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Arginine amino acid essential for children and pregnant women and the effect of deficiency on the human body

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Abstract

Arginine is a C₆H₁₄N₄O₂ alpha amino acid with a chemical formula, an essential amino acid for children and an unnecessary amino acid for adults. This amino acid contains an α -amino group, a group of α -carboxylic acid, which produces nitric oxide gas. Arginine is synthesized from citrulline in the metabolism of arginine and proline, and has been converted to arginine by the enzymes cytosolic arginine succinate synthetase and arginine sucrose liaez. One of the properties of arginine in the body is the expansion and improvement of the immune system, which is the size of the amino acid. Increases the activity of the thymus gland, which produces T lymphocytes. Arginine metabolism by iNOS or Arginase 1 produces a variety of products, of which Orentin is one of the predictors of various products, including polyamines and proline, and thus can play an important role in cell proliferation and wound healing, and cytokine The anti-inflammatory humoral IL-4, IL-10, IL-13 and TGF- β result in the expression of arginine 1.

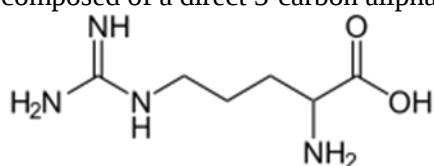
Keywords: Arginine, T lymphocyte, Arginase 1, Nitric oxide gas, Cytokine

Research Methodology

This review article provides an explanation of the amino acid source of arginine and the reasons for its need for children and the mechanism of its impact on the immune system. It is useful for the reader and the listener to be complete.

Introduction

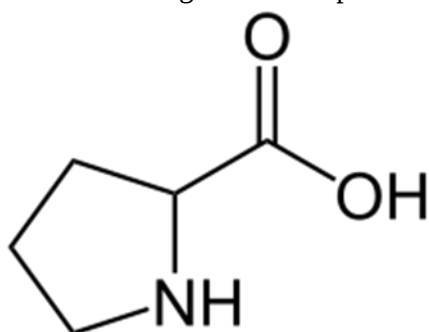
Arginine is an alpha amino acid with the chemical formula $C_6H_{14}N_4O_2$ and is a semi-essential amino acid, which is one of the elements of the production of nitric oxide gas. This substance causes vasodilatation, which causes the blood vessels to be absorbed into the organs that are involved in the activity of the sport. And thus can increase the athlete's performance especially in aerobic activity. {1} This amino acid contains an α -amino group, a group of α -carboxylic acid and a side chain that is composed of a direct 3-carbon aliphatic chain in the guanidine group.



In humans, arginine, depending on the growth stage and the health status of a person, is an essential amino acid component so that premature infants can not form and synthesize arginine in the body, so amino acids are essential for them. That most healthy people do not need an arginine supplement because it is part of all protein-rich foods that can be produced from citrulline in glutamine. {2} It should be noted that the main source of arginine biosynthesis in the intestine Small and kidney. Accordingly, the synthesis of arginine occurs mainly through the intestinal and kidney axis in this way Epithelial cells of the small intestine produce citrulline, mainly from glutamine and glutamate, which circulates through the bloodstream into proximal tubular kidney cells, which diverts citrulline from the circulation and transmits it to arginine, which has returned to circulation. . This means that small bowel dysfunction or kidney function can reduce the synthesis of arginine, and increase the need for a diet. Therefore, it can be said that people with a kidney or small intestine problem will have difficulty in producing arginine and urea. {10}

Arginine is synthesized from citrulline in the metabolism of arginine and proline, and has been converted to arginine by the enzymes cytosolic arginine succinate synthetase and arginine sucrose lialase, which can be derived from several sources: citrulline,

- Arginine itself through nitric oxide synthase, as a nitric oxide production product for signal targets
- Ornithine through the decomposition of proline or glutamine / glutamate



Remind: Arginine, Glutamine, and Proline are two-way connections. Therefore, pure consumption or production of these amino acids is highly dependent on cell type and growth stage.

