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***Research Article***

# THE IMPACT OF ONE AEROBIC AND RESISTANCE TRAINING SESSION ON SOME HEMATOLOGICAL RESPONSES OF NON-ATHLETE WOMEN

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## ABSTRACT
This study aimed to investigate the impact of one aerobic and resistance training session on platelet count, mean platelet volume, prothrombin time (PT), activated partial prothrombin time (APTT), and blood clots in non-athletic women. The sample consisted of 45 non-athlete30- 45 years old women in Ilam; they were randomly divided into three groups of 15 subjects: two experimental groups (resistance exercise group and aerobic exercise group) and one control group. The resistance training and aerobic training were conducted in one session for 60 minutes. The blood samples were collected in two stages (before exercise and immediately after exercise) to measure platelet count, mean platelet volume, PT, APTT, and blood clots. The independent T-test, one-way analysis of variance, and Kolmogorov-Smirnov (KS) were used for analyzing the data. The findings showed that after one aerobic and resistance training session, the platelet count and mean platelet volume was significantly increased in both of the experimental groups.Both groups showed a significant decrease in PT. The resistance training group showed a significant increase in APTT; while, it had a significant reduction in aerobic group. The blood clots were significantly reduced in the resistance training group. The results suggested that one resistance training and aerobic training session stimulated theclotting system of non-athlete women.

***Keywords:*** *Resistance Training, Aerobic Training, Platelets, Clotting Time, APTT, PT*

## INTRODUCTION
Because of industrialized and mechanized societies and increasing sedentary lifestyle among the people, the chronic diseases such as cardiovascular diseases have been increased amongyoung population. The absence of classical risk factors (lipids, hypertension, diabetes, etc.) in young people with cardiac infarction confirms this hypothesis that the imbalance in hemostasis system components may be the cause of thrombosis formation and myocardial infarction in this age group (Muhammadi *et al.*, 2007). In a study, Robinson and colleagues found that blood coagulation and fibrinolysis aretwo important physiological systems that are regulated by the balance between activators and inhibitors (Robinso *et al.*, 2007). AalSayed and colleagues found that the activation of blood coagulation is determined by accelerated clot structure; then, the blood fibrinolysis activity causes blood clots (El-sayed *et al.*, 2000).
For many years, it has been shown that collected blood samples after exercise represented a hypercoagulation. This is achieved by testing the coagulation total time. These changes are also seen by activation of activated partial prothrombin time which measures the common route and domestic route activities (Smith, 2003).
Blood platelets are the first cells that are responsible for controlling bleeding. Under normal conditions, their activity is response to launch of coagulation processes. However, inappropriate activation may lead to thrombosis. The activity of thrombosis subsequently leads to coronary obstructive disease and then heart attack. Thus, the tendency of blood to clot and fibrinolytic activities are important factors in the occurrence of atherosclerosis (Andrews, 2003). The previous research on the effects of resistance exercise on platelet activation and their activity is obscure and theirresults are unclear. For example, an increase, decrease, and even no change in platelet activation and their activity have been reported (Rezaeian *et al.*, 2005; Hasanloui and Ebrahim, 2004). Meanwhile, the available findings show that acute and chronic exercise not only increases the index of platelet, but also increases the platelet activation and aggregation

(Lee and Lip 2004). Ribeiro *et al.*, (2006) found a significant increase in these two parameters after a session of step test (Ribeiro *et al.*, 2006). In their study, Hasanloui and colleagues concluded that resistance exercise do not cause significant changes in prothrombin time (PT). Also, these exercises did not lead to significant change in platelet volume (MPV) (Hasanloui and Ebrahim, 2004). After graded resistance training, however, Ahmadinejad et al found a significant increase in platelet volume (MPV) (Ahmadizad and Ei-Sayed, 2003).

There is strong evidence on the role of aerobic exercise in reducing cardiovascular disease risk factors. Often, it is believed that the cardiovascular benefits and aerobic exercise are significantly affected by adaptations in skeletal muscle and itsarteries. Creating appropriate physiological changes, the aerobic exercise reduces the risk of heart attack. These changes include larger coronary arteries, increased heart size, and increased heart's contractile capacity. Aerobic exercise also has good effects on other risk factors of coronary artery disease (Vilmour *et al.*, 2009).

Given the contradictory results of research carried out on the effect of exercise on blood homeostasis, there are still questions such as: Whether aerobic and resistance training may have significant effect on platelet count, platelet volume, clotting time, PT, and APTT in non-athlete women? Is there any difference between the impact of two types of aerobic and resistance training on hematological responses of non- athlete women? Therefore, due to lack of access to these researchonnon-athlete women in Iran, logically it seems that conducting this research will be an important step in the field of women's sports and their health. Also, due to the fundamental role of exercise in blood clotting and important factors in this process, a reasonable solution may be achieved by conducting a research. Therefore, this study aims to compare the impact of one aerobic and resistance training session on some hematological responses of 30- 45 years old non-athlete women.

