The effects of low impact aerobic exercise on acute phase proteins in older obese women with type II diabetes

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Abstract

Several studies have shown that adipose tissue plays an important role to produce large amounts of inflammatory cytokines such as IL-6 and CRP by the development of insulin resistance, diabetes and metabolic syndrome. The aim of this study is investigation of the effect of low impact aerobic exercise on acute phase proteins (APPs) and lipid profile status in older obese women with type II diabetic. Twenty diabetic old women (mean age 55.05, BMI=28.06 Kg/m\textsuperscript{2}) from Izeh diabetic clinic with no specific disease were randomly assigned to two groups of training (3 times a week, 60 minutes per session), aerobic group (n=10) and control group (n=10) that blood samples were taken each of them. Then resting blood sampling and anthropometric factors were taken from anterior vein in 5cc amount, while they did not eat any breakfast for 8-hours. Experimental group were directed to the LIA exercise program such as musical aerobic exercise with 40-60 percent of maximum heart rate for 50 minutes, 3 sessions per week for 8 weeks. After 8 weeks blood samples, APPs, lipid profile and anthropometric measures were taken from two groups. 8 week Low impact aerobic exercise in diabetic old women caused a significant decrease in CRP concentrations (p=0.01) A slight but no significant decrease in serum IL-6 (p=0.85), fibrinogen (p=0.29), WBC (p=0.14), TG (p=0.26), LDL (p=0.12) and TC (p=0.63), also caused a slight but no significant increase in HDL (p=0.93) compared with the control group. Based on research results, probably more intense or over 8 weeks aerobic training could be effective on APPs levels and lipid profile in obese diabetic elderly women.

Keywords: Diabetes type II, Aerobic dance training, APPs and obese older women

1. Introduction

The applied exercise physiology track in the sport and exercise science program provides people with knowledge in health/wellness and applied physiology. In addition, many exercise physiologists study the effect of exercise on the mechanisms by which exercise can reduce or prevent diseases. Nowadays diabetes diseases is fifth leading cause of mortality in the community and is fourth most common
cause of visits to the doctor. According to the latest WHO report in 2025, the population of people with diabetes will increase to 122% (Kashfi et al. 2008).

Type II diabetes or NIDDM is common in middle-aged and older people especially in people who have overweight. Risk factors for Type II diabetes could be obesity, age, glucose intolerance, hyperlipidemia etc. On the other hand, diabetes, high blood harmful lipoproteins (LDL, VLDL, TG, and TC), inactivity and other traditional risk factors are predictors of cardiovascular diseases. While the acute phase proteins are known as new risk factors (Dehghan et al. 2013). Relationship between obesity, NIDDM and cardiovascular risk factors, particularly new acute phase proteins has been shown in several studies. Acute phase proteins (APPs) are a group of glycoprotein that released under the effect of some factors such as inflammation, necrosis, bacterial and viral infections and malignancies of the liver. Most of these proteins decrease inflammatory in tissue, removal and destruction of tissue blocks the repair of damaged tissue. CRP, fibrinogen and white blood cells are some of well-known APPs that are important in the development of insulin resistance, diabetes (Licastro et al. 2005).

Studies have shown that large amounts of inflammatory cytokines (IL-6 and CRP) are important in the development of adipose tissue, insulin resistance, diabetes and metabolic syndrome (Amani Shalamzari et al. 2008). IL-6 is involved in the metabolism of carbohydrates, with absorption of glucose into the muscles. Therefore, it could reduce blood sugar, glucose consumed to provide muscular and with one hand lipolysis in adipose tissue decreases body weight is fat. Also, by blocking TNF-α receptor reduces insulin resistance. So it could be useful in both I and II diabetes and reduce heart disease risk factors.

Data from studies agree on the idea that increased levels of physical activity and beneficial effects on reducing inflammation in conditions such as obesity, metabolic syndrome and diabetes and healthy individuals too (Agha Alinejad et al. 2011). Iuiza et al. (2011) showed decrease in CRP at patients with type II diabetes after 12 weeks endurance aerobic exercise. Medina et al. (2005) were found that 6 months physical activity caused significant reduction on CRP in 40 ≤ years’ old women. Gulcan et al. (2007) were studied the prognostic value of CRP in obese non-diabetic renal patients and showed CRP is a significant factor for coronary heart and kidney diseases. Low impact exercise has shown a significant reduction in cardiovascular risk factors for women (Dehghan et al. 2009) but there is no document about the effects of low impact exercise on older obese women with type diabetes. So, employing these exercises as sustained physical activity in the elderly (who entered the menopause stage and have more cardiovascular risk factors) could increase the effectiveness of these activities. Due to the important role of APPs in occurrence of CVDs and causing mortality in the elderly people -especially diabetic people- and growing elderly population, physical activity in mentioned people seems necessary. In order to encourage the elderly people to continue physical activity through their life, besides the positive effects of exercise in reducing indices of obesity, use of the beat of music (rhythmic aerobic exercise) seems effective in low impact exercises. Hope that result of current study answer a question in applied exercise physiology.