Asymmetric Dimethyl Arginine via DDAH

Arginine Properties in the Body: {3}

Intervention in the synthesis and manufacture of nitric oxide NO (responsible for vascular dilatation and vasodilation)



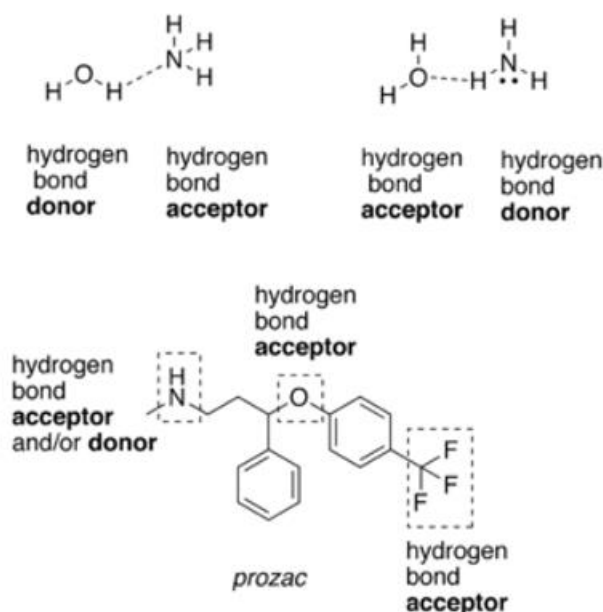
- Extending and improving the immune system
- Reduce wound healing and injuries
- Accelerating the time to repair and improve damaged tissues
- Reduce the risk of heart disease
- Increase muscle mass and volume
- Reducing body fat adipose tissue and helping to lose weight
- Help increase insulin sensitivity and function
- Helping to lower blood pressure
- Increased fertilization of men and women, increased sperm production
- Increase the ability of the reproductive device
- Increasing the effects and performance of bodybuilding
- Removal of ammonia from the body

All people need arginine. People who need more arginine include growing children, babies, athletes and Obese or overweight people, as well as the elderly. In the adult population of arginine, an amino acid is unnecessary, while for children, arginine is essential for the immune system and the body's defense. People who suffer from physical damage can take advantage of the benefits of arginine supplements. Because the body's need for Arginine at the time of damage and repair is very high. Individuals suffering from sexual problems can help arrhythms in vasodilatation. {5}

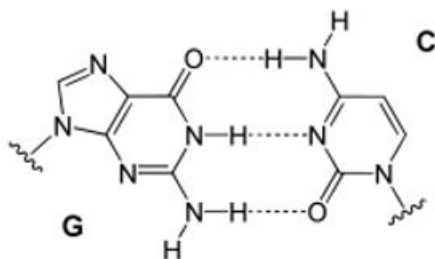
Arginine delays the growth of tumors and progresses in cancer by enhancing the body's defensive function. This amino acid increases the size and activity of the thymus gland, which produces T lymphocytes. It is useful for people with AIDS and malignant diseases that interfere with the work of the body's defenses. This acid is useful for the treatment of liver disorders such as liver cirrhosis and fatty liver accumulation in the liver (fatty liver). By eliminating ammonia, arginine helps detoxify the liver. The semen has arginine. Studies show that sexual maturation may be delayed due to lack of arginine. Arginine is useful for the treatment of male sterility. This acid is found in high concentrations in the skin and connective tissues and is useful for the treatment and repair of damaged tissue. Its existence is essential for the metabolism of the muscles. It acts as a carrier in the transport and storage of nitrogen, and thus serves to maintain the correct nitrogen balance, and also plays an important role in the extraction of nitrogen. This amino acid is effective in weight loss, because it helps to increase muscle volume and reduce body fat. This amino acid also affects a number of enzymes and hormones. Arginine stimulates lupus erythematosus to release insulin, which is part of the vasopressin drug, and helps release hormones of growth. Because arginine is a component of collagen, it helps in the construction of new bones and ligament cells, which is why it is useful for the treatment of arthritis and connective tissue disorders. The bone tissue formed during wound healing is made up of collagen, which is rich in arginine. When the amount of arginine is not sufficient in the body, there will be damage to a number of body functions, including insulin production, glucose tolerance, and liver lipid metabolism. This amino acid can be produced in the body, however, the rate of production of this substance in the neonates is not enough to meet their needs. {4} {6} {7}

Chemical characteristic:

The arginine side chain is amphipathic because it contains a positive polynucleotide guanidinium group in the physiological pH and a hydrophobic aliphatic hydrocarbon chain at its extremity. Since spherical proteins have hydrophilic levels, arginine is usually found outside of the protein, where hydrophilic surf groups can interact with the environment, for example, participation in hydrogen bonds and salt bridges.



