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Comparison of L-FABP concentration in obese and lean men after one bout intensive aerobic exercise

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Abstract

Introduction: Liver fatty acid binding protein (L-AFBP) is a novel biomarker of liver disease. Liver enzymes levels are higher in the obese than the lean people; however the effect of intensive aerobic exercise (IAE) on liver enzymes in the obese and the lean people not well known. Thus the aim of the present study was to comparison of L-FABP concentration in the obese and lean men after one bout IAE.

Material & Methods: Nine sedentary obese men (BMI: 33.7 ± 2.1 kg/m^2; $\pm$SD) and nine sedentary lean men (BMI: 17.6 ± 1.6 kg/m^2; $\pm$SD) volunteered to participate in this study. All the subjects were performed the Bruce test as the intensive aerobic exercise. Blood samples were taken before and immediately after the IAE.

Results: The results showed that alanine aminotransferase (ALT) was higher in obese group than the lean group at the baseline ($P<0.05$). L-AFBP decreased and ALT and aspartate aminotransferase (AST) increased after the IAE in the both groups ($P<0.05$). By comparison, the results indicated that the increase of ALT was higher in the obese group than the lean group ($P<0.05$); however, for L-AFBP and AST no significant differences were observed between two groups.

Conclusions: One bout IAE increases AST and ALT and decreases L-AFBP in the obese men same as lean men.

Key words: Liver function, L-AFBP, AST, ALT

1. Introduction

Overweight and obesity are potential risk factors for devastating diseases such as hypertension, coronary heart disease, hyperlipidemia, type-II diabetes, insulin resistance, stroke, cancers, sleep disorders and several others. Liver is profoundly affected by obesity where it may be associated with hepatomegaly, increased liver biochemistry values and alterations in liver histology like macrovesicular steatosis, steatohepatitis, fibrosis and cirrhosis (1). The most sensitive and widely used liver enzymes are the aminotransferases especially aspartate aminotransferase (AST) and alanine aminotransferase (ALT) (2). Previous studies indicated that the obesity is the main cause of elevated AST and ALT (3).

Fatty acid binding proteins (FABPs) are small cytoplasmic lipid binding proteins that are expressed in a tissue specific manner (4). FABPs bind free fatty acids, cholesterol, and retinoids, and are involved in intracellular lipid transport. Circulating FABP levels are used as indicators of tissue damage (5). Some FABP polymorphisms have been associated with disorders of lipid metabolism and the development of atherosclerosis (6). Liver fatty acid binding protein (L-AFBP), also known as FABP1, is highly expressed in the liver, intestine, kidney and lung. L-AFBP binds free fatty acids and their co-enzyme A derivatives. L-AFBP is thought to be involved in intracellular lipid transport. L-FABP is a sensitive marker for cell damage of liver cells in vitro and in vivo. L-FABP is also a marker for rapid hepatocyte lysis in vitro (as for example in toxicology assays) and for detection of liver damage during and after transplantation (7).

Although several studies reported the acute or chronic changes of AST and ALT concentration after exercise (2,8), the effect of exercise on L-AFBP is not well known. People who exercise heavily (eg, weight lifters, marathon runners, soldiers who perform heavy-duty labor) can have abnormal transaminase levels, as can those suffering muscular trauma, such as myocardial infarction or even surgery in which some muscles are cut. The normal repair process in these cases engenders inflammation and raises transaminase levels (9).

Previously Ahmadlu and Moghadasi (2014) reported that L-FABP was decreased ($P<0.05$) after 8 weeks concurrent training compared to the control group; however, for AST and ALT no significant changes were observed after the intervention (10). Hiraki et al. (2013), on the other hand, reported that L-FABP level did not significant changes after a single 20-min moderate-intensity exercise session (11), while Lira et al. (2010) noted that L-FABP level was decreased after 8 weeks endurance exercise with 60% VO_{2max} in rats (12). Liver enzymes levels are higher in the obese than the lean people (3); however the effect of intensive aerobic exercise (IAE) on liver enzymes in the obese and the lean people not well known. Thus the aim of the present study was to comparison of liver enzymes concentration in the obese and lean men after one bout IAE.

