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The Effect of Three Months of Aerobic Training on Serum Levels of Adiponectin and Resistin in Obese Men

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Abstract

Introduction: Nowadays, obesity is one of the major health problems in the world which is associated with lipid disorders and inflammatory profile. The aim of the present study was to determine the effect of three months of aerobic training on serum levels of adiponectin and resistin in obese men.

Methods: In this quasi-experimental study, 24 middle-aged obese men who previously had an inactive lifestyle were selected through convenient sampling in Larestan and were then randomly assigned to one experimental group (performing aerobic training three sessions per week for three month) and one control group (with no training). Fasting levels of serum adiponectin and resistin were measured in both groups before and 48 hours after the last training session. Independent samples t-test and paired samples t-test were used to determine the intra- and inter-group changes. The level of significance was set at ($p \leq 0.05$).

Results: The results revealed that three months of aerobic training led to a significant decrease in participants' body fat percentage, body mass index, and weight ($p < 0.05$). Furthermore, though there were no significant changes in the resistin levels ($p = 0.34$), serum levels of adiponectin ($p = 0.04$) were significantly increased after aerobic training.

Conclusion: It is expected that a 3-month aerobic training with an intensity of 60-80% maximum heart rate could increase the serum levels of adiponectin in the middle-aged men due to improved homeostasis and fat metabolism.

Keywords: Adiponectin, Training, Obesity, Resistin

Introduction

Although high prevalence of obesity has been reported in Europe and North America more than the rest of the world, its side effects and the resulting mortality rate in Asian countries are higher than the other countries (1). The fatty tissue is an endocrine organ that produces many factors; it affects the absorption of food, the metabolism of lipids and carbohydrates, and other processes in the human body; and also secretes a number of hormones and cytokines called adipocytokines, to which adiponectin and resistin belong (2). Resistin, a hormone secreted from adipocytes, belongs to a family of proteins with a cysteine-rich carboxyl terminus, called resistin-like molecules or proteins in the inflammatory zones (3). Adiponectin is also one of the adipocains secreted from fatty tissues which plays a crucial role in regulating the energy needed to maintain the homeostasis of the body and metabolism of fats and carbohydrates (4). Unlike other cytokines derived from fatty tissues, adiponectin has anti-inflammatory, anti-atherogenic, and anti-diabetic effects (5). Adiponectin levels have a negative correlation with the body fat percentage, and the patients with diabetes, high blood pressure, and ischemic heart disease have lower adiponectin concentrations compared with healthy individuals (6). Moreover, adiponectin levels decrease in obese individuals (7). However, the effect range of exercise training on these factors has

been reported to be very wide (8); Ping et al. (2007) and Kadoglou *et al.* (2007) indicated a significant decrease in resistin after aerobic trainings (9, 10). Balducci *et al.* (2009) reported that 12 months of regular physical activity reduced resistin in patients with diabetes and overweight (11). Likewise, the results of a study conducted by Friedenreich *et al.* (2011) revealed that the level of serum resistin decreased after six and nine weeks of aerobic training in postmenopausal women (12). Based on the presented results, it is expected that aerobic training could moderate the general risk factors for obesity such as decreasing the serum resistin and reducing the insulin resistance and its associated abnormalities (13). Regarding the effect of aerobic training on adiponectin, the results of pertinent studies indicate that exercise with an appropriate intensity for a period of more than two months has a beneficial effect on adiponectin (14). The effectiveness of each of the high-intensity interval training (15) and continuous training (16) on increasing the levels of adiponectin has been confirmed (17). Hence, it seems that aerobic exercise training can reduce the inhibition of adiponectin expression by decreasing the inflammatory factors (18), and thereby it can decrease the risks of obesity (6). In a study conducted by Akbar pour (2013), it is reported that a 12-week course of aerobic training resulted in improved adiponectin in obese and inactive young men (19). Ko *et al.* (2014) revealed that serum levels of adiponectin have increased after 12 weeks of regular aerobic training (20). Despite the above evidence, the results of a study by Haghighi *et al.* (2013) addressing the effect of a course of aerobic training on serum levels of resistin in obese men indicated that ten weeks of aerobic training did not have any effects serum levels of resistin in obese men (21). In addition, Shahgholi *et al.* (2012) showed that exercise training in the absence of diet control has no effect on serum resistin levels in obese subjects (22). Śliwicka *et al.* (2012) specified that the effect of systemic exercise training on the concentration levels of adiponectin and resistin is low (23). Moreover, Punyadeera *et al.* (2005) reported no significant changes in the levels of adiponectin following exercise in healthy participants with normal weight (24). Therefore, the study of research evidence suggests a contradiction in the response of these variables to exercises training. The observed contradictions in the findings can be attributed to the differences in the type of exercise protocol in terms of the duration, intensity, and frequency of exercise sessions, as well as the type of study population, which make it difficult to achieve a comprehensive and consistent outcome. Therefore, considering the contradictions in the presented evidence, the present study aimed at determining the effects of three-month aerobic training on serum levels of adiponectin and resistin in the middle-aged obese men, who previously had an inactive lifestyle.

