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The Effects of Supplementary L -Arginine Dietary on Metabolism and Performance in Anaerobic Exercise

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ABSTRACT

Arginine exists in the body as a free amino acid; constituent of most proteins and as a precursor to several non-proteins such as nitrogen compounds. This amino acid also functions as an intermediate mediator in urea formation cycle in the production of adenosine tri-phosphate, cell proliferation, vascular dilation, neural transmission, calcium release and the immune system. L-arginine is present most in dietary protein and people normally receive more than 5 grams of it daily. Almost 25 years ago this supplement became popular among athletes. Most scientists describe oral arginine as a growth-enhancing hormone.The aim of this study was to evaluate the effect of L-arginine on changes in lactate and ammonium concentrations. The research population included 30 male students randomly picked out from among students representing research population willing to participate in the project. Out of this number 10 were assigned to the experimental group 1 consuming L-arginine supplements and 10 were chosen as experimental group 2 consuming branched amino acid supplements and 10 were assigned to control group. Results showed that consumption of L-arginine supplements reduces ammonium. Although different studies have reported different results in this field it is likely that arginine delays fatigue through interfering in the metabolism of ammonium.
KEY WORDS: L-arginine Supplement, Athletes, Ammonium.

INTRODUCTION

Arginine is an essential conditional amino acid. This means that under certain conditions the body's this amino acid that seems to be essential of which the period of rapid growth of the body during pregnancy and the period after injury can be named. Arginine is synthesized by the liver in urea cycle that also includes waste products resulting from protein metabolism. L- Arginine is found in dietary protein and people normally receive 5 grams of it on a daily basis. It was almost 25 years ago when this supplement became popular among athletes. Most scientists have described taking oral arginine as a growth hormone enhancer. In a research aiming to determine the adequate level of oral arginine, 12 healthy men were asked to take pure form of L-arginine for 4 weeks. The intake of arginine by these individuals was in an ascending manner; they started with 3 grams a day and increased the dosage to 9.21 and finally to 30 grams a day. 5 of them complained about side effects such as diarrhea, nausea and nosebleeds in the dosage of 21 grams per day. When taking a dose of 30 mg per day were two of the volunteers refused to take it further and the nine other people who continued using it suffered from diarrhea, and in some case headache and dry mouth were also reported. No adverse effects were observed at low doses (2). Despite this there are still a lot of people using supplements containing arginine hoping that using arginine will increase their physical strength and delay fatigue during physical activity. The effect of arginine on exercise capacity and exercise capability in healthy individuals has been less studied (3). It is estimated that oral supplementation with arginine and glycine alpha-Ketoisocaproic acid may increase the efficiency of healthy young athletes in exhausting anaerobic exercise (4). Also using arginine and alpha-ketoglutarate supplements for 8 weeks can increases muscular power in men trained with endurance exercise (5). It can be inferred from the above discussion that taking a combination of the listed supplements together with arginine has increased athletic capacity and performance, but in the case of using L-arginine alone, little research has been done. In a research, 14 days of intake of arginine aspartate intake brought about no change in performance of marathon endurance athletes (6). The study aims to explore the role of L-arginine supplementation on metabolism following strenuous anaerobic exercise. In better words, the main purpose of this study is to

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evaluate the effect of L-arginine supplementation on changes in lactate concentration and serum ammonium, resting heart rate and absolute maximum oxygen consumption in athletes.

MATERIALS AND METHODS

This semi-experimental study was conducted on 30 volunteer athletic students in with a history of 2 to 3 years the field of bodybuilding. All participants were examined by a general practitioner to ensure that their general health and general health questionnaires including factors of age, height, weight, blood pressure, etc were completed. Also after the first blood sampling a series of blood samples of experimental and control groups were sent to the laboratory to ensure the health of the livers and kidneys. Of these subjects without being informed (Single-blind experiment) 10 were assigned to experimental group 1 and took L-arginine supplement used by athletes supplied by Pouyan Company (produced in Canada) during the 6 weeks of body building training, and 10 were assigned to experimental 2 group who in addition to 6 weeks of training used the same kind of supplementation but containing branched amino acids (leucine, isoleucine and valine) not containing arginine and 10 were assigned to control group (placebo), consuming lactose as a placebo and participated in the 6-week training. The first instance of blood sampling was done before the 6-week body building exercise and before intake of supplements immediately after ergometry test and a second blood sampling was done after 6 weeks and immediately after ergometry test and all samples was sent to the laboratory to determine lactate and ammonium concentrations. The results were analyzed in SPSS-16 software using t-test and Anova test. Less than 0.05 was considered significant for all tests.