2. Materials and Methods

Subjects

Nine sedentary obese men (BMI: 33.7 ± 2.1 kg/m^2; $\pm$ SD) and nine sedentary lean men (BMI: 17.6 ± 1.6 kg/m^2; $\pm$ SD) volunteered to participate 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. The study was approved by the Islamic Azad University, Marvdasht branch Ethics Committee.

Measurements

Anthropometric and body composition measurements

Height and weight were measured, and body mass index (BMI) was calculated by dividing weight (kg) by height (m^2). Waist circumference (WC) was determined by obtaining the minimum circumference (narrowest part of the torso, above the umbilicus) and the maximum hip circumference (HC) while standing with their heels together. The waist to hip ratio (WHR) was calculated by dividing waist by hip circumference (cm). Body fat percentage was assessed by skinfold thickness protocol. Skinfold thickness was measured sequentially, in chest, abdominal, and thigh by the same investigator using a skinfold caliper (Harpenden, HSK-BI, British Indicators, West Sussex, UK) and a standard technique (13).

Biochemical analyses

Fasting blood samples were collected at rest (before training) and immediately after one bout IAE. Blood sample was obtained by venipuncture and plasma obtained was frozen at -22 ^{oC} for subsequent analysis. The plasma L-FABP was measured in duplicate using an enzyme-linked immunosorbent assay (ELISA) kits (EASTBIOPHARM CO., LTD Hangzhou, China). The sensitivity of kit was $<$5.13 ng/L. Plasma AST and ALT levels were measured in duplicate using an enzyme-linked immunosorbent assay (ELISA) kits (Pars Azmoun, Tehran, Iran). The sensitivity of kits were $<$4 IU/L.

Intensive aerobic exercise

All the subjects were performed the Bruce test as the IAE. This test includes 7 phases. This test is done on the treadmill and started with low intensity; every 3 minutes. The speed and the gradient (slope) of the device increased up to the level in which the subject could not perform the test anymore and became totally exhausted. For hart rate control during the exercise, each participant was equipped with a heart rate monitor (Polar, FS3c, Finland).

Statistical analysis

Results were expressed as the mean $\pm$ SD and distributions of all variables were assessed for normality. Data were analyzed using independent and paired sample t-test. The level of significance in all statistical analyses was set at P<0.05. Data analysis was performed using SPSS software for windows (version 17, SPSS, Inc., Chicago, IL).

3. Results

Anthropometric and body composition parameters of the subjects are presented in Table 1. The results indicated that body weight, BMI, body fat percent and WHR were higher in the obese group in compare to the lean group (P<0.05).

Table 1. Anthropometric and body composition parameters (mean ± SD) of the subjects

	Obese group (mean±SD)	Lean group (mean±SD)
Age (Year)	21.7 ± 2.1	20.5 ± 0.7
Body weight (Kg)	107.5 ± 5.7*	59.3 ± 4.5
BMI (Kg/m²)	33.7 ± 2.1*	17.6 ± 1.6
WHR	1.14 ± 0.01*	0.81 ± 0.04
Body Fat (%)	34.5 ± 2.1*	6.8 ± 1.6

*P<0.05 for between-group differences.

The results of L-AFBP at baseline and after the intervention are presented in Figure 1.

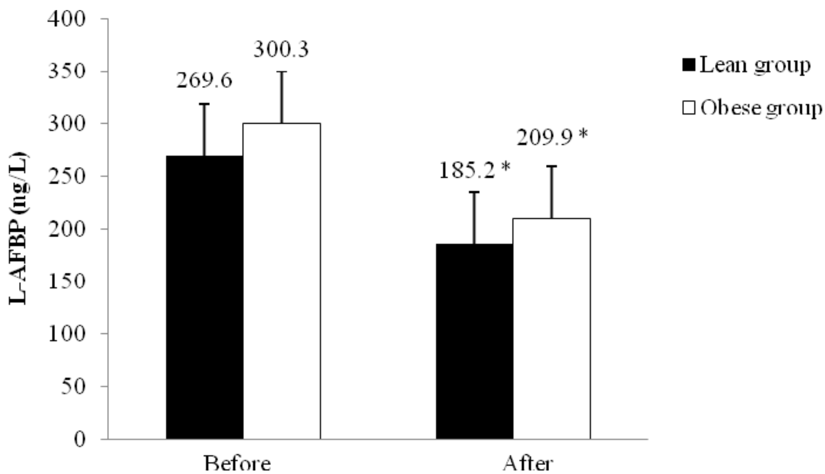

Fig 1. Changes of L-AFBP in the obese group and lean group after one bout IAE

* P<0.05 for pre-post test differences.

