

Similar effects of low to moderate-intensity exercise program vs moderate-intensity continuous exercise program on depressive disorder in heart failure patients

A 12-week randomized controlled trial

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Abstract

Background: Heart failure related depression is recently increased worldwide. Heart failure (HF) disease is identified as a critical cause of increasing morbidity, hospital readmission, and mortality. The most important purpose of treatment of HF disease is to relieve disease problems, improve functional performance, and achieve better quality of life.

Objectives: This study was proposed to evaluate the effects of low to moderate-intensity exercise program vs moderate-intensity continuous exercise program on the level of depressive disorder in heart failure patients.

Study design: 12-week randomized controlled trial.

Methods: Sixty nine HF patients with mild to moderate level of depression and ejection fraction <40% were examined before and after 12-week intervention. Their age was ranged from 40 to 60 years. Patients were randomly classified into 3 groups. Group I (n=23) received low to moderate intensity exercise program (LMIEP), group II (n=23) received moderate-intensity exercise program (MICEP), and group III (n=23) did not receive any exercise program (Non-exercised group). All patients were instructed to conduct home-based exercise with their pharmacological therapy. The level of depression was evaluated before and after 12 weeks of the intervention program.

Results: The 3 study groups were associated with significant decrease of depression level ($P < .05$). Significant differences were exhibited between the 3 groups in favor to both exercise programs ($P < .05$) with non-significant differences between the 2 exercise programs ($P > .05$).

Conclusions: Both exercise programs had positive effects in reducing the severity of depression in HF patients. Low to moderate and moderate-intensity exercise programs should be proposed for depression illness specially patients with heart failure.

Abbreviations: HF = heart failure, LMIEP = low to moderate intensity exercise program, max HR = maximum heart rate, MICEP = moderate-intensity exercise program, PHQ-9 = patient health questionnaire-9, SPSS = statistical package for social sciences.

Keywords: depression illness, ejection fraction, exercise, heart failure, PHQ9

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1. Introduction

Heart failure related depression is recently increased worldwide. Heart failure (HF) disease is identified as a critical cause of increasing morbidity, hospital readmission, and mortality.^[1] The most important purpose of treatment of HF disease is to relieve disease problems, improve functional performance, and achieve better quality of life.^[2,3]

Many problems of HF disease due to decrease of physical activity level which leads to muscular fatigability and respiratory dysfunction.^[4] Incidence of depression illness are greatly extended among HF patients throughout the world from 9% to 60% based on the features of depression illness.^[5]

Major depression illness is a common manifestation in the clinical care with consequential outcomes in expression of expenditures of health care and health-related quality of life.^[6] Depression illness plays an important role in health and live of population. Depression is considered as a major health problem throughout the world causing high mortality rate and functional impairments.^[7] Early studies approved that depression illness is identified as a prominent cause of risky health problems in HF patients such as hospitalization and decease.^[8]

Traditional treatment includes psychological dimensions (psychotherapy, social therapy, and family therapy) or biological dimensions (pharmacological therapy and modification of medical disorder).^[9] Combination between psychological and biological dimensions in the treatment of depression illness is usually performed for appropriate and effective results. Pharmacological therapy of depression illness is usually leading to undesired results^[10] or contraindicated in cardiac patients. Therefore, intervention of aerobic exercise may present a safe and proper method for depression illness in HF patients.

It was reported that aerobic exercise with different intensities has a beneficial influences in patients with HF^[11–13] but few researches were proposed to compare the effects of low to moderate exercise program vs moderate-intensity continuous exercise program on depression illness in HF patients. Based on these documents, the hypothesis of the study was that both of the exercise programs could be effective in controlling depression in HF patients. The main aim of our study was to assess the therapeutic effects of low to moderate exercise program vs moderate-intensity continuous exercise program on depression disorder in HF patients.

2. Materials and methods

2.1. Ethical approval

A 12-week randomized controlled study was designed to evaluate the effects of low to moderate and moderate-intensity exercise programs on the depression disorder HF patients. The study proposal was approved by the localized ethical committee of physical therapy department, Prince Sattam bin Abdulaziz University [RHPT/017/010]. The present study complies with the guidelines of Helsinki Declaration.

