Original Article

Effects of Changes in Myocardial Dysfunction on Quality of Life in Patients Undergoing Coronary Angioplasty After Cardiac Rehabilitation

Alireza Parsa[1], MD; Masoumeh Sadeghi[*2], MD; Farshad Roghahi[3], MD; Jafar Golshahi[4], MD; Azam Khani[1], MSc; Safoura Yazdekhasti[2], MSc

ABSTRACT

Background: Comprehensive cardiac rehabilitation programs constitute a treatment method in patients with coronary artery disease and can prolong patients' lifespan and reduce the frequency of readmission. The present study aimed to determine the effects of changes in myocardial dysfunction on quality of life after cardiac rehabilitation.

Method: The present interventional case-control study randomly assigned patients with coronary artery disease undergoing percutaneous coronary intervention to a case group (n = 40) and a control group (n = 40). A demographic questionnaire, the Beck Depression Inventory (BDI), the Baecke Physical Activity Inventory, and the MacNew Quality of Life Questionnaire were completed for all the patients before and after the study. Echocardiography and laboratory tests were also conducted. The case group underwent the cardiac rehabilitation program. The data collected were analyzed in SPSS 21 using measures of the independent and paired *t*-test, as well as the χ^2 test.

Results: The mean age of the study patients was 57.71 years. Moreover, 92.5% of the patients were male in both groups. The 2 groups were matched in terms of demographic characteristics. Cholesterol, fasting blood sugar, and smoking status were found to show statistically significant differences in the case and control groups after the intervention compared to before the intervention, whereas the difference in the mean scores of myocardial dysfunction was statistically insignificant at both time points. The intervention also improved the quality of life of the participants in the emotional, physical, and social dimensions ($P < 0.01$).

Conclusions: Cardiac rehabilitation programs are recommended with a view to improving quality of life in patients undergoing coronary angioplasty. ***(Iranian Heart Journal 2018; 19(1):52-60)***

KEYWORDS: Cardiac rehabilitation, Quality of life, Myocardial dysfunction, Coronary angioplasty

[1] Isfahan Cardiovascular Research Center, Cardiovascular Research Institute, Isfahan University of Medical Science, Isfahan, IR Iran.
[2] Cardiac Rehabilitation Research Center, Cardiovascular Research Institute, Isfahan University of Medical Science, Isfahan, IR Iran.
[3] Department of Cardiology, School of Medicine, Isfahan University of Medical Science, Isfahan, IR Iran.
[4] Hypertension research Center, Cardiovascular Research Institute, Isfahan University of Medical Science, Isfahan, IR. Iran.

***Corresponding Author:** Masoumeh Sadeghi, MD; Cardiac Rehabilitation Research Center, Cardiovascular Research Institute, Isfahan, IR Iran.
Email: sadeghimasoumeh@gmail.com **Tel:** 031 36115208-10

Received: October 8, 2017 **Accepted:** January 15, 2018

The growing prevalence of coronary artery disease (CAD) has turned into a health problem in recent decades, and researchers have sought therapeutic methods to reduce the burden and mortality caused by the disease. In Iran, CAD constitutes the first cause of death in women and the fourth in men. [1-2] The increasing prevalence of CAD coupled with more available treatment facilities has increased the frequency of performing coronary artery bypass graft surgery (CABG) and percutaneous coronary intervention (PCI) in Iran. Meanwhile, according to the guidelines designed by different cardiovascular societies across the world and depending on the disease risk, the methods of treating patients with CAD encompass invasive procedures such as coronary angioplasty and CABG, medicinal treatments in conjunction with lifestyle modification, and nonmedical treatments [3] including comprehensive cardiac rehabilitation programs in patients with ischemic heart disease. [4]

According to the American Heart Association, cardiac rehabilitation refers to a comprehensive lifestyle modification program and a secondary preventive measure that helps cardiovascular patients improve their symptoms, return to work more quickly, and promote their quality of life. [5] Researchers have suggested that this rehabilitation program can positively affect mortality, exercise tolerance, functional capacity, lipid levels, blood pressure, angina symptoms, shortness of breath, weight reduction, smoking, stress levels, psychological functions, and quality of life in cardiovascular patients. [6-15]

