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The Effects of Tailored Energy Preservation Training on Fatigue and Re-admission in Patients with Heart Failure: A Randomized Clinical Trial

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Abstract

Background: Fatigue and re-admissions are the important consequences of heart failure that cause limitations in patients' daily activities, personal, and social affairs. Energy conservation techniques are among evidence-based and non-pharmacological approaches that can reduce fatigue in patients with chronic disease.

Aim: The present study was performed with aim to determine the effects of tailored energy conservation training on fatigue and readmissions of patients with heart failure (HF).

Method: This randomized clinical trial study was performed from May 2019 to March 2020 on 96 patients with HF admitted to CCU and cardiovascular clinics affiliated to Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran. Patients who met the inclusion criteria were randomly assigned to the intervention and control groups. A three-part tool (demographic-clinical questionnaire and need assessment), the Fatigue Severity Scale (FSS) and a readmissions record checklist were used to collect data. After determining the training needs of each individual, the intervention group received five 45-minute face-to-face individual training sessions of energy conservation strategies reinforced by telephone support every two weeks and followed up for 12 weeks. The control group only received routine post-discharge training. Fatigue scores by FSS and the readmissions recorded were tested at baseline and three months after the end of the intervention.

Results: At baseline, the two groups were comparable in the mean hospital admissions and fatigue scores. However, after the intervention, the mean frequency of hospital admissions and the mean fatigue score were significantly lower in the intervention group (1.36±1.26, P< 0.001; 2.86±1.01, P< 0.001) than in the control group (0.42±0.77, P< 0.001; 5.25±1.03, P< 0.001) respectively.

Implications for Practice: Nurses and physicians are recommended to teach energy conservation methods to patients with HF and chronic conditions who are prone to fatigue and its side effects.

Keywords: Education, Fatigue, Heart failure, Patient readmissions, Patient-specific

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Introduction

Congestive heart failure (CHF) is a complex, debilitating, and chronic syndrome (1). It affected about 64.34 million people worldwide suffered from heart failure (HF). Approximately, 9.91 million years lived with disability (2). Fatigue is one of the most common and debilitating problems that is experienced by almost 75% of patients with CHF (3). Fatigue manifests in the physical dimension as lack of energy and need for rest, in the cognitive dimension as poor concentration, and in the emotional dimension as declining motivation and interest (4). On the one hand, fatigue imposes high costs on the health care system, and on the other hand, it negatively affects the quality of life (QOL) of patients and their families (5). The study conducted in Iran found that 30% (6) and In the United States, 20.2% of patients with HF were readmitted within 30 days of discharge (7). Stressful events, non-compliance with medication orders, inappropriate diet and activity patterns are among the main factors related to readmission (8). Also, these patients are at risk of disease recurrence. Therefore, one of the main goals is to prevent re-hospitalization due to heart failure (9).

Care management practices increasingly involve human factors that can influence therapeutic interventions. If interventions are made in some components, possible readmissions will be reduced. These components include education and assessment, rest and relaxation, exercise and patient outcomes for hospitalization. A person-centered approach can enhance self-efficacy for the patients with HF (10).

Although drug interventions are often used as the easiest way to get rid of symptoms, they cannot relieve symptoms on their own, and even some of these drugs may be contraindicated in heart failure, so the use of non-drug methods seems reasonable to reduce patients' fatigue (11). Evidence suggests that self-care training based on learning needs improves self-care behaviors in HF patients (12). One of the self-care training methods which can be used to gradually increase the patient's capacity and ability is teaching the use of energy conservation techniques (13).

Energy conservation techniques (ECT) such as simplifying tasks, reducing workload, planning and scheduling daily tasks, using proper body mechanics, using effective methods, using energy conservation devices, and adequate rest are among evidence-based and non-pharmacological ECT that can reduce fatigue in patients with CHF (11) . Tailored and pre-designed training of patients and their families can significantly contribute to the implementation of therapeutic and rehabilitation strategies by reducing the likelihood of errors and inconsistencies between the training provided and the needs of clients (3).

