Kufa Journal for Nursing Sciences
Open Access Full Text Article

Publisher
University of Kufa, Faculty of Nursing

Received: 03 August, 2023
Accepted: 28 August, 2023
Published: 06 September, 2023
Vol. 13(2), 2023: 306 – 319

https://doi.org/10.36321/kjns.vi20232.12931

ORIGINAL RESEARCH

Effect Of Multicomponent Exercise Program on the Dyspnea and Fatigue for Patients with Cardiac Dysfunction

Safaa Abdallah Eydan [1], Mohammed A. Mustafa [2], Fadhil G. Al-amran [3].

[1] *College of Nursing, University of Kufa, Najaf, Iraq.*
[2] *College of Nursing, University of Kufa, Najaf, Iraq.*
[3] *College of Medicine, University of Kufa, Najaf, Iraq.*

CORRESPONDING AUTHOR: Safaa A. Eydan, College of Nursing, University of Kufa, Najaf, Iraq. Email: safaaalsalamy377@gmail.com

ABSTRACT

Background: Cardiac dysfunction is the term for the heart's diminished capacity to pump blood efficiently, which can cause a number of symptoms like fatigue and dyspnea. The quality of life and functional ability of people with heart dysfunction can be greatly impacted by these symptoms. Exercise has been acknowledged as a crucial part of managing and rehabbing people with cardiovascular diseases. Exercises have shown potential outcomes in reducing dyspnea and fatigue in this population. The ECHO parameters help in diagnosing and monitoring cardiac dysfunction and guiding the rehabilitation strategies.

Objectives: To determine the effect of multicomponent exercise program and to Evaluate patients' fatigue and dyspnea in pre-test, multi-period and post-test.

Methodology: this randomized controlled trial examine the effectiveness of the Multicomponent exercise program in improving the ECHO parameters in cardiac dysfunction patients. Non-probability (purposively) sample of 80 participants randomly divided into two groups of 40; The study group have been exposed to multicomponent exercise program by the researcher and the control group follow the traditional program provided by the Heart Center. Then the Dyspnea Index scale and the Fatigue severity scale were measures for both groups measured on different intervals during the program period.

Results: The results show a statistically significant (P value less than 0.05) enhancement of both scales among the study group.

Conclusion: The Multicomponent exercise program has improved the levels of dyspnea and fatigue in those patients who attended the program. These results have important implications for the management and rehabilitation of heart failure patients, highlighting the effectiveness of integrated exercise programs to improving the overall quality of life for individuals with cardiac conditions.

Keywords: Heart failure, exercise, fatigue, dyspnea.

How to Cite: Eydan, S., Mohammed A. Mustafa, & Fadhil G.Al-amran. (2023). Effect of multicomponent exercise program on the dyspnea and fatigue for patients with cardiac dysfunction. *Kufa Journal for Nursing Sciences, 13*(2), 306-319. https://doi.org/10.36321/kjns.vi20232.12931

INTRODUCTION

Chronic heart failure (CHF) arises from structural or functional issues in cardiac tissue, causing dyspnea, fatigue, and exercise reluctance due to improper heart function, either systolic or diastolic dysfunction, leading to congestion. Acute decompensated heart failure episodes display worsened respiratory distress, reduced cardiac output, and poor perfusion, associated with higher hospitalizations, healthcare expenses, and reduced quality of life, eversible CHF cases depend on the cause (Mann et al., 2022). The idea of minimizing physical activity to prevent exercise-induced symptoms and hemodynamic overload for the sick ventricle predominated the textbooks when it came to HF patients' activity and exercise (Aljanabi and Hassan, 2020). It might be expected that there would be a close relationship between indices of resting ventricular function and exercise capacity, but people with HF experience significant burden that includes low exercise tolerance, which negatively affects their activities, most of the symptoms experienced by patients with HF may be the inability to perform exercise without discomfort (Poole et al., 2018).

Disease management guidelines address HF symptoms like blood pressure, pulse, ejection fraction, and volume status, making it challenging for clinicians to prioritize fatigue. Fatigue is prevalent and intertwined with various HF symptoms, both physiological and psychological, complicating its assessment. Studies highlight fatigue's multifaceted nature and its connection to exhaustion and various symptoms in HF patients (Polikandrioti et al., 2019). Pavlovic et al., (2022) claimed fatigue presents in two forms: exertional weariness post-effort and general exhaustion unrelated to exertion. Dyspnea, the sensation of breathing difficulty or discomfort, is a hallmark of persistent congestive heart failure.

In systolic HF, dyspnea significantly impairs functional capacity and quality of life, irrespective of disease severity. This leads to fluid leakage into lung alveoli and interstitial space, reducing pulmonary compliance and exacerbating breathing challenges making daily tasks harder as the condition progresses. Cattadori et al., (2018) claimed that exercise is beneficial in alleviating symptoms of various cardio-metabolic disorders, supported by public health guidelines and extensive research. Muscular function decline and reduced functional capacity are closely linked to physical inactivity. In patients with chronic HF, physical inactivity doubles the risk of cardiac and all-cause mortality. Heart Failure Association Guidelines advocate moderate continuous rehabilitation training, proven effective, safe, and well-tolerated by HF patients.

