International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

A Pilot Study on Aerobic Exercise and Inspiratory Muscle Training in Reducing Dyspnoea among Heart Failure Patients

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Abstract: ***Heart failure is a common, costly, disabling and deadly condition. Inspiratory muscles of patients with congestive heart failure are weaker than those of normal persons. This weakness may contribute to the dyspnea and limit exercise capacity in these patients. An experimental study has been carried out to determine the effectiveness of aerobic exercise training and inspiratory muscle training programmes on improvement of inspiratory muscle strength and reduction of dyspnea among heart failure patients in selected cardiac rehabilitation centers of Dakshina Kannada District. The results shows that there is a significant decrease in the mean dyspnea scores after aerobic exercise training 2.06 (p<0.05), inspiratory muscle training 2.04 (p<0.05) and combained training 2.03 (p<0.05) programmes by using Wilcoxon signed rank test value. The study concluded that The respiratory muscles can be trained for both strength and endurance and thereby severity of dyspnoea can be reduced among heart failure patients.***

Keywords: Heart Failure, Dyspnea, Aerobic Exercise Training, Inspiratory Muscle Training, Cardiac Rehabilitation Centers

1. Introduction

Heart failure is a condition in which a problem with the structure or function of the heart impairs its ability to supply sufficient blood flow to meet the body's needs. Heart failure is a common, costly, disabling and deadly condition. In developing countries around 2% of adults suffer from heart failure, but in those over the age of 65, this increases to 6-10%.[1]

Dyspnea is defined as an uncomfortable sensation in breathing and it is a common symptom associated with moderate-to-severe heart failure. As heart failure progresses, dyspnea becomes increasingly troublesome for individuals and frequently worsens their quality of life. Despite its high prevalence, the pathophysiology of dyspnea is still not well understood. It remains one of the most refractory symptoms of advanced heart failure. [2]

Prior to the late 1980s bed rest and restricted physical activity were recommended for all stages and forms of heart failure. However, prolonged bed rest and physical inactivity could lead to skeletal muscle atrophy, pulmonary embolism, venous thrombosis, and a further reduction in exercise tolerance and exacerbation of symptoms. The concept of exercise training in patients with chronic heart failure developed in the late 1980s.The first randomized study of training patients with stable heart failure showed that, eight weeks of exercise training led to an increase in exercise capacity and to an improvement of the abnormal sympathovagal balance.[3]

Inspiratory muscle weakness is prevalent in patients with chronic heart failure caused by left ventricular systolic dysfunction, which contribute to reduced exercise capacity and the presence of dyspnea during daily activities. Inspiratory muscle strength has independent prognostic value in congestive heart failure. Results of trials with inspiratory muscle training indicate that this intervention improves exercise capacity and quality of life, particularly in patients with congestive cardiac failure and inspiratory muscle weakness. Inspiratory muscle training results in improved cardiovascular responses to exercise and to those obtained with aerobic training. These findings suggest that routine screening for inspiratory muscle weakness is advisable in patients with congestive cardiac failure, and specific inspiratory muscle training and/or aerobic training are of practical value in the management of these patients. [4]

2. Literature Survey

A study conducted to determine the prevalence, incidence rate, lifetime risk and prognosis of heart failure shows that the prevalence was higher in men and increased with age from 0.9% in subject aged 55-64 to 17.4% in those aged 85 and the incidence rate increased with age 1.4 per 1000 person-years in those aged 55-59 to 47.4 per 1000 person-years in those aged 90. Lifetime risk was 33% for men and 29% for women at the age of 55. Survival after incident heart failure was 86% at 30 days, 63% at 1 year, 51% at 2 years and 35% at 5 years of follow-up. Prevalence and incidence rates of heart failure are high. In individuals aged 55, almost 1 in 3 will develop heart failure during their remaining life span. Heart failure continues to be a fatal disease, with only 35% surviving five years after the first diagnosis. [5]

A retrospective cohort study to determine the incidence and prevalence of heart failure in elderly between the year 1994and 2003 revealed that the incidence of heart failure declined from 32 per 1000 person-years in1994 to 29 per 1000 person-years in 2003. Incidence declined most sharply among beneficiaries aged 80 to 84 years and increased slightly among beneficiaries aged 65 to 69 years. Although risk-adjusted mortality declined slightly from 1994 to 2003, the prognosis for patients diagnosed as having heart failure remains poor. [6]

