







## Original Article

# Effect of the rehabilitation program on the fatigue of patients with coronary artery diseases

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## Abstract

**Background:** This study aimed to evaluate the changes in fatigue of patients with coronary artery diseases after the rehabilitation intervention based on demographic and clinical variables.

**Methods:** This study was a single-arm clinical trial with a pre and post-intervention design. The statistical population of the study included patients with coronary artery diseases who underwent coronary artery bypass surgery or percutaneous coronary interventions, 4-6 weeks after discharge, referred to Khorramabad Cardiac Rehabilitation Center. They were selected by a purposeful sampling method. The data were collected through demographic and clinical information questionnaires and Piper Fatigue Measurement Questionnaire. Education on risk factors at home (weeks 4 and 8) was presented in the area of rehabilitation, the data were analyzed with descriptive and analytical statistics in SPSS software.

**Results:** Most of the patients were male (54.4%), married (87%), and in the age group of 47-58 years (50%). Their mean age was  $54.63 \pm 8.87$  years, and the mean duration of heart disease in the subjects (by months) was  $33.24 \pm 50.84$ . Comparing the mean changes in fatigue after the intervention based on some influencing demographic variables of the patients, including age, gender, type of treatment, and the duration of the disease showed no significant difference ( $p > 0.05$ ).

**Conclusion:** The implementation of a home cardiac rehabilitation program by nurses, as a low-cost, accessible, and feasible intervention, can be considered an effective step in reducing the fatigue of patients with coronary artery disease and should be considered by managers.

**Keywords:** Clinical Trial; Coronary Artery Disease; Fatigue; Rehabilitation.

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## Introduction

Chronic diseases are one of the most important causes of death and disability around the world (1). Coronary artery diseases (CAD) are among

the chronic diseases, so out of 58 million deaths that occurred worldwide in 2005, 17.5 million of them were related to coronary artery diseases and this figure is

three times more than infectious diseases, including AIDS, Malaria, and Tuberculosis (2). In Iran, coronary artery disease with 25.6% is considered the first cause of death in the country (3). In addition to increasing the mortality rate, it causes disability, lowers the quality of life, and imposes heavy costs of about four hundred billion dollars and many social problems. In England, 1.6 billion pounds are spent annually on coronary artery diseases, and hospital care for these diseases is 55% of the total costs (4).

In Iran, the prevalence of coronary artery diseases and their complications have resulted in the death and disability of a large part of the country's productive workforces, especially in the best years of work efficiency, production reduction, and increase in medical costs (5).

Studies in post-MI patients reported medium associations between fatigue and anxiety and weakness to strong associations between fatigue and depression. These contradictory findings, based on relatively small sample sizes, indicate the need for additional investigations in larger samples and suggest that the relationship between symptoms of depression, symptoms of anxiety, and fatigue in CAD patients may be complex. The measurement of exercise capacity was not incorporated in these studies. Therefore, the association between subjective symptoms of fatigue and objectively evaluated exercise capacity was not evaluated. Such evaluations may have important implications for differentially targeting psychologic fatigue versus exercise capacity in the treatment of CAD.

In this regard, fatigue is one of the most uncomfortable symptoms in all stages of this disease. It is defined as a lack of energy and inability to perform physical and mental activities that cannot be resolved by resting. Puetz et al. (6) showed that the implementation of cardiac rehabilitation programs, especially exercise, reduces fatigue symptoms in coronary artery patients who have undergone heart surgery.

Cardiac rehabilitation has positive impacts on improving physical performance after coronary artery bypass surgery, relieving post-operative symptoms such as reducing chest pain and fatigue (7), anxiety, and depression, regulating blood pressure, and maintaining patient independence (8). Hoeman proposed different models for rehabilitation in nursing, including client-centered models, level-of-intervention models, care provider-centered models, and collaborative practice models. Home care rehabilitation models are useful in meeting the health needs of people who need rehabilitation and are considered one of the most valuable health care services due to their low-cost, feasibility, patient comfort, reduction in hospitalization, and establishment of communication between the hospital and the patient (9). Given what was stated above, this study aimed to investigate the changes in fatigue of patients with coronary artery diseases after the rehabilitation program intervention based on demographic and clinical variables.