Cardiac rehabilitation (CR), a comprehensive and long-term intervention, integrates illness education, exercise, dietary guidance, risk management, and stress relief for HF patients. CR exercise involves structured, purposeful, and repetitive movements aimed at maintaining or enhancing physical fitness. (NHS, 2020). Nursing considerations alleviate patient distress, leading to notable drops in morbidity and mortality rates among program recipients. Educating patients on self-care management reinforces behavior and yields positive results, encompassing subjective symptom management, weight monitoring, low-sodium diets, enhanced activity, psychological aid, medication adherence, and strategies for managing escalated symptoms (Al-Hchaim & Hamza, 2016).

AIMS OF THE STUDY

To determine the effect of multicomponent exercise program and to Evaluate patients' fatigue and dyspnea in pre-test, multi-period and post-test.

METHODOLOGY

Design of the study:

The effectiveness of the program is investigated using a Randomized Control Trial (RCT).

Ethical consideration:

follow the standards established by the National Study Ethics Committee and getting the required government approval. After the researcher explained the study's objectives, patients' rights to freely engage in the study, and patients' right to withdraw from the study at any time, written informed consent was obtained.

The Setting of the Study:

The targeted location for data collection was the Al Najaf Center for Cardiac Surgery and Cardiac Catheterization.

Study Sample and sampling technique:

During the study period, patients were chosen through non-probability (purposively) and were randomly divided into two groups of (40) patients each. This was a randomized control trial that was conducted on (80) patients referred for consultation and rehabilitation at the Al Najaf Center for Cardiac Surgery and Cardiac Catheterization. During the course of the study, a total of (116) patients were referred to the Al Najaf Center for heart surgery and cardiac catheterization. They were split up as follows: (3) Pilot study participants are not included in the analysis. The study sample is also omitted for (10) patients who were chosen for need assessments. Twenty patients are turned down for research participation. (2) The program is not finished by the patients. According to the requirements for the study sample, (11) is also disqualified. There are two groups made up of the 80 patients in the study sample. Patients who had been diagnosed with heart failure for at least six months prior to the study's selection were required to meet the following criteria: they had to be adults (18-69) years old and conscious, have an ejection fraction (EF) of less than 50, and be compliant with their medication and diet.

Study instruments and tools:

Part I: The socio-demographics of patients with heart dysfunction: This section involves gathering demographic information from heart failure patients via an interview questionnaire sheet, which includes questions on gender, age, education level, occupation, and monthly income.

Part II: The Clinical Characteristics of Patients with Cardiac Dysfunction: This section focuses on the collection of clinical characteristics, including information on body mass index (BMI), the length of the illness since diagnosis, smoking status, and chronic diseases, which is collected from patients with cardiac dysfunction through an interview questionnaire.

Part III: Dyspnea index Scale (DI) for Patients cardiac dysfunction: Index of Dyspnea (DI) The Scale is a tool used to evaluate a person's level of dyspnea (breathlessness). Patients are asked to rate their level of dyspnea while engaging in different activities on a scale of 0 to 10, with 0 denoting no dyspnea and 10 denoting the greatest possible dyspnea. In total, there are ten of them (Ntouniadakis and Brus, 2021).

Part IV: Fatigue severity scale (FSS) for Patients cardiac dysfunction: Originally established in 1989 by Lauren Krupp and colleagues, the fatigue severity scale (FSS) is a self-reported questionnaire used to assess the intensity of exhaustion and its effects on daily activities. On a scale from 1 (totally disagree) to 7 (absolutely agree), respondents score their level of agreement with each of the nine statements in the FSS that discuss how exhaustion affects daily activities. To determine the overall score for fatigue severity, the ratings for each statement are then totaled up and the average score is determined. There is a scale from 1 to 7, with higher ratings indicating more weariness. It comprises of 9 items and is used to assess the level of exhaustion caused by heart failure (Geffen et al., 2015). The steps of program application are shown in figure (1).

Statistical Analysis:

After the data are prepared for statistical analysis, the descriptive and inferential statistics employ for data analysis using the Statistical Package of the Social Sciences (SPSS), version (IBM 22).

RESULTS

Table (1) show that the distribution of patients in both groups according to demographic data. Regarding patients age; the mean of patients age in control group is (53.98%) and study group patients is (56.25%). concerning the patient's gender, male presents (82.5%) and (75%) respectively in control and study group, the male to female ratio in the

control group was about 4.7:1 while in the study group was 3:1, most of the patients in both groups are males. In the other hand; (25%) of patients equally between primary and secondary school in control group, while in study group (22.5%) of patients with intermediate and (institute, college or postgraduate).

Regarding the monthly income predominantly of control group patients (57%) was (300001-600000), while in study group frequently (42%) of patients with (<=300000) income. On reviewing the occupational status, (32.5%) the patients in control group are either Governmental employee or Self employee, while (27.5%) of study group are governmental employee, Self-employee and housewives.