The findings of the study by Wang et al. (2015) also confirmed the positive effect of educational-supportive nursing care programs on reducing fatigue and readmission of patients with HF (14). However, findings of some studies did not show a significant reduction in readmission rate of HF patients (15, 16)

The researchers are challenged regarding the effects of education and the selection of effective educational methods in patients with heart failure that can reduce the important complications of the disease. Therefore, this study was conducted with aim to determine the effects of tailored energy preservation training on fatigue and readmission of patients with HF.

Methods

This clinical randomized controlled trial study was conducted from May 2019 to March 2020 0 on 96 patients with CHF admitted to the coronary care units (CCU) and cardiovascular clinics affiliated to Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

The sample size was estimated based on the results of a previous study (17) and considering power of 90%, $\alpha = 0.05$, $s = 0.47$ and $d = 0.3$, and using the formula. Therefore, the sample size was calculated to be 43 subjects in the control group and 43 in the intervention group. Considering 10% attrition rate, the final sample size was set at 48 per group.

Inclusion criteria were: a medical diagnosis of stable CHF of grade 2, 3, or 4 for at least six weeks, an ejection fraction (EF) of less than 45%, the ability to read and write in Persian, full consciousness and awareness of time and place. Absence in more than one training session, deterioration of the clinical condition, decision to withdraw from the study and death of the patient were considered as the exclusion criteria.

Participants were recruited and randomly divided into two groups of intervention and control using

the block randomization with a block size of four and an allocation ratio of 1:1. The randomization list was prepared by a biostatistician. Due to the nature of this study, it was not possible to blind the researchers and participants, but after randomization, codes allocated to each participant were kept by the secretary of each clinic for preserving allocation concealment. Therefore, neither the participant nor the researcher was aware of the allocation order until the intervention started. All participants signed the written informed consent. Questionnaires were completed by participants in the presence of one of the researchers to ask their questions.

Data was collected through a two-part tool. The first part included questions on patients' demographic and clinical characteristics and the second part was the needs assessment questionnaire. The researcher-made needs assessment questionnaire was extracted using review of literature and confirmed by qualitative content validity and Cronbach's alpha and the internal consistency (α=0.976). The Fatigue Severity Scale (FSS) was used to measure the severity of fatigue and a checklist was applied to record the frequency of readmissions during the study. FSS was developed and validated by Krupp et al. (1989) to measure the severity of fatigue (18). The validity and reliability of FSS have been verified in various populations. Ziaeirad et al. evaluated the validity and reliability of the Persian version of the FSS and its Cronbach's alpha coefficient was reported 0.8 and 0.92, respectively (3). All participants completed the demographic questionnaire and the FSS at baseline. At the end of the study, they again completed the FSS.

Patients in the intervention group received a 12-week educational supportive care program exactly based on the needs assessment at first visit, and every three weeks in the CCU or cardiovascular outpatient clinics. Patients in the control group received only routine training on post-discharge care, follow-up care and follow-up visits, as well as referrals to rehabilitation clinics. This information was provided by the nurses in charge and the ward secretary. After the interventions (about 3 months after the pre-test), the post-test was performed with a FSS for both intervention and control groups and the results were compared. Also, the number of readmission of patients after 3-month was recorded.The stages of the study and intervention process is given in Table 1.

Results were presented as absolute frequencies and percentages for qualitative variables. The continuous variables results were reported as mean±SD (and median (first quartile, third quartile) for abnormal variables). Normality distribution of data was assessed using the Shapiro-Wilk test. Quantitative variables were compared with t-test or Mann-Whitney U-test, whenever appropriate. Wilcoxon's paired samples test and paired samples t-tests were used to compare the frequency of admission and fatigue at baseline and week 12. Categorical variables were compared using the Chi-square or Fisher's exact test. Generalized linear models were used to compare week 12 measurements of outcomes between the two groups adjusted for baseline frequency of hospital admissions, weight, disease duration, echocardiography and IHD. Two-sided $P < 0.05$ were considered statistically significant. Data were analyzed by SPSS statistical software (version 18.0.0.) (SPSS Inc. Chicago, IL, USA).

