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Glutamine Supplementation is not Associated with Anabolic Property after Resistance Exercise in Non-trained Individuals

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ABSTRACT: Glutamine has anabolic effects on glycogen metabolism that are beneficial for athletes involved in resistance training. To establish whether glutamine supplementation is associated with anabolic effect after resistance exercise in non-trained subjects, twenty four non-trained boy students aged 18-24 years of old were randomly divided into experimental (glutamine supplementation/ 30 g) or control (placebo) groups. All subjects of two groups were completed a intense resistance test (20 minutes up and down the bench 60 cm with a weight equivalent to 13 percent of their weight) then ingested glutamine and placebo (30g). Serum testosterone, cortisol and the ratio between them were measured before the resistance test and 24 hours after. Student's paired't' test was applied to compare the pre and post values. A p-value of less than 0.05 was considered to be statistically significant. There were no statistically significant differences between two groups with regard to all variables at baseline ($p>0.05$). No significant differences were found in serum testosterone and cortisol by glutamine supplementation with compared to baseline ($P>0.05$). Testosterone/cortisol ration was not altered after supplementation in either group ($P>0.05$). Based on these finding, we concluded that glutamine supplementation is not associated with anabolic property after a intensity resistance exercise in non-trained subjects.

Keywords: Glutamine supplementation, Resistance test, Anabolic

INTRODUCTION

Nowadays, the use of dietary supplements such as proteins has become a growing trend among athletes, especially resistance athletes. Probably the most important reason for getting a high-protein diet, especially among resistance athletes and bodybuilders is to increase muscle mass. The resistance athletes take about 2 grams of protein per kilogram of body weight every day, which even amounts to 3 grams of protein in some cases (Phillips, 2004, 2006).

Protein is one of the most essential dietary supplements recommended for athletes and active individuals. Protein supplements increase muscle mass in athletes, preventing from muscle protein catabolism during long-term exercise. Furthermore, it leads to higher glycogen synthesis after exercise along with increased synthesis of hemoglobin, myoglobin, mitochondrial and oxidative enzymes during aerobic exercise (William, 2005).

It has been demonstrated that simultaneous intake of carbohydrate and protein can lead to lower muscle exercise-caused damage through altering the protein metabolism. The protein intake will raise the amino-acid intake available, thus providing carbohydrate intake through increasing blood insulin, desirable hormonal environment for greater uptake of amino acids. The combination of these two factors will increase protein synthesis However, the question is whether the use of protein supplements alone will bring about beneficial effects equivalent to their blend (carbohydrate + protein). Among nutritional supplements or protein shakes, creatine and glutamine are commonly used by athletes with the notion of enhancing athletic performance. These supplements are effective in improvement of performance during the weight loss phase and recovery after reaching the right weight (Cockburn *et al.*, 2008, Newsholme and Calder 1999, Bird, 2003).

Glutamine is an amino acid widely used as a nutritional supplement in sports. Most athletes use it for strengthening the immune system and maintaining muscle protein level during vigorous bodybuilding workout for boosting muscles and healing the damaged tendons. It is also regarded an important fueling source for immune cells and any excess consumption may theoretically prevent from diseases or greatly curtail their severity (Waddell and Fredricks 2005).

Despite the relevant literature highlighting the importance of glutamine in exercise performance and emphasis on its anabolic properties (Keast *et al.*, 1995), it is not yet clear whether supplementation in early sessions of muscle contractions in non-athletes is associated with anabolic properties. So far, there has not been a single study focusing on the effect of supplementation on cortisol or testosterone levels as two catabolic and anabolic hormones or their ratio following an intense resistance exercise in non-athletes.

Since increase in the ratio of testosterone to cortisol is an anabolic process, the question is whether or not glutamine changes the ratio. This study attempts to ecamine the effects of glutamine supplementation on cortisol and testosterone their ratio, following a session of muscle contraction in non-athlete male students.

METHODS

Subjects: Twenty-four non-trained boy students age-matched (18-24 year) were recruited in this study. Aim of the study is to investigate whether glutamine supplementation can improve the anabolic status after resistance exercise. All participants gave their informed written consent before participation in accordance with the ethical guidelines set by Islamic Azad University, Saveh Branch, Iran.

Inclusion and exclusion criteria: Participants were non-athletes, non-smokers and non-alcoholics. All subjects had not participated in regular exercise/diet programs for the preceding 6 months. The exclusion criteria were as follows: Patients with known history of acute or chronic respiratory infections, diabetes and cardiopulmonary disease.

Anthropometric measures: Both populations underwent anthropometric measurements. Weight was measured to the nearest 100 g using digital scales. Height of the barefoot subjects was measured to the nearest 0.1 cm. BMI was calculated as weight (kg)/height (m^2).

Resistance test and supplementation: Blood samples were collected, via the cannulated antecubital vein, between 8:00-9:00 a.m. after an overnight fasting for two groups then centrifuged for separate serum. All participants refrained from any severe physical activity 48 h before measurements. Serum used to measuring testosterone (DR Diagnostic Testosterone Eliza-EIA-1559, Germany) and cortisol (G diagnostic KS18EW, England) by ELISA method. After blood samples, the subject of two groups were completed a resistance exercise test [9]. In this protocol, each subject was performed a 20 minutes up and down the bench 60 cm with a weight equivalent to 13 percent of his weight. Glutamine and placebo (30g) were provided to each participant 20 min after exercise test in experimental and control groups respectively. Blood samples were repeated at next morning after overnight fast.

