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CHANGES OF PLASMA ADIPOCYTE FATTY ACID BINDING PROTEIN LEVELS FOLLOWING 8 WEEKS AEROBIC EXERCISE

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ABSTRACT

Moghadasi, M.; Barzegar, F.; Nuri, R. Changes of plasma adipocyte fatty acid binding protein levels following 8 weeks aerobic exercise. Brazilian Journal of Biomotricity. v. 7, n. 4, p. 150-155, 2013. The aim of this study was to examine the changes of plasma adipocyte fatty acid binding protein (A-FABP) levels following 8 weeks aerobic exercise in female athletes. Twenty female karate athletics were randomly assigned to one of the exercise group (n=10) or control group (n=10). The training group performed endurance training 3 days a week for 8 weeks at an intensity corresponding to 50-60% individual maximum oxygen consumption for 45 min. Body mass and BMI increased (P<0.05) after 8 weeks aerobic exercise compared to the control group. For WHR, body fat percentage and maximal oxygen consumption there were no significant difference between the exercise group and the control group. The results showed that A-FABP, fasting glucose and insulin and insulin resistance determined by HOMA-IR did not change in the exercise training compared with the control group. In conclusion, serum A-FABP levels were not affected by 8 weeks moderate intensity aerobic exercise in female athletes.

Key-words: A-FABP, Aerobic exercise, Female athletes, Insulin resistance
INTRODUCTION

Fatty acid binding proteins (FABPs) are a family of proteins that are involved in shuttling fatty acids to cellular compartments for oxidation in mitochondria and peroxisomes or storage in the endoplasmic reticulum (BOORD et al., 2002). So far, nine types of these proteins have been described, and their name refers to the place in which they were first identified or where they can be found in the greatest concentration. The most important FABPs were isolated from the liver (L-FABP), heart (H-FABP), intestine (I-FABP), brain (B-FABP), epidermis (E-FABP) and adipocytes (A-FABP). A-FABP is a small lipid-binding protein, highly expressed in adipose tissue and also expressed in macrophages. It is one of the most abundant cytoplasmic proteins in mature adipocytes (MAEDA et al., 2005) and A-FABP has been suggested as a central regulator of insulin sensitivity, lipid metabolism, and inflammation (MAKOWSKI & HOTAMISLIGIL, 2004) associated with metabolic syndrome (XU et al. 2007; MAKOWSKI et al., 2005), atherosclerosis (MAKOWSKI et al., 2005; HOLM et al., 2011), type 2 diabetes (TSO et al., 2007), cardiac dysfunction (CHOROMANSKA et al., 2011; HOLM et al., 2011). Amongst the FABPs, A-FABP is of special interest in atherogenesis. While originally described as an adipose tissue protein (HOTAMISLIGIL et al., 1996), the studies have shown a pivotal role for A-FABP in macrophages in relation to cholesterol trafficking and inflammation (FURUHASHI et al., 2008). In line with this, total or macrophage-specific A-FABP-deficiency has been shown to protect against atherosclerosis in apolipoprotein E-deficient mice (MAKOWSKI et al., 2001) and A-FABP has been suggested as a potential drug target in diseases like diabetes and atherosclerosis (FURUHASHI et al., 2008). Exercise has been shown to have beneficial effects on obesity, type 2 diabetes, and the metabolic syndrome. Although the changes in A-FABP levels might be an important clue for understanding the beneficial effects of exercise, a little data on exercise-induced changes of A-FABP have been reported. Choi et al. (2009), in an only available study, reported that A-FABP level decreased in obese women after 12 weeks moderate exercise training. Research result showed that A-FABP level associated with insulin resistance and obesity profiles, including body weight, BMI and waist circumference (CHOI et al., 2006). We hypothesized that exercise training would reduce the insulin resistance and adipose tissue and decrease A-FABP concentrations; therefore, we investigated the effects of 8 weeks of moderate intensity aerobic exercise on body composition, insulin resistance and A-FABP concentrations in female athletes.

MATERIALS AND METHODS

Subjects

Twenty female karate athletics (24.3 ± 4.8 years; mean ± SD) participated in this study. All the subjects were asked to complete a personal health and medical history questionnaire, which served as a screening tool. The subjects were given both verbal and written instructions outlining the experimental procedure, and written informed consent was obtained. Our participants were nonsmokers and none of them had any disease. All the subjects completed the 3-day diet recall forms and were instructed to maintain their normal physical activity and dietary habits throughout the study. The subjects were randomly assigned to one of the exercise group (n=10) or control group (n=10). The study was approved by the Islamic Azad University, Fars Science & Research branch Ethics Committee.