## Methods

The present study was a single-arm clinical trial with pre-intervention and post-intervention design. The statistical population in this study included all patients with coronary artery diseases who underwent coronary artery bypass surgery or percutaneous coronary interventions (such as percutaneous coronary angioplasty and stenting) and were diagnosed by a cardiologist, 4-6 weeks after discharge from the hospital, referred to the Khorramabad Cardiac Rehabilitation Center for rehabilitation and met the inclusion criteria of the study. The inclusion criterion of the study included being in the age range of 35-70 years, vital signs should be stable, 4-6 weeks after the patient's discharge, not suffering from restrictive movement diseases, not suffering from uncontrolled heart failure, arrhythmia, and unstable angina, not having known mental disorders and not taking medication, not

being treated with anti-fatigue medications and sedatives such as amantadine, having the ability to understand conversation in Farsi language, having at least reading and writing skill, having the ability to perform the exercises of the rehabilitation program and participate in the related sessions, having access to the phone, and not suffering from local or general complications after surgery. Informed written consent was obtained from all patients after the oral explanation of the study description.

The sample size was estimated at 50 people considering 95% confidence, 80% test power, and estimation of fatigue change before and after the intervention [based on similar studies, its standard deviation (sigma) was considered to be 7 units] and assuming error level of 4 units (delta), and by using the following formula. Accordingly, 50 eligible patients were selected using the purposeful sampling method.

$$n = \frac{16\sigma^2}{\Delta^2} + 1$$

In this study, a questionnaire was used to collect data. A demographic and clinical information questionnaire including information about age, gender, type of treatment, and duration of heart disease, was completed through an interview with the patients. Information about the fatigue intensity was collected through the Piper Fatigue Measurement Questionnaire. This tool was developed by Piper B.F. (1990) to measure fatigue in clinical tests (Izadpanah et al. 2012). It includes 23 questions, in which questions 2 to 23 are scored on an 11-point scale from zero to 10, and question 1 is also included to evaluate the duration of fatigue. This tool includes different behavioral (questions 2-7), emotional (8-12), sensory (13-17), and cognitive (18-23) domains. According to the study conducted by Izadpanah et al. (2012), the fatigue intensity of patients is scored in the spectrum of no fatigue (0), mild fatigue (1-

3), moderate fatigue (4-6) and severe fatigue (7-10). The face and content validities of the questionnaire were examined and revised using the opinion of 10 members of the Faculty of Nursing and Midwifery of Shahid Beheshti University of Medical Sciences. The Cronbach's alpha coefficient of this questionnaire was calculated as higher than 0.7, which indicated the internal consistency of the items and confirmed the reliability.

Home cardiac rehabilitation also means a set of strategies used by researchers to improve the health of patients, including education about the disease, its complications, and treatment, the definition of cardiac rehabilitation and its application, education about risk factors (such as cardiac nutrition, weight control), stress control, smoking cessation, hyperlipidemia, hypertension), medication regimen, performing simple and useful sports activities and pulse counting technique at home during four 1-hour training sessions at the heart rehabilitation center and two visits at home (week 4 and week 8). The educational booklet prepared in this regard was given to the samples and in addition to the researcher's weekly contact with the patients, the researcher's phone number was also provided to the patients to ask questions and solve possible problems. The collected data were analyzed using SPSS-19 software. To analyze the data, descriptive statistics (absolute and relative frequency, mean and standard deviation) and analytical statistics (analysis of covariance) were used. A significance level of 0.05 was considered.

## Results

The demographic information presented in Table 1 shows that the age of the majority of patients with coronary artery disease (50%) was in the age range of 47-58 years and their mean age was 54.63 with a standard deviation of 8.87. The minimum and maximum ages of the patients participating in this study were 37 and 70 years, respectively, and the majority of the

Table1. The demographic information of the respondent

Variable	Group	N	Percentage
age category	35-46 years	8	17.4%
	47-58 years old	23	50%
	59-70 years old	15	32.6%
gender	Female	21	45.7%
	Man	25	54.3%
Type of treatment	Percutaneous coronary interventions	17	37%
	Coronary artery bypass surgery	29	63%
marital status	married	40	%87
	Separated from spouse	2	%4.3
	deceased spouse	4	8.7%
Duration of heart disease (by month)	Mean		SD
	33.24		50.84%

subjects (54.3%) were male. Most of the subjects (63%) had undergone coronary artery bypass surgery, and the mean duration of heart disease was 23.24 with a standard deviation of 50.84.

