

The role of Amino Acids in improving immunity and growth factors of Volleyball players

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ABSTRACT

Amino Acids are the monomeric constituents of proteins and serve a variety of functions; some are converted to carbohydrates by Rosine forms hormones such as thyroid hormones; Tryptophan can synthesize niacin vitamin, Methionine, creatine glutamate, synthesize glutathione for immunity, and cystine as a source of sulfur. Amino Acids are used in several biological actions. As an example, athletes use them as a safe Supplement. The study aimed to investigate the role of Amino Acids in immunity and as a stimulant for growth factors of volleyball players. Materials and Methods: Twenty volleyball players were Randomly divided into two groups, players in the experimental group ingested 2 tablets of AA, one between meals and another after training for two months, and those in the control group ingested a placebo. Blood samples (10 ml) were drawn from the antecubital vein before and after the two-months experiment; Blood samples were taken from every player and analyzed for several parameters as follows: white blood cells, immunoglobulins IgG, IgA, IgM, and glutathione (GSH), together with growth factors (Vascular endothelial growth factor and Basic - Fibroblast growth factor). Results revealed a significantly increased number of WBC, immunoglobulins IgG, IgA, IgM, glutathione (GSH), concentration, and significantly increased growth factors (VEGF, 10-FGF) after Amino Acids ingestion for two months compared to the control group. In conclusion, Amino Acids administrations improved immunity and muscle growth and angiogenesis of volleyball players.

Keywords: Amino Acids, Immunity, Growth factors, Angiogenesis, Volleyball players.

Introduction

Amino Acids are the principles for the formation of proteins. There are 20 Amino Acids, ten of which are essential, and the others are non-essential. The non-essential ones can be synthesized in the body. The precise distribution of Amino Acids in the blood depends on the eaten proteins. But the

concentrations of some Amino Acids are regulated by the selective synthesis in the different cells. The Amino Acids form cellular proteins, so they are stored in the form of proteins, but can be turned into Amino Acids once again by digestive enzymes. Some tissues in the body store Amino Acids more than others; for example, the liver and kidney can both store a large number of exchangeable proteins ^[1-3].

Protein term was derived from the Greek word proteins meaning primary, holding in the first place, or preeminent because it is thought to be the most important one of the biological substances as they are the main structural components of the cytoskeleton, and are biochemical catalysts known as enzymes that serve as defenses against bacterial and viral infections. Besides, protein furnish mechanical support and contractile proteins, carry specific substances across the membrane in the

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body fluids and they may act as storage substances or respiratory pigments and other functions^[4, 5].

The human body can resist most organisms or toxins that tend to damage the tissues or organs. This ability is called immunity; this may be the acquired immunity that does not develop until after the body is first attacked by an organism, virus or toxin, and requires weeks or months to develop. Another type of immunity results from general processes, rather than those directed at specific disease organism. This is called innate immunity which includes phagocytosis of bacteria by white blood cells, destruction of swallowed organisms by acid secretions or enzymes of digestive organ, the resistance of the skin to invasions or presence of lysozyme, basic polypeptides or the complement complex or natural killer lymphocytes that destroy foreign cells^[6-8].

Amino Acids supplementation has been clinically proven to build muscle, improve athletic performance, help in reducing body fat, and boost immune system function. This occurs through the different aminos found; as an example, Amino Acid arginine increases growth hormone levels, branched-chain Amino Acids increase energy level, arginine aids in the production of creatine, an important source of energy, and glutamine boosts maintain muscle mass, prevent muscle catabolism and immune system function^[9]. Growth factors including growth hormone, vascular endothelial growth factor, b- fibroblast growth factors play important roles in muscle growth, angiogenesis, and energy production^[10]. Growth happens through several metabolic effects, promoting protein deposition, enhancement of amino acid transport, cell membranes, enhancement of RNA translation to cause protein synthesis by the ribosomes, and increased transcription of DNA to form RNA^[11].

Additionally, Murray *et al.*^[4] reported that many growth factors regulate the production of white blood cells, together with other cells in the blood including red blood Corpuscles, for example, and erythropoietin-increased red cells. This area of study adds to knowledge about the differentiation of blood cells, provides factors that may be useful in treatment, and also has implications for understanding the abnormal growth of blood cells. They added that granulocyte-macrophage Colony stimulating factors (G-CSF) are specific growth factors for stimulation granulocyte. Hoffman *et al.*^[12] added that Vascular endothelial growth factor (VEGF) may promote the increase of blood cells to different tissues by stimulating angiogenesis.