2. Materials and methods

Samples election: The participants of the study were 20, postmenopausal diabetic women (mean age: 55.05) from diabetic clinic at Izeh, Iran. Subjects were divided purposefully to experimental (n=10) and control (n=10) groups. Subjects were informed of the experimental procedures
and potential risks associated with participation and they signed written consent. All subjects had mental health, no cardiovascular diseases, and they did not smoking and no regular exercise before present study. Participants were asked to don’t alter their diet during the study and to record their daily food intake. General properties of subjects are showed in Table 1.

Pre-test measurements: The subjects anthropometric measurements (weight, height) were measured and 5cc blood sample were taken from their anterior venous brachial in 8:30 am, after 12 hours overnight fasting. Then blood samples were immediately froze and were transferred to the laboratory in order to measurement their APPs and lipoproteins.

Training period: Low impact aerobic training program was consisted of 8 week (3 days a week) rhythmic aerobic exercise. Each session including three sections, warm up, main training and recovery period or cold down for 50 minute and Exercise intensity of 40-60 % maximum heart rate. Exercise intensity controlled by heart rate during exercise using Polar heart rate meter (S-Series Toolkit) (Kempele Finland). Maximum heart rate of individuals was determined in each session by calculate 220 age method. The exercise intensity began with 40% of maximum heart rate and increased gradually until the last session (to 60 percent of maximum heart rate).

Post-test measurements: After the end of training program and 24 hours after the last session of training, anthropometric measurements and resting blood sampling were performed in the same condition as pre-study and serum APPs (fibrinogen, WBC, CRP and IL6) and lipid profile (LDL, HDL, TG, TC) were evaluated. Binding Site special kit (0.4 gr/lit accuracy) and immune torpedo metric technique (S Coulter counter) were used for assessment of serum CRP and WBC, respectively. Then fibrinogen level was assessed after centrifuge using immune analyze apparatus.

Statistical analysis: Obtained data were analyzed by SPSS software. Collected data were examined at the two levels of descriptive and inferential statistics. To test the research hypotheses and in order to eliminate the effect of pre-test was used Univariate Analysis of Variance.

3. Results

8 week Low impact aerobic exercise in diabetic old women caused a significant decrease in CRP concentrations (p=0.01) A slight but no significant decrease in serum IL-6 (p=0.85), fibrinogen (p=0.29), WBC (p=0.14), (table 1) and TG (p=0.26), LDL (p=0.12) and TC (p=0.63), also caused A slight but no significant increase in HDL (p=0.93) compared with the control group (table 2).

4. Discussion

Obtained results were accordant with some studies that showed the effects of regular aerobic exercise on decrease of CRP (luiza et al (2011), Medina et al. (2005), Gulcan et al. (2007), Milani et al. (2004)). luiza et al (2011) showed decrease in CRP
at patients with type II diabetes after 12 weeks endurance aerobic exercise. Although exercise duration was different, the results are consistent with our findings. Medina et al. (2005) were found that 6 months physical activity caused significant reduction on CRP in 40 ≤ years’ old women. Gulcan et al. (2007) were studied the prognostic value of CRP in obese non-diabetic renal patients and showed CRP is a significant factor for coronary heart and kidney diseases. In their study anthropometric measurements, renal function tests and serum CRP levels were showed enhancement of body weight accompanied with CRP increase. Also they found that CRP is the strongest predictor of inflammation, especially in obese individuals. So, CRP concentration is a risk factor for coronary heart diseases and also significant factor in kidney diseases. Milani et al. (2004) were studied the effect of 3 months of cardiac rehabilitation and exercise training on CRP levels in patients with CHD. The results showed that mean CRP levels were reduced to 41 percent in patients who participated in those study. They were observed the remarkable improvement in lipid profile, abdominal circumference and fat percentage in the experimental group.

Excessive production of inflammatory cytokines is important such as IL-6 and acute phase proteins such as CRP by adipose tissue in the development of insulin resistance, diabetes and metabolic syndrome. One of the productions of Adipose tissue is IL-6. CRP is produced by IL-6.

