

# Left Ventricular Function Response to Aerobic Training after Coronary Angioplasty

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## ABSTRACT

**Background:** Coronary artery disease (CAD) patients improved their health status with percutaneous coronary intervention (PCI), aerobic training and weight reduction.

**Purpose:** was to investigate the alteration in left ventricular function, body mass index (BMI), and quality of life after 36 sessions of aerobic training after PCI for coronary artery diseased patients.

**Methods:** Forty patients of both sexes (5 women and 35men) with coronary artery disease and underwent PCI were included, their ages ranged from 45 to 65 years. They were chosen from Agouza Police Hospital and National Heart Institute. They were assigned in a single study group which received twelve weeks of a treadmill walking exercise for 30 minutes three times a week.

**Results:** BMI, LV-36, and E.F variables within study group application of treatment revealed significant improvement ( $P < 0.05$ ) in BMI by 5.37% and LV-36 by 51.47%, and in E.F. by 14.82%.

**Conclusion:** It was concluded that twelve weeks of aerobic training in addition to PCI and low caloric diet altered not only the body mass index, but also Left Ventricular Function in coronary artery diseased patients.

**Keywords:** Coronary artery disease, Aerobic exercise, Left Ventricular Function.

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## INTRODUCTION

Despite recognized approaches to prevent and treat heart problems, heart disease stills the main source of death in developed countries. One basic kind of heart illness is alluded to as coronary artery disease. Greasy Plaque harms the coronary arteries, and blood platelets can adhere to these hurt locales, obstructing of blood stream. This can lead to ischemia or myocardial infarction (heart attack) [1].

The commonest expression of coronary heart illness is stable angina. While trying to control angina side effects, patients can experience two fundamental types of elective coronary revascularisation: percutaneous transluminal coronary angioplasty (PTCA) and coronary vein sidestep join (CABG) surgery [2]. Despite numerous subsequent randomized trials and meta-analysis of these trials, which have demonstrated no decrease in death or myocardial infarction, the utilization of percutaneous coronary intervention (PCI) has developed exponentially. Some of this development was driven by information from clinical trials recommending that PCI was more successful in relieving angina than medical therapy alone [3].

No realistic proof shown that PCI alone improves survival in patients with stable ischemic heart diseases who have no obvious indication for CABG, compared with the combination of prescriptions for prevention and lifestyle alteration, for example, healthy diet, smoking cessation, and regular moderate-to-high intensity exercise [4]. Regular exercise training (ET) decreases ischemic heart diseases morbidity and mortality through general and cardiac-specific variations. ET increases myocardial oxygen demand stimulating coronary blood flow to increase with consequent increase in myocardial oxygen supply, which reduces angina

and myocardial infarction. ET augments coronary blood flow by directly acting on the vasculature through improving endothelial function, promoting coronary vasodilation. Furthermore, ET improves collateralization, thus, increasing blood flow to ischemic myocardium by reducing the progression of coronary induration of the arteries and restenosis, possibly by stabilizing atherosclerotic lesions. ET can be used as a generally safe and inexpensive approach for CAD prevention and treatment [5].

Habitual bodily activities utilizing large muscle groups, as, swimming, walking, or running induces vascular adjustments that augments exertional capability, stamina, and musculoskeletal power. It also prevents CAD progressing and lessens symptoms in patients with established cardiovascular disease [6].

Therefore, the target of this research was to investigate the alteration in left ventricular function, body mass index (BMI), and quality of life after 36 sessions of aerobic training after PCI in coronary artery disease.

## MATERIALS AND METHODS

This research is a Pre –post- test research. It was carried out in out-patient clinic in Agouza Police Hospital between July 2019 to March 2020.

## Ethical approval

The current research was approved by the Research Ethics Committee of the Faculty of Physical Therapy, Cairo University.

Informed consent was obtained from all the patients after the detailed explanation of the study. Confidentiality was assured for all patients.

### Patients

A sample of 35 males and 5 female patients diagnosed as Coronary artery disease were recruited according to the following criteria: Successful procedure of percutaneous coronary intervention, both sexes and their age are 45-65, all patients were medically stable, Ejection Fraction >40%, BMI (class I-II obesity), controlled mild to moderate hypertensive patients, controlled diabetic patients (type II). The participants were excluded if they had Heart failure, unstable angina, uncontrolled hypertension, unsuccessful PCI (persistent obstruction more than 30%), cardiogenic shock, ventricular arrhythmias, uncontrolled diabetes, patients with neurological, neuromuscular and orthopedic diseases.

### Interventions

Individuals attended 3 sessions per week, every other day, for 12 consecutive weeks.

Study group received PCI and aerobic training on treadmill for a periods of 12 weeks.

The aerobic training, Intensity starts by 60%-75% of maximum heart rate then increases gradually according to each patient response, starting 60% till reaching 75% at end of training programme Duration each session will be 45 minutes divided into 10 minutes warm up, 30 minute walking on treadmill and 5 minutes cool down. Frequency will be 3 times per week.

### Outcome measures

-Weight scale and height scale to measure weight and height and calculate body mass index (BMI=weight (kg)/height(m)<sup>2</sup>). Model: MC, Health scale, RTZ-120A. 120x0.5 kg. Weight and Height measuring to find BMI:

Patients weighed in light-weight wear and exposed feet, fasting and with an empty bladder. Patients stood in exposed feet kept beside each other with head kept vertical [7].

- Echocardiography to measure differences in LV diameters and volumes, end-systolic volume and ejection fraction and systolic wall thickening. M-mode, Simpson's method and 2-D eye balling. Model: Acusoncv 70. evaluation of the different cardiac parameters was performed using a colour-coded echodoppler (Siemens' Acuson Cypress)[8].

