Research Paper

Effect of 2-Weeks Coenzyme Q10 Supplementation on Malondialdehyde and Catalase Serum Levels Following Moderate and Severe Acute Resistance Training in Inactive Female Students

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ABSTRACT

Aims Physical activity is usually accompanied by free radicals' production and oxidative stress. Moreover, to prevent adverse effects, coaches and athletes have to use proper supplementation. Therefore, the present study aimed to investigate the effect of short-term coenzyme Q10 supplementation on malondialdehyde and serum catalase enzyme activity following moderate and severe acute resistance training in inactive female students.

Methods & Materials In total, 27 female students were randomly divided into three groups; the groups were homogeneous and equal (two groups of resistance training and one control group). The experimental groups were subjected to moderate-intensity acute (70% 1RM) acute and severe acute activity (85% 1RM) and supplemented with coenzyme Q10 (30 mg /d). CAT and MDA were measured in ELISA using a human kit.

Findings Moderate and severe acute resistance activities did not alter MDA and catalytic activity (P>0.05); however, after 2 weeks of coenzyme Q10 supplementation, those resulted in a significant decrease in MDA (0.006 and 0.01, respectively) and CAT (0.04 and 0.007, respectively). There were no significant differences between the effects of two exercises (P>0.05).

Conclusion Short-term (two weeks) supplementation of coenzyme Q10 and severe acute resistance activity could reduce two important oxidative stress indexes (MDA and CAT).

Extended Abstract

1. Introduction

The body cells are part of the metabolism process and are consistently producing free radicals and reactive oxygen species. It is also highly responsive and susceptible to damage to all cellular attachments [1]. Oxidative stress refers to a state in which the balance between oxidants and antioxidants tends to favor the oxidants, and this unbalance can affect intracellular oxidation and cause oxidative damage. In the face of oxidative stress, the antioxidant system of the human body has the task of producing and applying antioxidants to break down the chain of reactions created by free radicals. It maintains the body's natural balance (homeostasis) and modulates the oxidative stress caused by the increase in free radicals [2, 3].

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Few kinds of research were conducted on the effect of resistance exercise on oxidative markers and antioxidant defense than on aerobic exercise; however, during resistance exercise, anemia muscles and production of free radicals, which occur from oxidative bursts in neutrophils, are considered critical maters [8]. Exercise intensity, which is a component of physical activity, affects free radical production and oxidative stress. As the intensity of physical activity increases, the oxidative stress and inability of the antioxidant defense system become more evident [9].

Coenzyme (Q10) is one of the supplements that have bioenergetic effects and can neutralize some of the damage caused by free radicals. This supplement, as a kind of antioxidant, has a protective function against oxidative stress [15]. This study aimed to investigate the effect of acute and moderate resistance exercise combined with coenzyme supplementation on Malondialdehyde (MDA) and the Chloramphenicol acetyltransferase (CAT) serum activity in passive girls to answer the following questions: does acute and moderate resistance exercise significantly change the indices of MDA and CAT in passive girls? If we combine resistance exercise with two weeks of coenzyme supplementation, how or what would be the change in these indices? Is there a difference between the effect of the two types of resistance exercise in terms of intensity (acute vs. moderate)?

2. Methods

Pal et al. [1] investigated the effect of high-intensity exercise on oxidative stress and skeletal muscle damage in postpubertal boys and girls. They found that the exercise increased the Catalase (CAT) level and lipid peroxidation. Ogonovszky et al. examined the effect of moderate and strenuous training and reported that the Malondialdehyde (MDA) was increased by enhancement in free radicals [10]. Zarghami Khameneh et al. also observed increased MDA serum level after conducting one session of resistance training (7 movements in 3 sets) with 80% of 1 Repetition Maximum (RM) until exhaustion [11].

Bloomer et al. also reported increased MDA levels following Wingate anaerobic test and Bruce treadmill protocol [12]. Nakhostin Rohy et al. assessed the effect of acute resistance training on brain-derived neurotrophic factor, CAT, and vitamin C; they concluded that the measured levels decreased after exercise [13]. Silva et al. evaluated the effect of acute resistance training on oxidative stress in trained individuals. They found that the training increased the CAT and MDA levels and improved their protective adaptation to oxidative stress [14].

