forté elements

Forté Amino Acid™

Science-based Amino Acid Nutritional Support

prepare
recover
revitalize

PREPARE / RECOVER / REVITALIZE

amino acid

Targeted Amino Acid Supplementation to Support Recovery

Protein is the major functional and structural component of all cells in the body. Proteins also function as enzymes, membrane carriers, blood transport molecules, and hormones. Their component amino acids serve as precursors for nucleic acids, hormones, vitamins, and other molecules that are essential for life. Thus, an adequate supply of dietary protein and amino acids is essential for maintaining cellular integrity and function, as well as for health and reproduction.

Types of Amino Acids

Amino acids that are biologically active in humans can be divided into three categories:

- Essential amino acids are those that cannot be synthesized de novo in the body. As these amino acids are not produced or stored in the body, they must be obtained through diet or supplementation.
- Conditionally essential, or semi-essential, amino acids are those whose synthesis may be limited under certain pathophysiological conditions, such as infant prematurity or severe catabolic stress, which may occur with surgery or trauma.
- Non-essential amino acids are those that can be synthesized in the body.

Figure 1. Biologically active amino acids in humans

Essential Amino Acids	Conditional Essential Amino Acids	Non-Essential Amino Acids
Histidine	Arginine	Alanine
Isoleucine	Cysteine	Asparagine
Leucine	Glutamine	Aspartate
Lysine	Glycine	Glutamate
Methionine	Proline	Serine
Phenyalanine	Tyrosine	
Threonine		
Tryptophan		
Valine		

Protein and Amino Acid Homeostasis

From a nutritional and metabolic perspective, it is important to recognize that protein synthesis is an ongoing process that takes place in the majority of cells. In a steady state, protein synthesis is balanced by an equal amount of protein degradation. However, in the context of inadequate protein intake, increased protein demand or diets low or lacking in specific essential amino acids, there can be a shift in this balance such that rates of synthesis of some body proteins decrease while protein degradation continues in order to provide an endogenous source of those amino acids that are needed most.

Body Protein Reserve

The body of a 70-kilogram man contains about 11 kilograms of protein, nearly half (~43%) of which is present as skeletal muscle. The skin and blood each account for approximately 15 percent of protein, while the metabolically active visceral tissues and other organs, such as the brain, lungs, heart, and bone, contribute the remainder.[1] Despite the wide variety of enzymes and proteins within the human body, approximately 50 percent of our total protein content is present in just four proteins—myosin, actin, collagen, and hemoglobin. Collagen alone may gained or lost from the body as short-term storage for use in emergencies or to account for day-to-day variations in dietary intake.[2] During times of stress or trauma, breakdown of this labile protein reserve becomes a source of amino acids needed for synthesis of proteins critical to maintaining essential body function.[3]

Under normal conditions, the body is able to adapt to a wide range of variation in daily dietary protein intake over a period of days, after which no further change in body protein content occurs. However, in severe disease states, increased demand for either amino acids or carbon skeletons to meet local energy demands can result substantial rates of protein loss. If these conditions go unchecked for more than a few days, there can be a serious depletion of the body's protein mass, including loss of skeletal muscle protein.[4]

Free Amino Acids

Although the free amino acids dissolved in plasma and tissue represent only a very small proportion of the body's total mass of amino acids, they are critical for the nutritional and metabolic control of the body's proteins. Unlike total body protein, the concentrations of individual free amino acids in body fluids can change substantially in response to dietary variations or pathological conditions.[5] Of note, the body's capacity to conserve individual amino acids at low intakes varies widely, so the pattern of amino acids needed in the diet to match their individual catabolic rates does not correspond precisely with the composition of body protein.[6] Under conditions of protein deprivation, amino acids are recycled at an efficiency of more than 90 percent, though the rate of recycling varies.[7]