Examples of hydrogen bond donating. 1



Hydrogen bonding between G and C in DNA.1

For this reason, it is often found in the interface between two proteins {8}. Arginine residues in proteins can be used by the PAD enzymes to produce citrulline in a reformation process after translocation called citrullination {9}. This is important in the development of embryos, a part of the natural safety of proteins, as well as control Gene expression, but also significant in autoimmune diseases {10}.

Food containing arginine

Corn, Chocolate, Coconut, Dairy, Gelatin, Red meat, Oatmeal, Peanut, Soybean, Walnut, White Flour, Wheat and Wheat Germ. {11}

The metabolism of arginine in the immune system

Children have a higher degree of susceptibility to diseases due to having a weaker immune system than adults and lack of arginine, which is mentioned below:



TABLE 1

Regulation of iNOS and arginase I expression

Enzyme	Cytokine stimulation	Other stimulation
iNOS	IL-1, TNF- α , IFN- α , IFN- β , IFN- γ	Endotoxine, lipopolysaharide
Arginase I	IL-4, IL-6, IL-10, IL-13, TGF- β	PGE1, PGE2, catecholamine

Observing that iNOS and arginase 1 are confined to stimuli (at least to a certain extent), the researcher (at least theoretically) is required to determine the inflammatory state created by the disease process that is being studied. If the expression of iNOS and high NO production is observed, the inflammatory stimulus (cell) may be predominant. In contrast, if the expression of a significant organigenic 1 is detected by increasing or increasing the expression expressed in iNOS, it appears that this condition causes a humoral response. It actually appears to be severe in trauma and in sepsis, both with severe critical illness and impaired functioning of the body. In 1991, it has been shown that NO metabolites exist in human plasma during sepsis. This coincided with an increase in circulating endotoxin levels and a decrease in systemic vascular resistance (as measured by excessive vasodilatation). In contrast, trauma is accompanied by a high induction of expression of arginine 1 and its simultaneous reduction in circulating NO metabolites (nitrite / nitrate), although the negative induction of the iNOS messenger RNA can be observed in certain conditions.

Since the expression of arginase 1 and iNOS is symmetrically affected by Th1 and Th2 cytokines, activation of each one may be limited to separate isolation of the cell derived from the myeloid, in the name of alternative activation. Recently, both enzymes have been shown to be produced in CD11b + IL-4 α + MSC receptors, and MSC produces both Th1 and Th2 cytokines IL-13.

T lymphocyte and arginine responses:

For years, researchers have shown that the availability of arginine for the proliferation and function of T-cells is essential. As in myeloid cells, the use of arginine in resting conditions is minimal, but its absorption has increased dramatically. As a result, increased CAT activity in the activation of T cells is interesting. Maximum T cell proliferation with arginine levels in the culture medium $\approx 100\mu\text{mol} / \text{L}$ without further increase in proliferation with higher concentrations. Therefore, apparently, there is no rationale behind the hypothesis that supplementation of arginine increases the hyperphysiological concentration of the immune system.

Following the deprivation of arginine, there is a progressive reduction (up to 25% of basal levels) in a number of T cell receptors in the cell membrane. This is mainly due to the useful regulation of the expression of the ζ chain peptide, which is an essential component of the T receptor collection. Interestingly, the loss of the ζ chain in some cancers and after surgery / trauma, both the process of disease associated with decreased T cell function and increased expression of arginine.

Another effect of arginine deprivation is that it refract from transcription of artemisinectosin cytostate expression. Therefore, regulating the amounts of argininosucinathine synthase allows T-lymphocytes to produce endogenous arginine from citrulline, even in the absence of arginine, or in the presence of increased expression of arginine 1 by myeloid cells. These observations allow the use of citrulline as a solution to overcome the deficiency of arginine.

Arginine deficiency syndrome:

The shortage of arginase 1 in MSC results in a shortage of arginine, which leads to a weakening of the function of T cells and NO production, and ultimately leads to increased susceptibility to infection. Advances in cancer research strongly suggest that the pathological upgrade of arginine 1 in MSC in tumor invasion undermines the function of T cells by reducing the amount of arginine. Similar



observations show that the lack of arginine can also be a cause of T-cell dysfunction after surgery and trauma, increasing the sensitivity of the infection.

