

Interaction Effect of 8-Week Aerobic Exercise and Omega-3 Fatty Acid Supplementation on Plasma Adiponectin Concentration

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Article information	Abstract
<p>Article history: Received: 1 Dec 2011 Accepted: 27 Feb 2012 Available online: 30 Oct 2012 ZJRMS 2013; 15(3): 36-41</p> <p>Keywords: Adiponectin Aerobic Exercise Omega-3 Fatty Acids Cardiovascular Disease</p> <p>*Corresponding author at: Department of Exercise Physiology, University of Sistan and Baluchestan, Zahedan, Iran E-mail: m_mogharnasi@yahoo.com</p>	<p>Background: Scientific evidence indicates the impact of aerobic exercise and omega-3 fatty acids - both –are for the improvement of the cardiovascular system .The purpose of this research was about studies interaction effect of 8 weeks aerobic exercise and omega- 3 fatty acids supplementation on plasma adiponectin concentration of elderly men.</p> <p>Materials and Methods: In this study, 36 male non-athletes aged were between 50 to 70 year age range of men aged the city of Genaveh. Statistical sample of 36 male non-athletes in the age range 50 to 70 years old randomly selected in four groups of nine persons, respectively, the first group: exercise supplemental omega-3, Group II: Exercise placebo group: supplementation with omega-3 groups quarter: placebo. Endurance exercise training program includes 24 sessions and 3 sessions per week, with duration and intensity was determined. (55-70% HRmax). Daily supplements of omega-3 fatty acids were 2 Capsule. Blood samples were taken after fasting 14 hours before the study and 48 hours after the last training session was conducted. The data Kolmogrov-Smirnov, <i>t</i>-test, One-Way Anova at significance level of $p \leq 0.05$ were analyzed in SPSS 17.</p> <p>Results: The results of research after 8 weeks showed that moderate-intensity aerobic exercise and omega-3 fatty acids supplementation, only increased in the exercise + omega-3 fatty acids group (7.8%) that could not created a significant increase in plasma adiponectin concentration groups. Also in final of research did not show a significant difference between groups in compare after 8 weeks.</p> <p>Conclusion: The results showed that by aerobic exercise and use of omega-3 fatty acids and increase amounts of adiponectin and its anti boil property, perhaps maybe that, adiponectin by effect of its preservation has a great role in prevention and reduce of cardiovascular diseases.</p> <p>Copyright © 2013Zahedan University of Medical Sciences. All rights reserved.</p>

Introduction

Adiponectin gene expression in fat cell size is regulated, and whatever size is smaller fat cells, adiponectin gene expression will be more [1, 2]. Obesity is increasing the size of fat cells, while is reduced adiponectin gene expression. Smaller fat cells secrete more adiponectin after weight loss [3]. Adipose tissue is not just a place to store surplus energy, but fat cells, some proteins are secreted, that they regulate different biological functions. These proteins, called generally adipocytokines, which include a leptin, rsystyn, adypsyn and adiponectin [4]. Level of physical activity and physical fitness may be a vaccine for prevention and treatment of mental disorders and physical diseases to some extent the change [5]. Adipose tissue, which is more than 10 % of body weight, not only is as a source of energy storage, but is considered as an active endocrine tissue [2]. Adipose tissue produces actually several cytokines Action-oriented, which are called adipocytokine [6]. Adiponectin is an adipocytokine which has effects of important metabolic [7]. Adiponectin has close relationship with obesity that has been considered by

scientists in this field. Adiponectin levels with weight fat body gain decreased, especially visceral fat. Also shown is, the amounts of the hormone leptin is an inverse relationship [8, 9]. Patients with diabetes, high blood pressure and ischemic heart disease suffer, Adiponectin levels is lower than in healthy subjects [5].