Moreover, longevity alone is no longer considered a measure for recovery and response to treatments inasmuch as quality of life is also an important measure in successful treatments. Health-associated quality of life is an indicator of individuals' feelings about their own health in terms of different physical, spiritual, mental, social, and environmental aspects. [12] Different studies have revealed that reduced quality of life in patients with ischemic heart disease increases the risk of the reoccurrence of cardiovascular events. [7-13] According to Dantas et al, [14] the progression of chronic diseases affects quality of life and cardiovascular patients vitally require changes in their lifestyle to control the symptoms and reduce the disease progression. Although cardiac rehabilitation is a comprehensive program for modifying lifestyle, identifying the elements of this program—which can improve quality of life—is rarely possible. Improving psychological factors—especially anxiety, [9] age, income, place of residence, the patient's ECG, [10] and no history of myocardial infraction [15] have been proposed as the factors associated with improving quality of life after participating in cardiac rehabilitation courses. Clinical symptoms in patients can also affect their quality of life. Myocardial dysfunction is an indicator that affects clinical symptoms in patients with ischemic heart disease and can cause asthma, fatigue, chest pain, and ultimately left or right ventricular failure and their symptoms in the patients. [16] Cardiac rehabilitation has been shown to improve these symptoms—particularly in patients with heart failure. [17-18] Improvements in quality of life have also been demonstrated to be associated with improvements in myocardial function in patients with myocardial infarction 1 year after the infliction. [7] Nevertheless, only a few studies have been conducted on the effects of changes in the myocardial function on improvements in quality of life following cardiac rehabilitation.

The present case-control intervention, therefore, sought to investigate the effects of cardiac rehabilitation on both improvement in quality of life and myocardial dysfunction in patients undergoing PCI.

METHOD

The present case-control study recruited patients with CAD undergoing PCI in private or public hospitals in Isfahan, Iran, between 23

August 2014 and 20 January 2015. The inclusion criteria comprised age over 40, no history of ischemic heart disease, no heart failure, patient's consent to participate in the study, no contraindications for cardiac rehab, physician's approval for the patient's participation in the study, and a maximum elapsed time of 2 weeks following PCI.

Patients who withdrew from cardiac rehabilitation before the end of the program, those who were absent in 3 consecutive sessions, or those suffering new cardiovascular problems during the program were excluded. The participants were briefed on the study objectives, and written consent was obtained. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences.

The patients were randomly assigned to a case group (n = 40) and a control group (n = 40) after being matched in terms of age and gender. A trained nurse completed the demographic questionnaires for all the patients. The questionnaires used in the present study were the Beck Depression Inventory (BDI) and the MacNew Quality of Life Questionnaire. The nurse also recorded the patients' history of having risk factors, diseases, and medication history. Twelve-hour fasting blood samples were also collected from all the patients to measure their complete blood count, fasting blood sugar, and lipids—namely cholesterol, triglyceride, high-density lipoprotein, and low-density lipoprotein. The patients' blood pressure was also measured 10 minutes after the test. In addition, a cardiology resident performed electrocardiography and measured the left ventricular (LV) function indicators—comprising the LV end-systolic dimension, LV end-diastolic dimension, posterior wall thickness, ventricular septum thickness, and LV ejection fraction.

The case group underwent cardiac rehabilitation within 2 days following the completion of the questionnaires and blood sampling. The rehabilitation program comprised 24 sixty-minute sessions of aerobic exercise during 8 weeks. The first 5 to 10 minutes were assigned to warm-up, followed by 20 to 40 minutes of aerobics and 10 minutes of cool-down. The main exercises included cycling using ergometers or walking and running using treadmills. Low-intensity stretching exercises were used for warm-up and cool-down. Individual specific diets were prescribed for all the participants at the beginning of the program as per their anthropometric measurements and also their test results of blood sugar and lipids. After the study, all the mentioned tests, questionnaires, and ECGs were repeated for all the participants. The subjects diagnosed with depression or anxiety based on the BDI as well as smokers and drug abusers were referred to relevant physicians. Risk factors in the patients including hyperlipidemia, diabetes, improper diets, and smoking were also treated in this program.

