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# The effects of 12 weeks aerobic continue exercise on cardiovascular function in patients after angioplasty

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**ABSTRACT**

*The aim of this prospective randomized study was to evaluate the impact of long-term aerobic exercise training cardiovascular function, left ventricular systolic function and remodeling in patients with coronary heart disease after successful angioplasty.In this quasi-experimental study, 30 patients who had undergone coronary artery angioplasty were enrolled. In the pre-test phase, exercise tolerance test and echocardiography were done for the patients. The aerobic exercise was running on a treadmill to achieve 55% of the maximum heart rate in the first 4 weeks, 60% in the second 4 weeks, and 65% in the last 4 weeks. In each 60-mintute session, 20 minutes was for warming up, 30 minutes for the main exercise, and the last 10 minutes was for cooling down. In the last session, exercise tolerance test and echocardiography were repeated. After 12 weeks of aerobic exercise, the quality of all cardiac function parameters improved. However statistically significant improvement was seen in systolic and diastolic blood pressures during and after the exercise, heart rate, fractional shortening percentage, and duration of the exercise (P<0.001). 12-week aerobic exercise had positive effect on cardiovascular factors in Patients after Angioplasty. Therefore, aerobic exercise is recommended during 12 weeks, 3 sessions per week and for 60 minutes with moderate intensity that lead to improve cardiovascular factors.*

**Key words:** Aerobic exercise, cardiovascular diseases, Exercise tolerance test, Echocardiography, Angioplasty

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## INTRODUCTION

Despite the great strides in drug and interventional treatment of CHD, exercise training (ET) continues to play the main role in cardiovascular rehabilitation and secondary prevention. Regular and aerobic ET in cases of CHD improves coronary blood flow, increases oxygen consumption and reduces probability of new cardiac events [1]. Aerobic physical exercise decreases hyperventilation in heart failure patients and influences the acid-base imbalance [2]. Left ventricular remodeling plays a key role in the progression of heart failure. Long-term exercise training (6-12 weeks) improves left ventricular diastolic function in cases of CHD: left ventricular wall diastolic pressure diminishes, velocity of left ventricular diastolic filling increases, velocity of left atrium filling during atrium contraction decreases[3,5], neurhormones activity decreases[2,7,35]. Training benefits have been contributed predominantly to adaptations in the peripheral circulation and skeletal muscle rather than to adaptations in cardiac performance [6,34], a possible attenuation of left ventricular remodeling has also been document- selected patients

with left ventricular dysfunction and heart failure [6,7]. Long-term ET impact on left ventricular systolic function and remodeling is controversial in patients with CHD and heart failure [7,8]. Such data after successful angioplasty remains underestimated [9,11]. The necessity to treat patients with emphatically aerobic ET must be noted [12,33]. The aim of our study was to evaluate the impact of a long-term aerobic ET on cardiovascular function, left ventricular systolic function and re- modeling in patients with CHD and chronic heart failure after successful angioplasty

## MATERIALS AND METHODS

In this quasi-experimental study, 30 patients who had undergone coronary artery angioplasty were enrolled. In the pre-test phase, exercise tolerance test (Track master, USA) and echocardiography were done for the patients. Then they were asked to have aerobic exercises using a treadmill for 12 weeks, 3 sessions per week, and for 60 minutes each session. In the last session, the exercise tolerance test and echocardiography were repeated.

The aerobic exercise was running on a treadmill (Techno gym, Italy) to achieve 55% of the maximum heart rate in the first 4 weeks, 60% in the second 4 weeks, and 65% in the last 4 weeks. In each 60-mintute session, 20 minutes was for warming up, 30 minutes for the main exercise, and the last 10 minutes was for cooling down. Statistical analyses were done using the SPSS software, version 16.0. Paired t, Kolmogorov-Smirnov, and Wilcoxon tests were used as appropriated.

## RESULTS

The mean (±SD) age and body mass index of the patients were 46.1 (±3) years and 25.3 (±1.7) kg/m², respectively. A significant decrease was observed in the mean systolic (P<0.001), and diastolic blood pressures (P<0.017) and heart rate (P<0.001) after exercise (table1).

After the exercise, a significant increase was observed in the time needed to reach 85% of the maximum heart rate (P<0.001). The diastolic blood pressure decreased significantly as well (P=0.006), whereas there was no significant change in systolic blood pressure (P=0.086). Electrocardiographic changes were observed before the exercise in the 7.4$^{th}$ minute, but after the exercise no such changes was detected in patients (table 2).