Table (2) show the clinical characteristics of both study and control groups, regarding smoking (42%) of control group patients and (35%)of study group patients are smokers ,while (32%)of control and (45%)of study were nonsmokers, on other hand the disease duration is slightly higher among the control group with mean of 3.18 years while in the study group only 2.95 years. in addition, BMI shows higher mean in the study group (33.48) compared to (29.51) in the control group. also, the table shows the percentage of each comorbid disease as follow (the control group mentioned first): the hypertension dominated in both groups with a percentage of 85% and 90%, diabetes comes in a consistent percentage of 55% and 50%. While the IHD frequently found in percentages of 62.5% and 67.5% the valvular disease shows a consistent percentage (47.5%) among the control group compared to a less frequent percentage (30%) among the study group. Lastly the other comorbidities (CVA, renal failure and thyroid disease) show sporadic frequency with percentages less than 18%.

Table (3) demonstrate the mean of the DI in the pretest period for both control and study groups approximate (29.80 and 31.38) respectively then during the post-test (1,2,3) period the mean of (DI) in control group is increase while in study group began to decrease.

Table (4) shows that a significantly different between pre-test and post-test (1,2,3) at p value (0.05). That mean (DI) of patients in control group is deteriorate

Table (5) illustrate that a significantly different between pre-test and post-test (1,2,3) at p – value (0.05). that mean the (DI) in study group is decrease, that mean patients in study group at enhancement during the period of measurement.

Table (6) demonstrate that a non- Significant different between study and control group in pre-test. while a Significant different between groups in post-test (1,2,3). That mean the (multi component exercises program) has direct effect on the study group patients.

Table (7) demonstrate that the (FSS) mean for control group patients is (3.63) and for study group patients is (4.42) in pretest, while posttest (1,2,3) the FSS mean increase in control group and decrease in study group. Table (8) shows that a significant deferent between Period measurement (pre-test, post-test 1, post-test 2, post-test 3) regarding (FSS) the control group patients are deterioration. The table (9) illustrate that a significant different between pretest and post-test (1,2,3) regarding the FSS the study group patients are enhancing during the period of measurement. The table (10) shows that a non-Significant different in pre-test and post-test 1, while a Significant different between study and control group in (post-test 2, post-test 3) at p value (0.05).

DISCUSSION:

Discussion of the Dyspnoea level (Tables 3, 4, 5, 6):

The mean DI for both the control and study groups was approximately 29.80 and 31.38, respectively. These values indicate a similar level of dyspnea experienced by the patients in both groups at the beginning of the study. During the post-test periods (post 1, 2, and 3), the mean DI in the control

group started to increase, while the mean DI in the study group began to decrease. This suggests a divergence in the severity of dyspnea experienced by the two groups over time, with the control group experiencing an increase and the study group showing improvement or reduction in dyspnea symptoms.

It is noteworthy to mention the RCT study which done by Oz Alkan H et al (2017) found that breathing exercise training applied to patients with heart failure improved dyspnea level and sleep quality. Bruno-Pierre and his colleagues (2016) also proved that Exercise training has been shown to improve the sympatho-vagal and ventilatory responses to exercise in patients with heart failure, which may be mediated by a reduction of the exaggerated ergo reflex.

In the current study, the inspiratory muscle training performed at home using the incentive spirometer device, and assessment of the dyspnea level performed using the DI scale, while Moreno et al. (2017) achieved their results using the Threshold Inspiratory Muscle Training Device and POWER breathe device, assessed the effectiveness using the NYHA classification, they conclude that the change in time to reach respiratory fatigue (dyspnea) in the intervention group was greater than of the Control group, that mean improvement in the dyspnea symptoms. The dyspnea scale on the other hand, is noticeably changed to a better score in the current study and in similar study done by Hossein et al. (2020) when they did a 6 weeks controlled trial to assess the effect of inspiratory muscle training on fatigue and dyspnea in patients with heart failure, Amir et al. also shows in their study a significant improvement in the FSS as the current study show. Inspiratory muscle weakness can occur in 30% to 50% of the heart failure patients, inspiratory Muscle training is an effective therapeutic approach to reduce the dyspnea and muscle fatigue of heart failure patients, promoting their sense of independence and psychosocial health. The above are statements of the study conducted by Pradnya (2023) which provide insight in to the finding of the present study with regards to the improvement of dyspnea level in the study group patients. In conclusion, dyspnea may be considered a hallmark in patients who suffer from heart failure and It is worth noting that muscle weakness appears first in the respiratory muscles (due to increased muscle metabo-reflex leading to sympathetic–adrenal system hyperactivity and increased pulmonary ventilation), Consequently, respiratory muscle weakness produces exercise limitations in these patients. Inspiratory muscle training seems to be a useful personalized medicine intervention in order to increase patients' exercise tolerance under HF condition.

