ABSTRACT

The physical activity influences specific mechanisms responsible by a reduction in the power production, and consequently on the fatigue. It has been proposed premises to improve the physical performance, and we observed that some studies have been focused on the reduction of the metabolites that decrease the fatigue on intense physical exercising, using aminoacids known for their properties to induce to metabolic changes, and among these, it is the arginine. The present study had the purpose to study the effects of the acute arginine aspartate supplement in trained healthy individuals submitted to an exhaustion protocol on ergonomic bicycle. Twelve 22.6 ± 3.5 years old trained individuals were used in the research. After taking a single dose of arginine aspartate or a placebo solution, they performed three 90 minute test on an ergonomical bicycle to which load increments were added up to reaching the exhaustion. The blood samples were obtained through biochemical analysis, such as: creatinine, urea, glycogenesis, and lactate. It was found no statistical differences upon the comparison of the Maximal Heart Rate, Maximal Time and Load, and also comparing to the previous and later results on the urea, creatinine and glycosis tests. The lactate concentrations (mmol/l) presented statistical differences compared to the pre-test values (Control: 2.2 ± 0.14; Arginine: 2.43 ± 0.23; Placebo: 2.26 ± 0.11) to the post-test values (Control 10.35 ± 0.57; Arginine: 12.07 ± 0.88; Placebo: 12.2 ± 0.96), p < 0.001. The main results found in this study indicate that the acute administration of arginine aspartate did not show effective to increase the fatigue tolerance in the individuals evaluated and treated in the incremental test protocol up to the exhaustion. Thus, it can be concluded that the dosage used was not able to increase the muscular fatigue tolerance.

INTRODUCTION

It is known that during high intensity exercising, the major ways for the ATP supply are the phosphate creatine breakdown, and the degradation of the muscular glycogen to the lactic acid. Thus, the reduction in the phosphate creatine and glycogen contribute to the decrease in the anaerobic production of the energy and in the exercise performance(1-3). It is clear that the fatigue is followed by several physiological and metabolic changes, and we observed that some studies have been focused on the reduction of the metabolites that decrease the fatigue on intense physical exercising, using aminoacids known for their properties to induce to metabolic changes, and among these, it is the arginine. Thus, it can be concluded that the dosage used was not able to increase the muscular fatigue tolerance in trained volunteers

Keywords: Lactate. Aminoacid. Exhaustion.

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Effects of the acute arginine aspartate supplement on the muscular fatigue in trained volunteers

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Thus, the concern on the improvement in the physical performance using several resources has been proposed in the last few years[30,31]. This way, we observed that studies are more focused in the reduction of the metabolite accumulations that decrease and/or induce the fatigue during physical exercising using aminoacidic supplements known for their property to induce to beneficial metabolic changes[32,33]. Among these aminoacids, the L-arginine, which is essential to the child’s growth and a substrate for different and important enzymes, such as the arginase, the NO synthase (NOS), decarboxylase arginine, etc. The arginase is a catalytic enzyme of the arginine in the Urea Cycle, and the decarboxylase arginine catalyzes the change of the L-arginine to the agmatine, an endogenous agonist of the α2-adrenoceptors that can have a role in the antihypertensive effect of the L-arginine. In healthy humans and in some animals, the L-arginine has been elucidated by being able to induce hypotension caused by the stimulation of the nitric oxide (NO) through the L-arginine-NO way[13,36-42]. The arginine’s biochemistry is complex, and it involves several metabolic ways and organic systems. Arginine has an important role in the urea, protein, high energy compounds (creatinine and phosphate creatine), polyamine, and nitric oxide synthesis[42-48].

The vasodilation of the muscle-skeletal arteriole as a response to the exercising increases the nutrient and oxygen supply to the muscles that are requested during the movement. Studies conducted with mouse and the action of the L-arginine supplement as determinant of the ability to perform a specific physical activity have showed an improvement in the ability to perform the activity due to the systemic increase in the production of the nitric oxide derived from the endothelium[49]. Some studies have already pointed out that the arginine supplements helped to reduce the physiological fatigue through the reduction of the ammonia a few time after the oral ingestion[50].

The present study had the purpose to study the effects of the acute arginine aspartate supplement in trained healthy individuals submitted to an exhaustion protocol on an ergometric bicycle.

**METHODOLOGY**

The sequence of the arginine aspartate administration for each volunteer was based on a randomized schedule previously approved by the Committee of Ethics in Human Researches under the number A020/2003/CEP.

To perform this study it was used tablets containing 1.5 g of arginine aspartate, commercially known as TARGIFOR® produced by the company Aveistpharma, batch number 300971, and expiration date 02/2006. Volunteers received orally 4.5 g (3 tablets) of arginine aspartate in a sole dose diluted in mineral water (250 ml) containing a non-energetic dye. The placebo group received only dyed mineral water (250 ml).

It was used twelve healthy male individuals with ages from 22.6 ± 3.5 years.

Volunteers were submitted to a fatigue-inducing protocol organized as follows: all volunteers were evaluated, in order to obtain the controlling values. Later, they passed through the below described two experimental phases (Fl and Fi):

- Fl: 4.5 g administration of the arginine aspartate to volunteers I, II, IV, VII, IX, and XI.
- Fi: 4.5 g administration of the arginine aspartate to volunteers III, V, VI, VIII, X, and XI.

The fatigue-inducing protocol was performed 90 minutes after the administration of the arginine aspartate or the placebo solution, when volunteers were oriented to be positioned in one ergonomic bicycle (LifeFitness).