The purpose of this study was to examine the role of Amino Acids in improving immunity growth factors of volleyball players. It is hypothesized that Amino Acids would improve the immunity and growth factors of volleyball players.

Materials and Methods

Research Method: The experimental method was used in the study of pre-post designs due to its suitability to the study of two groups. The experimental group ingested 2 tablets of Amino Acids, one between meals and the other after training for two

months, while the control group ingested placebo for the same period.

The research sample included twenty volleyball players from different clubs in Cairo that were divided into two equal groups

Table 1: Basic Characteristics of the Sample

| Variables | Mean | Median | SD | Skewness |
|-------------|-------|--------|------|----------|
| Age (years) | 22.3 | 23 | 2.3 | -.813 |
| Weight (kg) | 80.4 | 81 | 3.9 | -.438 |
| Height | 181.2 | 182 | 4.06 | -.614 |
| BMI | 22.6 | 23 | 1.8 | -.723 |

Table (1) revealed that skewness was between (± 3), which indicated the homogeneity of the sample variables.

Amino Acid Contents (Each Tablet)

Essential AA

- Leucine: 184 mg
- Lysine: 158 mg
- Threonine: 142 mg
- ISO Leucine: 105 mg
- Valine: 100 mg
- Phenil Alanine: 58 mg
- Methyonine: 37 mg
- Tryptophan: 37 mg

Conditionally Essential AA

- Proline: 105 mg
- Cystine: 53 mg
- TyRosine: 47 mg
- Arginine: 42 mg
- Histidine: 32 mg
- Glutamic Acid: 532 mg
- Non-essential AA
- Aspartic Acid: 300 mg
- Alanine: 84 mg
- Glycine: 37 mg
- Serine: 100 mg

The blood samples were drawn from the antecubital vein before and after the experiment carting two months. The following parameters were determined:

- White blood cell using coulter counter
- Immunoglobulin IgA, IgG, IgM using radiation plates
- Glutathione (GSH) using spectrophotometer
- Growth factors (vascular endothelial GF, b- fibroblast GF) using Elisa techniques

Statistical Analysis

A non-parametric test evaluated the differences between the two groups, and they were compared using the Mann Whitney LL

Test for comparison of the pre-post treatment using Wilcoxon Rank sum; the paired test statistical significance difference was at $P < 0.05$.

Results

Table (2) revealed that the immune variables (Wbcs, IgA, IgG, IgM, Glutathione (GSH)) of the control group, showed non-significant changes after placebo ingestion.

Table (3) indicated that the immune variables of the experimental group showed significant differences after Amino Acids' ingestion.

Table (4) showed that the growth factors of the vascular endothelial growth factor, b-fibroblast growth factor of the control group, showed non-significant changes after placebo ingestion.

Table (5) revealed that the growth factors of the experimental group showed a significant difference after Amino Acids ingestion. Table (6) indicated that immune and growth factors of control and experimental groups showed a significant difference after Amino Acids and placebo ingestion in favor of the experimental group.

Discussion

The immune system is a system that protects the body from different invaders. It can remember, and in a second exposure to a foreign substance produces a more rapid and greater response. There are two types of immune defense systems, namely, humoral and cellular that both react to foreign bodies named antigens such as bacteria or foreign tissue. The humoral immune body is immunity due to circulating antibodies in the gamma globulin of the plasma protein and protects the body against bacteria.

Cellular immunity is responsible for delayed allergic reactions and rejection of foreign tissue. It protects the body against the virus, fungi, and a few bacteria, and helps to defend against tumors [4, 13, 14].

Table (2) indicated that there are non-significant differences in immune variables of white blood cells, IgA, IgG, IgM immunoglobulin, and glutathione (GSH) of the control group before and after placebo ingestion, which denotes that the participants health and fitness are stable throughout the experiment which lasted two months. There are normal levels of the test variables in immunoglobulins and immune cells together with the antioxidant glutathione (GSH) that was also reported by researchers [15-17].

Table (3) indicated that the immune variables of the experimental group before and after Amino Acids ingestion, showed a significant increased WBC, IgG, IgA, IgM, together with glutathione (GSH).

Amino Acids, as the principle stones for the formation of protein, induce a growth function and an immune action, as

immunoglobulins are proteins in nature and affect the immunity of the participants^[18].

Reduced glutathione (GSH) significantly increased after Amino Acids administration which indicated that Amino Acids ingestion affected immunity positively. Butterfield [19] and Meister [20], reported that GSH is a non-protein thiol-containing compound presents in most mammalian cells. Its metabolic functions include detoxication reactions against free radicals and toxic compounds and it also plays an important immunoregulatory role.