Discussion of the Fatigue level among the study population (Tables 7, 8, 9, 10):

The present study demonstrated a significant improvement in FSS scores within the study group during the post-test periods, indicating a reduction in fatigue levels. These findings highlight the positive effects of the multicomponent exercise program in managing fatigue in patients with cardiac dysfunction. A systematic review by Younis et al. (2014) examined the effectiveness of aerobic exercise on the level of fatigue and the QoL among patients with heart failure and reported consistent findings of reduced fatigue in the exercise intervention groups across multiple studies. This systematic review provides further support for the present study's findings of improved fatigue in the study group.

Furthermore, the current study expands upon the work of van Geffen et al. (2015), investigated a related aspect of the cardiac rehabilitation on the fatigue level. To further support the current study findings, the results consistent with what found by Abdolahi et al. in 2020 when they investigate the educational plan based on Roy adaptation model on fatigue and daily activities of patients with heart failure and revealed a significant decrease in the fatigue scale mean. A study done by Chen et al. in 2018 also discuss fatigue in heart failure patients,

their aim was to examine the effects of Baduanjin exercise on fatigue and QoL in heart failure patients, they found a significant decrease of fatigue from the baseline.

Also, these results congruous with Shuxin Lei et al. (2023) study results. Paulino Alvarez et al. in 2016. investigates the effectiveness of graded exercise program on the exercise intolerance (fatigue) in patients with heart failure, he concludes that these programs are essential component of comprehensive cardiac rehabilitation in these patients, and also exercise training remains grossly underutilized. Finally, exercise can improve fatigue symptoms in heart failure patients throughout many physiological aspects; by Enhancing Energy Efficiency, enhancing cardiovascular function, enhancing cardiorespiratory fitness, optimizing oxygen utilization and delivery to the muscle, improving muscle strength and coordination and improve overall endurance.

CONCLUSIONS:

The study strongly supports the researcher's hypothesis, rejecting the null hypothesis. The Multicomponent exercise program improved echo cardiographic parameters in attending patients, indicating its vital role in heart patient management and rehabilitation. Integrated exercise programs enhance quality of life for cardiac patients, making them a crucial part of comprehensive care. Combining aerobic and resistance training significantly improves physical and psychological well-being, reducing symptoms, enhancing cardiac function, and decreasing hospitalizations. Structured exercise programs also promote medication adherence and reduce healthcare reliance.

RECOMMENDATIONS:

Recommendations for the Ministry of Higher Education and Scientific Research:

1- Collaborative Research Initiatives foster collaboration among universities, research institutions, and healthcare facilities, facilitating multidisciplinary research for knowledge sharing and translating findings into clinical practice.
2- Longitudinal Studies track heart patients over time to gauge rehabilitation's lasting benefits, assessing effects on mortality, quality of life, functionality, and healthcare expenses.
3- Rehabilitation in Special Populations research addresses unique rehab requirements in the elderly, women, those with comorbidities, and diverse cultural groups, tailoring interventions for more effective strategies.
4- Knowledge Translation urges active dissemination of research through publications, conferences, and collaborations with healthcare pros, ensuring evidence-based practices in cardiac rehab programs and policies.
5- Education and Training enhance healthcare pros' cardiac rehab expertise via improved education, curriculum, competency frameworks, and continuing education efforts.

Recommendations for the Ministry of health:

1- Establish Cardiac Rehab Centers: Create specialized centers with advanced facilities and skilled staff dedicated to tailored cardiac rehabilitation programs for patients with heart issues.
2- Raise Awareness: Launch educational campaigns for healthcare pros and the public, using workshops and materials to improve understanding of cardiac dysfunction, risk factors, and early management.
3- Support Research: Allocate funds for innovative research collaborations between healthcare, research institutions, and industry to advance treatment, prevention, and risk management for cardiac dysfunction.
4- Promote Team Care: Foster teamwork among various healthcare disciplines like cardiologists, surgeons, nurses, and therapists for comprehensive patient care covering medical, psychosocial, and lifestyle aspects.
5- Empower Patients: Develop resources enabling cardiac patients to actively manage their health,

including self-care tactics, adherence guidance, and emotional support through education and peer networks.

6- Improve Access: Ensure fair access to cardiac care via enhanced facilities, more experts, and telemedicine, addressing geographical disparities and underserved communities.

Limitations:

1- Many patients traveled from distant locations, making attendance for exams and follow-ups challenging.

2- Ethical concerns arise when conducting exercise studies on heart failure patients, especially regarding randomization and control groups. Balancing participant safety, scientific validity, and minimizing harm is crucial.

3- Some rehabilitation research has brief follow-up periods, potentially missing the intervention's prolonged effects. Prolonged follow-ups are vital to assess the durability of rehabilitation outcomes and comprehend how patient health and functionality evolve over time.

4- Substantial funding and resources are vital for comprehensive exercise studies on heart failure patients. Limited funds might restrict factors like participant numbers, study duration, and access to specialized equipment or staff.