Statistical analysis: All values are reported as mean and standard deviation. Data were analyzed by computer using the Statistical Package for Social Sciences (SPSS) for Windows, version 15. Normal distribution of data was analyzed by the Kolmogorov-Smirnov normality test. At baseline, comparisons of parameters between the two groups were made by unpaired Student t test. Student's t-tests for paired samples were performed to determine whether there were significant within-group changes in the outcomes. All statistical tests were performed and considered significant at a $P>0.05$.

RESULTS

Means and standard deviations of physical characteristics of the subjects are shown in Table 1. At baseline there were no differences in the age, body weight and other anthropometrical indexes between the two groups. There were no differences in serum testosterone and cortisol concentrations or their ratio between two groups ($p>0.05$).

Table 1: The descriptive anthropometric features of studied groups.

Variable	Experimental	Control
Age (years)	23.4 (3.75)	21.2 (1.3)
Weight (kg)	77.4 (12.3)	77.8 (6.30)
Height (cm)	176.5 (1.18)	177.8 (1.11)
Body mass index (kg/m^2)	24.5 (3.9)	24.6 (1.95)

Table 2: Pre and post values of biochemical variables of studied groups.

Variables	Experimental group		Control group	
	Pre	Post	Pre	Post
Serum testosterone (ng/ml)	**9.7** (2.13)	**9.1** (3.12)	**9** (2.02)	
Serum cortisol (µg/dl)	**31.07** (15.21)	**35.3** (25.13)	**34.4** (22.37)	**34.4** (26.9)
Testosterone/cortisol ratio	**0.37** (0.16)	**0.42** (0.41)	**0.35** (0.24)	**0.33** (0.19)

As mentioned above, our aims of present study was to estimate the anabolic property of glutamine supplementation after resistance exercise in non-trained subjects. Based on data of paired T test, serum testosterone concentrations did not change with glutamine supplementation in experimental group ($p = 0.618$). No significant difference was also observed in serum cortisol between pre and post test values ($p = 0.469$). Testosterone/Cortisol ratio was not affected by glutamine after resistance exercise test ($p = 0.688$). All variables remained changes in control subjects ($p > 0.05$) (Table 2).

DISCUSSION

The findings of this study showed that glutamine supplementation does not affect the serum levels of cortisol and testosterone after a resistance exercise in non-athletes. In other words, oral administration of glutamine (30 grams) does not lead to anabolic properties after vigorous resistance exercise. Glutamine is the most abundant amino acid in plasma and skeletal muscle. It accounts for about 60 percent of amino acid reserves within the muscles. Glutamine supplementation is a routine by athletes during prolonged exhaustive exercise, but the effect on strength training or muscle damage caused by intense contraction has rarely been studied. Muscle glutamine reserves are significantly reduced after certain metabolic activity (Michael, 1995, Curi *et al.*, 2005, Antonio *et al.*, 2002, Jeff, 1994, Jean and Douglas 1990).

Theoretically, glutamine has performance-enhancing effects in various sports. As an important fuel protein in some immune cells such as lymphocytes and macrophages, glutamine is curtailed in extreme long sports such as those associated with overtraining. Glutamine boosts the muscle synthesis, thus leading to higher muscle strength.

Some researchers have hypothesized that those athletes involved in heavy exercise or overtraining are likely to face lower glycogen levels in plasma, which in turn gives rise to damages in the immune system and predisposing the athlete to a variety of diseases. Such diseases will lead to sports injury and decreased performance. The findings about the role of glutamine in sport are multifaceted, as some studies have reported slow spread of infection among athletes who take glutamine-containing drinks after extreme workout. Other studies have suggested that although such glutamine supplementation helps maintain plasma levels after intense exercise, it never affects the immune system response to exercise tests (Williams, 2005, Budgett 1998, Castell, 1996, 2003, Rohde 1998).

Recent inspections have revealed that few studies support the use of glutamine for enhancing immune system performance (Hargreaves and Snow 2001, Nieman, 2001).

Moreover, it was found out that both short and long-term glutamine supplementations do not leave performance-enhancing effects on muscle mass or muscle performance. These studies have shown that glutamine supplementation one hour before exercise test would leave no impact on resistance performance until the exhaustion as compared to the placebo group. In another study, 6 weeks of glutamine supplementation during endurance exercises did not lead to any change in increased muscle mass or muscle strength as compared to the placebo group (Candow, 2001).

The findings of this study demonstrated that both glutamine and placebo intake respectively in the control and experimental groups led to no change in serum cortisol within 24 hours after the exercise test. Based on this evidence, it can be concluded that glutamine supplementation does not affect the serum levels of cortisol and testosterone and their ratio within 24 hours after an intense resistance workout session in young male non-athletes.

Based on this evidence, the findings of the current study strongly support the non-impact of such glutamine supplementation on the testosterone to cortisol ratio after the intense resistance workout. In other words, the comparison of changes in cortisol and testosterone than their ratio between the experimental and control groups is suggestive of non-anabolic properties of glutamine through such supplementation on the mentioned variables. Although the relevant literature has always supported the anabolic properties of glutamine aimed at increasing muscle size and strength, the glutamine intake among athletes is quite common, even though its non-impact supplementation in this study may be associated with the type of supplementation, initial fitness level the population under study or the intake dose. After all, a few studies reported about the beneficial effects of protein supplementation during pre-exercise periods or its supplementation during the exercise sessions, justifying that increase in muscle reserves size of such anabolic supplements takes place in the pre-test exercise period rather than transient changes in plasma. On the other hand, such lack of change may be associated with the initial fitness level of the population examined in the present study, as the subjects were in the non-athletes and inactive group. In other words, it is also likely that hormonal changes caused by eccentric resistance testing in inactive individuals might be so intense that glutamine supplementation or other protein additives at the given doses fail to improve or impact the changes.

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