2.2. Patients

Sixty nine HF patients with mild to moderate depression (40–60 years) were included in the study from June to September 2017. The medical diagnosis of the study patients was systolic HF with reduced ejection fraction <40% (class II–III based on the New York Heart Association classification concerning symptoms intensity with physical activity practice.^[14]

Each patient was clinically stable with no medical interference for 30 days at least. Also, all patients were diagnosed with mild to moderate depression on the basis of validated patient-health questionnaire-9 (PHQ-9) integrating the diagnosis criteria of depression illness by psychiatrist at university hospitals.^[15] Each patient was referred to physical therapy outpatient clinic after agreement of the physicians of cardiology and psychiatry at the university hospital. All patients had no reasons to fulfill the study protocol. Any patient has severe depression, musculoskeletal disorders, neuromuscular disorders, life limiting-diseases, and cognitive dysfunctions, was excluded from the study.

This study recruited a sample size of 69 patients according to available resources more than power estimation. Avoiding the type II error, the 69 patients were classified into 3 groups (each group included 23 patients) by the random number table. Group I, 23-patient (16 males and 7 females), conducted a program of low to moderate-intensity exercise (LMIE) for 12-week, 3 times/week. Group II, 23-patient (18 males 5 females), conducted a program of moderate-intensity continuous exercise (MICE) 12-week, 3 times/week. Group III, 23-patient (17 males and 6

females), did not conduct any exercise program (Non-exercised group). Eighty patients were examined for eligibility to participate in the study program. Seven patients did not have the study inclusive criteria and 4 patients refused to conduct the study program. Randomization was allocated before conducting the program of the study. The flow diagram of the study participants through the trial is shown in Figure 1.

2.3. Study procedures

2.3.1. Assessment. All patients of the 3 study groups were examined for the level of depression illness utilizing validated PHQ-9 at the beginning of the study program at baseline, after 6 weeks, and after 12 weeks of the study program by blinded examiners. PHQ-9 was equipped for assessing the level of the depression illness on the basis of the questionnaire score. From 5 to 9 means mild, from 10 to 19 means moderate, and more than 20 means severe depression illness.

2.4. Intervention

All of the 69 patients were instructed to conduct home-based exercise with their pharmacological therapy. The 2 exercise groups were supervised and designated feedback to adjust the prescribed exercise intensity.

2.4.1. Group I (LMIEP). The patients of this group conducted a low to moderate-intensity exercise program 3 sessions/week for 12 weeks. Each session was started by 5 to 10 minutes warming-up and ended by 5 to 10 minutes cooling-down. A maximum heart rate (max HR) was estimated before starting the exercise program. During the first 6 weeks, the patients conducted low-intensity treadmill exercise at 40% to 50% of the max HR (20–30 minutes/session, 3 sessions/week). While during the last 6 weeks, the patients conducted moderate-intensity treadmill exercise at 50% to 70% of the max HR (30–40 minutes/session, 3 sessions/week).

2.4.2. Group II (MICEP). The patients of this group conducted a moderate-intensity continuous exercise program 3 sessions/week, 40 to 50 minutes for 12 weeks. Each session included a 5 to 10 minutes warm up, followed by 30 minutes of moderate aerobic exercise (treadmill walking exercise) with constant intensity at 60% to 70% of max HR and 5 to 10 minutes cool down.

2.4.3. Group III (non-exercised). The patients of this group conducted only patient recommendations which given by cardiologist and psychiatrists to do home program protocol that includes being active, staying with helpful or supportive people, doing fun work each day, relaxing, and setting simple goals for 12 weeks.

2.5. Statistical analysis

The data were analyzed using the statistical package for social sciences (SPSS v.20, Chicago, IL, USA). Kolmogorov–Smirnov test was performed to assess the normality of data. Categorical variables were reported as numbers and percentages, while the continuous variables were reported as means \pm standard deviations (SD). Interferential statistics were used to evaluate the changes of depression scores utilizing unpaired one-way ANOVA between the 3 study groups and between the 3 measures within each group. Statistical significance was set at P value < .05.