Measurements

The MacNew Quality of Life Questionnaire was developed in the 1990s and psychometrically validated and used in different studies on quality of life in patients with cardiovascular diseases. This 27-item scale measures physical, psychological, and social dimensions in cardiovascular patients on a 7-point Likert scale. [19-20] Asadi Lari et al [21] adapted this questionnaire for the Farsi language and confirmed its validity and reliability by calculating a Cronbach's alpha of 0.92 for the physical and emotional dimensions and 0.95 for the social dimension.

The standardized Farsi version of the BDI was completed by the patients to diagnose their possible depression. Twenty-one items of this questionnaire were rated 0 to 3 and the score of depression was calculated as the sum of scores of all the items—with the score of at least 17 indicating depression. [22]

The Baecke Physical Activity Questionnaire was also used to assess the level of physical activity in the subjects. Given that the patients

underwent PCI upon the commencement of the study, their physical activity was determined before performing PCI. This questionnaire comprised 16 spectra and 3 indices: sports index, work index, and leisure index. [23, 24]

Data Analysis

Descriptive statistics—consisting of frequency tables, diagrams, and descriptive indicators—were first used to analyze the data and explain the most important demographic characteristics, disease history, and smoking status of the participants. The independent *t*-test, paired *t*-test, and the χ^2 test were employed to compare the 2 groups. All the data collected were analyzed in SPSS 21 using a significance level of a *P* value less than 0.05.

RESULTS

The age of the study patients was between 40 and 79 years, with a mean of 57.71 years. Moreover, 92.5% of the patients were male in both groups. The 2 groups showed no significant differences and were matched in terms of underlying and confounding variables—including age, gender, weight, marital status, education level, occupation, history of hypertension, diabetes, smoking, and other underlying diseases. Table 1 presents more details by group and gender.

Table 1. Clinical and demographic characteristics of the case and control group by gender

Variable		Case Group (N=40)		Control Group (N=40)	
		Men frequency (%)	Women frequency (%)	Men frequency (%)	Women frequency (%)
Gender		37 (92.5%)	3 (7.5%)	37 (92.5%)	3 (7.5%)
Education level	Illiterate	5 (13.5%)	1 (33.3%)	3 (8.1%)	0 (0.0%)
	Primary school	7 (18.9%)	1 (33.3%)	9 (24.3%)	3 (100%)
	High school	14 (37.8%)	1 (33.3%)	19 (51.4%)	0 (0.0%)
	Diploma-bachelor's degree	3 (8.1%)	0 (0.0%)	2 (5.4%)	0 (0.0%)
	Master's degree and higher	6 (16.2%)	0 (0.0%)	3 (8.1%)	0 (0.0%)
	Seminary education	2 (5.4%)	0 (0.0%)	1 (2.7%)	0 (0.0%)
Marital status	Married	36 (97.3%)	3 (100%)	33 (89.2%)	2 (66.7%)
	Single	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Divorced	1 (2.7%)	0 (0.0%)	2 (5.4%)	0 (0.0%)
	Widow	0 (0.0%)	0 (0.0%)	2 (5.4%)	1 (33.3%)
Occupation	Self-employed	14 (37.8%)	0 (0.0%)	21 (56.8%)	0 (0.0%)
	Public	11 (29.7%)	0 (0.0%)	1 (2.7%)	0 (0.0%)
	Retired	11 (29.7%)	0 (0.0%)	12 (32.4%)	0 (0.0%)
	Housewife	0 (0.0%)	3 (100%)	0 (0.0%)	3 (100%)
	Unemployed	1 (2.7%)	0 (0.0%)	3 (8.1%)	0 (0.0%)
History of hypertension	Yes	13 (35.1%)	1 (33.3%)	11 (29.7%)	1 (33.3%)
	No	24 (64.9%)	2 (66.7%)	26 (70.3%)	2 (66.7%)
History of diabetes	Yes	9 (24.3%)	0 (0.0%)	12 (32.4%)	1 (33.3%)
	No	28 (75.7%)	3 (100%)	25 (67.6%)	2 (66.7%)
History of smoking	Never	27 (73%)	3 (100%)	16 (43.2%)	3 (100%)
	Used to	5 (13.5%)	0 (0.0%)	8 (21.6%)	0 (0.0%)
	Currently do	5 (13.5%)	0 (0.0%)	13 (35.1%)	0 (0.0%)