## MATERIALS AND METHODS

### *Methodology*

The population consisted of non-athletes 30 to 45 years old healthy women (without liver disease, without blood cholesterol, and without using anticoagulant drugs such as warfarin, heparin, etc.) in Ilam. The subjects were selected as follows.

After filling the medical data form, getting examined by a cardiologist and getting permission to participate in sporting activities, 45 subjects was selected from 57 cases. They were randomly divided into three groups (two experimental groups and one control group)(each n = 15). After filling out a consent form, they participated voluntarily in training.

*Data Collection Method*

For collecting the blood samples, all the subjects were called to the laboratory an hour before two training with controlled feeding. The APTT, PT, CT, MPV, PLT of their blood were measured by specific kits. Then, they began to exercise. Immediately after completion of the exercise, their blood sample was taken again in the same conditions to investigate the possible changes in the mentioned parameters. In this research, the resistance training and aerobic training was held in an indoor hall:

Resistance training: After ten minutes of warm-up, the subjects were asked to begin the main exercise (circuit training). The circuit training included ten stations: push- up, jumping, using dumbbells, sit-ups, lifting the body from the side with one arm, twisting with medical ball, stationary bike, using modified horizontal bar, compressed abdomen movement with medical ball, using 20 cm stairs. The activity time at each station was 15 seconds with 45 seconds rest between each station. In total, the circuit training lasted 45 minutes. The intensity of resistance training was 40 to 60% of one maximum repetition. At the end, 5 minutes cooling down was conducted by stretching to reduce the heart rate and body temperature (Rahimi and Safayinejad, 2009).

Aerobic training: After ten minutes of warm-up, the subjects were asked to begin the main exercise. This phase lasted for 45 minutes. The subjects began brisk walking and smooth running by controlling heart rate, 70 to 85 percent of maximum heart rate. At the end, 5 minutes cooling down was conducted by stretching to reduce the heart rate and body temperature (Rahimi and Safayinejad, 2009).

*Research Statistical Methods*

The inferential analysis was used to achieve the objectives of the study. The paired and independent T-test was used to compare the mean values of variables before and after training. Before the T-test, Kolmogorov-Smirnov test was used to evaluate the normal distribution of data among the three (control, resistance, and aerobic) groups. One-way ANOVA was used to compare the pre and post test of three groups. The 18 SPSS software was used for statistical calculations.

## RESULTS AND DISCUSSION

***Results***

Table 1 shows the statistical indicators of dependent variables inpre-test and post-test of groups.

Table 2 shows the dependent variables of exercise (aerobic and resistance) groups before and after the training.

**Table 1: Statistical indicators of dependent variables among the subjects**

| **Groups** | | **Control group** | | **Resistance exercise group** | | **Aerobic exercise group** | |
|---|---|---|---|---|---|---|---|
| **Variable Stage** | | **Mean** | **Standard deviation** | **Mean** | **Standard deviation** | **Mean** | **Standard deviation** |
| Platelet count (cubic millimeter) | Pre-test | 250666.6 | 53065.5 | 260466.6 | 49727.6 | 276333.3 | 593.3.7 |
| | post-test | 250666.6 | 53065.65 | 272200 | 51127.5 | 289200 | 65966.6 |
| Blood clotting time (min) | Pre-test | 3.1 | 0.533 | 3.55 | 0.592 | 3.78 | 0.520 |
| | post-test | 3.1 | 0.533 | 1.66 | 0.644 | 2.70 | 0.540 |
| Prothrombin time (sec) | Pre-test | 13.06 | 0.622 | 13.2 | 0.861 | 13.5 | 0.654 |
| | post-test | 13.06 | 0.622 | 7.66 | 2.49 | 12.7 | 0.923 |
| Activated partial prothrombin time (sec) | Pre-test | 35.8 | 4.97 | 34.5 | 5.95 | 40.47 | 5.08 |
| | post-test | 35.8 | 4.97 | 38.9 | 4.83 | 36.2 | 2.78 |
| Platelet volume (femtolitersfl) | Pre-test | 10.11 | 1.04 | 9.08 | 0.786 | 8.96 | 0.506 |
| | post-test | 10.11 | 1.04 | 9.42 | 0.722 | 9.18 | 0.534 |