REFERENCES:

Abdolahi, M., Doustmohamadi, M. M., & Sheikhbardsiri, H. (2020). The Effect of an Educational Plan Based on the Roy Adaptation Model for Fatigue and Activities of Daily Living of Patients with Heart Failure Disease. *Ethiopian journal of health sciences*, 30(4), 559–566.

Al-Hchaim, M. H. S., & Hamza, R. (2016). Effectiveness of educational program on nurse's knowledge about management of patients with heart failure. *Int J Sci Res Publ*, 6, 416-2250.

Aljanabi, M.., & Hassan, H. (2020). Effectiveness of Nursing Intervention on Physiological Status for Patients Undergoing Coronary Catheterization. *Kufa Journal for Nursing Sciences*, 10(1), 1–11.

Alvarez, P., Hannawi, B., & Guha, A. (2016). Exercise and Heart Failure: Advancing Knowledge and Improving Care. *Methodist DeBakey cardiovascular journal*, 12(2), 110–115.

Bruno-Pierre Dubé, Agostoni, P., & Laveneziana, P. (2016). Exertional dyspnoea in chronic heart failure: the role of the lung and respiratory mechanical factors. European respiratory review: *an official journal of the European Respiratory Society*, 25(141), 317–332.

Cattadori G, Segurini C, Picozzi A, Padeletti L, Anzà C. (2018). Exercise and heart failure: an update. *ESC Heart Fail*.5(2):222-232.

Chen, D. M., Yu, W. C., Hung, H. F., Tsai, J. C., Wu, H. Y., & Chiou, A. F. (2018). The effects of Baduanjin exercise on fatigue and quality of life in patients with heart failure: A randomized controlled trial. *European journal of cardiovascular nursing*, 17(5), 456–466.

Hossein Pour, A. H., Gholami, M., Saki, M., & Birjandi, M. (2020). The effect of inspiratory muscle training on fatigue and dyspnea in patients with heart failure: A randomized, controlled trial. *Japan journal of nursing science: JJNS*, 17(2), e12290.

Krupp, L. B., LaRocca, N. G., Muir-Nash, J., & Steinberg, A. D. (1989). The fatigue severity scale. Application to patients with multiple sclerosis and systemic lupus erythematosus. *Archives of neurology*, 46(10), 1121–1123.

Mann, D. L., Givertz, M. M., Vader, J. M., Starling, R. C., Shah, P., McNulty, S. G., Anstrom, K. J., Margulies, K. B., Kiernan, M. S., Mahr, C., Gupta, D., Redfield, M. M., Lala, A., Lewis, G. D., DeVore, A. D., Desvigne-Nickens, P., Hernandez, A. F., Braunwald, E., & Investigators, L. S. (2022). Effect of treatment with Sacubitril/Valsartan in patients with advanced heart failure and reduced ejection fraction. *JAMA Cardiology*, 7(1), 17.

Moreno, A. M., Toledo-Arruda, A. C., Lima, J. S., Duarte, C. S., Villacorta, H., & Nóbrega, A. C. L. (2017). Inspiratory Muscle Training Improves Intercostal and

Forearm Muscle Oxygenation in Patients with Chronic Heart Failure: Evidence of the Origin of the Respiratory Metaboreflex. *Journal of cardiac failure*, 23(9), 672–679.

Ntouniadakis, E., Brus, O., & von Beckerath, M. (2021). Dyspnea Index: An upper airway obstruction instrument; translation and validation in Swedish. Clinical otolaryngology: *official journal of ENT UK; official journal of Netherlands Society for Oto-Rhino-Laryngology & Cervico-Facial Surgery*, 46(2), 380_387.

Oz Alkan H, Uysal H, Enç N, Yigit Z (2017). Influence of Breathing Exercise Education Applied on Patients with Heart Failure on Dyspnea and Quality of Sleep: A Randomized Controlled Study. *International Journal of Medical Research & Health Sciences (IJMRHS)*, 6(9), 107-113.

Pavlovic, N. V., Gilotra, N. A., Lee, C. S., Ndumele, C., Mammos, D., Dennisonhimmelfarb, C., & AbshireSaylor, M. (2022). Fatigue in Persons with Heart Failure: A Systematic Literature Review and Meta-Synthesis Using the Biopsychosocial Model of Health. *Journal of cardiac failure*, 28(2), 283-315.

Polikandrioti, M., Koutelekos, I., Panoutsopoulos, G., Gerogianni, G., Zartaloudi, A., Dousis, E., Babatsikou, F., & Toulia, G. (2019). Hospitalized patients with heart failure: the impact of anxiety, fatigue, and therapy adherence on quality of life. Archives of medical sciences. *Atherosclerotic diseases*, 4, e268–e279.

Poole, D. C., Richardson, R. S., Haykowsky, M. J., Hirai, D. M., & Musch, T. I. (2018). Exercise limitations in heart failure with reduced and preserved ejection fraction. *Journal of applied physiology (Bethesda*, Md.: 1985), 124(1), 208–224.