- Dobutamine echocardiography to measure left ventricular ejection fraction as indirect measure of myocardial perfusion. The dobutamine infusion would be made through a peripheral vein, beginning with an infusion rate of 10 µg/kg/min and increasing the dose every 3 min by 10 µg/kg/min for a total dose of 40 µg/kg/min. This last stage lasted 6 min [9].

- The left ventricular dysfunction questionnaire (LVD-36): is a 36 item questionnaire for patients with left ventricle dysfunction. Replies are dichotomous (true or false). Genuine answers are added and communicated as a rate, with the goal that 100 is the most noticeably awful score and 0 the best score. The LVD-36 takes around five minutes to finish [10].

### Statistical analysis

The current study evaluated the Left Ventricle function response to aerobic training after coronary angioplasty. Before terminal analysis, data were displayed, for normality assumption test, using Shapiro-Wilk test, that reveal the data was normally distributed after removing outliers that were identified by box and whiskers plots. All these findings to do it parametric. The statistics was done using SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL). The following statistics measures were performed:

- Descriptive statistics including the mean and standard deviation for age, BMI, LV-36, and E.F. variables.
- Paired t-test to compare between pre and post-treatment for BMI, LV-36, and E.F variables within study group.
- Statistical level all statistical analyses were significant at level of probability less than an equal 0.05 (P ≤ 0.05).

### RESULTS

The current study was conducted on forty patients (5 females and 35 males) underwent PCI after myocardial infarction. The participants with average age was 53.70 ±5.79.

Within group comparison: There was a significant reduction in BMI post treatment contrasted with that pre treatment (p <0.05) with improvement percentage 5.37%. There was a significant reduction in LV-36 post treatment compared with that pre treatment (p <0.05) with improvement percentage 51.47%. There was a significant increment in E.F. at post treatment contrasted to pre-treatment (p<0.05) with improvement percentage 14.82% (table 1)

**Table 1:** Comparison of ER/IR ratio, Pain severity and Functional disability between pre and post treatment in study group:

	$\bar{x} \pm SD$		MD	% of change	t-value	p-value
	Pre treatment	Post treatment				
BMI	32.01 ±1.98	30.29 ±2.13	1.72	5.37%	6.743	0.0001**
LV-36	0.68 ±0.10	0.33 ±0.12	0.35	51.47%	15.900	0.0001**
EF	49.32 ±5.12	56.63 ±5.49	7.31	14.82%	9.153	0.0001**

BMI, body mass index; LV-36, left ventricular questionnaire; EF, ejection fraction;  $\bar{x}$ , Mean; SD, Standard deviation; MD, Mean difference; p value, Probability value; \*\*, Significant.

### DISCUSSION

The current study investigated the effect of cardiac rehabilitation on EF, QoL by LV-36 and BMI and follow up

after 36 sessions. It found differences between EF, LV-36 and BMI at post treatment and pre treatment. There were improvements in EF, LV-36 and BMI. These findings prefer

aerobic exercise after PCI, and recommended to add it to a cardiac rehabilitation program to enhance left ventricular function in patients underwent PCI.

In the current study, the EF increased and BMI, LV-36 decreased post treatment. It is hypothesized that, the aerobic training should be enough to improve left ventricular function after PCI. It is known that Cardiac rehabilitation enhances **rapid patients' revival** and decreases death rate for acute myocardial infarction (AMI) patients. Cardiac rehabilitation after MI, has well-known benefits many years ago. It diminishes major adverse cardiac incidents after CABG surgery and PCI. It confirmed a 15-31% decline in deaths due to heart illness. additional gains of CRP encompasses improving blood pressure, lipid profile, exercise capability, and strain levels, obesity reduction, and most likely cigarette quitting and so improved shortness of breath [11, 12].

This study results are consistent with the results reached by Hassan and El Nahas [13] investigating the impacts of cardiac rehabilitation after PCI. But their study has a control group and study group, assessed quality of life by 36-Item Short-Form Health Survey (SF-36) that made different to current study. They found a positive effect of cardiac rehabilitation on quality of life and BMI. The current study investigated the effect of cardiac rehabilitation on EF, QoL by LV-36 and BMI and follow up after 36 sessions.

Also, the improvements in the current study are compatible with Xu et al [14] achievements investigating the effects of early home-rehabilitation program for patients who underwent PCI after acute MI. But their study has a control group and study group, all of the echocardiographic image acquisitions were performed in all participants at the start, within 48hours after PCI and after 4-weeks that made different to current study.

This study is convenient with what achieved by Acar et al [15] investigating the impact of aerobic training on Left sided heart Function and Its association with alterations in Arterial Stiffness in AMI Patients, and successfully revascularized by PCI. They found a positive effect of cardiac rehabilitation on EF.

Soleiman Nejad et al [16] results are congruent with current study investigating the effects of Evaluation of the Effect of Cardiac Rehabilitation on Left Ventricular Diastolic and Systolic Function and Size after PCI. But their study has a control group and study group, the CR exercise program encompassed 24 sessions that made different to current study. They found a positive effect of cardiac rehabilitation on EF.

The outcomes of the current research are compatible with the results approved by Kim et al [17] exploring if there any undesirable outcome on myocardium functioning after early regular cardiac rehabilitation program in patients who received PCI after AMI. But their study has a control group and study group that made different to current study. They found a positive effect of cardiac rehabilitation on EF.

Moreover, Yohannes et al [18] approved the results of current study that investigated the CR advantages on depressive, anxiety symptoms, daily living activities and quality of life. But their study use Mac New Heart Disease Health- Related Quality of Life (MacNew) and Hospital Anxiety and

Depression scale (HADS) at baseline, six weeks, six and 12 months that made different to current study.

## CONCLUSIONS

This study suggests that PCI, aerobic training and diet improve left ventricular function, body mass index, quality of life.

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