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Original article

Effects of short-term L-arginine supplementation on lipid profile and inflammatory proteins after acute resistance exercise in overweight men

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SUMMARY

Background & aim: Dyslipidemia is involved with in development of cardiovascular diseases and obesity, exercise is recommended as a successful intervention. Dietary L-arginine (L-arg) supplementation may improve in lipid metabolism. However, these combined strategies on lipid profile were not tested yet. This study examines the effects of short term of L-arg supplementation and acute resistance exercise (AREX) on the blood lipid profile and inflammatory proteins in overweight men.
Methods: Seven overweight men, 46 ± 5 yrs, body weight 93.1 ± 12.0 Kg and BMI 31.7 ± 3 kg/m^2, participated in a randomized, double-blind and crossover study, distributed into exercise groups, based on the supplementation (6 g/day of placebo or Arginine for 7 days). Supplementation periods were separated by 7-days of wash-out. The AREX was comprised of eight exercises, with an exercise intensity of 60% 1RM. The glucose, lipid profile (NEFA, triglycerides, HDL cholesterol, LDL cholesterol and total cholesterol) and inflammatory proteins [plasminogen activator inhibitor-1 (PAI-1) and adiponectin] were determined at rest, immediately, after exercise and 1 h after exercise sessions.
Results: Triglycerides, total cholesterol, and adiponectin levels not showed time-dependent changes under the different conditions. LDL cholesterol and NEFA levels decreased after 1 h recovery periods when compared to rest periods only in L-arg supplementation group ($P < 0.05$). PAI-1 was reduced and HDL cholesterol exhibits increases immediately after AREX and 1 h recovery periods when compared with rest periods in both groups ($P < 0.05$).
Conclusion: These results indicate that L-arg supplementation can potentiate the effects of exercise inducing changes in the LDL cholesterol and NEFA levels.

1. Introduction

It is known that physical inactivity is related to excess plasma lipoproteins concentration, which contributes to increased disease risk as: atherosclerosis, hypertension, diabetes, and obesity,[1–3] as well as with many other diseases that are linked to inflammatory markers in the plasma, which includes reduced plasmatic adiponectin, increased

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C-reactive protein (CRP) and increased plasminogen activator inhibitor-1 (PAI-1).[2,4,5]

Exercise (acute or chronic) shown favorably effects on plasma lipid profile.[6] However, other strategies associated or not are recommended to reduced lipid profile, including the use of statins, tea extracts, and some amino acids such as arginine.[7–9]

L-Arginine (L-arg) is a conditionally essential amino acid in human diet that serves as the substrate for nitric oxide synthases (NOS). Boger (2008),[7] showed the ability of dietary L-arg supplementation to improve the functional properties of the cardiovascular system.

Some authors shown that L-arg improves the metabolic profile.[10,11] Although its effects in adipose tissue (improves insulin sensitivity, immune status, hypertension) are well documented,[12–14] the effects of short-term of L-arg supplementation combined with AREX on lipid profile and inflammatory proteins in overweight men remain unclear.

Given the paucity of studies investigating the effects, and combination of L-arg supplementation with AREX on lipid profile, and inflammatory protein. We hypothesized that short-term L-arg supplementation combined with AREX may induce a beneficial effect on lipid profile and inflammatory proteins in overweight men.

2. Methods

2.1. Subjects

Seven overweight, hypertensive men, non-smoking and sedentary with a mean age of 46 ± 5 yrs, body weight 93.1 ± 12.0 Kg and body mass index (BMI) 31.7 ± 3 kg/m^2, participated in this study. At protocol, benefits and risks were explained before written consent was obtained. The study procedures were previously approved by the Ethics Committee of the Universidade Federal de São Paulo – CEP #001/10. Food intake of macronutrients, arginine and energy was made from records during the experimental periods.

2.2. Supplementation

The supplementation was oral administration of L-arg (Sigma®) or placebo (starch) gelatinous capsules (2 g, three times on day) for one week.[15] The study used a 2-supplementation, double blind, randomized and crossover design. Supplementation periods were separated by 7-days washout for change supplementation. The placebo capsules were at the same size, color and flavor as the L-arg capsules.

2.3. Acute resistance exercise session

After medical evaluation, the volunteers underwent three sessions of exercise adaptation to learn the correct technique for the execution of movements. The exercises were conduced at the Centro de Estudos em Psicobiologia e Exercício (CEPE). After the adaptation we performed one maximum repetition (1 MR) test, to determine the percentage of the workload for all exercises. The maximum weight lifted in a single repetition was identified as the 1 MR.

The volunteers performed four sessions of AREX, in three sets of 12 repetitions, as shown in the study design (Fig. 1). The intensity of the exercise session was 60% of 1RM and the method was alternated by segment, beginning with exercises that required a larger muscle group and then moving to the smaller one. The following weight machine (Technogym®, Italy), exercises comprised the AREX: chest press, leg press, handle back, leg extension, deltoids, leg curl, biceps curl, and triceps pulley. The execution speed of 2:2 was used with recovery intervals of 60 s between sets and two minutes between exercises. Before each exercise session, stretching exercises for the major muscle groups were performed.

2.4. Blood sampling and analysis

A baseline blood samples were collected after fasting for 12 h. Blood samples (10 mL) were immediately allocated into two 5-ml vacutainer tubes (Becton Dickinson, BD, Brazil) containing EDTA for plasma separation. The tubes were centrifuged at 2500 g for 12 min at 4 °C, and plasma samples were stored at −20 °C until analysis. Triglycerides, HDL-cholesterol, total cholesterol were assessed trough commercial enzymatic kits (Labtest®, Brazil). LDL-cholesterol was calculated according to Friedewald et al.[16] Plasma glucose concentration was analyzed using the enzymatic colorimetric method (Biotécnica, Brazil). PAI-1 and adiponectin were assessed through commercial kits (R&D systems®, Brazil).

2.5. Statistical analyses

The data distribution was previously checked by Shapiro–Wilk's test and the data are reported as mean ± standard error of the mean. The differences for the blood parameters were evaluated by a 2 × 2 factorial with 2 supplements (placebo or arginine) and two AREX sessions (before and after exercise). The ANOVA with covariance structure and the confidence interval were adjusted by the Bonferroni test. The supplementation and exercise were also evaluated for interaction effects. The analysis was conducted using GraphPad Prism (version 5.0) software, and the significance level was set at $p < 0.05$.

3. Results

In Table 1 are described the baseline characteristics of subjects. It was observed that, fat mass (%), BMI and waist circumference/Hip circumference were bigger than the considering normal ranges to

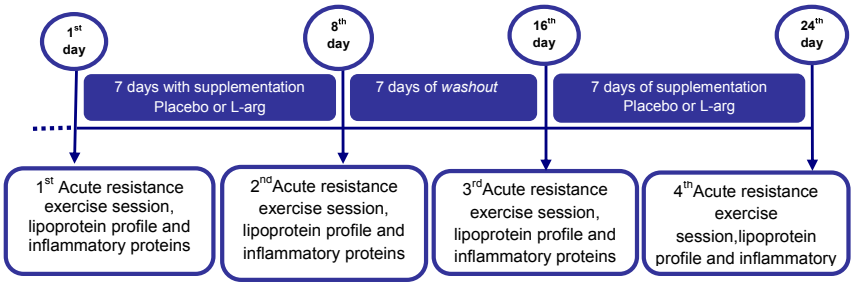

Fig. 1. Study design.