The results indicated that no significant difference was at baseline for L-AFBP between obese group and lean group (t=-0.9, P=0.3). After one bout IAE, L-AFBP concentration decreased in the lean group (t =6.1, P= 0.001) and obese group (t=4.2, P=0.003). No significant differences were observed for the change of L-AFBP concentration after the one bout IAE between two groups (t=1.4, P=0.1).

As the shown in Figure 2, baseline levels of ALT were higher in the obese group than the lean group (t = -2.1, P = 0.04). After one bout IAE, ALT concentration increased in the lean group (t = -2.8, P = 0.02) and obese group (t = -5.4, P = 0.001). The increase of ALT after one bout IAE was higher in the obese group than the lean group (t = -4.0, P = 0.001).

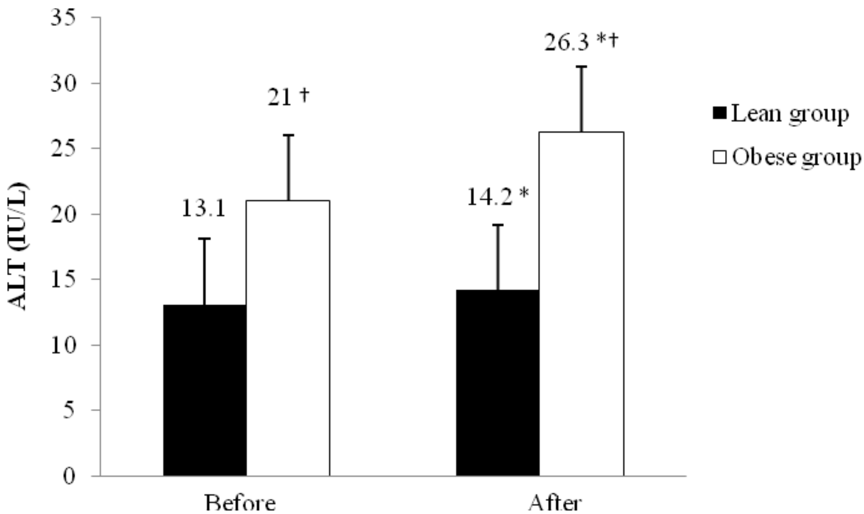

Fig 2. Changes of ALT in the obese group and lean group after one bout IAE
*P<0.05 for pre-post test differences.
*P<0.05 for between-group differences.

As the shown in Figure 3, no significant difference was observed at baseline for AST between obese group and lean group (t = -1.9, P = 0.06). After one bout IAE, AST concentration increased in the lean group (t = -8.4, P = 0.001) and obese group (t = -6.2, P = 0.001). No significant differences were observed for the change of AST concentration after the one bout IAE between two groups (t = -0.3, P = 0.7).

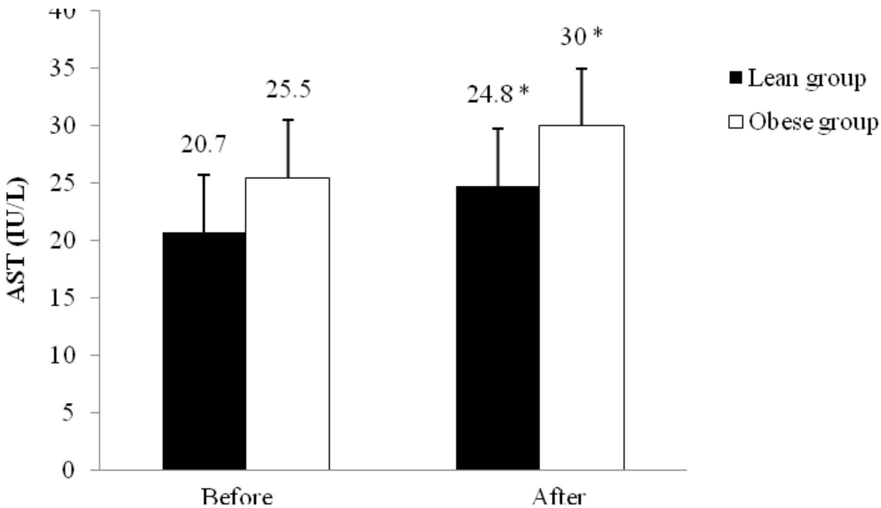

Fig 3. Changes of AST in the obese group and lean group after one bout IAE

*P<0.05 for pre-post test differences.

