The effect of 8-week low impact aerobic exercise on plasma fibrinogen concentration in old women

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ABSTRACT

Applied Exercise Physiology focuses on the physiological effects of exercise training on physiological processes, health, and physical well-being. The aim of this study was investigation of effects of 8-week low impact aerobic exercise on plasma fibrinogen concentration in old women. Fibrinogen is one of the most important inflammation factors and a prediction index in cardiovascular diseases. Iranian women especially older ones are generally sedentary because of their traditional and religious believes. Samples were 23 healthy and enable to do physical activity old women of Shahrekord (Chaharmahal va Bakhtiary province, Iran) retirement home. Subjects were randomly divided to two groups including experimental (n=14 individuals) and control (n=11 individuals). First, for assessment of fibrinogen level, 5cc blood samples were obtained after 8 hours nightly fasting from anterior vein in resting condition. Experimental group was participated in 8 week (three times a week) LIA training program (15 min in first day with 40% of maximum heart rate until 40 min in last day with 65% of maximum heart rate). All of mentioned measurements repeated at the end of 8 week training. The obtained results showed that 8 week LIA program has significant effect on reduction of old women plasma fibrinogen level (P=0.02). It seems that use of 8 week LIA training has positive effects on improvement of cardiovascular health and prevention of inflammation disease related to plasma fibrinogen level in Iranian old women.

Key words: aerobic exercises, old women, fibrinogen.

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INTRODUCTION
Exercise physiologists study the effect of exercise on the mechanisms by which exercise can reduce or prevent diseases. Cardiovascular diseases and coronary problems are the main causes of death in the new century and the leading causes of death in Iranian patients (Rana et al. 2009). Recently, many studies have shown a link between inflammation and atherosclerosis. Researchers have found inflammatory markers such as fibrinogen that are common CVD indicators and useful predictors for cardiovascular diseases (Danesh et al. 2005; Ernest, 1993; Lominadze et al. 2010). Fibrinogen is known as an inflammatory marker and increases the risk of cardiovascular diseases (Ernest, 1993; Woodward et al. 1998; Lominadze et al. 2010). It seems that the effect of fibrinogen on CVDs is similar to cholesterol effects (Ernest, 1993). People with high fibrinogen level in their blood have cardiovascular diseases more (2-3 times) than those with low fibrinogen level (Lominadze et al. 2010). Fibrinogen is a protein with a high molecular weight and 100-700 mg/dl Plasma concentration. It is one of the blood coagulation factors and is made in the liver (Lominadze et al. 2010). Fibrinogen is a large molecule; therefore a very small amount of it crosses the blood vessels into the interstitial fluid normally. If the permeability of vessels increases due to disease, fibrinogen will enter the interstitial fluid and cause blood to clot (Desouza et al. 1997). Although fibrinogen high level is accompanied with coronary artery diseases risk factors such as age, smoking, hypertension, elevated blood lipids and diabetes, the fibrinogen is an independent risk factor in the pathogenesis of atherosclerosis. Indeed, importance of elevated plasma fibrinogen in coronary diseases is similar to other elevated risk factors such as hypertension and hyperlipidemia (Sumaray, 1999). It is unclear how the fibrinogen level can reduce the risk of cardiovascular diseases. Lifestyle modification affects fibrinogen levels (Danesh et al. 2005; Smith et al. 2003). It seems that some of the ways that may reduce fibrinogen levels are physical activity and lifestyle change (Danesh et al. 2005; Smith et al. 2003; Ernest, 1993). Some studies have shown a significant inverse association between physical activity and fibrinogen (Desouza et al. 1997; Danesh et al. 2005; Ernest, 1993). They also shown that people with sedentary lifestyle have higher fibrinogen than those are physically more active (Desouza, et al. 1997; Ernest, 1993). The increase in the elderly population in the 21st century is considered as one of the major challenges of social, economic and health (Lominadze et al. 2010) and the sedentary elderly causes many problems such as high strength blood clotting and interstitial fluid that can lead to increased cardiovascular risk factors (Desouza et al. 1997; Lambert & Evans, 2005). Research on older women also indicated that all female athletes and non-athletes with increasing age is a significant increase in plasma fibrinogen levels. However, this increase is lower in women who are doing regular physical activity (Desouza et al. 1997). Decrease in fibrinogen level may cause desirable changes in the blood viscosity, adhesion and platelets aggregation and by reduction of fibrin formation could decrease the risk of arteriosclerosis, thrombosis and CVDs. Mechanism by which physical activity could reduce age-related plasma fibrinogen is not clear, but some studies have shown diverse correlation between plasma fibrinogen and regular physical activity (Desouza et al. 1997). Aerobic activities using music to extra motivation could encourage all people (especially the elderly) to exercise regularly (Dehghan & Faramarzi 2013, Dehghan,
et al. 2009). Today, women are interested in aerobic exercises and low impact rhythmic aerobic in Iran (Mazzeo, 2001). Results of this study could be useful and applied to older women, retirement centers and aerobic clubs.

**MATERIAL AND METHODS**

**Samples election**

The participants were 23 individuals of 60-85 years old women of Taravat retirement home at Shahrekord, Iran. Subjects were divided randomly to experimental (n=13) 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 (hypertension, high blood lipids), and they did not smoking. They all had similar diet during the study and no regular exercise before present study.