**Table 2: Comparison of dependent variables in exercise (aerobic and resistance) groups before and after exercise**

| Variable | Exercise | Pre-test | | Post-test | | statistics t | Significance level ) $\rho$ ( |
|---|---|---|---|---|---|---|---|
| | | Mean | Standard deviation | Mean | Standard deviation | | |
| Platelet count (cubic millimeter) | Resistance | 260466 | 49727 | 272200 | 51127 | -2.50 | 0.025* |
| | Aerobic | 276333.3 | 59307.5 | 289200 | 65966.6 | -4.34 | 0.001** |
| Clotting time (min) | Resistance | 3.55 | 0.592 | 1.66 | 0.644 | 4.01 | 0.000** |
| | Aerobic | 3.78 | 0.520 | 2.70 | 0.440 | 1.10 | 0.090 |
| Prothrombin time (sec) | Resistance | 13.6 | 2.29 | 7.6 | 2.49 | 6.00 | 0.000** |
| | Aerobic | 13.5 | 0.65 | 12.73 | 0.93 | 2.40 | 0.030* |
| Activated partial prothrombin time (sec) | Resistance | 34.5 | 5.95 | 38.9 | 4.83 | -2.42 | 0.041* |
| | Aerobic | 40.47 | 5.08 | 36.27 | 2.78 | 2.63 | 0.019* |
| Platelet volume (femtolitersfl) | Resistance | 9.08 | 0.786 | 9.42 | 0.722 | -5.26 | 0.000** |
| | Aerobic | 8.96 | 0.50 | 9.18 | 0.53 | -3.21 | 0.003** |

** Significance at 0.05** Significance at 0.01*

***Discussion and Conclusion***

This study investigated the effect of one resistance exercise sessionon PLT, MPV, PT, APTT, CT in non-athlete women. The results indicated a significant increase in PLT, MPV, PTT and significant decrease in PT and CT. This is consistent with the findings of (Ahmadizad *et al.*, 2006; Ahmadizad and Sayed, 2003; Habibian *et al.*, 2009; Riberio *et al.*, 2007). The reasons of consistency may be the similarity in duration of exercise, exercise intensity, exercise type, exercise protocol nature.

Also, this study investigated the effect of one aerobic exercise session on PLT, MPV, PT, APTT, CT in non-athlete women. The results indicated a significant increase in PLT and MPV,significant decrease in PT and APTT, and no significant effect on clotting time (CT). This is consistent with the findings of Lekakis *et al.*, 2008; Radmehr *et al.*, 2006; Ahmadizad, 2003; Singh *et al.*, 2006; Li *et al.*, 2007; Karakok *et al.*, 2005; Ikarugi *et al.*, 2003; Habibian *et al.*, 2009; Malekizad *et al.*, 2009; Rezaeian *et al.*, 2005; Hilberg *et al.*, 2002). The exercise impacts on the coagulation cascades and fibrinolytic activation) (Habibian *et al.*, 2009; Li *et al.*, 2007; Singh *et al.*, 2006). The fibrinolytic activity in postmenopausal women can be improved by a under the maximum three-week training program (Jahangard *et al.*, 2009).

The fibrinogen is the final substrate of coagulation system that is converted to fibrin by thrombin. This process depends on the amount of plasma fibrinogen. Fibrinogen is involved in the initial formation of atherosclerotic plaques. Also, high level of plasma fibrinogen inhibits plasminogen binding to its receptors and thus increases the rate of fibrinolysis (Karakok *et al.*, 2005).

In most of the studies on the relationship between physical activity and levels of fibrinogen, the focus is more on the pre-coagulation activities of fibrinogen than its inflammatory activity. The exercise stimulates the secretion of inflammatory cytokines and increases acute coagulation proteins such as fibrinogen. The results of other studies have shown that anaerobic intense exercises, especially eccentric exercises, stimulate the acute phase response and reactant protein production by high sensitive C - reactive protein and hs-CRP (Robinson *et al.*, 2005).

In regard with the comparison of aerobic and resistance exercises impact on coagulation factors, it can be said that resistance training reduces blood clotting time (CT) more than aerobic exercises. It seems that

reduced blood clots time, especially after resistance training in the present study, is due to reduced plasma volume and accumulation of important metabolites such as lactic acid in active muscles and increased mean of arterial blood pressure. Fibrinogen is a reactive protein of acute phase that play a central role in the final stage of coagulation cascade; it is one of the most important parameters of blood viscosity. With 3 to 6 days plasma half-life of fibrinogen, some researchers suggested the fibrinogen decrease after exercise, fibrinogen remove through leakage to intercellular space, and fibrin clot formation increase (Ahmadizad and EI- Sayed, 2003; Ahmadizad *et al.*, 2066).

In this study, both aerobic and resistance exercises decreased prothrombin time (PT). The researchers have mentioned several different mechanisms as factors affecting the PTT and PT coagulation time such as blood lactate concentration, platelet counts, and changes in KatkoLamins (Lee and Lip, 2004; Li *et al.*, 2007). Also, there were no significant difference in the mean of platelet volume (MPV), activated partial prothrombin time (APTT), and the number of blood platelets (PLT) in both resistance and aerobic exercise groups. According to some researchers, the PTT various responses to exercise in different studies ensure us that the type of training (in addition to age and gender) impacts significantly on coagulation system response.

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