Methods

In this study, 24 participants were selected purposefully from the accessible population of obese men in Larestan, and divided into two groups including 1.Cotrol (without with no training program), and 2. Experimental (with a three-month training program). Inclusion criteria were non-smokers with 30≤BMI; non-specific diseases such as cardiovascular disease, diabetes, thyroid and metabolic disorders, and hormone imbalance; lack of orthopedic problems; lack of specific medications and any specific diets; and lack of any regular exercise trainings over the past six months. Furthermore, participation in any diet control or weight loss programs over the last six months was considered as the exclusion criterion. An introductory session was arranged for the selected participants, in which all the individuals were informed about the objectives and conditions of the research. Moreover, a written consent was obtained from the participants. All tests were carried out two days before and two days after the

study in two phases. At first, anthropometric indices such as height, weight, abdominal circumference, body mass index, and body fat percentage were measured in both experimental and control groups. To this end, the weights of the participants were measured, while they had the least pieces of clothing, using a Digital weight Meter with a precision of 100 grams, which was made in Taiwan. Moreover, participants' height was measured using a Digital Height Meter while the participants were barefoot. Body mass index (BMI) was calculated by dividing participants' body weight (kg) by the square of their height (m^2). To measure the body fat percentage, first, the thickness of the subcutaneous fat was measured at seven sites of the body, then body fat percentage and fat-free body mass were calculated using the Jackson-Pollock equation. Next, all participants were gathered at the medical laboratory between 8:00 and 9:00 a.m. after 10-12 hours of fasting and 8 hours of sleep 8:00. Five cc of venous blood samples was taken from participants' vein, the specimens were then centrifuged to separate the serum, and the sera were frozen and stored at -86 ° C to be used for measuring the desired variables. The adipocytokine values of adiponectin and resistin were measured by the enzymatic glucose oxidase assay (kits of ***Pars*** Azmun ***Co.)*** using the Cubas autoanalyzer device made in Germany. It should be mentioned that all participants were prohibited from any heavy physical activity for at least three days before blood sampling in the pre-test phase. The experimental group program included running on a treadmill with ***zero***-percent gradient and with an intensity of 60-80% maximum heart rate in three sessions of 45-60 minutes per week for three months. Ten minutes to warm up and ten minutes to cool down were considered in each session. The intensity of training over the first sessions was minimized and was then gradually increased. The control group was obliged to refrain from any additional physical activities, with the exception of their daily activities. Finally, Kolmogorov-Smirnov test was used to determine the homogeneity between the groups and the independent samples t-test was used to determine the intra- and inter-group changes ($p \leq 0.05$).