Exercise training

The 8 weeks exercise training program included 3 running sessions per week. The intensity of exercise was customized for each subject based on the relationship between heart rate and oxygen uptake measured at baseline. During the 8 weeks intervention, the subjects were trained for 45 min per session at a heart rate corresponding to 50-60% of the maximal oxygen uptake measured at baseline. Each participant was equipped with a heart rate monitor (Beurer, PM70, Germany) to ensure accuracy of the exercise level. Subjects performed the exercise training besides their karate training of team.

Measurements
Anthropometric and body composition measurements

Height and weight were measured, and body mass index (BMI) was calculated by dividing weight (kg) by height (m2). Waist circumference was determined by obtaining the minimum circumference (narrowest part of the torso, above the umbilicus) and the maximum hip circumference while standing with their heels together. The waist to hip ratio (WHR) was calculated by dividing waist by hip circumference (cm) (ACSM, 2005). Body fat percentage was assessed by skinfold thickness protocol. Skinfold thickness was measured sequentially, in triceps, suprailiac, and thigh by the same investigator using a skinfold caliper (Harpenden, HSK-BI, British Indicators, West Sussex, UK) and a standard technique (ACSM, 2005).

Measurement of VO2max

VO2max was determined by Rockport One-Mile Fitness Walking Test. In this test, an individual walked 1 mile as fast as possible on a track surface. Total time was recorded and HR was obtained in the final minute (ACSM, 2005). VO2max was calculated using formula (ACSM, 2005).

Biochemical analyses

Fasted, resting morning blood samples (10 ml) were taken at the same time before and after 8 weeks intervention. All the subjects fasted at least for 12 hours and a fasting blood sample was obtained by venipuncture. Serum obtained was frozen at -80 oC for subsequent analysis. The serum A-FABP level was measured in duplicate using an enzyme-linked immunosorbent assay (ELISA) kits (Casabio Biotech Co. LTD.; China). The sensitivity of kit was 0.156 ng/ml. Serum glucose was determined by the enzymatic (GOD-PAP, Glucose Oxidase-Amino Antipyrine) colorimetric method (Pars Azmoun, Tehran, Iran). The intra and inter-assay coefficients of variation for glucose were <1.3% and a sensitivity of 5 mg/dl. The serum insulin level was measured by an electrochemiluminescence immunoassay (ECLIA) and the insulin resistance index was calculated according to the homeostasis model assessment (HOMA-IR) which correlates well with the euglycemic hyperinsulinemic clamp in people with diabetes (EMOTO et al., 1999).

Statistical analysis

Results were expressed as the mean ± SD and distributions of all variables were assessed for normality. Mean values of two groups in pre and post tests were compared by paired-samples t-test and independent-samples t-test for all variables. The relationships between variables in the training groups were determined using Spearman correlation test. The level of significance in all statistical analyses was set at P ≤ 0.05. Data analyses were performed using SPSS software for windows (version 13, SPSS, Inc., Chicago, IL).

RESULTS

Physical and physiological characteristics of the subjects at baseline and after training are presented in Table 1. Before the intervention, there were no significant differences in any of variables among the two groups. Body mass and BMI increased (P<0.05) after 8 weeks aerobic exercise compared to the control group. For WHR, body fat percentage and maximal oxygen consumption there were no significant difference between the exercise group and the control group.
Table 1. Anthropometric and metabolic characteristics (mean ± SD) of the subjects before and after training and detraining.

<table>
<thead>
<tr>
<th></th>
<th>Control (mean±SD)</th>
<th>Training (mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretraining</td>
<td>Posttraining</td>
</tr>
<tr>
<td><strong>Body mass (Kg)</strong></td>
<td>57.8 ± 8.4</td>
<td>57.9 ± 8.4</td>
</tr>
<tr>
<td><strong>BMI (Kg/m²)</strong></td>
<td>21.4 ± 3</td>
<td>21.4 ± 3</td>
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<tr>
<td><strong>Body fat (%)</strong></td>
<td>17.3 ± 5</td>
<td>17.8 ± 5.2</td>
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<tr>
<td><strong>WHR</strong></td>
<td>0.74 ± 0.05</td>
<td>0.75 ± 0.05</td>
</tr>
<tr>
<td><strong>VO₂max (ml·Kg⁻¹·min⁻¹)</strong></td>
<td>47.7 ± 3.5</td>
<td>47.9 ± 3.4</td>
</tr>
</tbody>
</table>

*: P<0.05 for between-group differences.
†: P<0.05, pretraining vs. posttraining values.