Study design

This was a quasi-experimental study.

Study population, place, time

The study population consisted of all female students of Birjand University of Medical Sciences, aged 18-25 years. The study protocol period was 2 weeks. First, one training session was performed. Then, Co-Q10 supplementation was administered for 14 days. Next, another training session was conducted. Before beginning the main exercise, individuals in the two experimental groups were referred to the gym for two sessions to become familiarized and learn the method of performing the movements and having one maximum repetition until fatigue.

Study samples

Twenty-seven students were selected based on the study inclusion criteria (no cardiovascular, pulmonary, respiratory diseases, and being physically inactive for the past 6 months), using a convenience sampling technique. All subjects were on the same diet (the provided food by college). They were randomly assigned into three moderate RES+Q10 (n=9), severe RES+Q10 (n=9) and control (n=9) groups. The control group received no intervention. Subjects in two experimental groups consumed a CoQ10 tablet (30 mg) once a day after lunch. The moderate RES+Q10 group performed one session of circular strength training with 70% 1RM. Moreover, the severe RES+Q10 group performed one session of circular strength training with 85% 1RM.

Before collecting the data, the study objectives and methods were explained to the samples. Furthermore, after obtaining the study participants' informed consent, they completed Baecke Habitual Physical Activity Questionnaire (BHPAQ), with the validity and reliability coefficients of 0.65 and 0.90, respectively [1] and Food Frequency Questionnaire with the validity and reliability coefficients of 0.60 and 0.60, respectively [2]. Then, in a session, the training protocol and proper performance of the movements were educated to the study subjects. Next, their height and weight were measured. Blood samples were poured into in test tubes without anticoagulant, and after 30 minutes of clotting, the samples were centrifuged (at 5000 rpm for 5 minutes).

3. Results

The moderate and severe acute resistance training had no significant effect on MDA and CAT serum levels (P>0.05). However, moderate and severe acute resistance training following CoQ10 supplementation could reduce

MDA (P=0.01 and P=0.006) and CAT (P=0.004 and P=0.007). The combined effect of resistance training and CoQ10 supplementation was not significant on their measured levels (P>0.05).

4. Discussion

Cooke et al. studied trained and untrained men; they reported that 14-day coenzyme Q10 supplementation increased muscle CoQ10 concentration and reduced MDA level during and following exercise [3]. Laaksonen et al. suggested that CoQ10 supplementation cannot prevent undesirable MDA changes as the primary indicator of peroxidation in biological membranes by increasing total antioxidant capacity [4].

Recommendations

Some studies have documented that acute resistance training increased lipid peroxidation and stress in the body's antioxidant system; thus, we recommend nutritional strategies to enhance the antioxidant system. Based on the present study findings, applying coenzyme Q10 at different doses and different supplementation periods may be useful in reducing MDA level and regulating catalase enzyme activity.

Limitations

Subjects had physical health and age range of 18 to 25 years. They were also instructed to avoid heavy exercise at 48 hours before taking the test. In addition, they were requested to refrain from taking any medication or dietary supplements during the study period to prevent affecting the study outcomes.

5. Conclusion

Coenzyme Q10 supplementation reduced MDA and CAT levels. The same feature of this supplement modified MDA and CAT serum levels after acute resistance training. No significant difference was found between the effect of acute resistance training with two intensities on the oxidative stress indices. Therefore, definitive and clear claim on the role of coenzyme Q10 supplement requires the manipulation of the intensity of resistance training and the dose that produces different levels of oxidative stress indices.

Ethical Considerations

Compliance with ethical guidelines

This study obtained its ethical clearance from the Ethics Committee of Birjand University of Medical Sciences (Code: IR.BUMS.REC.1397.183).

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Authors' contributions

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Conflicts of interest

The authors declared no conflicts of interest.

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