Pradnya Gaikar, & Milind Kale. (2022). A Study to Assess the Effectiveness of the Inspiratory Muscle Training Program on level of Dyspnea among Heart Failure Patients Attending Cardiac Tertiary Care Centers, Maharashtra. *Indian Journal of Public Health Research & Development*, 14(1), 190–195.

Shuxin Lei, Bao, Q., Guo, S., Wang, Z., Yu, J., You, Y., Zhang, N., & Xie, X. (2023). Effect of Traditional Chinese Exercises on Patients with Chronic Heart Failure (TCE-HF): A Systematic Review and Meta-Analysis. *Journal of clinical medicine*, 12(6), 2150.

van Geffen, M. E., Ter Hoeve, N., Sunamura, M., Stam, H. J., van Domburg, R. T., & van den Berg Emons, R. J. (2015). Fatigue during and after cardiac rehabilitation. *Journal of rehabilitation medicine*, 47(6), 569–574.

Younis, Y. M. (2014). Nurse's Knowledge about Modifiable and Non-Modifiable Risk Factors of Heart Failure Patient in Erbil Teaching Hospitals. *Kufa Journal for Nursing Sciences*, 4(3), 162–171.

FIGURES and TABLES:

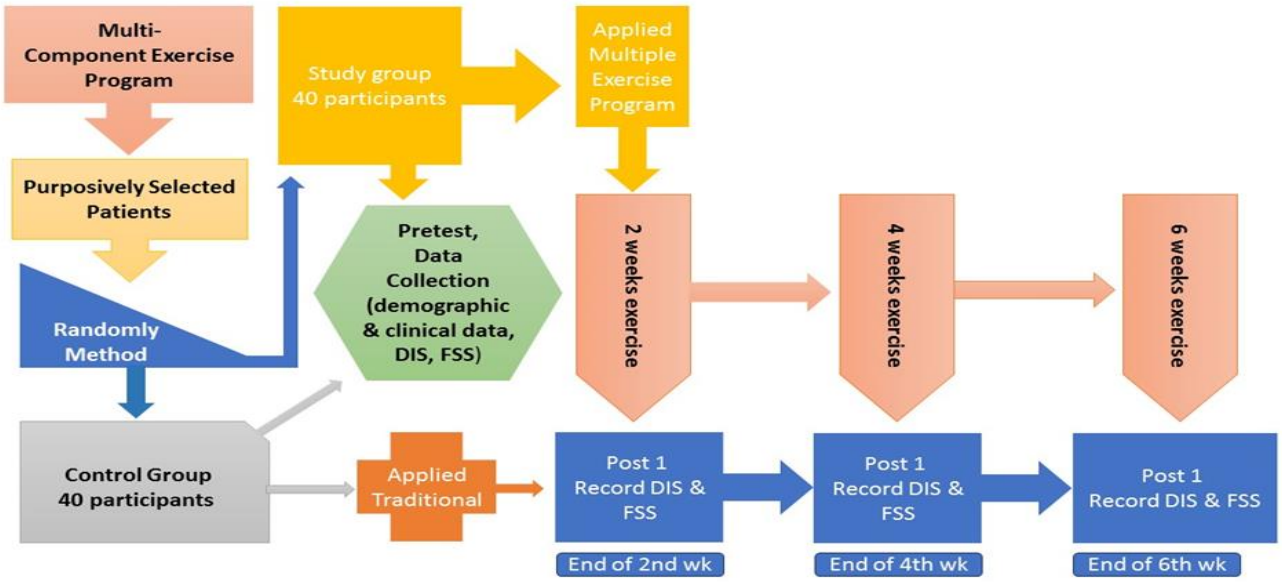

Figure (1) show the steps of MCEP

Table (1): Distribution of Socio-Demographic Characteristics for both Study and Control Groups

Demographic Variables	Categories	Statistics	Grouping		Total
			Control	Study	
Age	<= 25	F.	1	0	1
		%	2.5%	0.0%	1.3%
	26 – 34	F.	0	1	1
		%	0.0%	2.5%	1.3%
	35 – 43	F.	4	2	6
		%	10.0%	5.0%	7.5%
	44 – 52	F.	13	11	24
		%	32.5%	27.5%	30.0%
	53 – 61	F.	11	14	25
		%	27.5%	35.0%	31.3%
	62+	F.	11	12	23
		%	27.5%	30.0%	28.8%
	Mean		**53.98**	**56.25**	**100%**
	S.D.		**10.16**	**9.93**	
Gender	Male	F.	33	30	63
		%	82.5%	75.0%	78.8%
	Female	F.	7	10	17
		%	17.5%	25.0%	21.3%
Level of Education	Doesn't read &write	F.	0	2	2
		%	0.0%	5.0%	2.5%
	Read and write	F.	5	8	13
		%	12.5%	20.0%	16.3%