A syndrome is defined as a set of signs or symptoms that indicate a specific disease. The lack of arginine pathology actually addresses all the necessary requirements for the term "arginine deficiency syndrome" (ADS). The set of signs or symptoms (biomarkers) in ADS include: pathologic enhancement in arginase 1, reduced availability of arginine, NO production reduction, abnormal cell T cell function characterized by loss of ζ chain and adverse biological outcome (Table 2)

TABLE 2

Disease condition and arginine deficiency

Disease condition	Arginine level	Arginase activity	Abnormal biomarkers
Cancer (41)	↓	↑ in MSC	↓ ζ -Chain ↓ T-cell proliferation
Trauma (42)	↓	↑ in MSC	↓ ζ -Chain ↓ T-cell proliferation
Chronic infection tuberculosis (83)	↓	↑ in MSC	↓ ζ -Chain ↓ T-cell proliferation
Liver necrosis (43)	↓↓	↑ in serum	↑ Pulmonary hypertension
Hemolytic disease (44)	↓	↑ in serum	↑ Pulmonary hypertension

It seems that the increasing number of diseases in humans is associated with a lack of arginine and ADS, and candidates are critical to treatment. It includes certain tumors, such as renal cells and prostate cancer, tuberculosis, and post-operative or traumatic conditions.

Perhaps one of the simplest ways to prevent and treat the lack of arterial regimen.

Interleukin 13 is a protein encoded in humans by the IL13 gene. Interleukin 13 was cloned for the first time in 1993, and its gene is located on the long arm of chromosome 5 and is 1-4 kb long. Interleukin 13 is the major regulator of IgE production, goblet cell hyperplasia, mucosal patches, excessive irritability of respiratory tract infections, fibrosis, and elevated chitinase.

Interleukin 10, or an inhibitor of human cytokine production, is one of the most important interleukins in the body that secretes from white blood cells and is involved in inhibiting inflammatory and immune responses. Interleukin 10 is secreted from monocyte cells, as well as from lymphocyte-T donator, macrophage, lymphocyte t-regulator and mast cell, and is effective on helper lymphocytes, lymphocytes, mast cells and herbicides. IL-10 is a cytokine with several functions in the regulation of immunity and inflammation. This interleukin reduces the expression of helper lymphocyte cytokines and the antigens of the class II main tissue compatibility set. Interleukin 10 also increases the proliferation and survival of b-lymphocytes and produces antibodies. IL-10 can block NF-kB activity. Inter ligin ten is located on chromosome 1q31.2 with three polymorphisms of 819c / t, 1082G / A, 592C / A. is

Interleukin 4 is one of the most important interleukins in the body that secretes from the white blood cells and contributes to inflammatory and immune responses. Interleukin is secreted from lymphocyte T cells, herpes simplex, mast cells, and natural lethal cells, and acts on lymphocyte cells. The main function of this cytokine is to differentiate and produce antibodies and antibodies faster.

Food containing arginine

Chocolate, Coconut, Dairy, Gelatin, Meat, Oatmeal, Peanut, Soybean, Walnut, White Flour, Wheat and Wheat Germ. {11}



Discussion and conclusion:

Arginine is a $C_6H_{14}N_4O_2$ alpha amino acid with a chemical formula, an essential amino acid for children and an unnecessary amino acid for adults. This amino acid contains an α -amino group, a group of α -carboxylic acid, which produces nitric oxide gas, which makes the vessel expand. As noted above, this amino acid is for non adult adults. It is essential for babies, babies and pregnant women, because they are living in an inefficient and poorly immune system of children, due to the fact that one of the properties of arginine in the body is expanding and improving. The immune system is an amino acid of the size and activity of the thymus gland, which produces T lymphocytes. Increases. Arginine metabolism by arginase produces a variety of products, one of which is NO, which under physiological conditions plays an important role in killing parasites, bacteria, viruses, and cancer cells and producing vaginitis. The endotoxin causes the existing children's arginine to become Arginar 1, and Arginase 1 causes the production of hydroxyl L-arginine to convert it into nitric oxide gas. Although gas is expressed by arginase 1, it expresses IL-1, TNF- α , IFN- γ and IL-2, and if indicated by iNOS, express the humoral anti-inflammatory cytokines IL-4, IL-10, IL-13 and TGF- β . In other words, it can be said that by measuring the amount of iNOS and arginase 1 for Determine the inflammatory state of the disease caused by the disease process and it can be said whether the person has inflammation or not. Investigators have shown that arginine deprivation is reduced in a number of T cell receptors in the cell membrane. This is largely due to the useful regulation of the expression of the peptide chain ζ , an essential component of the T cell receptor. Therefore, with regard to the above, arginine is indispensable for strengthening the immune system, including the immune system of children, and parents must pay attention Put on foods that are rich in arginine, including chocolate, coconut, dairy, gelatin, red meat, oats, peanuts, soy beans, walnuts, white flour, wheat and wheat germ in your child's nutrition basket.