Zoccoli and colleagues studied four years stated, Subjects had adiponectin deficiency, and most normal people have died due to heart disease [10]. Therefore, reduction of adiponectin as a novel cardiovascular risk factor-disease is mentioned [11]. Also has been observed that adiponectin exerts insulin-independent activation of AMP kinase [12]. Researchers have also stated Pharmacological effects of adiponectin related in reducing insulin resistance in obese mice, the role of hormones in plasma fatty acid and triglyceride stores in muscle and liver [13]. This is how changes in tissue hormone content of the various interventions such as diet, exercise and use of supplements such as omega-3 and less attention has been done. Omega-3 fatty acids, these fatty acids are polyunsaturated fatty acids and the nomenclature, is

bonding structure of carbon – carbon. Eicosapentaenoic acid and docosahexaenoic acid, belong to the group of omega-3 fatty acids. Scientific evidence suggests omega-3 fatty acids on health of the heart - vascular and brain, it called and classified. "Essential", Because of the body cannot manufacture them from other materials and should be provided through normal supply [14]. Several studies have been done on omega-3 fatty acids and its effect on the cardiovascular system is specified healthy. According to studies, Omega 3 fatty will help to improve cardiovascular health and strengthen these acids for the long term. However, aerobic exercise using aerobic machines can be cause of efficiency of cardiovascular system. Therefore, the research background check, a study of the effects of aerobic exercise and omega-3 fatty acid supplementation on plasma adiponectin concentration was not available to review. Studies only the effect of aerobic training on plasma adiponectin concentration has been emphasized, The study was conducted to answer this question, the interaction effect of 8-week aerobic exercise and omega-3 fatty acid supplementation on plasma adiponectin concentration in elderly people?

Materials and Methods

This quasi-experimental study was conducted in 1389 a sample of 36 men age range 70-50 years old with no regular exercise were formed. Sampling in the study sample was available. This study was conducted randomized double blind. After completing a consent form and demographic questionnaire containing personal data, medical records and was athletic, 36 people without disease of the research community (Cardiovascular, pulmonary, renal, etc.) skeletal abnormalities and were not taking medications, Volunteers were selected and randomly (Based on random numbers table) divided into four groups: 1. Exercise+Omega-3 supplements, 2. Exercise+placebo, 3. Supplements Omega-3, 4. Placebo groups. Training program in the two groups were followed for 8 weeks, while the subjects in the placebo group and omega-3 fatty acid supplementation had no special training. Subjects in the group receiving omega-3 fatty acid supplement daily for 8 weeks and 2,000 milligrams of omega-3 fatty acid supplement containing 360 mg to 2 capsules and 240 mg eicosapentaenoic and docosahexaenoic acid received. Placebo group received two placebo capsules daily look quite similar to capsules of omega-3 fatty acids.

Training for 8 weeks with three sessions per week, on Saturdays, Mondays and Wednesdays for training was conducted in two groups. Each training session in all groups consisted of three stages, 1. Stage warm up, running down the steps of 6 minutes and 4 minutes in each session was a stretch to 10 minutes totally waiting. 2. Stages of specific exercises, began 20 minutes of aerobic exercise include running with 65-55% of maximum heart rate (HR max) in the first four weeks in each session. To control the intensity of exercise training heart rate for

individuals taking the pulse in the wrist area and was calculated using POLAR heart rate meter, therefore the equation of maximum heart rate (MHR) =220 – age, were determined and the 55 to 70 % of maximum heart rate, heart rate was determined for each individual. After a period of four weeks to observe the principle of overload intensity aerobics for 26 minutes and then increased to 70-65 % of maximum heart rate. 3. Cool down stage, the cool down allocated to be used include 4-3 minutes of running and walking, and then after 5 minutes of stretching exercises and was less than 10 minutes total time.

Dietary recommendations for subjects according to their normal diet and no special diet and did not taking certain medications. From all subjects after 14 hours fasting blood samples to determine blood adiponectin levels were performed as pre-test. After controlling for health status questionnaire were present for measuring physical activity and body weight, blood pressure and were taken 10 ml of blood from the vein right arm in the elbow by a laboratory scientist.

Blood taken into tubes vano jacket kept and after about half an hour 15 minutes with blood tubes containing blood were centrifuged at 3000 rpm and blood plasma was separated. After 8 weeks of exercise and 48 hours after the last training session and the same way pre-test. Blood samples were taken from four groups and the results were recorded as the test.