1– Lentner C. Geigy Scientific Tables, 8th ed., vol 1. Units of Measurement, Body Fluids, Composition of the Body, Nutrition, 1981. West Caldwell, NJ Ciga-Geigy Corporation.
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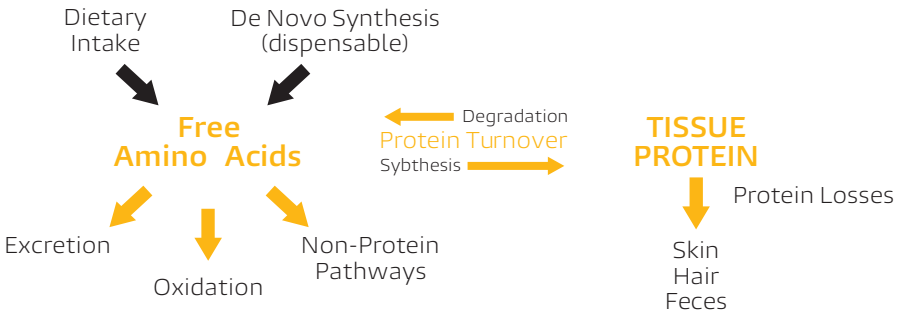
Recommended Protein and Amino Acid Intake

In adults, more than 250 grams of protein are synthesized and degraded per day, compared to an average daily intake of approximately 55-100 grams per day.[1] According to the Food and Nutrition Board (FNB) at the Institute of Medicine, the re commended dietary allowance of protein for both adult men and women is 800 milligrams of good quality protein per kilogram of body weight per day. While an upper range for total protein in the diet as a percentage of total energy intake has been set at no more than 35 percent, there are insufficient data to establish a tolerable upper intake level for total protein or for any of the amino acids. Consequently, caution is warranted in using any single amino acid at levels that are significantly higher than those found in food.[2]

Figure 2. Exchange between body protein and free amino acid pools[3]

Populations Who May Benefit from Amino Acid Supplements



In the U.S., protein-energy malnutrition is seen predominantly in hospitals and among the elderly, or in the setting of disease. However, amino acid imbalances may be more common. Aging, strenuous exercise, drug use, certain medications, infections, vitamin C deficiency and B complex vitamin deficiency can all cause an imbalance in amino acids in the body. Below are some examples of circumstances where amino acid supplementation may be beneficial:

- The stress of surgery or major trauma creates a hypermetabolic state with increased protein and energy demands, and targeted amino acid supplementation may be beneficial for accelerating recovery in pre- and post-operative patients and trauma patients.[4]
- In the context of bone fracture, amino acid building blocks are needed to synthesize a new structural bone protein matrix. Amino acids of specific importance for fracture healing include lysine, arginine, proline, glycine, cysteine, and glutamine. In addition, protein supplementation increases growth factors such as insulin-like growth factor-1 (IGF-1), a polypeptide that exerts a positive effect on skeletal integrity, muscle strength, immune response, and bone renewal.[5,6]

1– Waterlow JC. Protein turnover with special reference to man. Quart J Exp Physiol 1984;69:409-438.
2– National Academy of Sciences. Institute of Medicine. Food and Nutrition Board. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids (macronutrients), 2005. Available at http://www.nal.usda.gov/fnic/DRI//DRI_Energy/energy_full_report.pdf.
3- National Academy of Sciences. Institute of Medicine. Food and Nutrition Board. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids (macronutrients), 2005. Available at http://www.nal.usda.gov/fnic/DRI//DRI_Energy/energy_full_report.pdf.
4- Botella--Carretero JI, et al. Perioperative oral nutritional supplements in normal or mildly undernourished geriatric patients submitted to surgery for hip fracture: a randomized clinical trial. Clinical Nutrition 2010;29(5):574--579.
5- Bonjour JP, Schurch MA, Rizzoli R. Nutritional aspects of hip fractures. Bone 1996; 18:139S--144S.
6- Schurch MA, et al. Protein supplements increase serum insulin--like growth factor--1 levels and attenuate proximal femur bone loss in patients with recent hip fracture. Ann Intern Med 1998;128(10):801--809.