Growth factors are polypeptides and proteins that had become increasingly important in different aspects of physiology. They are divided into three groups:

1. A group of agents that foster the multiplication and development of various types of cells on nerve growth factor, VEGF, and basic – fibroblast growth factor (b-FGF).
2. Lymphokines and cytokines produced by macrophages and lymphocytes, which are important in the regulation of the immune system.
3. Colony-stimulating factors that are used in the proliferation and maturation of red and white blood cells as erythropoietin [21]. Ferrara [22] reported that vascular endothelial growth factor (VEGF) is an important factor affecting angiogenesis; and Li [23] stated that the b-fibroblast growth factor is involved in the proliferation, differentiation of a variety of normal tissues, and malignant transformation.

Table (4) revealed that growth factors, vascular endothelial growth factor (VEGF), and basic fibroblast growth factor (b-FGF) did not change significantly in the control group after placebo ingestion for 2 months, and they were within normal values. This indicated that no changes occurred in the case of the control group as placebo ingestion did not contain any supplement as in the case of the experimental group [21]. Hindmarsh and Dattani [24] stated that there are stimuli that affect growth and hormonal secretion in humans, namely: Exercise, Fasting, Amino Acids, protein meals, stressful stimuli, psychological stresses, dopamine receptor agonists and sex hormones, estrogen, androgens, and glucagon.

In the case of Amino Acids administration in the experimental group, Table (5) showed that Amino Acids ingestion increased significantly in both vascular endothelial growth factor and b-fibroblast growth factor, indicating that Amino Acids used in this study may be used as stimuli of increasing growth factors as they affect growth and growth hormone stimulation. As Amino Acids are the building stones of protein, their effect on growth hormone is well documented, and the growth hormone alone or with other growth factors directly or indirectly stimulate the process of growth in muscle tissue, cartilage, and bones^[25-30].

Many factors are involved in angiogenesis. A key compound is the protein growth factor named vascular endothelial growth factor (VEGF). It appears to be primarily responsible for vasculogenesis and may also play a prominent role in the

formation of lymphatic vessels lymphangiogenesis together with the formation of blood vessels [21, 27, 28, 31-33].

Soad *et al.* [34] and Banks *et al.* [35] stated that VEGF and b-fibroblast growth factors have received attention because of the requirement for angiogenesis in the development of tumors. Zimering and Thakker-aria (2002) [36, 37] reported that b-FGF is a potent tumor angiogenic factor that is also involved in the proliferation and differentiation of normal tissues. From the proceeded discussion, the hypothesis of the study has been realized.

Conclusion:

It is concluded that Amino Acids administrations could improve immunity, muscle growth, and angiogenesis through immune cells and immunoglobulins and glutathione (GSH) of volleyball players.

Recommendations:

It is recommended to use Amino Acids as a safe supplement for improving immunity and muscle growth and angiogenesis in competitive sports and strength sports.

Table (2) Immune Variables of the Control Group before and after Placebo Ingestion

| Variables | B | | A | | Sig |
|-----------------------------|-------|------|-------|------|-----|
| | m | SD | m | SD | |
| White Blood Cells (cell/ml) | 7024 | 112 | 7264 | 121 | NS |
| IgA | 198,4 | 11,4 | 196,3 | 10,2 | NS |
| IgG | 970,2 | 23,4 | 976,4 | 25,3 | NS |
| IgM mg/de | 116,7 | 6,5 | 119,3 | 5,4 | NS |
| glutathione (GSH) mg/de | 22,8 | 1,13 | 23,1 | 1,15 | NS |

P<0.05

Table (3) Immune Variables of the Experimental Group before and after Amino Acids Ingestion

| Variables | B | | A | | Sig |
|-----------------------------|-------|------|-------|------|-----|
| | m | SD | m | SD | |
| White Blood Cells (cell/ml) | 7114 | 104 | 9316 | 112 | S |
| IgA | 196,9 | 10,9 | 318,4 | 21,5 | S |
| IgG | 964,7 | 21,4 | 1456 | 32,3 | S |
| IgM mg/de | 194,8 | 5,8 | 3358 | 11,4 | S |
| Glutathione (GSH) mg/de | 23,9 | 1,16 | 48,4 | 3,2 | S |