In this study, adiponectin measured by ELISA kits midagonestik made in Germany and 2100 State Fax machine was made in America. In this study, according to the consent of individual subjects and their voluntary participation in the study and practice of compliance Practice with regard to age, with the direct supervision of a researcher, compliance with ethical issues in human studies were considered. Data analysis using tests of Kolmogorov-Smirnov, independent *t*-test, one-way analysis of variance (ANOVA) at levels significantly $p \leq 0.05$ conducted through SPSS-17 software.

Results

In table 1 have been determined general characteristics of subjects in four groups. *t*-test to compare pre-test results between 4 groups of adiponectin are presented in Table 2 that there was no significant difference with *p* values. In other words, 8 weeks of aerobic exercise and omega-3 fatty acid supplementation has failed to make significant change in plasma adiponectin concentration.

Table 3 shows ANOVA test varies between different groups in the pre-test adiponectin. Given that the *p* value obtained from 0.05 is larger, there is no significant difference between the mean adiponectin in different groups. It means the four groups before the exercise, of adiponectin have been in similar situations ($p=0.153$).

ANOVA test results showed at the end of the study variables between different groups in adiponectin-test there is no change in of adiponectin average significant differences between different groups (Table 4).

Table 1. General characteristics of research subjects

Groups	Age(yr) (Mean±SD)	Weight(kg) (Mean±SD)	Height(cm) (Mean±SD)
Exercise+Omega-3 supplement	58.80±3.63	86.90±8.74	178±4.16
Exercise+placebo	56.30±3.45	78.80±10.83	177±6.20
Omega-3 supplement	56.90±3.02	78.32±8.51	175±5.98
Placebo	57.50±3.48	80.35±11.50	176±4.80

Table 2. Changes in plasma adiponectin in pre-test in different groups

Groups	Pre-test Mean±SD	Post-test Mean±SD	p-value
Exercise+Omega-3 supplement	10.34±1.65	11.16±8.74	0.079
Exercise+placebo	12.76±3.38	12.99±3.97	0.494
Omega-3 supplement	13.70±2.98	13.73±2.42	0.937
Placebo	12.32±3.91	12.39±3.94	0.617

Table 3. ANOVA test for comparison between groups in pre-trial adiponectin

Variable	Sum of squares	df	Mean Squared	F-statistics	p-value
Between groups	53.92	3	17.97	1.88	0.153
Within groups	306.18	32	9.57		
Total	360.01	35			

Table 4. ANOVA test for comparison between the four groups of adiponectin in the test

Variable	Sum of squares	df	Mean Squared	F-statistics	p-value
Between groups	3.52	3	1.171	1.16	0.341
Within groups	32.39	32	1.01		
Total	35.90	35			

Discussion

In this study, 8 weeks of aerobic exercise and the intake of omega-3 fatty acid supplement did not cause significant change in plasma adiponectin concentration. Although were not found to pay research into the interactive effects of omega-3 supplementation on exercise and adiponectin concentrations. The findings with other studies regarding the effects of omega-3 supplementation on exercise or cardiac index-vessel to be discussed. According to research findings, despite the tangible increase in adiponectin concentration the omega-3 supplements and exercise + exercise + placebo groups but this increase in adiponectin was not significant between groups.

Most of the observed increase in plasma adiponectin concentrations of omega-3 supplements + exercise group compared with the three other groups. We know, this can increase the plasma adiponectin concentration is primarily due to the simultaneous effect exercise and consume omega-3 on this index. Although this increase was not significant, But could be significant in terms of percent (8.7 %). This is indicated, that The intensity and duration of exercise in order to further increase adiponectin

concentrations were not effective, or perhaps a tangible increase in adiponectin concentration Because of last session effect And blood samples within 48 hours after the test was considered to be.

Mohebhi and colleagues showed that 12 weeks of intense aerobic exercise, 4 days a week with an intensity of 80-75% of Vo2max, Increased plasma adiponectin in obese middle-aged men and stated the volume of aerobic activity (duration, intensity and frequency), high plasma adiponectin levels increased in healthy middle-aged men and obese [15].