Results

For declaring the finding of research and achieving objectives, the collected data after statistical analysis are presented in two Tables. The demographic characteristics of the subjects under review are in Table 2. Both groups were compared regarding age, height, weight, lean body mass (LBM), and body fat percentage (BFP), and the homogeneity of the two groups was confirmed by the Kolmogorov-Smirnov test. In other words, in this test, considering the higher significance level of the value 0.05, the assumption of normal distribution of these variables in the study groups is approved ($p \geq 0.05$). In the study of intergroup variations, it's been specified that aerobic training significantly reduced the body weight, body mass index (IBM) and body fat percentage (BFP), also changes in plasma levels of adiponectin, significantly increased in the training group than the control group ($p \leq 0.05$). Also, the results of the independent t-test for Resistin changes showed that despite the decrease in serum resistin levels in the exercise group, the discrepancy between the training group and the control group was not significant ($p \geq 0.05$). The results of this study are shown in Table 3.

Discussion

The findings of this study indicate a significant increase in serum adiponectin levels following aerobic training in the experimental group. In other words, in this three-month study on the middle-aged obese men who previously had a sedentary lifestyle, aerobic training led to a significant rise in the serum's adiponectin level.

Table1. The results of Kolmogorov- Smirnov test for homogenous distribution of research variables in the study groups

Variable	Groups		P
	Experimental group (M± SD)	Control group (M± SD)	
Age (year)	36.54 ± 55.5	34.83 ± 4.62	0.258
Height (m)	178.43 ± 7.37	162.17 ± 6.42	0.870
Weight (Kg)	98 ± 9.28	100.36 ± 3.51	0.241
Body fat percentage	31.88 ± 3.33	33.12 ± 1.55	0.882
BMI Kg/m	31.54 ± 2.54	32.57 ±1.90	0.423

Table 2. the results of independent t- test for review the changes of research variables in experimental and control groups

Variable	Time	Experimental group	Control group	P
Weight	Pre-test	98 ±9.28	100.36±3.51	0.001*
(Kg)	Post-test	92.41 ±8.86	101.92 ±3.96	
Body fat percentage	Pre-test	31.88 ±3.33	33.12 ±1.55	0.001*
(%)	Post-test	28.04 ±2.75	32.97 ±1.12	
BMI	Pre-test	31.54 ±2.54	32.57 ±1.90	0.001*
(Kg/m^2)	Post-test	29.63 ±2.11	33.06 ±1.59	
Resistin	Pre-test	3.28 ±2.85	3.41 ±3.12	0.34
(pg/ml)	Post-test	3.20 ±1.01	3.52 ±1.2	
Adiponectin	Pre-test	5.9 ±1.3	5.62 ±1.18	0.043*
(µg/ml)	Post-test	6.97 ±1.51	5.53 ±1.34	

*P ≤ 0.05 is significant

This finding is consistent with the results of the investigation of Kraemer and Castracane (14), Keating *et al.* (15), Pasqualini *et al.* (16), Jeremy *et al.* (25), Akbarpour (19), Ramezani *et al.* (26), Dehghani and Mogharnasi (27), Abbasi-daloii and Maleki-dollarsataqi (28). Based on human and animal research, about this finding, it could be said that negative energy balance methods such as aerobic exercises will improve the symptoms of obesity, through various cellular mechanisms such as changes in the level of adiponectin (29). In explaining this finding, in the first place, regarding adiponectin function in the presence of obesity, there is a negative correlation between weight, body mass index and body fat percentage with adiponectin levels, And in the case of obesity, due to inflammatory effects of overweight, high fat accumulation, and high body mass, adiponectin secretion decreases; this reduction in adiponectin makes the regulation of the energy needed to maintain homeostasis, metabolism of fat and carbohydrates difficult. Therefore, it is necessary to provide an intervention program and treatment with low complications in obese people in whom having reduced adiponectin secretion and with defective hemostasis and metabolism of fats and carbohydrates. As the results of this study show, the aerobic exercises with an intensity of 60-80% of maximum heart rate can be a