P<0.05

Table (4) Growth Factors of the Control Group before and After Placebo Ingestion Control

| Variables | B | | A | | Sig |
|---------------------------------|-------|------|-------|------|-----|
| | m | SD | m | SD | |
| Vascular Endothelial gf (pg/ml) | 113,6 | 11,4 | 116,3 | 10,3 | NS |

| | | | | | |
|-------------------------|------|-----|------|-----|----|
| b-fibroblast gf (pg/ml) | 12,7 | 2,4 | 13,6 | 2,3 | NS |
|-------------------------|------|-----|------|-----|----|

P<0.05

Table (5) Growth Factors of the Experimental Group before and after Amino Acids Ingestion Experimental

| Variables | B | | A | | Sig |
|---------------------------------|-------|-----|-------|------|-----|
| | m | SD | m | SD | |
| Vascular Endothelial gf (pg/ml) | 110,7 | 9,6 | 218,4 | 13,8 | S |
| b-fibroblast gf (pg/ml) | 11,4 | 1,9 | 25,6 | 3,5 | S |

P<0.05

Table (6) Immune Variables, Growth Factors after Ingestion in Control and Experiment Group

| Variables | Control A | | Experimental A | | Sig |
|---------------------------------|-----------|------|----------------|------|-----|
| | m | SD | m | SD | |
| White Blood Cells (cell/ml) | 7264 | 121 | 9316 | 112 | S |
| IgA | 196,3 | 10,2 | 318,4 | 21,5 | S |
| IgG | 976,4 | 25,3 | 1456 | 32,3 | S |
| IgM mg/de | 119,3 | 5,4 | 335,8 | 11,4 | S |
| Glutathione (gsh) mg/de | 23,1 | 1,15 | 48,4 | 3,2 | S |
| Vascular Endothelial gf (pg/ml) | 116,3 | 10,3 | 218,4 | 13,8 | S |
| b-fibroblast gf (pg/ml) | 13,6 | 2,3 | 25,6 | 3,5 | S |

P<0.05.

References

1. Pencharz PB, Ball RO. Amino acid needs for early growth and development. *The Journal of nutrition.* 2004;134(6):1566S-8S.
2. Fukagawa NK, Galbraith RA. Advancing Age and Other Factors Influencing the Balance between Amino Acid Requirements and Toxicity. *The Journal of Nutrition.* 2004;134(6):1569S-74S.
3. Tessari P. Protein metabolism in liver cirrhosis: from albumin to muscle myofibrils. *Curr Opin Clin Nutr Metab Care.* 2003 2003/01//;6(1):79-85.
4. Murray K, Rodwell V, Bender D, Botham KM, Weil PA, Kennelly PJ. *Harper's illustrated biochemistry.* 28: Citeseer; 2009.
5. Chatterjea M, Shinde R. *Textbook of medical biochemistry.* India: JAY PEE 2006.
6. Kupper TS, Fuhlbrigge RC. Immune surveillance in the skin: mechanisms and clinical consequences. *Nature reviews. Immunology.* 2004 Mar;4(3):211-22.
7. Albert ML. Death-defying immunity: do apoptotic cells influence antigen processing and presentation? *Nature Reviews Immunology.* 2004;4(3):223-31.