Kriketos and colleagues also increase adiponectin concentrations in obese and diabetic patients after short-term physical training reported [16]. Another issue is about the lack of significant changes in adiponectin concentrations in different intensities of exercise and the relationship between adiponectin and lipid changes. Research shows changes in blood concentrations of adiponectin have an inverse relationship to fat mass [17]. The positive changes associated with weight loss and increased muscle mass, No significant change in adiponectin concentrations of subjects in this study for aerobic activity during 8 weeks it may be No significant effect of 24 sessions of physical activity is the amount of fat mass. In numerous studies conducted in adiponectin, this point is very evident; this indicator is very closely related to obesity. It means whatever the rate of obesity is increasing, Adiponectin concentration is reduced. In considering this issue, is likely one reason for the lack of significance in this study, the average weight of the participants had a normal or desirable. Although the precise pathway by which adiponectin is the oxidation of fatty acids remains unknown, but it is clear that is related in adiponectin gene expression and adipose tissue the change. As mentioned the samples were randomly selected and weighted selection has not been made, So, One reason for this failure is achieving significant results the participants of the test weight were not separated. If another group were includes people with high body weight increases, more favorable results were obtained. While hamedinia and its colleagues found a significant inverse relationship between adiponectin and insulin resistance were observed and they concluded that aerobic exercise is not associated with weight loss, it can help to improve insulin sensitivity, but has no effect on adiponectin, and adiponectin is inversely associated with insulin resistance [18].

Berg and colleagues showed in their study, Adiponectin treatment of muscle and gluconeogenesis in rat liver triglycerides is reducing, And this suggested that raised it is Interface message between muscle and adipose tissue adiponectin , Accordingly, Adiponectin activated protein kinase pathway with activation of AMP, Fatty acid oxidation in muscle cells increases [19].

Ring-Dimitriou and colleagues also were investigated Changes of plasma adiponectin with the metabolic syndrome in adults aged over 24 months exercises And reported increased heart and respiratory fitness adiponectin to increase 15 percent [20]. Kroemer and colleagues in a study , Review and revise Began to

investigate the effect of exercise on adiponectin concentration and this hypothesis suggested that to consider it Volume response to exercise in how influential factor is adiponectin, so that long-term exercise training volume (intensity, duration, frequency), high adiponectin concentration is effective. It may be and perhaps no significant changes in this study, from short periods of exercise and moderate exercise that was 55 to 70% HRmax. There is some evidence that the effect of adiponectin to insulin sensitization as a result of activation of AMP kinase Enzyme. It seems to be that adiponectin is a hepatic glucose production via a direct effect on the increased fat oxidation in liver and muscle can be reduced fat stores. It can increase insulin sensitivity. Adiponectin can by negative regulation of Key enzymes from process of gluconeogenesis such as pyruvate phosphatase and glucose 6-phosphate to prevent from hepatic glucose production and to enhance the effect of insulin. Similarly, Low concentrations of adiponectin in obese man with increased intracellular fat stores and is associated with impaired insulin action [21]. Dabrowski and colleagues showed, that an exhaustive training session Intensity 65-55% of maximum heart rate, statistically significant increase was in levels of adiponectin than the relaxation time. so adiponectin levels increased in higher intensity, but this increase was not significant statistically [22].