Echocardiographic evaluation showed that cardiac diameters during diastole (P=0.088) and systole (P=0.119) as well as ejection fraction (P=0.317) did not changed while fractional shortening (which is used to measure the strength of left ventricular contraction) increased significantly (P=0.007, table 3).

**Table 1: Mean and the standard deviation (SD) of the blood pressure and heart rate in the studied patients**

| The studied parameters | Before the exercise | | After the exercise | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **Systolic blood pressure (mmHg)** | 133.8 | 9.5 | 130.7 | 9.0 | >0.001 |
| **Diastolic blood pressure (mmHg)** | 86.6 | 5.4 | 84.5 | 5.1 | 0.017 |
| **Heart rate** | 78.6 | 7.9 | 74.6 | 7.4 | >0.001 |

**Table 2: the results of exercise test before and after the test**

| The parameters studied | Before the exercise | | After the exercise | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **Time to reach 85% of max heart rate (min)** | 7.93 | 0.65 | 9.20 | 0.75 | >0.001 |
| **Systolic blood pressure(mmHg)** | 156.5 | 11.1 | 154.7 | 11.0 | 0.086 |
| **Diastolic blood pressure(mmHg)** | 94.0 | 4.6 | 90.8 | 6.8 | 0.006 |
| **The time of onset of ECG changes (min)** | 7.4 | 0.7 | - | - | - |

**Table 3: The results of echocardiography before and after the exercise**

| The studied parameters | Before the exercise | | After the exercise | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| **Diastolic heart diameter (cm)** | 4.82 | 0.31 | 4.85 | 0.29 | 0.088 |
| **Systolic heart diameter (cm)** | 2.73 | 0.35 | 2.76 | 0.34 | 0.119 |
| **EF (%)** | 60.0 | 3.2 | 60.3 | 3.2 | 0.317 |
| **FS (%)** | 57.3 | 3.1 | 58.8 | 3.6 | 0.007 |

## DISCUSSION

The features of the training response in our study were consistent with a normal response to regular exercise [12, 16, 17].

Our finding show that aerobic exercises decrease chest pain in patina after angioplasty in comparison with before it. The most important factors have role in this included: 1- Activity improves endothelial vasodilatation and decreases the endothelial dysfunction 2- Activity could decrease the oxygen requirement. The need for oxygen is calculated by the multiplication of heart beat and systolic blood pressure [29,31].

We found that fractional shortening improved after 12 weeks continue training that was due to the positive effects on left ventricular contraction [18, 19].

Finding show that there was not any significant difference in ejection fraction before and after training which can be caused by the short duration of exercise. These results were consistent with the findings of other studies. [19, 22, 23].

Our finding shows that 12 weeks continue training lead to reduce significantly heart rate after angioplasty in penitent. Also amount of systolic and diastolic pressure after exercise in comparison before exercise had significant decrease. Some reasons for decrease is as follow:
1- Changes in the activity of autonomic nervous system (increased activity and decreased sympathetic tone) results in a heart rate decrease. 2- Improvement in endothelial function and decrease in oxidative stress by affecting vascular system. 3- By affecting neurohumoral system angiotensin and aldosterone secretion will be reduced, which lead to Improvement in systolic function and ejection fraction by reducing the after load and increasing the pre-load 4.( increase in the cardiac contractile strength, which pumps the blood to all organs by strong contraction[29,30].

The results of this study indicate that the heart (particularly the left ventricle) enlarges following aerobic training. It seems that this enlargement not only hinders cardiac function, but also enhances it. Changes in the thickness of the myocardium inter ventricular septum in the continue training and in the posterior wall thickness in the continuous training group represent heart adaptations to excessive stress caused by application of these training programmers.

Our findings showed that heart rate and systolic and diastolic blood pressure significantly compared to the prior practice has been altered in patients.

Aerobic exercise could also improve the chest pain in the patients who suffered from such pain before the exercise. A as well as an increase in fractional shortening showing developed left ventricular contraction. Also 12 weeks exercise training lead to reduce shortening fraction, ejection fraction in patient after angioplasty.

## CONCLUSION

Long-term aerobic exercise training is effective and workable measure improving respiratory efficiency, left ventricular systolic function, attenuating a negative remodeling and stopping further progression in patients with coronary heart disease and chronic heart failure after successful angioplasty.12-week aerobic exercise can positively affect the cardiovascular function of the patients who have undergone angioplasty. Therefore, aerobic exercise is recommended with moderate intensity 3 sessions per week and for 60 minutes with moderate intensity that leads to improve cardiovascular factors.

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