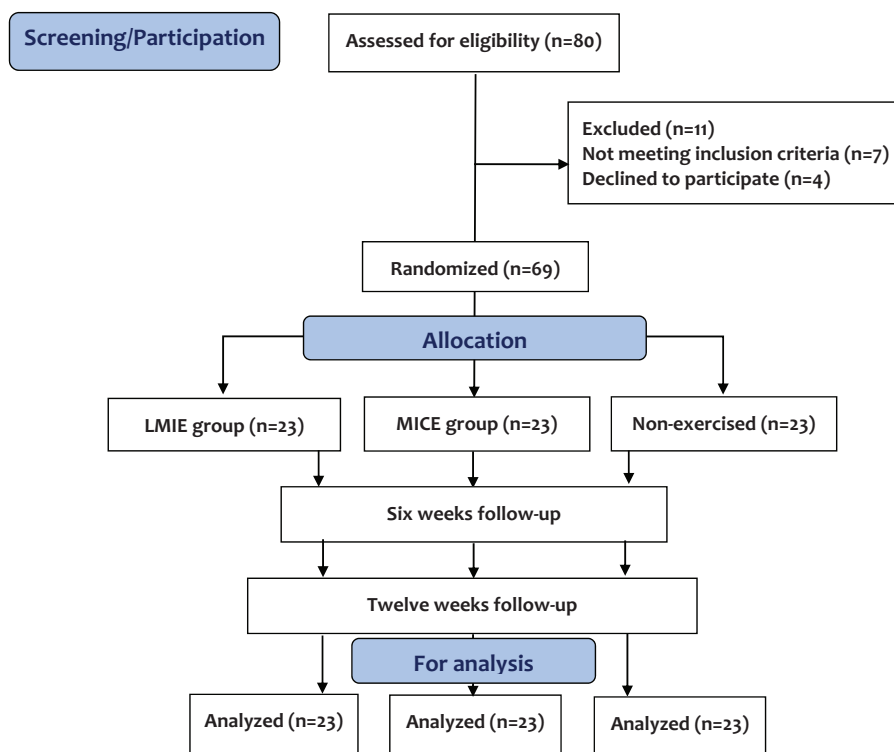


Figure 1. The flow diagram of the study participants through the trial.

3. Results

Eighty volunteered patients were assessed for eligibility, 69 patients (51 males and 18 females) were enrolled in the study program. Analysis of demographic data and clinical characteristics demonstrated non-significant differences between the 3

Table 1
Demographic and baseline features of the 3 studied groups.

Variables	LMIE (n=23)	MICE (n=23)	Non-exercised (n=23)	P value
Age (years)	52.6±7.1	53.4±6.3	52.9±7.8	.93
Gender, n (%)				
Males	16 (69.5)	18 (78)	17 (74)	.94
Females	7 (30.5)	5 (22)	6 (26)	
BMI (kg/m ²)	29.8±2.8	29.4±3.5	30.2±2.4	.65
Hemodynamics				
Rest HR (beat/min)	87.2±19.4	85.6±21.8	86.5±22.3	.97
Rest SBP (mm Hg)	122.5±18.3	117.2±23.4	120.4±22.7	.71
Rest DBP (mm Hg)	79.4±10.2	78.6±11.5	76.4±9.8	.61
Education level, n (%)				
No formal education	3 (13)	5 (21.7)	3 (13)	.81
Primary school	7 (30.5)	4 (17.4)	5 (21.7)	
Middle school or more	13 (56.5)	14 (60.9)	15 (65.3)	
Marital status, n (%)				
No	15 (65.2)	19 (82.6)	17 (74)	.80
Yes	8 (34.8)	4 (17.4)	6 (26)	
Ejection fraction (%)	34.2±4.8	37.5±5.6	36.3±3.4	.06
VO _{2peak} (mL min ⁻¹ kg ⁻¹)	15.42±3.4	15.17±3.6	14.85±3.7	.86

BMI=body mass index, DBP=diastolic blood pressure, HR=heart rate, LMIE=low to moderate-intensity exercise, MICE=moderate-intensity continuous exercise, SBP=systolic blood pressure, VO_{2peak}=maximal oxygen uptake.

study groups before conducting the study program ($P > .05$) as described in Table 1.

The scores of PHQ-9 were significantly decreased in the 3 groups of the study after 6 and 12 weeks follow-up ($P < .05$) with significant changes between the 3 groups in favor to the 2 exercise groups when compared with the non-exercised group ($P < .001$) as described in Table 2.

After 6 weeks follow-up, the PHQ-9 score was decreased in the LMIE, MICE, and non-exercised groups about (51.9%, 52.1%, and 26.95%, respectively) while after 12 weeks follow-up, the PHQ-9 score was decreased in the LMIE, MICE, and non-exercised groups about (77.4%, 80.9%, and 46.46%, respectively) as presented in Table 2.