	Primary school	**F.**	10	7	17
		%	25.0%	17.5%	21.3%
	Intermediate school	**F.**	6	9	15
		%	15.0%	22.5%	18.8%
	Secondary school	**F.**	10	5	15
		%	25.0%	12.5%	18.8%
	Institute, college or Postgraduate	**F.**	9	9	18
		%	22.5%	22.5%	22.5%
Monthly Income	**<= 300000**	**F.**	9	17	26
		%	22.5%	42.5%	32.5%
	300001 - 600000	**F.**	23	11	34
		%	57.5%	27.5%	42.5%
	600001 - 900000	**F.**	8	10	18
		%	20.0%	25.0%	22.5%
	900001+	**F.**	0	2	2
		%	0.0%	5.0%	2.5%
	Mean		**500000**	**473125**	**100%**
	S.D.		**183973**	**251112**	
Occupation Status	**Governmental employee**	**F.**	13	11	24
		%	32.5%	27.5%	30.0%
	Self-employee	**F.**	13	11	24
		%	32.5%	27.5%	30.0%
	Retired	**F.**	3	3	6
		%	7.5%	7.5%	7.5%
	Housewife	**F.**	8	11	19
		%	20.0%	27.5%	23.8%
	Jobless	**F.**	3	4	7
		%	7.5%	10.0%	8.8%
Total		**%**	100.0%	100.0%	100.0%

%= percentage, freq. = frequency, S.D. = Standard Deviation.

Table (2): The Distribution of the Clinical Characteristics for both Study and Control Groups

Clinical Variables	Categories	Statistical	Grouping		Total
			Control	Study	
Smoking	**Yes**	**F.**	17	14	31
		%	42.5%	35.0%	38.8%
	No	**F.**	13	18	31
		%	32.5%	45.0%	38.8%
	Passive	**F.**	10	8	18
		%	25.0%	20.0%	22.5%
Disease duration	**<= 3**	**F.**	27	28	55
		%	67.5%	70.0%	68.8%
	4 – 6	**F.**	13	11	24
		%	32.5%	27.5%	30.0%
	7+	**F.**	0	1	1
		%	0.0%	2.5%	1.3%

	Mean		**3.18**	**2.95**	**100%**
	S.D.		**1.06**	**1.38**	
BMI	**Normal**	**F.**	1	3	4
		%	2.5%	7.5%	5.0%
	Over Weight	**F.**	24	18	42
		%	60.0%	45.0%	52.5%
	Obese	**F.**	15	19	34
		%	37.5%	47.5%	42.5%
	Mean		**29.51**	**33.48**	**100%**
	S.D.		**3.18**	**22.13**	
Hypertension	**Yes**	**F.**	34	36	70
		%	85.0%	90.0%	87.5%
	No	**F.**	6	4	10
		%	15.0%	10.0%	12.5%
DM	**Yes**	**F.**	22	20	42
		%	55.0%	50.0%	52.5%
	No	**F.**	18	20	38
		%	45.0%	50.0%	47.5%
CVA	**Yes**	**F.**	2	5	7
		%	5.0%	12.5%	8.8%
	No	**F.**	38	35	73
		%	95.0%	87.5%	91.3%
Renal Failure	**Yes**	**F.**	0	5	5
		%	0.0%	12.5%	6.3%
	No	**F.**	40	35	75
		%	100.0%	87.5%	93.8%
Thyroid Disease	**Yes**	**F.**	5	7	12
		%	12.5%	17.5%	15.0%
	No	**F.**	35	33	68
		%	87.5%	82.5%	85.0%
IHD	**Yes**	**F.**	25	27	52
		%	62.5%	67.5%	65.0%
	No	**F.**	15	13	28
		%	37.5%	32.5%	35.0%
Valvular Disease	**Yes**	**F.**	19	12	31
		%	47.5%	30.0%	38.8%
	No	**F.**	21	28	49
		%	52.5%	70.0%	61.3%
Total		**%**	100.0%	100.0%	100.0%

%= percentage, freq. = frequency, S.D. = Standard Deviation.

Table (3): Assessment of Patient Dyspnea Level (Dyspnea Index) in Period of Measurements for both Study and Control Groups

Period of Measurement	Categories	Statistical	Grouping		Total
			Control	Study	
Pre-test	**Moderate dyspnea**	**F.**	22	17	39
		%	55.0%	42.5%	48.8%
	Severe dyspnea	**F.**	18	23	41
		%	45.0%	57.5%	51.3%
	Mean		**29.80**	**31.38**	**100%**
	S.D.		**5.58**	**3.73**	
Post-test1	**Moderate dyspnea**	**F.**	18	31	49
		%	45.0%	77.5%	61.3%
	Severe dyspnea	**F.**	22	9	31
		%	55.0%	22.5%	38.8%
	Mean		**31.08**	**28.35**	**100%**
	S.D.		**4.23**	**3.77**	
post-test2	**Mild dyspnea**	**F.**	0	3	3
		%	0.0%	7.5%	3.8%
	Moderate dyspnea	**F.**	13	35	48
		%	32.5%	87.5%	60.0%
	Sever dyspnea	**F.**	27	2	29
		%	67.5%	5.0%	36.3%
	Mean		**32.68**	**24.63**	**100%**
	S.D.		**4.75**	**3.31**	
post-test3	**Mild dyspnea**	**F.**	1	21	22
		%	2.5%	52.5%	27.5%
	Moderate dyspnea	**F.**	2	17	19
		%	5.0%	42.5%	23.8%
	Sever dyspnea	**F.**	37	2	39
		%	92.5%	5.0%	48.8%
	Mean		**35.10**	**20.90**	**100%**
	S.D.		**4.19**	**4.47**	