The results showed that A-FABP, fasting glucose and insulin and insulin resistance determined by HOMA-IR did not change in the exercise training compared with the control group (Table 2). A-FABP levels after 8 weeks exercise were correlated positively with body mass (r= 0.44; P= 0.04) and inversely with maximal oxygen consumption (r= -0.46; P= 0.03). No significant relationship was observed between A-FABP with BMI, body fat percentage and insulin resistance.

Table 2. Biochemical characteristics (mean ± SD) of the subjects before and after training and detraining.

<table>
<thead>
<tr>
<th></th>
<th>Control (mean±SD)</th>
<th>Training (mean±SD)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pretraining</td>
<td>Posttraining</td>
</tr>
<tr>
<td><strong>Fasting glucose (mg/dl)</strong></td>
<td>90.3 ± 8.8</td>
<td>85.8 ± 8.5</td>
</tr>
<tr>
<td><strong>Fasting insulin (µU/ml)</strong></td>
<td>8 ± 2.9</td>
<td>9.6 ± 4</td>
</tr>
<tr>
<td><strong>HOMA-IR</strong></td>
<td>1.7 ± 0.5</td>
<td>1.9 ± 0.7</td>
</tr>
<tr>
<td><strong>A-FABP (ng/ml)</strong></td>
<td>2.9 ± 3.1</td>
<td>1.4 ± 1.2</td>
</tr>
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</table>

DISCUSSION

Excessive levels of free fatty acids are toxic to cells. The human body has evolved a defense mechanism in the form of small cytoplasmic proteins called fatty acid binding proteins (FABPs) that bind long-chain fatty acids, and then refer them to appropriate intracellular disposal sites (oxidation in mitochondria and peroxisomes or storage in the endoplasmic reticulum) (CHOROMANSKA et al., 2011; CHMURZNSKA, 2006). It is postulated that FABPs play an important role in the pathogenesis of metabolic diseases. Elevated levels of A-FABP have been found in the pericardial fat tissue and were associated with cardiac dysfunction in obese people (CHOROMANSKA et al., 2011). In addition, recent studies have shown that circulating A-FABP levels predict the development of the metabolic syndrome (XU et al., 2007) and type 2 diabetes (TSO et al., 2007). The present study demonstrated that A-FABP levels were not associated with body composition parameters such as body fat percentage, BMI and WHR in female athletes, however previous study demonstrated that a significant positive relationship between A-FABP levels with BMI and waist circumference in obese Korean women (CHOI et al., 2006). These discrepant results may be attributed to differences in subject populations because our subjects were athletes while obese women were participated in Choi et al. study. In our study, there was virtually no change in body fat percentage, fasting glucose and insulin and insulin resistance determined by HOMA-IR after 8 weeks training. Choi et al. (2009) showed that exercise induced improvement in body composition and insulin resistance are associated with the decrease in A-FABP. Therefore, it seems that the
lack of effect of exercise training on A-FABP in the present study might be due to the absence of reductions in body fat percentage and insulin resistance.

Therefore, it is concluded that the other mechanisms such as exercise per se, decrease of the inflammatory markers such as IL-6, TNF-α and hs-CRP and decrease of the triglyceride and total cholesterol levels might decrease A-FABP concentrations. Choi et al. (2009) showed that A-FABP levels were associated with hsCRP, triglyceride and total cholesterol levels. The research results showed that exercise training program decreased A-FABP levels along with changes of body composition and metabolic parameters, including triglyceride and total cholesterol levels (CHOI et al., 2006). Additional research is needed to examine these mechanisms.

PRACTICAL APPLICATION

As the plasma A-FABP levels were lower in female athletes than the sedentary subjects at the baseline, A-FABP levels not affected by 8 weeks moderate aerobic exercise in these subjects.

CONCLUSIONS

In this study we examined whether exercise – induced change in body composition and insulin resistance, decreases A-FABP levels in female athletes. It seems that that plasma A-FABP levels were not affected by 8 weeks moderate aerobic exercise in female athletes. Additional research is needed to examine our hypothesized.

REFERENCES