A study conducted on inspiratory muscle weakness and dyspnea in chronic heart failure revealed that the chronic heart failure patients, when compared with their matched control subjects, had reduced inspiratory and expiratory muscle strength and both were significantly correlated with dyspnea during daily activities. There was no correlation between lung volumes or spirometry and dyspnea in heart failure patients. The patients with stable chronic heart failure have inspiratory and expiratory muscle weakness and further suggest that the respiratory muscle pump significantly contributes to the dyspnea during the activities of daily living. [7]

A quasi-experimental study was conducted to evaluate a home-based nurse-coached inspiratory muscle training intervention. In 32 stable patients with heart failure, who were randomly assigned to the experimental or control group revealed that those in control group did not show any improvement on dyspnea but inspiratory muscle training group experienced significantly increased static inspiratory mouth pressure or Pi max, as well as decreased dyspnea. This study indicates the promise of implementing inspiratory muscle training as an adjuvant therapy for home intervention in patients with heart failure. [8]

A study was conducted to evaluate the benefit of selective respiratory muscle training on exercise capacity in patients with chronic congestive heart failure. It consisted of three weekly sessions of isocapnic hyperpnoea at maximal sustainable ventilatory capacity, resistive breathing and strength training. Findings revealed that selective respiratory muscle training improves respiratory muscle endurance and strength with an enhancement of submaximal and maximal exercise capacity in patients with heart failure. Dyspnea during activities of daily living was subjectively improved in the majority of trained patients. [9]

A study was conducted to examine the effects of inspiratory muscle training on ventilatory muscle strength and dyspnea in 14 patients with end-stage cardiomyopathy and chronic heart failure. Inspiratory muscle training was performed at 20% of maximal inspiratory pressure for 5-15 minutes, 3 times a day, for eight weeks, revealed that dyspnea scores at rest and during exercise, decreased after two weeks which was representing 29% and 28% improvement. Greater pulmonary function was associated with greater improvement in dyspnea and ventilatory muscle strength after inspiratory muscle training. These improvements may decrease the dependency and impairment associated with chronic heart failure. [10]

A study was conducted to evaluate the effect of specific inspiratory muscle training on inspiratory muscle performance, lung function, dyspnea and exercise capacity in patients with moderate heart failure. The traning was provided daily, six times per week, for one half an hour for three months by breathing at resistance equal to 15% of their pi(max) for one week. The resistance was increased incrementally to 60% .The study revealed that specific inspiratory muscle training resulted in inspiratory muscle strength and endurance and this increase was associated with decreased dyspnea, increase in submaximal exercise capacity and no change in maximal exercise capacity. This training may prove to be a complementary therapy in patients with congestive heart failure. [11]

A study was conducted to evaluate the effect of aerobic exercise training on inspiratory muscle performance and dyspnea in patients with chronic heart failure, revealed that aerobic exercise training improved maximal exercise capacity in patients with congestive heart failure with greater muscle performance and diminished dyspnea sensation after eight weeks of aerobic exercise training. Specific attention to the respiratory muscles of heart failure patients may improve the management of disease. [12]

A study was conducted to evaluate the evidence supporting the use of therapeutic exercise interventions like treadmill aerobic exercise, bicycle ergo meter aerobic exercise and resistance exercise in patients with congestive heart failure revealed that there was significant clinical importance of aerobic exercise in the outcomes of maximum oxygen consumption (VO_2 max) levels, dyspnea, work capacity and left ventricular function. Resistance exercise was shown to have clinical importance in improving left ventricular function, peak lactate levels, muscle strength and muscle endurance. These results support the inclusion of aerobic exercise programmes and resistance training for patients with congestive heart failure. [13]

A study was conducted to demonstrate in patients with moderate to severe heart failure that exertional dyspnea can be alleviated by improving muscle function through isolated lower- limb aerobic exercise training in 17 patients, which resulted in increased peak torque of leg flexors and reduced ratio of fatigue indicating improved strength and endurance of leg muscles. Duration of exercise at 70% peak VO_2 increased, dyspnea during the submaximal testing was decreased. Minnesota living with heart failure score & transitional dyspnea index were all improved with training.[14]

3. Problem Definition

Inspiratory Muscle Training Programme

Inspiratory exercise training programme in order to strengthen the inspiratory muscles by using threshold inspiratory muscle training device (Power Breath) for 12 weeks, 30 minutes, every alternative days, with an inspiratory load at 30% of maximal inspiratory muscle pressure (Pi max).