Table 2 compares the 2 groups before and after the intervention. Before and after the study, smoking status, cholesterol levels, and fasting blood sugar were significantly different between the case and control groups ($P < 0.05$).

Table 2. Results of the statistical tests of the study variables in the case and control groups before and after the study

Variable	Before the Study		*P*	After the Study		*P*
	Case Group (n=40)	Control Group (n=40)		Case Group (n=40)	Control Group (n=40)	
	mean±SD	mean±SD		mean±SD	mean±SD	
Duration of daily activity	6.25±0.96	6.45±1.37	0.73	7. 38±1.32	6.72±1.50	0.34
Fatigue	3.02±1.25	2.10±1.85	0.58	2.56 ±1.28	2.00±1.78	0.89
Smoking	1. 38±0.7	1. 80±0.79	0.01	1. 36±0.71	1. 85±0.83	0.006
Weight	74. 37±9.59	76. 52 ±11.25	0.36	73. 39±9.64	77. 83±11.52	0.07
Cholesterol	174.26±45.72	149.61±45.10	0.02	169.46±37.84	146.85±41.45	0.02
Depression	10.05±8.89	10.57±8.35	0.79	7. 89±7.17	10. 32±7.34	0.14
Fasting blood sugar	96.51±20.57	120.67±51.79	0.009	92.43±15.06	116.95±37.39	<0.001

Table 3 suggests that the mean scores of myocardial dysfunction exhibited an insignificant decrease in both groups except for the posterior wall thickness and the ejection fraction, which were insignificantly increased in the case group after the study.

Table 3. Results of the statistical tests of myocardial dysfunction in the case and control groups

Variable	Case Group		Paired *t*-test	*P*	Control Group		Paired *t*-test	*P*
	mean±SD				mean±SD			
	Before the Study	After the Study			Before the Study	After the Study		
ESD	35.18±9.91	33.44±8.5	1.24	0.23	39.27±18.16	39.02±16.32	0.12	0.90
EDD	50.65±12.38	50.54±10.14	0.05	0.96	50.98 ±8.58	50.64±6.58	0.30	0.76
PWT	8.01±3.25	9.58 ±1.50	1.25	0.24	9.82±2.94	9.32 ±2.42	1.61	0.11
VST	9.66±2.66	9.44 ±2.07	1.01	0.82	9.67 ±2.97	9.53 ±2.65	0.45	0.65
EF	52.92±11.84	54.22±11.52	1.002	0.32	51.41±11.48	51.23±9.83	0.16	0.87

ESD, End-systolic dimension; EDD, End-diastolic dimension; PWT, Posterior wall thickness; VST, Ventricular septum thickness; EF, Ejection fraction

Analyzing the data indicated that the mean score of all the dimensions of quality of life was increased in the case group after compared to before the intervention, while this increase was negligible in the controls. The statistical results showed no statistically significant differences in any dimensions of quality of life caused by the intervention in both groups except for the emotional dimension (Table 4).