Table 1. Individual training algorithm

Training steps		Educational measures
First stage	Formulation of goals based on the individual needs of patients	• Interview with patients individually about the disease focusing on the subjects of fatigue, factors, symptoms, monitoring, characteristics and ways to control it
	Formulation of goals based on the individual needs of patients' families	• Interviews with family members, considering that the patient's family is the main constituent of the patients' environment and have the most social relations with them in order to achieve the main goals based on the family and social needs of patients.
Second stage	Set educational priorities	• Classify the main objectives extracted in the previous step • Prioritization based on educational needs: in such a way that more basic and essential needs are prioritized and less important needs will be followed. • Personalize the educational content needed to achieve each of the goals

Table 1. Continued

Third stage	Interventions	• Patients in the intervention group received a 12-week educational supportive care program based exactly on the needs assessment developed in the previous stage (first visit, and every three weeks, a training session after the first visit and for twelve weeks after the first visit). The first visit was in the third week, the sixth week, the ninth week and the twelfth week in the CCU or cardiovascular outpatient clinics). • General trainings include: training to recognize the nature of the disease, diet, medication, non-drug diet, fatigue assessment and monitoring, fatigue management training (daily weight control, activity and rest, exercise, vaccination against Influenza, recognizing the worsening of symptoms and the need for regular visits to the doctor) and teaching energy conservation behaviors, including the principles of simplifying activities, reducing the amount of activities and planning and organizing activities including cleaning, bathing, preparation and eating food, shopping, as well as the proper use of body mechanics, the use of relaxation techniques (muscle relaxation, yoga, etc.) in order to balance work and rest • Performing educational interventions in face-to-face sessions with the presence of a companion in the form of a lecture and using slides, video projectors and, if necessary, in the form of a practical demonstration with questions and answers. • Provide educational CDs or educational brochures including information about the nature of heart failure and the principles of self-care and energy conservation techniques along with the relevant image.
The fourth step	Data Collecting	• After the interventions (about 3 months after the pre-test), the post-test was performed with a FSS for both intervention and control groups and the results were compared. Also, the number of readmission of patients after a 3-month follow-up was recorded.

Results

A total of 96 patients enrolled in the study, that 6 in control group and 1 in the intervention group lost the study. Finally, data from 42 subjects in the control group and 47 in the intervention groups were analyzed (Figure 1).

The two groups were homogeneous in terms of demographic and clinical characteristics (P> 0.05), except for history of ischemic heart disease (P= 0.02), the severity of CHF (P = 0.013), mean weight (P = 0.002), and mean disease duration (P = 0.005) (Tables 2).

In the control group, the mean frequency of hospital admissions was 7.36±6.03 at baseline and decreased to 1.36±1.26 at the end of the study (P < 0.001). Also, in the intervention group, the mean frequency of hospital admissions was 4.21 ± 4.63 at baseline and decreased to 0.42 ± 0.77 at the end of the study (P < 0.001) (Table 3). Although the mean baseline hospital admission was higher in the control group, the difference between the two groups was not statistically significant after controlling of confounding variables (P = 0.086). After the intervention, the mean frequency of hospital admissions was again higher in the control group than in the intervention group. However, the difference between the two groups was statistically significant after controlling of confounding variables (P = 0.001) (Table 3).

