

ANTRENMANLI BİREYLERDE AEROBİK EGZERSİZ İNDÜKLÜ METABOLİK VE KARDİYAK STRESİN İRİSİN SEVİYELERİNE ETKİLERİ

Effects of Aerobic Exercise Induced Metabolic and Cardiac Stress on Irisin Levels in Trained Subjects

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ÖZET

Amaç: Egzersizin vücudun oksidatif stres seviyesini ve metabolik aktiviteyi hızlandırdığı bilinmektedir. İrisin, egzersizle indüklenen oksidatif stres ve enerji regülasyonunda rol alan önemli bir miyokindir. Bu çalışmadaki amacımız antrenmanlı erkeklerde aerobik egzersiz ile indüklenen kardiyak ve iskelet kası stresinin belirlenmesinde malondialdehide (MDA), asymmetric dimethylarginine (ADMA) ve irisin düzeylerini belirlemektir.

Yöntem: Çalışmamızda toplamda 25 erkek deneye aerobik koşu egzersizi uygulandı, yaklaşık 45 dakikalık anaerobik eşik seviyesine denk geldi. Egzersizden hemen önce ve sonra venöz kan örnekleri alındı. Serum irisin seviyeleri ölçümünde ELISA, ADMA ve MDA ölçümünde HPLC kullanıldı.

Bulgular: Aerobik egzersiz ADMA (0.417±0.05 µmol/L vs 0.537±0.05 µmol/L), MDA (0.769±0.02 µmol/L vs 1.012±0.04 µmol/L) ve irisin (252±4 ng/ml vs 299±4 ng/ml) düzeylerinde sistematik artışa neden oldu. Ayrıca egzersiz boyunca ADMA ve irisin düzeyleri arasında anlamlı bir korelasyon gözlemlendi.

Sonuç: Egzersiz ile indüklenen kardiyak kalp stresi ile artmış ADMA ve irisin düzeyleri arasında bir ilişki gözlemlendi. Böylece irisin, kardiyovasküler bozukluğu olan hastalar için koruyucu madde olarak düşünülebilir.

Anahtar kelimeler: Aerobik egzersiz; Anaerobik eşik; MDA; ADMA ; Irisin

ABSTRACT

Objective: Exercise is known to be accelerates metabolic activity and increases oxidative stress levels of the body. Irisin is an exercise induced myokine which plays crucial role in energy regulation and oxidative stress. We aimed to evaluate effects of aerobic exercise induced cardiac and skeletal muscle stress as determined on malondialdehyde (MDA) and asymmetric dimethylarginine (ADMA) ADMA on irisin levels in trained male subjects.

Material and Methods: Total of 25 male performed aerobic running exercise corresponded to their anaerobic threshold levels approximately 45 min. Venous blood samples were taken before and immediately after exercise. Serum irisin levels were determined using enzyme-linked immunoassay (ELISA) method. ADMA and MDA measured by using high performance liquid chromatography (HPLC).

Results: Aerobic exercise led to systematic increase in ADMA (0.417±0.05 µmol/L vs 0.537±0.05 µmol/L), MDA (0.769±0.02 µmol/L vs 1.012±0.04 µmol/L) and irisin (252±4 ng/ml vs 299±4 ng/ml). In addition, we have observed significant correlation between increased ADMA and irisin levels during exercise

Conclusion: We observed close relationships between exercises induced cardiac muscle stress as determined from increased ADMA levels and increased irisin levels. Thus, irisin may be considered as a protective agent for the patients with cardiovascular system impairments.

Keywords: Aerobic exercise; Anaerobic threshold; MDA; ADMA; Irisin

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INTRODUCTION

Exercise training has been proposed as the main approaches to protect or improve fitness status against many metabolic diseases (1, 2). During exercise, an increased metabolic demands of muscle activity has vigorously effect on cardiac and metabolic systems functions (3).

In recently, irisin has been identified as an exercise induced myokine that has import role in regulation of energy metabolism (4). The impact of different types of exercise on enhanced irisin levels has been shown in several studies (4, 5). It is shown that irisin may have crucial role in metabolism of glucose and lipid and also regulation of cardiovascular and endothelial function (6-8).

Exercise is known to be associated with increased blood asymmetric dimethylarginine (ADMA) concentration that is an important biomarker used to evaluate stress level of cardiovascular systems (9). Malondialdehyde (MDA), reflecting lipid peroxidation, is well documented to increase following exercise indicating oxidative damage attributable to the exercise (10-12). Effects of exercise induced metabolic stress as determined from change of lipid peroxidation (MDA) and cardiovascular system stress as determined from change of asymmetrical dimethylarginine (ADMA) on irisin levels has not been described yet. Increase in skeletal and cardiac muscle irisin levels in mice following high intensity treadmill exercise have been reported (13). In addition, a close link between cardiovascular system disorders and irisin levels has been reported (14).

Thus we aimed to evaluate the relationships between MDA, ADMA and irisin levels during acute aerobic exercise in trained male subjects.

MATERIAL AND METHODS

Total of 25 healthy trained male subjects (age: 20.1±1.1 years, weight: 70.5±5.1 kg, height: 181±3.4 cm) were participated to this study. The ethical approval was taken from the local ethical committee. All subjects gave signed permission before participating to this study. The subjects were free of any illness

(cardiac metabolic or respiratory) and had a regular sportive activity (at least 3 years) and training (three times per week). The subjects were no smoking, no taking alcohol or any medication including vitamin or energy liquids.