Table 2 shows that before implementing the home cardiac rehabilitation intervention, most of the subjects had a moderate level of fatigue in the behavioral (58.7%),

emotional (58.7%), sensory (52.2%), and cognitive (50%) dimensions. Based on Table 3, there is no statistically significant difference between gender, age, type of treatment, duration of disease, and fatigue (p=0.001) and only those who had more initial fatigue showed significantly more fatigue after implementation of the rehabilitation program (p=0.001).

Table 2. Frequency distribution of fatigue intensity in the studied population

fatigue intensity	No fatigue (0)		Mild fatigue (1-3)		Moderate fatigue (4-6)		Severe fatigue (7-10)		P.value
	N	%	N	%	N	%	N	%	
Behavioral dimension	-	-	8	17.4%	27	58.7%	11	23.9%	0.01
Emotional dimension	3	6.5%	9	19.6%	27	58.7%	7	15.2%	0.021
Sensory dimension	1	2.2%	9	19.6%	24	52.2%	12	26.1%	0.011
Cognitive dimension	-	-	11	23.9%	23	50%	12	26.1%	0.01

Table 3. The relationship between fatigue and underlying and clinical variables by controlling the fatigue score before the implementation of the rehabilitation program

Fatigue score Demographic variables	Sum of squares	df	Mean of squares	F statistic	p-value
Model	21.431	6	3.572	5.096	0.001
intercept	0.087	1	0.087	0.124	0.727
Age	0.399	1	0.399	0.570	0.455
Fatigue before rehabilitation	17.008	1	17.008	24.268	<0.001
Duration of heart disease	0.008	1	0.008	0.012	0.915
gender	1.279	1	1.279	1.825	0.185
Type of treatment	0.542	1	0.542	0.774	0.384
The interaction of gender and type of treatment	0.534	1	0.534	0.762	0.388
error	27.333	39	0.701		
Total	48.764	45			

## Discussion

The main results of the study were investigating the changes in fatigue of patients with coronary artery diseases after the rehabilitation program. The mean duration of heart disease in the subjects (by months) was 33.24. Given that approximately one-third of individuals with coronary artery disease remain severely fatigued after completion the cardiac rehabilitation, it is necessary to identify reliable intervention targets aimed at reducing fatigue. The results shows that before implementing the home cardiac rehabilitation, most of the samples had a moderate level of fatigue in the behavioral, emotional, sensory, and cognitive dimensions.

Arefi et al. (2013), showed that the mean age of patients with acute coronary syndrome was  $58.03 \pm 6.22$  years, and most of the participants were male (62.5%) (10). Also, the results of a study conducted by Hosseinzadeh et al. showed that the majority of the subjects were male (53.8%), which are consistent with the results of the present study. In a study conducted by Khashai et al. (2013), most of the patients were male (60.8%) and had a mean age of  $57.75 \pm 7.88$  years, which is consistent with the results of the present study (11). The duration of fatigue in the patients participating in this study varies and it was reported from a few minutes to several months. Most of them (28.3%) reported fatigue for a few days and the minimum of them reported fatigue for 2 months (4.3%). In a study conducted by Nowicki et al., the duration of fatigue in the subjects was reported from a few minutes to several months, but the largest percentage of the subjects (24%) reported fatigue for several weeks, which is inconsistent with the results of this study (12).

The relationship of fatigue with background and clinical variables by controlling the fatigue score before implementing the rehabilitation program, the results showed that no significant difference was observed

in comparing the mean changes in fatigue after the intervention based on the influencing demographic variables of the patients, including age, gender, type of treatment, and the duration of the disease. Fennessy et al. reported a lack of a relationship between age and the type of treatment after myocardial infarction (including CABG and PCI) and fatigue, which are consistent with the findings of present the study (13). In examining the fatigue in 102 patients with coronary artery disease, Eckhart et al. reported that the fatigue intensity is higher in females than males (14), but the study conducted by Fazel Asgarpour et al. did not find a significant relationship between gender and fatigue (15). In their study entitled "Relationship of fatigue and hostility with health in patients with coronary artery disease", Zahid et al. showed that the mean fatigue of females was significantly higher than males ( $P < 0.001$ ), which is inconsistent with the results of the present study (16). Also, in a study conducted by Mollaoglu, a significant relationship was found between gender and fatigue, so females reported more fatigue compared to males. He attributed this difference to males' unwillingness to express their fatigue, which might be related to the cultural factors of societies. He also reported that females experience more fatigue due to more responsibilities at home. However, in the present study, no significant difference was seen between males and females in terms of fatigue experience (17).