Pedaling at a 60 rpm frequency and after a two minute period at 38 watt it increased approximately 25 watts every two minutes except in the sixth minute (50 Watts) up to reaching the fatigue using a frequency meter to record the heart rate.

Each volunteer performed four times the same fatigue-inducing protocol (adaptation, control, arginine, and placebo) always using the same criteria.

**Biochemical Analysis**: blood collection: 5 ml before and 5 ml after the protocol, in order to perform the biochemical analysis such as: creatinine, urea, glyceremia, and lactate. All biochemical analysis were made using Laborlab® diagnostic kits (Guarulhos/São Paulo, Brazil) through the non-kinetic methodology at 37°C in a Shimadzu UV-1650 PC spectrophotometer. The plasmatic lactate was analyzed before and after the fatigue-inducing protocol using an Accusport® equipment, and stripes for the BM-Lactate analysis (Roche Diagnostics, Manheim, Germany).

**Statistical Analysis**: It was used the variance analysis (ANOVA) followed by the Tukey test for independent sampling. The significance level lower than 5% (p < 0.05) was adopted.

**RESULTS**

The data below presented are the Mean ± Standard Error of the Mean (SEM). The Maximal Heart Rate (HR max) was recorded in beatings/minute (bpm) immediately after performing the fatigue-inducing protocol, and compared to the three groups, and it was found no statistically significant difference: Control (185 ± 4) vs. Arginine (184 ± 3), and Placebo (185 ± 4).

The Maximal Time (T max) obtained in the fatigue-inducing protocol for different groups did not present statistical significance where it was verified the Control (17.86 ± 0.78) vs. Arginine (18.87 ± 0.71), and Placebo (18.31 ± 0.72).

No statistical difference could be observed in response to the Maximal Load (Load max) obtained in Watts (W) after performing the fatigue-inducing protocol, with the following results: Control (266.08 ± 9.20) vs. Arginine (285.36 ± 8.23), and Placebo (276.67 ± 7.94).

The Lactate concentration (mmol/L) in trained volunteers was previously determined just after the conclusion of the fatigue-inducing protocol. Graphic 1 shows the plasmatic concentration of the pre-control Lactate, where it can be observed no difference between the experimental groups: Pre-Control (2.2 ± 0.14) vs. Pre-Arginine (2.43 ± 0.23), and Pre-Placebo (2.26 ± 0.11). The post-protocol plasmatic concentration, Post-Control (10.35 ± 0.57) vs. Post-Arginine (12.07 ± 0.88), and Post-Placebo (12.2 ± 0.96) did not present any statistical difference. Upon the comparison of the post-protocol concentration ([Lact]post) before and after the fatigue-inducing protocol in the different phases, it was observed statistical differences. The Pre-Control (2.2 ± 0.14) vs. Post-Control (10.35 ± 0.57); Pre-Arginine (2.43 ± 0.23) vs. Post-Arginine (12.07 ± 0.88); Pre-Placebo (2.26 ± 0.11) vs. Post-Placebo (12.2 ± 0.96), p < 0.001.

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Each volunteer performed four times the same fatigue-inducing protocol (adaptation, control, arginine, and placebo) always using the same criteria.

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It was observed no statistical difference related to the Urea, Creatinine, and Glycosis concentrations, and the results were: Urea: Pre-control (41.67 ± 3.4), Pre-Arginine (42.56 ± 2.58), and Pre-Placebo (42.54 ± 3.25); Post-Control (45.06 ± 3.58), Post-Arginine
DISCUSSION

It has been performed a great number of researches with the purpose to identify more effective ergogenic substances to improve the athletic performance, always focusing the demanded energy in all sports range, and in the control of the dietetic consumption[46]. The oral L-arginine supplement has shown both positive and negative results. The discrepancies between the clinic observations that in some cases, the L-arginine can increase the nitric oxide formation, added to the expectation that this could be the basis for the L-arginine’s kinetics to the NO reaction is called “the arginine paradox”. Theories related to the arginine paradox have focused the possibility that high doses of the L-arginine would provide the required effects[47], since if there will be an increase in the blood flowing, this would allow a higher lactate and ion releasing of the muscle, thus promoting a higher removal in the circulation due to the blood distribution[41].

The Maximal Heart Rate (HR_{max}) obtained in the tests during the phases clarifies the high intensity developed by volunteers, observing that the arginine aspartate supplement did not change the heart rate (bpm) of individuals along the test after the administration.

Another characteristic where it was obtained no changes was the Maximal Time (T_{max}) of the performance in different phases of the fatigue-inducing protocol, showing that the final performance was not changed by the administration of the 4.5 g of the arginine aspartate.

Upon the evaluation of the Maximal Load produced on the ergonomic bicycle when it was performed the fatigue-inducing protocol in the different phases of the administration, it was kept without any change, and this is certainly in conformity that the supplement used does not exert any effect on the attainment of the performance, since it did not help to increase the physical performance, characterizing the fact it did not help in the tolerance to the muscular fatigue.

Finally, this study had the purpose to study the effect of the acute supplement of the arginine aspartate in trained healthy individuals submitted to an exhaustion protocol in an ergometric bicycle. But in face of the results attained, it can be concluded that the acute supplement of the arginine aspartate in the 4.5 g dosage it was impossible to increase the physical performance, characterizing the fact.

All the authors declared there is not any potential conflict of interests regarding this article.

REFERENCES