Table (4): Comparison of Patient's (Dyspnea Index) for Control Group between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Mean	S.D.	Mean Rank	Friedman (Chi-square)	df	P-value
D.I.	**Pre-test**	29.80	5.58	1.84	37.794	3	0.000 S
	Post-test1	31.08	4.23	2.04			
	Post-test2	32.68	4.75	2.69			
	Post-test3	35.10	4.19	3.44			

Table (5): Comparison of Patient's (Dyspnea Index) for the Study Group between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Mean	S.D.	Mean Rank	Friedman (Chi-square)	df	P-value
D.I.	Pre-test	31.4	3.7	3.90	103.628	3	0.000
	Post-test1	28.4	3.8	3.00			
	Post-test2	24.6	3.3	1.93			
	Post-test3	20.9	4.5	1.18			

Table (6): Comparison of Patient's level of Dyspnea (DI) of Study and Control Groups between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Grouping	Mean Rank	Sum of Ranks	Mann-Whitney Test	P-value
D.I.	Pre-test	Control	37.03	1481.00	661	0.1799 NS
		Study	43.98	1759.00		
	Post-test1	Control	47.83	1913.00	507	0.004 S
		Study	33.18	1327.00		
	Post-test2	Control	57.08	2283.00	137	0.000 S
		Study	23.93	957.00		
	Post-test3	Control	58.73	2349.00	71	0.000 S
		Study	22.28	891.00		

Table (7): Assessment of Patient Level of Fatigue (FSS) in Period of Measurements for both Study and Study and Control Groups

Period of Measurement	Categories	Statistical	Grouping		Total
			Control	Study	
Pre-test	Moderate Fatigue	F.	21	0	21
		%	52.5%	0.0%	26.3%
	Severe Fatigue	F.	19	40	59
		%	47.5%	100.0%	73.8%
	Mean		**3.63**	**4.42**	**100%**
	S.D.		**0.60**	**0.31**	
Post-test1	Moderate Fatigue	F.	18	6	24
		%	45.0%	15.0%	30.0%
	Severe Fatigue	F.	22	34	56
		%	55.0%	85.0%	70.0%
	Mean		**3.86**	**4.04**	**100%**
	S.D.		**0.66**	**0.38**	
Post-test2	Moderate Fatigue	F.	10	20	30
		%	25.0%	50.0%	37.5%
	Severe Fatigue	F.	30	20	50
		%	75.0%	50.0%	62.5%

	Mean		**4.08**	**3.62**	**100%**
	S.D.		**0.57**	**0.42**	
Post-test3	**Mild Fatigue**	**F.**	0	2	2
		%	0.0%	5.0%	2.5%
	Moderate Fatigue	**F.**	9	33	42
		%	22.5%	82.5%	52.5%
	Severe Fatigue	**F.**	31	5	36
		%	77.5%	12.5%	45.0%
	Mean		**4.12**	**3.09**	**100%**
	S.D.		**0.59**	**0.49**	

Table (8): Comparison of Patient's (FSS) for the Control Group between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Mean	S.D.	Mean Rank	Friedman (Chi-square)	df	P-value
F.S.S.	**Pre-test**	3.63	0.60	1.68	31.485	3	0.000
	Post-test1	3.86	0.66	2.29			
	Post-test2	4.08	0.57	2.90			
	Post-test3	4.12	0.59	3.14			

Table (9): Comparison of Patient's (FSS) for the Study Group between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Mean	S.D.	Mean Rank	Friedman (Chi-square)	df	P-value
F.S.S.	**Pre-test**	4.4167	0.31402	3.93	113.917	3	0.000
	Post-test1	4.0389	0.37537	3.01			
	Post-test2	3.6222	0.41938	2.06			
	Post-test3	3.0861	0.48951	1.00			

Table (10): Comparison of Patient's Level of Fatigue (FSS) of Study and Control Groups between Pre and Posttest 1, Posttest 2, and Posttest 3

	Period of Measurement	Grouping	Mean Rank	Sum of Ranks	Mann-Whitney Test	P-value
F.S.	**Pre-test**	**Control**	25.93	1037.00	217	0.863 NS
		Study	55.08	2203.00		
	Post-test1	**Control**	37.88	1515.00	695	0.310 NS
		Study	43.13	1725.00		
	Post-test2	**Control**	49.58	1983.00	437	0.000 S
		Study	31.43	1257.00		
	Post-test3	**Control**	56.45	2258.00	162	0.000 S
		Study	24.55	982.00		