Table 4. Quality of life in both groups after rehabilitation compared to before rehabilitation

Dimension	Before the Study		*P*	After the Study		*P*
	Case Group (n=40)	Control Group (n=40)		Case Group	Control Group	
	mean±SD	mean±SD		mean±SD	mean±SD	
Emotional	4.81±0.90	4.93 ±0.74	0.56	5.49 ±0.90	4.95±0.69	0.006
Physical	5.03 ±0.86	5.21±1.22	0.46	5.59±1.06	5.27±1.13	0.21
Social	5.11±0.83	5.38±1.12	0.24	5.73±0.95	5.44±1.05	0.23

Table 5 shows the differences in the case and control groups after the intervention. The findings obtained suggest that weight ($P = 0.001$) and all 3 aspects of quality of life– namely emotional, physical, and social—exhibited significant improvement in the case group compared to the control group ($P < 0.01$).

Table 5. Comparisons of the differences in the case and control groups after the intervention

	Case Group	Control Group	*P*
Physical activity	0.77±1.43	0.14 ±0.54	0.38
Fatigue	0.24±1.98	0.05±0.71	0.60
Smoking	0.03±0.43	0.05±0.22	0.75
Weight	-0.79±1.99	1.31±3.03	0.001
Depression	-2.37±6.06	-0.25±3.18	0.06
Cholesterol	-1.97±36.24	-2.77 ±27.79	0.92
FBS	-3.60±15.22	-3.72 ±38.06	0.98
ESD	-1.74±7.31	-0.14±22.24	0.61
EDD	-0.11±12.17	-0.40±7.84	0.92
PWT	1.57±3.73	-0.52±2.16	0.14
VST	-0.21±2.64	-0.08±2.11	0.87
EF	1.29±7.87	-0.05±7.58	0.45
Emotional dimension	0.67±0.87	0.03±0.24	<0.001
Physical dimension	0.54±0.69	0.05±0.39	0.001
Social dimension	0.58±0.63	0.06±0.39	<0.001

FBS, Fasting blood sugar; ESD, End-systolic dimension; EDD, End-diastolic dimension; PWT, Posterior wall thickness; VST, Ventricular septum thickness; EF, Ejection fraction

DISCUSSION

The present findings reflected in the mean differences in quality of life before and after the intervention suggested that cardiac rehabilitation programs can improve quality of life and weight in patients with myocardial infraction. The findings of the current study are consistent with a study by Choo et al, [25] who reported improved health-associated quality of life caused by cardiac rehabilitation programs. After discharge, patients may gradually disregard the therapeutic recommendations learnt; running this rehabilitation program therefore appears to be crucial. According to the results, teaching, controlling, and following up health behaviors in the study subjects can positively affect cardiac risk factors such as smoking, overweight, cholesterol, fasting blood sugar, and hypertension. In other words, informing these patients and reminding them of educational points and lifestyle modification can significantly help them control their cardiac risk factors.

We observed no significant differences in myocardial dysfunction and quality of life after compared to before the intervention in both groups. Sadeghi et al [26] found that 8 weeks of rehabilitation programs caused no statistical changes in their patients with CAD in terms of end-systolic dimension and end-diastolic dimension—attributing no harmful effects on ventricular changes to rehabilitation exercises.

The results obtained from the differences in the mean changes suggested improvements in weight and quality of life after rehabilitation in both groups. Yu et al [27] studied 296 patients with myocardial infraction undergoing angioplasty and reported that cardiac rehabilitation was able to significantly improve the function and quality of life in these patients via reducing pains and anxiety. Atlantis et al [28] indicated that sports interventions and behavior modification for 24 weeks improved quality of life and mental health and thereby reduced stress and depression in their patients. Moreover, Sebregts et al [29] studied patients with myocardial infraction and CABG and found that teaching patients was able to alleviate the symptoms of fatigue and depression in the case group.

Stress and depression are the common complications of myocardial infraction. The findings obtained from the present study suggested that implementing rehabilitation programs could not improve depression in the patients. McCarthy and Condon [30] studied the attitude of patients with chronic myocardial infraction toward changing their lifestyle and found stress to be a major concept as per the

patients' statements. They also found that cardiac rehabilitation programs helped the patients control their stress and reduce their anxiety and fear and thereby reduced their depression.