The Punyadeera and colleagues reported that there was no change in their research, adiponectin levels following exercise. to consider it, cause of this difference in response rate adiponectin following the activity May be effective in changing variables adiponectin, including fitness level, weight, presence or absence of disease, diabetes, cardio - vascular and metabolic syndrome, age and sex of subjects and the intensity, duration and type of training [23]. Many of the changes in adiponectin levels may, with changes in plasma volume is related to the activity. survey showed that, with the onset of exercise Almost immediately, blood plasma volume due to the interstitial space is low, This event, There are two factors that result, Increase in capillary hydrostatic pressure of the hand, hypertension, therefore, Hypertension Pushing water through the vessel to the interstitial space. On the other hand, Accumulation of metabolic wastes resulting from the active muscles, Osmotic pressure Cell increases that attracts fluid into the muscle. Although may the amount of exercise-induced changes in plasma volume Is associated with physical fitness and sport adaptation, But clear that Prolonged activity of the plasma volume decreases from 10 to 20 percent and perhaps more. On the other hand It is hypothesis that The energy expenditure during exercise is more, organism will be under pressure of high metabolic and may be this hormone increases the likelihood of increased physical activity. The assumption is that, As regards Adiponectin concentration in group exercise and omega-3 supplementation in the present study, the effects of aerobic exercise is most of the omega-3 supplementation. And this result with the research achievement Jurimae and colleagues the effect of prolonged exercise on plasma

adiponectin in elite male rower was investigated is Being aligned. In this study, in addition, adiponectin, maximum oxygen uptake and aerobic power also measured before and after training. Exercise began by low intensity and long duration, while all the evaluations of body composition after training, Measures were similar before exercise, fasting adiponectin, after the training period, there was no significant variation, and significantly decrease body mass, body fat mass and lean body mass was associated. In general, fasting adiponectin, during prolonged exercise in men rower, despite significant changes in the amount of exercise did not change [24].

In this study, the possibility that omega-3 fatty acid supplementation in exercise at the same time with a non-significant increase in the exercise group and omega-3 supplements were not ineffective. Because in the second group also, Exercise and consuming similar placebo supplement omega-3 and only was consumption mega-3 in the third group. What is a significant issue in the present study, Research subjects who are living in the south of Iran the main diet the people is consists of fish that is rich source of omega-3. This is probably, that these people in front of the omega-3 are saturated in contrast, omega-3 supplement and not significant. If this research was done in the mountainous regions of Iran's border cities perhaps a more interesting result of omega-3 supplements are concluded, the simultaneous combination of omega-3 supplementation was associated with more effective workouts. It should be noted at this point, Research so far that omega-3 supplements and exercise can be done simultaneously, not been done. So, the background of this study is limited. Kondo and his colleagues showed, The shortest duration of exercise with a diet that could affect the amount of adiponectin, is a twelve week [25].

This suggests that, Omega-3 fatty acid supplementation during exercise may affect adiponectin concentration was not enough (8 weeks); It felt more time is needed for efficacy. In summary we can say, Although low doses of omega-3 may do not play a significant role in weight loss in the short term, But due to its positive effects (biochemical and psychological) with low calorie diets may help obese people to greater health, They continue to bear the weight loss program using appropriate and proper diet increase (diet of simple, easy and full of nutrients). Omega-3 fatty acids may be desirable, Mental and emotional conditions to help them achieve appropriate weight [26].

According to many researchers, Mechanism of gene expression and adiponectin concentrations after exercise - a long-term exercise, is weight loss and improve body composition [28, 27]. As was stated, Adiponectin and its expression is reduced in obese and negative correlation between adiponectin concentrations and visceral fat and subcutaneous fat is in the core area. Also, this protein has characteristics by inhibits TNF α and is anti-inflammatory and anti-atherogenic. Similarly regulate energy homeostasis; with body weight loss requires increased concentrations of circulating adiponectin [3, 15, 29]. The limitations of this study, was the Lack of precise control

diet throughout the study subjects, although the diet program was recommended for all. Also, the study measured adiponectin levels was performed 48 hours after exercise, it is recommended for accurate tracking of changes in adiponectin levels after shorter periods of physical activity will be investigated. Plasma volume changes were not measured in this study. So, seem necessary that adiponectin levels with changes in plasma volume correction. In general, Although the increase in adiponectin concentration was not significant, But practically significant increase in exercise, omega-3 fatty acid supplement (8.7 %) was observed, that shows due to the increase in adiponectin levels and its anti-inflammatory properties, as a result, aerobic exercise and supplementation of omega-3 fatty acids, Perhaps , this protein with its protective effect has an important role in

preventing and reducing cardiovascular disease including atherosclerosis, and the health of all people seem to be beneficial.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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