Moghadasi, Mehrzad; Nuri, Reza; Ahmadi, Narges
EFFECTS OF 8 WEEKS HIGH INTENSITY AEROBIC EXERCISE ON SERUM RETINOL BINDING PROTEIN 4 LEVELS IN FEMALE ATHLETES
Universidade Iguaçu
Itaperuna, Brasil

Available in: http://www.redalyc.org/articulo.oa?id=93026211005
EFFECTS OF 8 WEEKS HIGH INTENSITY AEROBIC EXERCISE ON SERUM RETINOL BINDING PROTEIN 4 LEVELS IN FEMALE ATHLETES

Mehrzad Moghadasi1, Reza Nuri2, Narges Ahmadi3

1-Department of Exercise physiology, Shiraz branch, Islamic Azad University, Shiraz, Iran.
2-Department of Physical Education and Sport Sciences, International Kish Campus, Iran.
3-Department of Exercise physiology, Fars Science & Research branch, Islamic Azad University, Iran.

Corresponding author:
Mehrzad Moghadasi
Assistant Professor in Exercise Physiology (PhD)
Tel: +98-07112342024
Fax: +98-07112334496
E.mail: moghadasi39@yahoo.com

Submitted for publication: Sep 2012
Accepted for publication: Feb 2013

ABSTRACT
Moghadasi, M.; Nuri, R.; Ahmadi, N. Effects of 8 weeks high intensity aerobic exercise on serum retinol binding protein 4 levels in female athletes. Brazilian Journal of Biomotricity. v. 7, n. 1, p. 37-42, 2013. Retinol binding protein 4 (RBP4), has recently been identified as novel adipokines associated with obesity, type 2 diabetes and the metabolic syndrome. The effects of exercise training on serum RBP4 is still unclear. The purpose of this study was to examine the effects of 8 weeks high intensity aerobic exercise on serum RBP4 levels in female athletes. Twenty female karate athletes 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 75-80% individual maximum oxygen consumption for 45 min. After 8 weeks of training, subjects underwent a week of detraining. Body mass and BMI increased (P<0.05) and WHR decreased (P<0.05) after 8 weeks high intensity exercise training compared to the control group. In our study, there was virtually no change in body fat percentage, fasting glucose and insulin, insulin resistance and RBP4 levels after 8 weeks training and a week detraining. In conclusion, serum RBP4 levels were not affected by 8 weeks high intensity aerobic exercise in female athletes.

Key-words: RBP4, aerobic exercise, female athletes, insulin resistance

INTRODUCTION
Retinol binding protein 4, also known as RBP4, is a human lipocalin family that in humans is encoded by the RBP4 gene (RASK et al., 1987, ROCCHI et al., 1989). RBP4 is a newly discovered fat derived adipokine that specifically binds to retinol (QUADRO et al., 1999) and transthyretin (KLOTING et al., 2007). RBP4 has been reported to provide a link between obesity, insulin resistance and type 2 diabetes in mice and humans (YANG et al., 2005, GAVI et al., 2007, GRAHAM et al., 2006). In fact, elevated serum RBP4 levels were associated with the components
of metabolic syndrome in insulin-resistant subjects (GRAHAM et al., 2006). Transgenic over expression of RBP4 or injection of recombinant RBP4 decreases insulin sensitivity in normal mice. In contrast, normalization of RBP4 levels in obese mice restores insulin sensitivity (YANG et al., 2005). In addition, Seo et al. (2008) demonstrated an association between RBP4 levels and non-alcoholic fatty liver disease.

Exercise has been shown to have beneficial effects on obesity, type 2 diabetes, and the metabolic syndrome. Although the changes in RBP4 levels might be an important clue for understanding the beneficial effects of exercise, a little data on exercise-induced changes of RBP4 have been reported. Choi et al. (2009) reported that there was no significant change in RBP4 levels in obese women after 12 weeks moderate exercise training, while Lim et al. (2008) indicated that RBP4 levels decrease after 10 weeks exercise in middle-aged women. Research result showed that RBP4 level associated with obesity profiles and insulin resistance, thus we hypothesized that exercise training would reduce the adipose tissue, insulin resistance and decrease RBP4 concentrations; therefore, we investigated the effects of 8 weeks of high intensity aerobic exercise on body composition, insulin resistance and RBP4 concentrations in female athletes. On the other hand, attempts to determine detraining effects on diseases risk factors are very little and by our knowledge no previous study has investigated the effects of detraining period on RBP4 levels. Thus we also examine the effects of one week detraining after the intervention on the serum RBP4 levels.

MATERIALS AND METHODS

Subjects

Twenty female karate athletics (24.1 ± 4.3 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. 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 75-80% 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.

Detraining

After completion of the 8 weeks intervention, the subjects were instructed to resume their normal lifestyles and avoid any type of high intensity physical activity for a week.