Given the present and similar findings, we recommend that cardiac rehabilitation programs be implemented after myocardial infraction with a view to furnishing patients with adequate knowledge and enabling them to make decisions on the necessity of changing their lifestyle and following the program (eg, quitting smoking, changing their diet, doing exercise, and regular walking).

CONCLUSIONS

The findings of the present study showed that early prevention is as effective as rehabilitation, awareness, commitment to accurate implementation of the rehabilitation program as well as patient encouragement to do their best to participate after angioplasty and effectively improve their quality of life compared to before participating in these programs.

REFERENCES

1. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. The Lancet. 2013; 380(9859):2095-128.

2. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The Lancet. 2013; 380(9859):2197-223.

3. Fihn SD, Gardin JM, Abrams J, Berra K, Blankenship JC, Dallas AP, et al. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. Journal of the American College of Cardiology. 2012; 60(24):e44-e164.

4. Hamm LF, Sanderson BK, Ades PA, Berra K, Kaminsky LA, Roitman JL, et al. Core competencies for cardiac rehabilitation/ secondary prevention professionals: 2010 update: position statement of the American Association of Cardiovascular and Pulmonary Rehabilitation. Journal of cardiopulmonary rehabilitation and prevention. 2011; 31(1):2-10.

5. King M, Bittner V, Josephson R, Lui K, Thomas RJ, Williams MA. Medical director responsibilities for outpatient cardiac rehabilitation/secondary prevention programs: 2012 update: a statement for health care professionals from the American Association of Cardiovascular and Pulmonary Rehabilitation and the American Heart Association. Circulation. 2012; 126(21):2535-43.

6. Marchionni N, Fattirolli F, Fumagalli S, Oldridge N, Del Lungo F, Morosi L, et al. Improved exercise tolerance and quality of life with cardiac rehabilitation of older patients after myocardial infarction: results of a randomized, controlled trial. Circulation. 2003; 107(17):2201-6

7. Ecochard R, Colin C, Rabilloud M, de Gevigney G, Cao D, Ducreux C, et al. Indicators of myocardial dysfunction and quality of life, one year after acute infarction. European journal of heart failure. 2001; 3(5):561-8.

8. Blankenship JC, Marshall JJ, Pinto DS, Lange RA, Bates ER, Holper EM, et al. Effect of percutaneous coronary intervention on quality of life: a consensus statement from the Society for Cardiovascular Angiography and Interventions. Catheterization and cardiovascular interventions: official journal of the Society for Cardiac Angiography & Interventions. 2013; 81(2):243-59.

9. Engebretson TO, Clark MM, Niaura RS, Phillips T, Albrecht A, Tilkemeier P. Quality of life and anxiety in a phase II cardiac

rehabilitation program. Medicine and science in sports and exercise. 1999; 31(2):216-23.

10. Muller-Nordhorn J, Kulig M, Binting S, Voller H, Gohlke H, Linde K, et al. Change in quality of life in the year following cardiac rehabilitation. Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation. 2004; 13(2):399-410.

11. Sarafzadegan N. Rabiei K. Kabiri A. Sadeghi M .Khosravi A. Asgari S. Taghipour HR. Roohafza H. Gender differences in risk factor and outcomes after cardiac rehabilitation. Acta Cardiol 2008 63(6); 763-70.

12. Health-Related Quality of Life (HRQOL) Atlanta, USA: Centers for Disease Control and Prevention; 2012. Available from: http://www.cdc.gov/hrqol/.

13. Mikkelsen SS, Mortensen EL, Flensborg-Madsen T. A prospective cohort study of quality of life and ischemic heart disease. Scandinavian journal of public health. 2014; 42(1):60-6.

14. Dantas RAS, Motzer SA, Ciol MA. The relationship between quality of life, sense of coherence and self-esteem in persons after coronary artery bypass graft surgery. International journal of nursing studies.2002; 39(7):745-55

15. Oldridge N, Gottlieb M, Guyatt G, Jones N, Streiner D, Feeny D. Predictors of health-related quality of life with cardiac rehabilitation after acute myocardial infarction. Journal of cardiopulmonary rehabilitation. 1998; 18(2):95-103.