In a study conducted by Eckhart et al., no significant relationship was found between the type of treatment (including CABG and PCI) with the level of fatigue, but there was a significant relationship between age and fatigue ( $P < 0.003$ ), so younger people compared to older people showed more fatigue. Its reason can be attributed to the active presence of young people in society and spending more energy performing activities, which is not consistent with the results of the present study (14). In a study conducted by Falk et al. (2007), it was

found that the mean fatigue scores increase with aging, which is inconsistent with the results of this study (18). The reason for this difference might be physiological changes caused by the nature of chronic diseases. Similarly, the results of this study are consistent with the results of a study conducted by Sajjadi et al., as their results revealed no significant relationship between the duration of the disease and fatigue (19).

In general, the lack of a significant relationship between some demographic information and fatigue does not mean the lack of a real relationship, but the sample size of this study was not estimated to investigate these relationships. To investigate these relationships, a more specific study with a suitable sample size that focuses on these variables is required. Arefi (quoted by Ezati) writes that the term cardiac rehabilitation has been used more synonymously with physical exercise. Although physical exercise forms the core of cardiac rehabilitation, other important activities are included in the program.

A comprehensive rehabilitation program includes components such as exercise, recommendations about psychological and social problems, and health education. Patient education is one of the main components of heart patient care in the hospital and society and is one of the fundamental principles of treatment in cardiac rehabilitation programs. The level of people's knowledge and their understanding of disease risk factors and their motivation to reduce these factors can improve health and prevent disease through changes in people's lifestyles (20).

According to World Health Organization (WHO), nurses are considered active members of the rehabilitation team. In other words, rehabilitation is a major part of the nursing profession and nurses play a major and key role in it (21). It has been revealed that hospital education and routine physician visits after discharge will not fully meet the needs of patients recovering

from a cardiac event. Fatigue control involves pharmacological and non-pharmacological interventions. Many patients suffer from fatigue despite the use of various disease-modifying medications (6). Common non-pharmacological interventions include rest and sleep, relaxation, exercise, education, counseling, and rehabilitation (22). Cardiac rehabilitation for patients with coronary artery diseases such as heart attack, coronary artery bypass surgery, stable chronic angina, valve replacement, heart failure, heart transplant, and patients with pacemakers has many clinical advantages (23). It causes a significant reduction in the total rate of general death and specific death caused by heart diseases by adjusting the risk factors of coronary artery diseases and unhealthy behaviors (24).

### **Recommendations**

The implementation of a home cardiac rehabilitation program by nurses, as a low-cost, accessible, and feasible intervention, can be considered an effective step in reducing the fatigue of patients with coronary artery disease and should be considered by managers.

### **Conclusion**

Given what was stated above and considering that the population of elderly and people with chronic diseases is increasing and more nursing care is needed for patients with chronic diseases, nurses can play an important and effective role in the well-being of the patients by using educational and rehabilitation programs and providing physical, emotional, mental and psychological support of these programs to patients with chronic diseases. Since the basis of chronic disease control is improving the client's knowledge and performance about the prevention of complications, implementing the mentioned rehabilitation program can help the client to return to normal activities.

### Authors' contribution

Saeedeh Piri and Zahra Safavi Bayat developed the study concept and design. Seyedeh Nafiseh Mohammadi Yousefnejad and Sima Zohari Anboohi acquired the data. Mohamad Amin Pourhoseingholi and Shokoufeh Shafiee analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

### Informed consent

Questionnaires were filled with the participants' satisfaction and written consent was obtained from the participants in this study.

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### Conflict of interest

The authors declare that they have no conflict of interests.

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