- Those with conditions that prevent them from eating solid foods may require amino acid supplementation to compensate for protein lost in their diet.
- Vegetarians—and especially vegans—may have difficulty obtaining all of the essential amino acids from their diet because the concentration of lysine, sulphur amino acids and threonine is often lower in plant food proteins than in animal food proteins. Although vegetables, grains, legumes, and nuts do contain protein, they must be consumed in wide variety in order to provide adequate amounts of all the amino acids.

  While adequate protein is an important part of nutrition, the right balance in the type of amino acids consumed is just as important as the amount of protein consumed. Consuming protein in excess will not solve amino acid deficiencies and may, in fact, cause other imbalances in the body. The nutritional value of a protein source is influenced by the relative content and metabolic availability of individual amino acids. If the content of a single essential amino acid in the diet is less than the individual's requirement for that amino acid, this will limit the utilization of other amino acids and, as a consequence, prevent normal rates of protein synthesis even if the total nitrogen intake level is adequate.

Figure 3. Recommended dietary allowance of essential amino acids for adults ≥ 19 years[1]

Essential Amino Acid	Recommended Dietary Allowance
Histidine	14 mg/kg/day
Isoleucine	19 mg/kg/day
Leucine	42 mg/kg/day
Lysine	38 mg/kg/day
Methionine (+ Cysteine)	19 mg/kg/day
Phenyalanine (+ Tyrosine)	33 mg/kg/day
Threonine	20 mg/kg/day
Tryptophan	5 mg/kg/day
Valine	4 mg/kg/day

Functions and Clinical Benefits of Select Amino Acids

Glutamine

Glutamine, the most abundant free amino acid in the human body, is needed for the synthesis of glucose and other amino acids. It also serves as an important energy source of cells of the immune system by providing fuel in the form of nitrogen and carbon. After surgery or traumatic injury, nitrogen is necessary for wound repair and organ function. About one-third of this nitrogen is derived from glutamine. In fact, after trauma the free pool of glutamine can become depleted by more than 50 percent, making a significant contribution to the total loss of nitrogen.[2] Prolonged exhaustive exercise can also lower the plasma level of glutamine.

Glutamine plays a role in fracture healing and the synthesis of new structural bone protein matrix. Studies have also shown that glutamine may enhance the bactericidal function of neutrophils in patients who have undergone surgery, reducing the risk of infectious complications, which remain the major cause of post-operative morbidity and mortality.[3,4]

1- Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients). Institute of Medicine of the National Academies. 2005. doi:10.17226/10490.
2– Labow BI, Souba WW. Glutamine. World J Surg 2000;24:1503-1513.
3– Furukawa S, et al. Glutamine-enhanced bacterial killing by neutrophils from postoperative patients. Nutrition 1997;13:863-869.
4– Geroulanos S. Infectious complications and risks in abdominal surgery: early recognition and prevention. Hepatogastroenterology 1991;38:261.

In addition, glutamine may be useful for athletes who undergo intense, prolonged training or participate in endurance events. These athletes are at increased risk of infection due to apparent immunosuppression. The provision of glutamine after exercise appears to have a beneficial effect on the level of subsequent infections.[1] Glutamine supplementation may also improve muscle glycogen synthesis and muscle protein levels, as well as increase growth hormone levels.[2]

Arginine

L-arginine is an amino acid that has been shown to stimulate wound healing.[3] In clinical studies, patients given arginine supplementation after major surgery experienced a faster recovery of immunological parameters and fewer infectious complications. [4]

L-arginine has been shown to have beneficial effects on bone health and has been associated with increased bone mineral density and improved bone strength when provided in physiological amounts.[5] L-arginine contributes to bone formation and remodelling, as well as increased calcium absorption and retention.

Arginine is also a precursor for nitric oxide, an important cellular signalling molecule and powerful vasodilator. At low levels, nitric oxide is important for protecting organs such as the liver from ischemic damage.[6]

Lysine

Lysine is known to enhance calcium absorption, increase the amount of calcium absorbed into the bone matrix and aid in tissue regeneration. Along with methionine, lysine is also a precursor for carnitine, an ammonium compound required for the transport of fatty acids from the intermembranous space in the mitochondria into the mitochondrial matrix during the breakdown of lipids for generation of metabolic energy.