Comparing the PHQ-9 score between the 2 exercise groups exhibited non-significant differences at 6 and 12 weeks follow-up ($P = .92$, $P = .14$, respectively) which indicates similar effects of the LMIE and MICE programs on the level of depression in HF patients as described in Table 3.

Table 2
Baseline and changes of the PHQ-9 scores after 6 and 12 weeks follow-up between the 2 exercise and non-exercised groups.

Depression Scale	LMIE (n=23)	MICE (n=23)	Non-exercised (n=23)	P value
Baseline	16.12±3.1	16.34±2.58	15.95±3.14	.90
6 weeks follow-up	7.74±3.26	7.83±3.22	11.65±3.28	<.001
12 weeks follow-up	3.65±1.21	3.12±1.18	8.54±2.14	<.001
P value	<.001	<.001	.002	
Percent of changes (%)	77.4	80.9	46.46	

LMIE=low to moderate-intensity exercise, MICE=moderate-intensity continuous exercise, PHQ-9=patient health questionnaire-9.

Table 3
Baseline and changes of the PHQ-9 scores after 6 and 12 weeks follow-up between the LMIE and MICE groups.

PHQ-9	LMIE (n=23)	MICE (n=23)	P value
Baseline	16.12 ± 3.1	16.34 ± 2.58	.79
6 weeks follow-up	7.74 ± 3.26	7.83 ± 3.22	.92
12 weeks follow-up	3.65 ± 1.21	3.12 ± 1.18	.14
P value	<.001	<.001	

LMIE = low to moderate-intensity exercise, MICE = moderate-intensity continuous exercise, PHQ-9 = patient health questionnaire-9.

4. Discussion

Although regular aerobic exercise training was identified as an important for general health well-being, the influences of aerobics training on particular population with psychological illness were subjected to be considered, and the most of researches showed safe and effective results,^[11,16] while other studies less encouraged this issue.^[17,18] This could be result from the different medical conditions of the examined patients, different levels of condition severity, medications, study procedures, outcome measures, and exercise types.

Our study was proposed to examine the effects of low to moderate-intensity exercise program vs moderate-intensity continuous exercise program on the level of depressive disorder in HF patients. The study findings showed that the 2 exercise programs have positive and beneficial effects to decrease the depression level in HF patients with no statistical differences between them. HF disease is identified as one of the common causes of depression illness. Achieving appropriate treatment of HF disease, the depression illness has to be relieved.^[19]

Various researches provided that aerobic training has effective results in HF disease and depression illness. Further reports provided that the aerobic exercise characteristics have to be well proposed including exercise intensity, duration, and exercise frequency to achieve the desired reduction in the symptoms of the major depressive disorder.^[20]

Previous studies approved that aerobic exercise training excites secretion of 4 molecules contradicting the impacts of depression illness and leading to neurogenesis. Moreover, the positive clinical effect of exercise training on depressed subjects involving, stress control, attitude improvement, outlook enhancement, self-dependence, confidence, trust, and healthy mentality.^[21]

The present study showed that low to moderate-intensity and moderate-intensity continuous exercise programs have been designed to provide a safe, advantageous culture, realizable, and evidence-based physiotherapy practice for depression status in HF patients.

In consistent with present study findings, it was documented that 10-day walking exercise (30 minutes/day) presented a definitive reduction in depressed individuals with MDD utilizing depressive rate-scale.^[22] As well, another study explained that short-term endurance exercise program resulted in a higher decrease of psychiatric depression illness than antidepressant medications in depressed patients.^[23] Additionally, others confirmed that supervised exercise program achieve beneficial effects on functional capacity and energy consumption than home-based aerobics in patients with coronary artery disease associating with a great reduction of depression manifestations.^[24,25]

4.1. Limitations of the study

This single blinded randomized controlled trial has some limitations. First, lacking of the pharmacological therapy for depression illness and HF disease for the study participants. Second, there was no evaluation of exercise compliance to pharmacological therap. Third, energy expenditure and fitness were not assessed which could achieve appropriate assessment of the exercise intensity. Additional trials are necessitated to assess the influences of various exercise intensities and durations on depression status in HF patients.

5. Conclusions

Briefly, it was concluded that both exercise programs had positive effects in reducing the severity of depression in HF patients. Low to moderate and moderate-intensity exercise programs should be proposed for depression illness specially patients with HF.

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