8. Abreu MT, Arditi M. Innate immunity and toll-like receptors: clinical implications of basic science research. *The Journal of pediatrics*. 2004;144(4):421-9.
9. Besser Gat, M. *Comprehensive clinical Endocrinology*. 3rd ed ed. Philadelphia: El Sevier; 2002.
10. Isley WL. Growth hormone therapy for adults: not ready for prime time?: American College of Physicians; 2002.
11. Butler AA, Roith DL. Control of growth by the somatropic axis: growth hormone and the insulin-like growth factors have related and independent roles. *Annual review of physiology*. 2001;63(1):141-64.
12. Hoffman R, Benz Jr EJ, Silberstein LE, Heslop H, Anastasi J, Weitz J. *Hematology: basic principles and practice*. 4th ed: El Sevier, Churchill livington; 2005.
13. Guyton AC, Edward J. Guyton, and Hall: *Textbook of Medical Physiology*. 11th ed. Philadelphia, Pennsylvania: Elsevier Inc; 2006.
14. Ganong WF. *Review of Medical Physiology*; 2000.
15. ElSaid S. Effect of aerobic and anaerobic activities on gene expression of the superoxide dismutase: Alex. Univ.; 2012.
16. Jeurissen A, Bossuyt X, Ceuppens JL, Hespel P. The effects of physical exercise on the immune system. *Nederlands tijdschrift voor geneeskunde*. 2003 Jul 12;147(28):1347-51.
17. Mooren F, Blöming D, Lechtermann A, Lerch M, Völker K. Lymphocyte apoptosis after exhaustive and moderate exercise. *Journal of applied physiology (Bethesda, Md. : 1985)*. 2002 08/01;93:147-53.
18. Mosbah A. *Immunity in stresses and pain Cairo: DarElmaaref*; 1997.
19. Butterfield DA, Pocernich CB, Drake J. Elevated glutathione as a therapeutic strategy in Alzheimer's disease. *Drug Development Research*. 2002;56(3):428-37.
20. Meister A. *The Liver Biology and pathobiology: Glutathione*. Second. New York: Raven Press, Ltd; 1998.
21. Barrett KE, Barman SM, Boitano S, Brooks HL. *Ganong's review of medical physiology*. McGraw-Hill Education New York; 2010.
22. Ferrara N. Vascular endothelial growth factor as a target for anticancer therapy. *Oncologist*. 2004 2004;9 Suppl 1:2-10.
23. Li J, Dai CH, Chen P, Wu JN, Bao QL, Qiu H, Li XQ. Survival and prognostic factors in small cell lung cancer. *Medical oncology (Northwood, London, England)*. 2010 Mar;27(1):73-81.
24. Hindmarsh PC, Dattani MT. Use of growth hormone in children. *Nature Clinical Practice Endocrinology & Metabolism*. 2006;2(5):260-8.
25. Boersma B, Wit JM. Catch-up growth. *Endocrine reviews*. 1997;18(5):646-61.
26. Sakoury MMA, Shalaby MN, Elmaghraby AM, Omar IM, Tahoun MMA. The effectiveness of a water sports program on the level of poly unsaturated fatty acids and the severity of the disease in children with Autism spectrum disorder. *Med. Sci*. 2020;24(101):143-64.
27. Shalaby M, Sakoury M, Rabei M, Alzayani A. Covid-19 Pandemic Era. *Aegaeum*. 2020 06/22;8:1083-93.
28. Shalaby MN. The Determinants of Leadership: Genetic, Hormonal, Personality Traits Among Sport Administrators. *International Journal of Pharmaceutical and Phytopharmacological Research*. 2017;7(5):9-14.
29. Shalaby MN. The Effect of Whey Protein (Natural Nanoparticle) on Muscle Strength, GH, IGF, T. Protein, and body composition. *International Journal of Pharmaceutical Research & Allied Sciences*. 2018;7(1).
30. Shalaby, M. N., Fadl, M. A. Relative Indicators and Predicative Ability of Some Biological Variables on Cardiac Neural Activity for Volleyball Players. *Systematic Reviews in Pharmacy*, 2020; 11 (9), 834-840. doi:10.31838/srp.2020.9.119
31. Shalaby MN, Liu JY, Kassem MM, Saad M. Circulating Hematopoietic Stem Cell and Some Physiological Parameters in Different Training Programs. *Life Science Journal*. 2012;9(1):965-71.
32. Shalaby MN, Saad M, Akar S, Reda MAA, Shalgham A. The Role of Aerobic and Anaerobic Training Programs on CD34+ Stem Cells and Chosen Physiological Variables. *Journal of Human Kinetics*. 2012;35(1):69-79.
33. Shalaby MN, Saad MM. Advanced Material Engineering and Nanotechnology for Improving Sports Performance and Equipment. *International Journal of Psychosocial Rehabilitation*. 2020;24(10).
34. Abdel Ghany S.M. EMNT, Mohamed A.A., Hana R.S. Serum & tissue levels of vascular endothelial growth factor, basic fibroblast growth factor, nitric oxide, sialic acid & glutathione -s-transferase in nonsmall cell lung cancer patients after treatment with nimesulide(cox -2 inhibitor) combined with che. *Proceeding of the international conference of ESBMB 2010*; 2010. 63-89.
35. Banks RE, Forbes MA, Kinsey SE, Stanley A, Ingham E, Walters C, Selby PJ. Release of the angiogenic cytokine vascular endothelial growth factor (VEGF) from platelets: significance for VEGF measurements and cancer biology. *British journal of cancer*. 1998;77(6):956-64.
36. Zimering MB, Thakker-Varia S. Increased fibroblast growth factor-like autoantibodies in serum from a subset of patients with cancer-associated hypercalcemia. *Life sciences*. 2002;71(25):2939-59.
37. Shalaby, M. N., Sakoury, M. M. A., Harthi, S. M., Alshalawi, F. M., Alhajji, M. M., Alshaikh, Z. H., Aljaber, A. H. Vitamin D3 for Health and Muscle Functions of Athletes. *Systematic Reviews in Pharmacy*, 2020; 11 (9), 851-854. doi:10.31838/srp.2020.9.12.