin B3 and serotonin hormones. This serotonin hormone plays a vital role in maintaining our appetite, regulating sleep and boosting our moods.
- Isoleucine plays a vital role in the formation of haemoglobin, stimulating the pancreas to synthesize insulin, and transporting oxygen from the lungs to the various parts.
- Methionine is used in the treatment of kidney stones, maintaining healthy skin and also used in controlling invade of pathogenic bacteria.
- Leucine is involved in promoting protein synthesis and growth hormones.
- Lysine is necessary for promoting the formation of antibodies, hormones, and enzymes and in the development and fixation of calcium in bones.
- Histidine is involved in many enzymatic processes and in the synthesizing of both red blood cells (erythrocytes) and white blood cells (leukocytes).

Functions of Non-Essential Amino acids

- Alanine functions by removing toxins from our body and in the production of glucose and other amino acids.
- Cysteine acts as an antioxidant and provides resistance to our body; it is important for making collagen. It affects the texture and elasticity of the skin

- Glutamine promotes a healthy brain function and is necessary for the synthesis of nucleic acids – DNA and RNA.
- Glycine is helpful in maintaining the proper cell growth, and its function, and it also plays a vital role in healing wounds. It acts as a neurotransmitter.
- Glutamic acid acts as a neurotransmitter and is mainly involved in the development and functioning of the human brain.
- Arginine helps in promoting the synthesis of proteins and hormones, detoxification in the kidneys, healing wounds, and maintaining a healthy immune system.
- Tyrosine plays a vital role in the production of the thyroid hormones -T3 and T4, in synthesizing a class of neurotransmitters and melanin, which are natural pigments found in our eyes, hair, and skin.
- Serine helps in promoting muscle growth and in the synthesis of immune system proteins.
- Asparagine is mainly involved in the transportation of nitrogen into our body cells, formations of purines and pyrimidine for the synthesis of DNA, the development of the nervous system and improving our body stamina.
- Aspartic acid plays a major role in metabolism and in promoting the synthesis of other amino acids.
- Proline is mainly involved in the repairing of the tissues in the formation of collagen, preventing the thickening and hardening of the walls of the arteries (arteriosclerosis) and in the regeneration of new skin.

Deficiency of Amino acids

As mentioned above, amino acids are the building blocks of proteins and proteins play a fundamental role in almost all life processes. Therefore, it is necessary to include all nine essential amino acids in our daily diet to maintain a healthy and proper function of our body. The deficiency of amino acids may include different pathological disorders, including:

- Edema.
- Anemia.
- Insomnia.
- Diarrhea.
- Depression.
- Hypoglycemia.
- Loss of Appetite.
- Fat deposit in the liver.
- Skin and hair related problems.
- Headache, weakness, irritability, and fatigue.