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 VO$_2$max

VO$_2$max 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). VO$_2$max 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 RBP4 level was measured in duplicate using an enzyme-linked immunosorbent assay (ELISA) kits (Casabio Biotech Co. LTD.; China). The sensitivity of kit was 0.1 µg/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 a 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. 2 × 3 repeated measures ANOVA was used to evaluate time-course change in variables. The relationships between variables in the training groups were determined using Pearson’s 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 and detraining 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) and WHR decreased (P<0.05) after 8 weeks high intensity exercise training compared to the control group. For body fat percent 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>Body mass (Kg)</td>
<td>57.8 ± 8.4</td>
<td>57.9 ± 8.4</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>21.4 ± 3</td>
<td>21.4 ± 3</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>17.3 ± 5</td>
<td>17.8 ± 5.2</td>
</tr>
<tr>
<td>WHR</td>
<td>0.74 ± 0.05</td>
<td>0.75 ± 0.05</td>
</tr>
<tr>
<td>VO2max (ml.Kg⁻¹.min⁻¹)</td>
<td>47.7 ± 3.5</td>
<td>47.9 ± 3.4</td>
</tr>
</tbody>
</table>

a: P<0.05 for between-group differences; b: P<0.05, pretraining vs. posttraining values; c: P<0.05, pretraining vs. detraining values.

The results showed that RBP4, 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). Although RBP4 levels decrease (P<0.05) after a week detraining, no significant differences were found between exercise and control group.

Pearson’s correlation demonstrated no significant relationship between serum RBP4 levels with body composition parameters 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretraining</td>
<td>Posttraining</td>
</tr>
<tr>
<td>Fasting glucose (mg/dl)</td>
<td>90.3 ± 8.8</td>
<td>85.8 ± 8.5</td>
</tr>
<tr>
<td>Fasting insulin (µU/ml)</td>
<td>8 ± 2.9</td>
<td>9.6 ± 4</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>1.7 ± 0.5</td>
<td>1.9 ± 0.7</td>
</tr>
<tr>
<td>RBP4 (µg/ml)</td>
<td>11.6 ± 4.1</td>
<td>12.5 ± 3.3</td>
</tr>
</tbody>
</table>

a: P<0.05, pretraining vs. detraining values

DISCUSSION

RBP4, another member of lipocalin family, has recently been added to the list of adipokines that may link obesity with insulin resistance and type 2 diabetes (YANG et al., 2005, GRAHAM et al., 2006). The results are in agreement with previous reports showing that there was no relationship between RBP4 levels and body composition parameters including body mass, BMI and WHR in female athletes. Coi et al. (2009) also indicated that RBP4 levels were not associated with body mass in obese Korean women. However previous study demonstrated that RBP4 concentration was higher in middle-aged women with higher BMI than young women (LIM et al., 2008). These discrepant results may be attributed to differences in subject populations because our subjects were athletes while non-athlete middle-aged women were participated in the Lim et al. (2008) study. The results showed that body fat percentage did not significant change after 8 weeks
exercise and after a week detraining, thus it seems that the lack of effect of exercise training on RBP4 in the present study might be due to the absence of reductions in body fat percentage. Studies demonstrated that the response of RBP4 to 1 month of exercise training was variable (GRAHAM et al., 2006), and RBP4 levels were decreased after exercise mainly in the subjects having higher RBP4 levels at baseline (LIM et al., 2008). Our results demonstrated that RBP4 levels at baseline were lower than the subjects that participated in the Lim et al. study, suggesting that athletes might have lower levels of RPB4 than non-athlete.

On the other hand, elevated RBP4 levels have been reported in subjects with insulin resistance and type 2 diabetes (GRAHAM et al., 2006, CHO et al., 2006) whereas other studies showed no relationship between circulating RBP4, obesity, and insulin resistance (JANKE et al., 2006, YAO-BORENGASSER et al., 2007). Our results showed that there was no significant relationship between RBP4 levels and insulin resistance determined by HOMA-IR. Coi et al. (2009) also indicated that RBP4 levels were not associated with insulin resistance while, Lim et al. (2008) showed that there was a positive relationship between RBP4 concentration and insulin resistance. In our study, there was virtually no change in fasting glucose and insulin and HOMA-IR after 8 weeks training and a week detraining, however Lim et al. (2008) reported that insulin resistance decreased after 10 weeks exercise training in young and middle-aged women.

CONCLUSIONS AND PRACTICAL APPLICATION
RBP4 level associated with obesity profiles and insulin resistance, thus we examined if exercise training would reduce the body fat and insulin resistance and decrease RBP4 concentrations. Our results showed that serum RBP4 levels were not affected by 8 weeks high intensity aerobic exercise in female athletes. Additional research is needed to examine our hypothesized.

ACKNOWLEDGEMENT
The work was supported by grants from the Fars Science & Research branch, Islamic Azad University. The authors gratefully acknowledge the all subjects whom cooperated in this investigation.

REFERENCES


