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Contents

Global Leader of Amino Acids 50th Amino Acids Business

"Amino Acids of the 21st Century" (7) –The Science of Amino Acid Supplements–

This is the concluding part of a description concerning the latest specific research on the use of amino acids presented by Professor Otani of the Graduate School of Frontier Sciences, the University of Tokyo.

Study in the field of lifestyle diseases

a. Changes in blood viscosity (changes in blood flow) due to long-term ingestion

The deterioration of the ability to synthesize nitrogen monoxide (NO) due to oxidation stress and mechanical stress is especially significant in patients with lifestyle diseases such as diabetes, hyperlipemia, and hypertension, and causes decreased vasorelaxant activity, enhanced platelet aggregation due to hypertension, deteriorated blood flow, and enhanced plaque formation in arterial stiffness. Rheological effects, such as arginine's inhibition of platelet aggregation, is said to require a minimum dosage of approximately 8 g/day with long-term single administration. However, when ingested as a supplement, heavy consumption of a single amino acid is not recommended in terms of nutritional balance.

Suzuki et al. conducted research on the effects of a mixture of 12 amino acids containing a significant amount of arginine (AVP) on subjects consisting of 18 postmenopausal women (60.6 ±9.1 years old) presumably subject to decreased estrogen production and hence a reduced ability to generate nitrogen monoxide.[6] A mixture of 12 amino acids (AVP) was ingested after each meal (2 g three times a day) for 10 weeks, followed by measurement of the arterial stiffness index (ASI) and blood rheology by MC-FAN. The results showed significant improvements in vessel elasticity and blood rheology ($p<0.05$) due to the ingestion of the AVP amino acid mixture (Fig. 4). It is interesting to note that approximately 1 g of arginine ingested in combination with other amino acids in the AVP mixture achieved effects equivalent to those obtained with single ingestion of 8 g of arginine.

b. Enhancement of alcohol metabolism

Fatty liver due to alcohol ingestion is caused by the lifestyle habit of alcohol consumption. It is known that γ-GTP, a blood index, is reduced and fatty liver is improved by limiting the amount of such consumption. However, in modern society, various stresses tend to trigger heavy drinking. Mawatari et al. found that a combination of alanine and glutamine has a greater effect on enhancing alcohol metabolism than other amino acids. (Fig. 5)[7] These researchers reported that ingestion of a combination of alanine and glutamine before the administration of alcohol significantly decreased blood alcohol level ($p<0.05$) in an animal experiment.

Research in the field of beauty products

Amino acids have been widely used in the field of beauty products, particularly in cosmetics and toiletries. As amino acids are a natural moisture factor (NMF) for the stratum corneum, they are used as a humectant in cosmetics. The NMF amino acid is generated by the hydrolysis of fillagrin, a protein in the horny cell layer, by an enzyme

Fig. 4 Changes in blood pressure and arterial stiffness index after ingestion of the AVP amino acid mixture

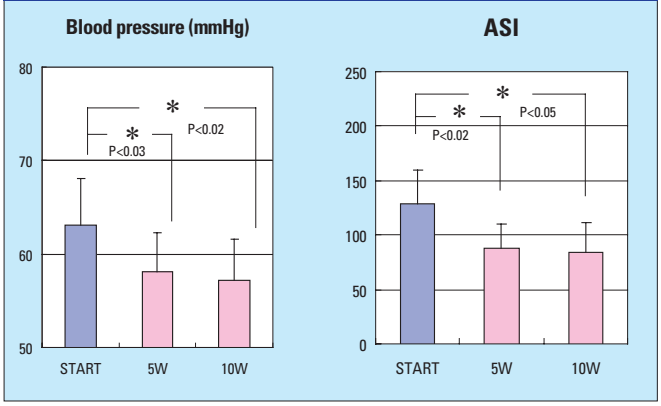
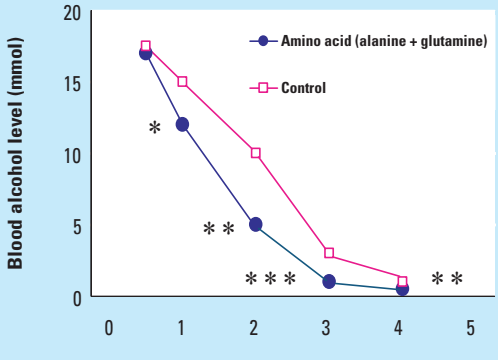


Fig. 5 Effect of a combination of alanine and glutamine on blood alcohol level in rats



produced in the process of skin regeneration. The amino acid is further metabolized into another amino acid having a different structure, and then converted into pyrrolidone carboxylic acid, which offers high moisture retention, in addition to other metabolized byproducts.