In the control group, the mean fatigue score was 4.83±0.83 at baseline and increased to 5.25±1.03 at the end of the study (P = 0.042). In contrast, in the intervention group, the mean fatigue score was 4.57±1.08 at baseline and decreased to 2.86±1.01 at the end of the study (P < 0.001) (Table 3). Furthermore, the mean baseline fatigue score was higher in the control group, and the difference between the two groups was statistically significant after controlling of confounding variables (P =

0.042). After the intervention, the mean fatigue score was again higher in the control group than that of the intervention group, and the difference between the two groups was statistically significant after controlling of confounding variables (P = 0.001) (Table 3).

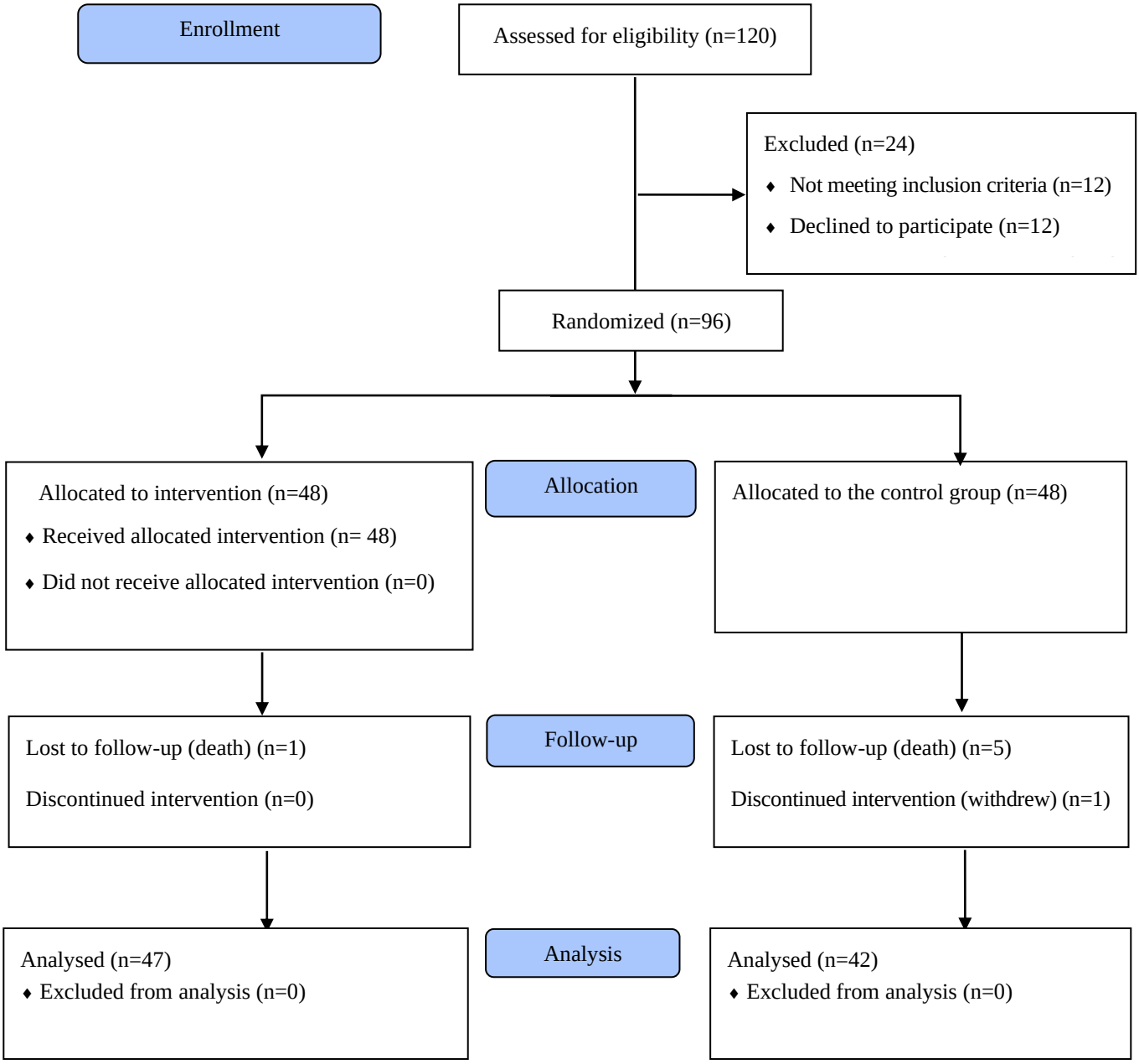

Figure 1. CONSORT 2010 Flowchart

Table 2. Characteristics of participants in the intervention and control groups

Characteristics		Control group (n = 42)	Intervention group (n = 47)	Statistics	P-value
Age; year	(Mean±SD)	60.19 ± 12.05	57.29 ± 11.14	t=1.17	0.243[a]
Weight; kg	Mean±SD	69.14 ± 10.92	78.19 ± 15.23	t=- 3.18	0.002[a]
Disease duration; month	Mean±SD	33.61 ± 28.75	24.58 ± 33.97	Z=- 2.78	0.005[b]
	Median (Q_1, Q_3)	23.0 (12.0, 51.0)	12.0 (6.0, 24.0)		

Table 2. Continued

Echocardiography	Mean±SD Median (Q_1, Q_3)	24.52 ± 7.71 25.0 (18.75, 31.25)	24.68 ± 6.86 25.0 (20.0, 30.0)	Z=- 0.143	0.886[b]
Gender: Female		20.0 (47.6)	17.0 (36.2)	Z=1.19	0.291[b]
Marriage status; n (%)	Single Married	1.0 (2.4) 41.0 (97.6)	0.0 (0.0) 47.0 (100)	Fet=1.13	0.472 [c]