Our results are accompanied with Esposeto, et all (2003) in IL6 de crease. They reported a significant decrease in IL-6 concentrations in obese or overweight women after two years exercise and diet. Non-significant level of IL6 in current study is probably due to differences in the duration of the exercise. It appears that the effect of exercise on the immune system and inflammation is depending on duration, intensity and type of training. Immune response, inflammation and muscle vulnerability is different in any physical activity, depending on the contribution of aerobic and anaerobic metabolic processes, intensity and duration of exercise or a combination of both. Also intensity used in these patients may be was higher. Metabolic stress (caused by the duration and intensity of exercise) and mechanical stress (due to restrictive and patterns of practice) are the factors that cause cell damage and release of the various tissues are damaged which in turn stimulates the body systems (including the immune system) to be adaptive responses. So it seems that the intensity and duration of exercise in this study was not sufficient to stimulate adaptation processes.

Obtained results were accordant with some studies that showed the effects of regular aerobic exercise on decrease plasma fibrinogen (Desouza et al. 1997, Ernest 1993, Smith, et al. 2003, Dehghan& Faramarzi, 2013). However, this decrease was not significant. Increased duration of the exercise training for more than 8 weeks may have better results. Increased fibrin deposition caused by increasing activity of Tissue-Type plasminogen activator (t-PA) antigen, have a major role in occurrence of atherosclerosis and thrombosis diseases (Desouza et al. 1997). Activation of t-PA in women during postmenopausal period that had regular physical activity decreased in comparison with sedentary individuals, as a result, deposition of fibrin decrease in their vascular walls (Desouza et al. 1997). Also increased (fibrin D-Dimer) level is a special product of the enzymatic activity of plasmin on fibrin that is deposition formation factor of fibrin and atherosclerosis occurrence. This factor also increased by aging. Also, Regular exercises reduce fibrin D-dimer and thus have impact on formation of fibrin. However, plasma fibrinogen may be reduced by increasing blood plasma (reduction in viscosity) that help reduce the risk of atherosclerosis, that seems to be the effect of regular exercises (Lambert & Evans, 2005; Desouza et al. 1997). Positive effects of aerobic exercises on the cardiovascular system are likely to decrease
plasma fibrinogen (Gaeini & Rajabi, 2005). Therefore, obtained results of current study were similar to performed short-term and long-term applied exercise physiology studies (Vilmor & Kastil, 2008; Gaeini & Rajabi, 2005).

Lamina and Okoye (2009) that showed WBC reduction occurs in men with normal weight and high blood pressure, but not in obese men. They also noted that more adipose tissue has occurred in more inflammatory reactions. They used exercise with 35-59% of maximum heart rate that was slightly lower than training intensity in our study. Results accompanied with Hamedi niya, et all (2009) in WBC reduction, although these results were not significant. Hamedi niya, et all (2009) showed that following an aerobic training with 75-85% of maximum heart rate that occurs in obese men decrease WBC, however their exercise intensity were higher than our study and subjects that they were used were health. According to the findings of the present study, there were no significant changes in blood lipid profile (LDL, HDL, TC, and TG) between the two groups after performing eight weeks training. Since the most important factor in endurance training researchers’ cardiovascular health and reducing risk factors considered, it was expected to see tangible improvement in the lipid profile.

Although some studies have shown improved the lipid profile and others have shown no significant changes. Overall, the researchers believe that LDL and HDL are hardly influence of exercised. HDL is particularly influenced by exercise intensity. Achieving this results Perhaps is reason for the intensity and duration of exercise. In general, comprehensive look at research on the effects of aerobic exercise on lipid profile shows the exercise period longer than eight weeks can be more effective. Because most studies have reported the effects of training, were used training programs for more than eight weeks (16, 20 or 24 weeks). Some researchers believe exercise rarely affect the levels of TC and LDL, unless they are accompanied by a decrease in diet or weight loss. This study has some limitations such as lack of complete control on mental stresses, nutritional habits etc., that their control could improve the preciseness of results in future studies. In general, companied exercises with proper nutrition can prolong this period may result in better outcomes.

Conclusion

Using low impact aerobic exercises with Greater exercise intensity or volume maybe effective in reduce of inflammatory markers, cardiovascular diseases and improve lipid profile in older diabetic women. In order to positive effects in elderly of low impact aerobic exercises, we suggest that it could be useful in retirement centers and diabetic clinics.

Acknowledgements

This research is the result of a research project at the Islamic Azad university izeh branch. We appreciate of all those who supported and helped us in performed this project.

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