RESULTS

The statistical results did not show any statistically significant changes in absolute maximum oxygen consumption which is one of the chief indices of cardiovascular fitness in the two experimental groups and the control group throughout study. In fact the intake of supplements in the experimental groups did not lead to an increase in VO2max in these groups. Also resting heart rate under supplementation and placebo conditions in all three groups did not change appreciably. Statistical test results showed that although basal levels of lactate in the arginine supplementation group had decreased slightly after 42 days supplementation, the difference was not statistically significant, while the findings showed a significant reduction in the levels of ammonium in this group. The results did not show any statistically significant changes in baseline levels of lactate and ammonium in the control group who had consumed branched amino acids supplements. Also the test results among the three groups showed no significant changes in lactate concentration, while ammonium concentration in L-arginine complementary group was significantly decreased compared with the experimental group 2 and the control group.

DISCUSSION

The results of this study showed a significant relationship between intake of L-arginine supplements and the decreased ammonium concentration during exercise while no significant changes were seen on such factors as resting heart rate and maximum oxygen consumption. The results were similar to the results of some other studies were inconsistent with those of some others. In a study in 1989 Gremion et al reported a significant increase in maximum oxygen consumption of up to 7.52 to 5.56 ml per minute, which was different from the results of this study (7). But in 2005, Abel et al did not observe any significant effect in this area, which was consistent with the results of this study (8). Also the results of Scheffer's research in 2002, examining the effect of arginine on intense exercises, were similar to the results of this study (9). Also in a research 2009 Bescós did not observe any significant effect on resting heart rate that is again consistent with the results of this study (10). Statistical data showed that changes in lactate concentration were not significant in any of the groups. In other words, the intake of arginine amino acids and BCAA had no significant effect on serum lactate concentration. These results were consistent with the results of Bescós's research who examined the effect of arginine supplementation in athletes with intense exercise (10). However, in a study Otto et al studied the effect of the L-arginine Hydrochloride salt on eight healthy non-athlete participants were and found significant results in the lactate concentration which is not consistent with the results of this study (9). Reviewing the literature of this study it seems that most researches similar to this study have found no significant differences in lactate concentration; among all Otto et al who studied the effect of arginine glutamate salt on cyclists (11). Also Tsai et al (12), Liu

(13), Hsu (14), Colombani (15), Abel (8), Dennis (16) and Schmid (17) found similar results to the results of this study in relation to lactate concentration. While ammonium concentration in the arginine group had significantly decreased against the other group and the control group conducting Tukey post hoc test confirmed these results. Also in a research Dennis showed that the intake of 5 grams of arginine aspartate in athletes for 10 days significantly reduced the concentration of ammonium against the control group (18). Otto et al studied the effect of arginine glutamate salt on ammonium changes on cyclists and reported a significant decrease in ammonium concentration (11). Also in similar research Spodaryk reported significant decrease in ammonium concentration (19). Scheffer also studied the effect of L-arginine on the changes of ammonium concentration and reported a significant reduction (9); and all the results are consistent with the results of this study. Examining the effect of L-arginine, Tsai et al did not find any significant changes in ammonium concentration (12) which is consistent with the results of this study. Moreover, scholars such as Liu (13) Hsu (14) Colombani (15) and Abel (8) did not report any significant changes in ammonium concentration.

Conclusion

Considering the results obtained in this study and other studies it seems that the intake of arginine amino acid alone or in combination with other substances, such as the Spartate leads to enhanced athletic performance through affecting metabolic substrates and endocrine parameters. In other words, arginine delays fatigue by interfering in ammonium metabolism. One of the questions raised in this area for researchers is whether arginine has a greater effect on performance through affecting metabolism alone or in combination with other substances. Researchers in this study only used L-arginine supplement; while other researches in the field of have been conducted by combining arginine with other compounds, including arginine aspartate, potassium and magnesium aspartate, arginine aspartate in combination with carnitine and lysine (20). The amount of arginine used in various researches varies from the daily doses of 3, 5, 5.5, 8.7 or the very high15 grams (22, 21). It is difficult to compare the findings of these studies as the methodologies used in them are different. Although it appears that arginine may reduce the production of lactic acid through inhibition of glycolytic and aspartate may facilitate oxidation of free fatty acids (23). Some researches have also pointed out that the long-term intake of arginine and aspartate has benefits for endurance performances; of course these researches are not well controlled (17). In contrast researchers like Colombani and Abel did not report any positive effect on the metabolism and performance following intake of arginine aspartate (8,15). Although the results of this study showed that the intake of L-arginine supplements may delay fatigue by reducing ammonium concentrations, given all the materials listed as well as the results of other studies to endorse entirely the intake of L-arginine amino acids in pure form or combined with other substances, requires further research.

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