Educational status; n (%)	Illiterate Under diploma Upper diploma	19.0 (45.2) 19.0 (45.2) 4.0 (9.6)	10.0 (21.3) 26.0 (55.3) 11.0 (23.7)	X=6.89	0.032[d]
Economic status; n (%)	Poor Moderate Good	12.0 (28.6) 25.0 (59.5) 5.0 (11.9)	6.0 (12.8) 35.0 (74.5) 6.0 (12.8)	X=3.48	0.175[d]
Current smoker; n (%)		10.0 (23.8)	12.0 (25.5)	Fet=0.03	> 0.99 [c]
Disease type	HTN; n (%) DM; n (%) IHD; n (%) HLP; n (%)	21.0 (50.0) 24.0 (57.1) 27.0 (64.3) 17.0 (40.5)	24.0 (51.1) 19.0 (40.4) 18.0 (38.3) 23.0 (48.9)	Fet=0.01 Fet=2.48 Fet=5.99 Fet=0.64	> 0.99 [c] 0.140 [c] 0.020 [c] 0.523 [c]
Heart failure functional class; n (%)	I II III IV	0.0 (0.0) 18.0 (42.9) 23.0 (54.8) 1.0 (2.4)	6.0 (12.8) 27.0 (57.4) 14.0 (29.8) 0.0 (0.0)	X2=10.47	0.013[d]

[a]Independent t test
[b]Mann-Whitney U
[c] Fisher's exact test
[d] Chi-square test.

Table 3. The outcomes at baseline and week 12 in the two groups

	Characteristics	Control group (n = 42)	Intervention group (n = 47)	Statistics	P-value	Statistics	P-value
Fatigue	Baseline	4.82 ± 0.82	4.56 ± 1.08	t=1.28	0.203[a]	GLM=0.613	0.434[b]
	Week 12	5.24 ± 1.03	2.86 ± 1.00	t=11.03	< 0.0001[a]	GLM=95.86	< 0.0001[b]
	Mean difference	- 0.42	1.70	-	-	-	-
	Statistics	t=- 4.51	t=19.09	-	-	-	-
	P-value	< 0.0001[c]	< 0.0001[c]	-	-	-	-
Frequency of hospital admissions	Baseline	7.35 ± 6.02	4.21 ± 4.63	t=- 2.79	0.005[a]	GLM=14.01	0.0001[b]
	Week 12	1.35 ± 1.26	0.42 ± 0.77	t=- 3.72	<0.0001[a]	GLM=10.89	0.001[d]
	Mean difference	6.00	3.78	-	-	-	-
	Statistics	t=- 5.32	t=- 5.62	-	-	-	-
	P-value	< 0.0001[c]	< 0.0001[c]	-	-	-	-