The horny cell layer is a barrier separating the inside from the outside of the body; many kinds of metabolic and biochemical reactions take place in this layer, which also retains skin moisture and prevents the incursion of foreign substances. Metabolic disorders caused by aging and stimulation such as drying and ultraviolet rays weaken the biological defense mechanisms. The reduction in amino acids in the horny cell layer with aging causes dry skin, which slows regeneration and thickens this layer. People with atopic dermatitis or pollen allergies have reduced levels of moisture and amino acids in the horny cell layer relative to healthy individuals.[8] Individuals with rough skin and those with smooth skin have different amino acids in the horny cell layer.

In addition to the relationship discussed above between the horny cell layer on the surface of the skin and amino acids, the relationship between the functions of the dermis layer and amino acids also merits discussion. The dermis layer lies beneath the skin surface, in which fibrocytes bind intracellular amino acids to synthesize proteins such as collagen and elastin. It has been reported that the addition of glutamine to the fibrocytes of cultured dermis enhances the synthesis of collagen.[9] It has also been reported that the administration of arginine promotes the regeneration of skin. This is considered to be due to enhanced collagen synthesis in the dermis layer by arginine.[10] These reports point to the substantial involvement of glutamine and arginine in the synthesis of collagen and elastin.

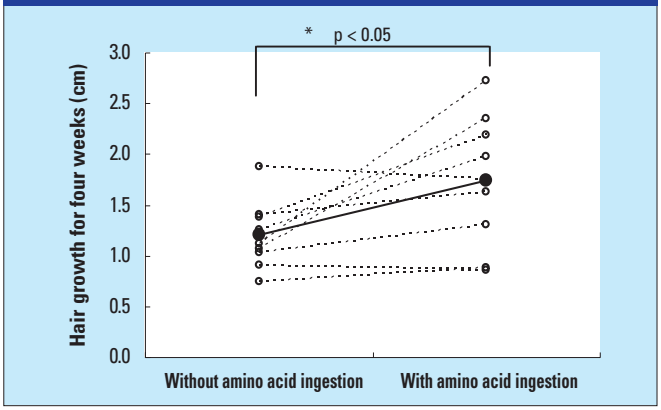
However, the effects of the ingestion of amino acid supplements on the skin and hair have not been studied in detail. Following is a discussion of reports on the effects of oral ingestion of an amino acid supplement (AVP) containing a significant amount of glutamine and arginine, particularly in terms of the field of beauty products (i.e., effects on skin and hair).

a. Effects on hair

Ogasawara et al. divided 10 women from 25 to 45 years old into two groups, and administered solely to one group an amino acid mixture (AVP, 2.0 g/day) twice a day for 15 weeks. The rate of hair growth was measured during the last four weeks, at which point the groups ingesting and not ingesting the amino acid mixture were switched, and the rate of hair growth was measured for four weeks in a similar manner.[11] The results of the study showed that the rate of hair growth significantly increased with the ingestion of the amino acid mixture (AVP) ($p<0.05$) (Fig. 6). Although further study with more subjects is warranted, this could be regarded as a new finding.

At present the effects of the ingestion of amino acids on the skin and on skin diseases are under study from various viewpoints.

Fig. 6 Comparison of rate of hair growth between groups with and without amino acid ingestion * $p<0.05$ Wilcoxon test



Precautions for safety and ingestion

This final section describes some precautions in the ingestion of amino acid supplements. To date amino acids have been exclusively used as medicines. The upper limit of content is determined when these are used in a medicine or a medicated cosmetic. There is no upper limit when they are used as food ingredients, and amino acids are highly safe. However, massive and continuous ingestion of a single amino acid should be avoided in terms of nutritional balance. Pregnant women, infants, and people on low-protein diets due to decreased renal function should consult a doctor regarding the ingestion of amino acid supplements.

When amino acids are ingested in combination with other medicines or supplements, great attention should be given to their pH values. There are neutral, acidic, and basic amino acids. Arginine is highly alkaline (pH 11 or higher), and aspartic acid is highly acidic (pH 3 or lower).

Summary and future development

This paper described the various effects of the ingestion of amino acid supplements, in addition to their nutritional effects. There is currently no doubt as to the beneficial effects of amino acids in maintaining good health; thus it is expected that further study will find a number of even more striking amino-acid effects.

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Profile of Professor Masaru Otani

Received a degree in amino acid sports nutrition at the Graduate School of Arts and Sciences, The University of Tokyo.
Visiting professor of the Sports Science for Health and Activity Course, Graduate School of Frontier Sciences, The University of Tokyo
Full-time lecturer at the Graduate School of Agriculture, Meiji University
Member of Information, Medicine and Science Commission of the Japan Olympic Committee (JOC)
Based on experience with amino acid conditioning for top athletes, Professor Masaru Otani is currently involved in developing exercise, nutrition, and diet programs for middle-aged and elderly individuals.
Research interests include the application of amino acid mixtures to lifestyle diseases and disease prevention programs, as well as the effects of long-term consumption of amino acids on nutritional status and exercise results.