Taurine

Although it is one of the few amino acids not incorporated into proteins, taurine is one of the most abundant amino acids in the brain, retina, muscle tissue, and organs throughout the body. Taurine serves a wide variety of functions in the central nervous system, and its deficiency is associated with developmental abnormalities, severe damage to retinal neurons, cardiomyopathy and renal dysfunction.[7]

Studies have demonstrated that taurine may protect cells against the oxidative damage caused by free radicals under many conditions, including exercised-induced oxidative stress. Moreover, taurine may enhance exercise capacity due to its cellular protective properties.

Supporting Recovery with an Amino Acid Mix

Forté Elements, the industry leader in mediceutical nutritional support systems, has developed the Forté Elements Amino Acid Mix to provide a balanced blend of glutamine, arginine, lysine,

1– Castell LM, Newsholme EA. The effects of oral glutamine supplementation on athletes after prolonged, exhaustive exercise. Nutrition 1997;13(7-8):738-742.
2– Gleeson M. Dosing and efficacy of glutamine supplementation in human exercise and sport training. J Nutr. 2008;138(10):2045S-2049S.
3– Desneves KJ, et al. Treatment with supplementary arginine, vitamin C and zinc in patients with pressure ulcers: a randomized controlled trial. Clinical Nutrition 2005;24:979-987.
4– Tepaske R. Immunonutrition. Curr Opin Anaesthesio 1997;10:86-91..
5– McCarty M. Supplemental arginine and high-dose folate may promote bone health by supporting the activity of endothelial-type nitric oxide synthase in bone. Med Hypotheses 2005;64(5):1030-1033.
6-National Academy of Sciences. Institute of Medicine. Food and Nutrition Board. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids (macronutrients), 2005. Available at http://www.nal.usda.gov/fnic/DRI//DRI_Energy/energy_full_report.pdf

and taurine to provide the building blocks for recovery from surgery, trauma, intense exercise, and other conditions associated with increased protein demand or amino acid depletion.[1]

Forté Elements Amino Acid Mix

Unlike nutraceuticals or other supplements that lack regulatory oversight or a rigorous testing, mediceuticals are an emerging category of nutritional supplements that are produced using pharmaceutical-grade ingredients and manufacturing practices and undergo a scientific, transparent testing process. In order to qualify as a mediceutical, a supplement must:

1. Be formulated to support a specific health condition or situation
2. Contain only non-synthetic, pharmaceutical-grade ingredients that are Generally Recognized as Safe (GRAS)
3. Contain elements that have been validated by clinical research for the specific health condition or situation, as published in peer-reviewed journals
4. Conform to pharmaceutical-grade dosage standards for the specific health condition or situation
5. Be produced in FDA-compliant manufacturing facilities using pharmaceutical-grade manufacturing practices
6. Product has a Certificate of Analysis available confirming that product ingredients meet the Mediceutical standard and are as listed on the product label.

Forté Elements' amino acid mix contains a specific blend of amino acids that have been carefully selected to reduce surgical or traumatic stress, support the immune system, and promote wound healing and tissue repair.

Supplement Facts

Serving Size 1 Pack (9.9 Grams)
Servings Per Container 30

Amount Per Serving	% Daily Value*
L-Glutamine 2000mg	**
L-Arginine 3000mg	**
L-Lysine 1000mg	**
Taurine 1500mg	**

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.
**Daily Value not established.

OTHER INGREDIENTS: CITRIC ACID, LEMON-LIME FLAVOR AND STEVIA (NON-NUTRITIVE SWEETENER).

THIS STATEMENT HAS NOT BEEN EVALUATED BY THE FDA. THIS PRODUCT IS NOT INTENDED TO DIAGNOSE, TREAT, CURE, OR PREVENT ANY DISEASE

1– Zhang M, et al. Role of taurine supplementation to prevent exercise-induced oxidative stress in healthy young men. Amino Acids 2004;26:203-207.

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A fusion of science and practical medical experience unlike anything that has come before.

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