16. SIGN 93 Acute coronary syndromes Edinburgh: Scottish Intercollegiate Guidelines Network; 2012. Available from: http://www.sign.ac.uk/pdf/qrgchd.pdf.

17. Keteyian SJ, Squires RW, Ades PA, Thomas RJ. Incorporating Patients with Chronic Heart Failure into Outpatient Cardiac Rehabilitation: PRACTICAL RECOMMENDATIONS FOR EXERCISE AND SELF-CARE COUNSELING-A CLINICAL REVIEW. Journal of cardiopulmonary rehabilitation and prevention. 2014; 34(4):223-32.

18. Zwisler AD, Soja AM, Rasmussen S, Frederiksen M, Abedini S, Appel J, et al. Hospital-based comprehensive cardiac rehabilitation versus usual care among patients with congestive heart failure, ischemic heart disease, or high risk of ischemic heart disease: 12-month results of a randomized clinical trial. American heart journal. 2008; 155(6):1106-13.

19. Lim L, Valenti L, Knapp J, Dobson A, Plotnikoff R, Higginbotham N, Heller RF.(1993). A self-administered quality-of-life questionnaire after acute myocardial infarction. J Clin Epidemiol, 46: 1249-1256.

20. Valenti L, Lim L, Heller RF, Knapp J. An improved questionnaire for assessing quality of life after acute myocardial infarction. Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation. 1996; 5(1):151-61.

21. Asadi-Lari M, Javadi HR, Melville M, Oldridge NB, Gray D. Adaptation of the MacNew quality of life questionnaire after myocardial infarction in an Iranian population. Health and quality of life outcomes. 2003; 1:23.

22. Beck A, Ward TC, Mendelson M. Beck depression inventory (BDI). Arch Gen Psychiatry. 1961; 4(6):561-571.

23. Baecke, J.A.H. and Burema, J.A (1982), short questionnaire for the measurement of habitual physical activity in epidemiological studies, American Journal Clinic Nutrition. 36:936-942

24. Khademi AR, Rahimi G, Mohammadi M. Comparison of physical activity and body mass index in women with and without miscarriage experiences. Advances in Natural and Applied Sciences. 2012 Oct 1;6(8):1336-48.

25. Choo J, Burke LE, Pyo Hong K. Improved quality of life with cardiac rehabilitation for post-myocardial infarction patients in Korea. European Journal of Cardiovascular Nursing. 2007;6(3):166-71.

26. Sadeghi M, Garakyaraghi M, Khosravi M, Taghavi M, Sarrafzadegan N, Roohafza H. The Impacts of Cardiac Rehabilitation Program on Echocardiographic Parameters in Coronary Artery Disease Patients with Left Ventricular

Dysfunction. Cardiology Research and Practice. 2013(2013), Article ID 201713, 4 pages.

27. Yu C-M, Lau C-P, Chau J, McGhee S, Kong S-L, Cheung BM-Y, et al. A short course of cardiac rehabilitation program is highly cost effective in improving long-term quality of life in patients with recent myocardial infarction or percutaneous coronary intervention. Archives of physical medicine and rehabilitation. 2014; 85(12): 1915-22.

28. Atlantis E, Chow CM, Kirby A, Fiatarone Singh M. An effective exercise-based intervention for improving mental health and quality of life measures: a randomized controlled trial. Preventive Medicine. 2004; 39(2): 424-34

29. Sebregts EHWJ, Falger PRJ, Appels A,Kester ADM, Bar FWHM. Psychological effects of a short behavior modification program in patients with acute myocardial infarction or coronary artery bypass grafting. A randomized controlled trial. Journal of psychosomatic research. 2005; 58(5):417-24.

30. Condon C, McCarthy G. Lifestyle changes following acute myocardial infarction: patients' perspectives. European Journal of Cardiovascular Nursing. 2006; 5(1):37-44.