4. 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) (14,15). It is postulated that FABPs play an important role in the pathogenesis of metabolic diseases. Elevated levels of L-FABP were associated with liver damage (16). Previous studies indicated that the obesity is the main cause of elevated liver enzymes (3); however, our results indicated that no significant difference was at baseline for L-AFBP between obese group and lean group. After one bout IAE, L-AFBP concentration decreased in the both group and no significant differences were observed for the change of L-AFBP concentration after the one bout IAE between two groups. Hiraki et al. (2013) reported that L-FABP level did not significant changes after a single 20-min moderate-intensity exercise session (11). These discrepant results may be attributed to differences in subject populations and exercise protocol. Lira et al. (2010) showed that L-FABP level was decreased in rats after 8 weeks endurance exercise on treadmill with 60% VO_{2max} for 60 min/day and 5 days/week

(12). Ahmadlu and Moghadasi (2014) reported that L-FABP was decreased ($P<0.05$) after 8 weeks concurrent training compared to the control group; however, for AST and ALT no significant changes were observed after the intervention (10). Recently, Kosaki et al. (2017) in a cross-sectional study showed that the urinary L-FABP levels were significantly lower in the higher physical activity group than in the lower physical activity group. In the interventional study, 12-week aerobic exercise training significantly decreased urinary L-FABP levels compare to the control group. Furthermore, the relative changes in urinary L-FABP levels were significantly correlated with the relative changes in physical activity levels and mean arterial pressure after intervention (17).

Our results indicated that ALT was higher in obese group than the lean group at the baseline. ALT and AST increased after the IAE in the both groups ($P<0.05$). By comparison, the results indicated that the increase of ALT was higher in the obese group than the lean group; however, for AST no significant differences were observed between two groups. Rezaei et al (2013) also showed that ALT and AST increased after three exercise sessions in negative slope (18).

Since there was the highest density of AST enzyme in heart, liver, and skeletal muscle respectively and there was the highest density of ALT in liver, kidney, heart and skeletal muscle respectively (19). This increase of serum level may result from damage and entrance of these enzymes from all mentioned organs. Results of the present research are similar to results of the previous researches in some cases and they are different in some other cases. Devaki et al. (2010) studied male adult rats and led them to swim compulsorily for 15 min and observed that there was no significant increase in serum level of enzymes AST and ALT, 4 hours after activity (20).

The reason for difference in results of the present study and study of Devaki et al. is type and term of exercise. In the present study, cells were damaged and serum level of enzymes increased significantly due to eccentric repeated contractions and long term exercise. Praphatsorn et al. (2010) studied effect of running on treadmill on serum level of enzymes AST and ALT in male rats of Sprague-Dawley race. At the end of exercise term, speed increased to 26.8 m/min, slope increased to 10 degrees and time increased to 60 min (21). Results of the research showed that serum level of both enzymes increased significantly immediately after the exercise.

Based on findings of this research, more intensive exercise which is performed in relatively short term damages different tissues of body such as skeletal muscles due to oxidation pressure and increase of the produced free radicals and their attacks to cellular membrane (22). Although the exercise was performed every other day, serum level of enzymes increased significantly, therefore, it is recommended that the sportsmen not use these exercises especially more intensive ones and in case they perform such exercises, they should spend longer time for taking rest compared with other exercises.

The drawbacks of this research are damage of electric shock of treadmill and entrance of needle of syringe into heart, some organs and its effect on serum level of enzymes. Since one cannot surely say that in what organ or part of body there was increase of serum level of enzymes of AST and ALT resulting from release of these enzymes and considering that these enzymes have different isoenzymes (23), it is suggested that serum level of different isoenzymes be studied in the future researches.

5. Conclusion

In conclusion, the present study suggests that One bout IAE increases AST and ALT and decreases L-AFBP in the obese men same as lean men.

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Conflict of interests: No conflict of interests amongst authors.

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