**Pre-test measurements**

Anthropometric measurements (weight, height, waist circumference and hip circumference) (table 1) 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 transferred to the laboratory in order to measure their fibrinogen level.

**Table 1 General properties of subjects**

<table>
<thead>
<tr>
<th>General properties</th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test Mean ± SD</td>
<td>Post-test Mean ± SD</td>
</tr>
<tr>
<td>Age</td>
<td>67.38 ± 3.37</td>
<td>-</td>
</tr>
<tr>
<td>Height(cm)</td>
<td>151.92 ± 4.82</td>
<td>-</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.56 ± 4.94</td>
<td>25.29 ± 4.74</td>
</tr>
<tr>
<td>WHR</td>
<td>0.99 ± 0.039</td>
<td>0.094 ± 0.04</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>58.42 ± 12.73</td>
<td>57.46 ± 12.65</td>
</tr>
<tr>
<td>Fibrinogen (mg/dl)</td>
<td>330.23 ± 61.81</td>
<td>292.92 ± 56.27</td>
</tr>
</tbody>
</table>

**Training period**

LIA training program was consisted of 8 week (3 days a week) rhythmic aerobic exercise. Each session including three section: warm up (5 min), main training (15 min in first until 40 min in the final week) and recovery period or cold down (5 min). The exercise intensity and duration of training provided using ACSM\(^1\) guideline (Miriam, et al. 2007). 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 (from 40-65 % of maximum heart rate).

**Post-test measurements**

Final anthropometric measurements and resting blood sampling were performed 24 hours after the last session of training (as same conditions as pre-test). Clauss method was used for measurement of fibrinogen amount. This method

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measures conversion of fibrinogen to fibrin in presence of high concentration of thrombin. According to Center for Disease Control (CDC) and College of American Pathologists (CAP) this procedure is the preferred method to measuring fibrinogen levels (Desouza et al. 1997). When plasma is diluted and clotted in the presence of large amounts of thrombin, low concentrations of fibrinogen has inverse direct relationship with coagulation time.

**Statistical analysis**

Obtained data were analyzed by SPSS 20.0 software. Kolmogorov-Smirnov test was used for determining normal distribution of data in groups. For analyze the data in order to compare plasma fibrinogen concentration pre-test and post-test in each group and compare that between experimental and control groups were used paired and independent t-tests.

**RESULTS**

Kolmogorov-Smirnov test showed that distributions of data are normal. The results of Independent t-test (to compare the mean differences between experiment and control groups) are presented in Table 2. Fibrinogen mean difference before and after the intervention was significant in the experimental group (p=0.03), while the control group did not show significant difference between pre-test and post-test (p=0.27).

Table (2): Result of fibrinogen Paired and independent t-test in experimental and control groups

<table>
<thead>
<tr>
<th>groups</th>
<th>mean</th>
<th>SD</th>
<th>P</th>
<th>mean difference</th>
<th>SD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>within group</td>
<td></td>
<td>between groups</td>
</tr>
<tr>
<td>experimental</td>
<td>330.23</td>
<td>61.81</td>
<td>0.03*</td>
<td>37.307</td>
<td>12.158</td>
<td></td>
</tr>
<tr>
<td>post-test</td>
<td>292.92</td>
<td>56.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>control</td>
<td>299.7</td>
<td>33.66</td>
<td></td>
<td></td>
<td></td>
<td>0.02*</td>
</tr>
<tr>
<td>pre-test</td>
<td>315.1</td>
<td>52.46</td>
<td>0.27</td>
<td>-15.40</td>
<td>4.46</td>
<td></td>
</tr>
<tr>
<td>post-test</td>
<td></td>
<td></td>
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</tbody>
</table>

(*) Show the significant difference in P<0.05.

According to the observed significance (P=0.02) the fibrinogen mean difference between two groups was significant. In other words, the independent variable (low impact aerobic exercise) in the experimental group had significant effect on fibrinogen. So, 8 weeks of aerobic exercise can be effective on fibrinogen decrease in older women. The results are demonstrated in figure 1.
The results showed that 8 weeks low impact aerobic exercise can have a significant effect on plasma fibrinogen may be effective in reduce the risk of cardiovascular disease in older women.

DISCUSSION
Obtained results were accordant with some studies that showed the effects of regular aerobic exercise on plasma fibrinogen (Desouza et al. 1997, Ernest 1993, Smith, et al. 2003, Dehghan & Faramarzi, 2013). 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, 2008). Therefore, obtained results of current study were similar with performed short-term and long-term applied exercise physiology studies (Vilmor & Kastil, 2008; Gaeini & Rajabi, 2005). Although this is the first study that has been used low impact aerobic exercise in order to reduce plasma fibrinogen. Current study used different exercise program (exercise walking) and samples (young women) in comparison with Fumiko, et al (2008) study. It seems that the use of aerobic exercise has greater impact on plasma fibrinogen of elderly women due to their specific characteristics (Furukawa et al. 2008). However, more researches are needed in this field.
Generally we suggest that LIA programs could be useful and applicable in retirement centers and aerobic clubs and older women could have a healthy life through the use of applied result of current study.

REFERENCES