Following an overnight fasting, all subjects performed an aerobic running exercise at their anaerobic threshold between 08:00 to 09:00 AM. Anaerobic threshold was estimated using the criteria of American Collage of Sport Medicine (15). In the study, 5 ml blood sample was obtained from antecubital vein before and after the exercise. Blood samples were taken into the aprotinin containing tubes to prevent protein denaturation. Serum was separated by centrifuging at 4000 rpm for 5 min. Serum irisin levels were determined using enzyme-linked immunoassay (ELISA) kit (Phoenix Pharmaceutical Inc, Burlingame, California, USA). Serum MDA and ADMA levels were measured using by high Performance Liquid Chromatography (HPLC) methods.

A paired t-test was used to analyse data between pre and post exercise values. P<0.05 was accepted as statistically significant. Pearson correlation analysis was applied to analyse significance between change in irisin, MDA and ADMA values.

RESULTS

The (mean±S.E.) pre-exercise irisin level and post exercise irisin level for the aerobic running exercise are presented in Table 1. There were significant differences in pre-exercise irisin levels and post exercise (p<0.001) (19% increase). Aerobic running exercise resulted systematic increase in ADMA levels in all subjects (Table 1). The increase was averaged to be 35%. MDA levels were increased in all subjects and averaged as 32% increase (Table 1).

Table 1: Mean (±SE) values of basal and end of exercise levels of ADMA, irisin and MDA. P shows statistical significance between pre-post values.

| | Basal | End | P |
|----------------|------------|------------|---------|
| ADMA (µmol/L) | 0.417±0.05 | 0.537±0.05 | p<0.001 |
| Irisin (ng/ml) | 252±4 | 299±4 | p<0.001 |
| MDA (µmol/L) | 0.769±0.02 | 1.012±0.04 | p<0.001 |

There was a linear positive correlation between post-pre exercise change of ADMA and irisin levels during exercise (Figure 1). However, there was no significant correlation between percent change of MDA and irisin levels during exercise (Figure 2).

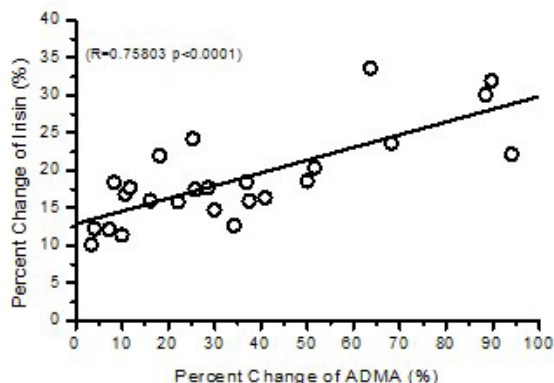


Figure 1: Correlation between percent change of irisin and ADMA levels for each subject (n=25)

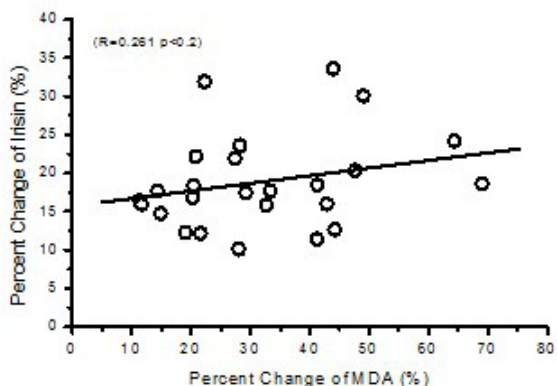


Figure 2: Correlation between percent change of irisin and MDA levels for each subject (n=25)

DISCUSSION

Anaerobic threshold, reflecting moderate aerobic exercise intensity is widely applied exercise protocol in clinical medicine sport science (1, 2, 16). Increase of irisin levels during aerobic exercise has been associated with the results of previous studies (4, 5, 17). The important interaction between irisin and many metabolic pulmonary or cardiac diseases has been shown (18).

We have observed significant positive correlation with an increased ADMA and irisin levels (Figure 2). This could be related with increased cardiac muscle function and irisin (19, 20). A protective role of irisin on cardiac muscle may have been responsible for this correlation between increases of irisin and ADMA (14, 21).

We have showed that aerobic exercise corresponded to anaerobic threshold led to a significant increase in lipid peroxidation (11, 22, 23). We have found no significant relationships between change of MDA and irisin levels (Figure 2). Exercise induced metabolic stress led to a significant increase in ADMA levels that has been used for evaluation of cardiovascular risk factor (9, 24). The increase of ADMA levels could be results of significantly increase in systematic vascular resistance and impaired cardiac output response to exercise (25). However, increase of ADMA levels varied among the trained subjects between 3% to 94 and averaged 35%. Serum irisin levels were positively associated to increased ADMA levels in young trained subjects. It is logical to expect beneficial effects of physical activity on metabolic and cardiovascular system which may results increased of irisin activity.

Consequently, we have suggested that irisin may have great contribution to increased exercise induced cardiac muscle stress. However, further studies with subject different fitness levels, including low and moderate, should be performed to obtain satisfactory information.

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