good suggestion. According to the results of this study, providing three-months of aerobic exercise with an intensity of 60-80% of maximum heart rate can significantly increase adiponectin secretion in middle-aged obese subjects, which can be due to three factors: First, the concentration of plasma fatty acids has a positive regulatory effect on the adiponectin secretion, and it is possible that aerobic exercise with an intensity of 60-80% of maximum heart rate has led to the rise in the plasma levels of fatty acids and Adiponectin in the intercellular space by increasing lipolysis in adipose tissue. Secondly, the more energy consumed during exercise and the higher the body's metabolism pressures, more adiponectin is needed to regulate metabolic flow during activity, and more adiponectin is secreted. Therefore, in this study, another cause of increased serum adiponectin levels in middle-aged obese men could be an increase in metabolic pressure induced by aerobic exercise with an intensity of 60-80% of maximum heart rate given to participants. In fact, the training program provided to the participants could increase the serum adiponectin levels in middle-aged men due to the intensity and duration required for metabolic pressure, weight loss, and body fat loss. Studies show that the minimum duration of exercise that has been able to positively affect adiponectin levels can be two weeks (35). Of course, physical exercises that have the severity and duration required to lose weight or reduce body fat mass will play a more important part in increasing adiponectin levels (36). Therefore, weight and body fat loss significantly affect serum adiponectin levels, and exercise without such weight loss and reduced fat mass cannot increase adiponectin (37). In this study, aerobic exercise caused a decrease in body weight and body fat mass and, consequently, increased serum adiponectin levels. Thirdly, the inactivity (sedentary) of middle-aged obese men preceding the training program and their lack of readiness could be another reason for increasing adiponectin following an aerobic exercise of 60-80% of maximum heart rate. Because of the intensity and duration of exercise, they may have better responded to the high metabolic rate due to the high excitability threshold and as a result, adiponectin secretion has increased in the participants. In this study, the serum resistin level did not significantly change in response to aerobic training intervention despite the significant increase in adiponectin. This finding is consistent with the results of investigations done by Jamurtas *et al.* (30), Samadian *et al.* (31), Shahgholi Abasi *et al.* (22). In contrast, it is inconsistent with the finding results of Shavandi *et al.* (32), Balducci *et al.* (11), Jones *et al.* (33), Tofighei *et al.* (34). In this regard, it can be said that research records about the effect of exercise on serum Resistin point to contradictory results of decreasing, increasing or not effecting. In this regard, it said that research records about the effect of exercise on serum resistin refer to contradictory results of decreasing, increasing or not affecting. In this research, regarding the performance of resistin in the presence of obesity and why three-months of aerobic exercises with an intensity of 60- 80% of maximum heart rate failed to change the level of serum resistin, First, it should be said that resistin is a protein hormone which is secreted from white and brown adipose tissue and released into the bloodstream. resistin regulates decreased mitochondrial activity and is also involved with many physiological systems such as inflammation and energy homeostasis. It is likely that serum level of resistin has been increased in the obesity. Therefore, in obese people who have an enhanced rate of Resistin secretion, it is expected that athletic exercises will reduce serum levels of Resistin due to positive effects on weight loss, increased adipose tissue lipolysis(fat burning), and other physiological factors. However, in this study, no such result was obtained and a three-month aerobic exercise period with 60-80% of maximum

heart rate did not result in a significant reduction of the serum Resistin level in obese men and only a slight decrease was revealed. Therefore, it seems that the duration, intensity, and type of exercise, plus gender, are factors influencing the production and reduction of Resistin, which requires more research to investigate their effects. However, in this research, it seems that if the intensity and duration of exercise were both respectively changed in different thresholds and lengthened, the probability of a significant decrease in the Resistin level was also increased. Moreover, the type of diet is among other suspicious factors that may have prevented Resistin from declining and should be considered in future research.

Conclusion

According to findings of present study it appears that although a three-month course of aerobic training with an intensity of 60- 80% maximum heart rate did not lead to a significant reduction in resistin level, however, it could significantly increase the serum level of adiponectin in the middle-aged obese men.

Ethical issues

Not applicable.

Authors' contributions

All authors equally contributed to the writing and revision of this manuscript**.**

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