[a] Independent samples t-test or Mann-Whitney test (i.e. without any adjustments).
[b] Generalized linear model adjusted for weight, disease duration, echocardiography and IHD.
[c] Paired t-test or Wilcoxon test.
[d] Generalized linear model adjusted for baseline frequency of hospital admissions, weight, disease duration, echocardiography and IHD.

Discussion

The results of the present study showed that both study groups experienced a significant decrease in their fatigue at the end of the study. However, the decrease in fatigue was dramatically higher in the

intervention group and the difference between the two groups was statistically significant. These findings indicate the effectiveness of the energy conservation training program. Consistent with the findings of the present study, previous studies have demonstrated the effectiveness of tailored training in enhancing patients' knowledge and performance.

In the study on patients with HF, Heidari et al. (2017) reported that tailored training combined with telephone follow-up significantly improved patients' health behaviors and QOL (19). Wang et al. (2016) also reported that the implementation of tailored, individualized face-to-face training could improve the QOL and reduce fatigue in patients with HF (14). In the current study, Fatigue Severity Scale (FSS) was used, which is a more appropriate tool than the tool used in the study of Wang et al. and does not have the limitations of long tools to measure fatigue. In addition, the present study was conducted with a larger sample size and a longer follow-up period that make the findings of the present study more reliable.

Ziaerad et al. (2017) also implemented an energy conservation training program and reported that the intervention could significantly reduce the severity of fatigue in patients with HF. However, some limitations were mentioned in their study, e.g. limited sample size (n=51), and the impossibility of investigating the effect of energy conservation techniques on patients' fatigue in a longer period of time (11) .

Patients with CHF experience frequent hospitalizations and readmissions. There are various reasons for readmission in heart failure, one of which is insufficient patient education (20). The independent and combined effects of education and evaluation are the most beneficial strategies to obtain positive benefits to prevent or reduce readmission of HF patients (10). In the present study, the training program significantly reduced the frequency of hospital readmissions in the intervention group. In line with the findings of the current study, some studies have shown that training programs can increase the knowledge of patients with HF (21), improve their self-care behaviors, and decrease their exacerbations and hospital readmissions (22). However, Roohani et al. (2015) have examined the effect of need-based patient education on the frequency of readmission in patients with HF and reported that the intervention did not significantly affect the patients' hospital readmissions. The authors attributed the insignificant effect of the intervention to the fact that most patients suffered from several comorbidities which caused them to refer to the hospital for non-cardiac reasons (15). The contradictory findings of the latter study might be attributable to the educational method used.

The present study had some limitations including no follow-up; hence the duration of the observed effects is unknown. Therefore, further studies with follow-up are recommended to be performed in the future. Also, some of the family members did not cooperate well and made difficulties in assessing the effects of the intervention. Moreover, there were difficulties in accessing educational facilities in the hospital and outpatient clinics, which made training sessions difficult.

Implications for practice

Teaching energy conservation strategies to patients with HF may not only reduce their fatigue but also reduce hospital readmissions. Such strategies if being tailored to the individual patient's needs would reduce their fatigue and readmissions and probably improve their QOL.

Nurses and physicians are recommended to teach energy conservation methods to patients with HF and chronic conditions who are prone to fatigue and its side effects.

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Conflicts of interest

The authors declared no conflict of interest.

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