References

- 1) Nomenclature and Symbolism for Amino Acids and Peptides". IUPAC-IUB Joint Commission on Biochemical Nomenclature. 1983. Archived from the original on 9 October 2008. Retrieved from 5 March 2018.
- 2) IUPAC-IUBMB Joint Commission on Biochemical Nomenclature. "Nomenclature and Symbolism for Amino Acids and Peptides". Recommendations on Organic & Biochemical Nomenclature, Symbols & Terminology, etc. Archived from the original on May 29, 2007. Retrieved 17/05/2007.
- 3) Glasel, Jay A. ; Deutscher, Murray P. (20.11.1995). Introduction to Biophysical Methods for Protein and Nucleic Acid Research. Academic Press. p. 456. ISBN 9780080534985.
- 4) Therapeutic Benefits of L-Arginine: An Umbrella Review of Meta-analyses. Marc P. McRae, MSc, DC, FACN, DACBN. 2016 Sep. doi: 10.1016/j.jcm.2016.06.002
- 5) Skipper, Annalynn (1998). Dietitian's Handbook of Enteral and Parenteral Nutrition. Jones & Bartlett Learning. p. 76. ISBN 9780834209206.
- 6) Supplemental Citrulline Is More Efficient Than Arginine in Increasing Systemic Arginine Availability in Mice. Umang Agarwal, 2017 Apr. doi: 10.3945/jn.116.240382
- 7) Brosnan JT, Brosnan ME. Creatine: endogenous metabolite, dietary, and therapeutic supplement. Annu Rev Nutr 2007;27:241–61
- 8) Marini JC, Keller B, Didelija IC, Castillo L, Lee B. Enteral arginase II provides ornithine for citrulline synthesis. Am J Physiol Endocrinol Metab 2011;300:E188–94.
- 9) The book "Principles of Body and Body Beauty and Fitness" consists of three volumes and 1964 pages with the following registration characteristics: ISBN Volume: 3-484-477-964-978 ISBN First Volume: 0-485-477-964-978 ISBN Volume II: 7 -486-477-964-978 ISBN Volume 3: 4-487-477-964-978 Congressional Classification: 2008 6 A 76 M 5/546 GV Classification Dewey: 713/613 National Bibliographic Number: 1250637 Pages 804-805
- 10) Schulze, E. ; Winterstein, E. (1899). "Ueber die Constitution des Arginins" [On the constitution of arginine]. Berichte der Deutschen Chemischen Gesellschaft (in German). 32: 3191-3194.
- 11) Watson, Ronald Ross; Zibadi Sherma (2012-11-28). Bioactive Dietary Factors and Plant Extracts in Dermatology. Springer Science & Business Media. p. 75. ISBN 9781627031677.
- 12) Mauro, Claudio; Frezza, Christian (2015-07-13). The Metabolic Challenges of Immune Cells in Health and Disease. Frontiers Media SA. p. 17. ISBN 9782889196227.
- 13) techmiller UK, Childress B, Cowan L (Feb 2005). "Arginine supplementation and wound healing". (review). Nutrition in Clinical Practice. 20 (1): 52-61. do: 10.1177 / 011542650502000152. PMID 16207646.
- 14) Arginine and Immunity . Petar J. Popovic Herbert J. Zeh, III Juan B. Ochoa. The Journal of Nutrition, Volume 137, Issue 6, 1 June 2007, Pages 1681S–1686S