Aerobic Exercise Training Programme

In this study it refers to a supervised exercise programme with light music, performed 3 times per week, for 12 weeks with duration of 30 minutes including 5 minutes warm up and 5 minutes cool down periods.

Combined Training Programme

Combined Training Programme includes various exercise programmes, that is inspiratory muscle training by using threshold inspiratory muscle training device alternative days for 30 minutes and aerobic exercise training by using light

music with supervised exercise steps on every alternate days for 30 minutes for a period of 12 weeks.

Inspiratory Muscle Strength

Inspiratory muscle strength refers to the ability of inspiratory muscles to contribute in maximum inhalation of air when the patient inhales through power breath and which is measured as inspiratory volume in this study.

Dyspnea

Dyspnea is defined as shortness or difficulty in breathing. [2] In this study, it refers to the degree of breathing difficulty as shown in Borg Dyspnea Scale.

Heart failure Patients

Heart failure is a syndrome manifesting as the inability of the heart to fill with or eject blood due to any structural or functional cardiac conditions. [1] In this study, it refers to patients with severely damaged heart due to any alteration in structural and functional capacity of the heart and it resulted in congestion, pulmonary edema and severe dyspnea.

4. Objectives of the Study

The objectives of the study are to:

- compare the inspiratory muscle strength and severity of dyspnea in heart failure patients before and after the interventional programmes, that is inspiratory muscle training, aerobic exercise training and combination training (of both).
- find out the association between inspiratory muscle strength and severity of dyspnea in heart failure patients and selected variables like age, sex, duration of illness, occupation, history of other respiratory diseases and regular exercises.
- determine the opinion on acceptability of the interventional programmes in heart failure patients.

5. Hypotheses

Hypotheses will be tested at 0.05 level of significance

H_1: There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after inspiratory muscle training programme.

H_2: There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after aerobic exercise training programme.

H_3: There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after the combined training programme with inspiratory muscle training and aerobic exercise training programme.

H_4: There will be a significant difference between the three experimental groups on inspiratory muscle strength and severity of dyspnea after the exercise training programme.

H_5: There will be a significant association between pretest scores of inspiratory muscle pressure and severity of dyspnea and selected variables that is age, sex, duration of illness, occupation, history of other respiratory diseases and regular exercises.

6. Methodology / Approach

1. Research Approach

An experimental research approach is used for this study. An experimental research approach is an applied form of research that involves, finding out how well a practice or procedure is working.[15]

2. Research Design

In order to accomplish the main objective of assessing the effectiveness of aerobic exercise training and inspiratory muscle training on inspiratory muscle strength and severity of dyspnea among heart failure patients, a pre-test – post-test multiple group design is adopted.

Pre-test was administered after ensuring that the patients are physically fit to undergo the training programme. Physical fitness was assessed by physical examination of the patients and by 6 minutes walk test.

GROUP I	R	O_1	X	O_2
GROUP II	R	O_1	X	O_2
GROUP III	R	O_1	X	O_2

GROUP I – Patients who are undergoing aerobic exercise training program

GROUP II – Patients who are undergoing inspiratory muscle training program

GROUP III – Patients who are undergoing both aerobic exercise training and inspiratory muscle training programs.

R = Randomization to treatment groups,

X = Interventions (aerobic exercise training program, inspiratory muscle training program and combined training programs)

O_1 = First observation on severity of dyspnea before treatment.

O_2 = Second observation on severity of dyspnea after treatment at 4^{th} week

3. Variables

Variables are also concepts at different levels of abstraction that are concisely defined to promote their measurement or manipulation within a study.[16] The following variables were identified in the present study:

- **Independent Variables:** Aerobic exercise training programme and inspiratory muscle training programme and the combined training programme.
- **Dependent Variables:** Inspiratory muscle strength and dyspnea.

4. Setting of the Study

The study was conducted in selected cardiac rehabilitation centers of Dakshina Kannada District.

5. Population

The population selected for the study comprised of heart failure patients from selected cardiac rehabilitation centers of Dakshina Kannada District.

6. Sample

In this study, the sample consists of 15 heart failure patients. i.e, 05 samples in each of the experimental group.

7. Sampling Technique

In this study purposive sampling technique is used to select the heart failure patients and samples are randomly assigned to experimental groups. **It is represented in Figure 1.**

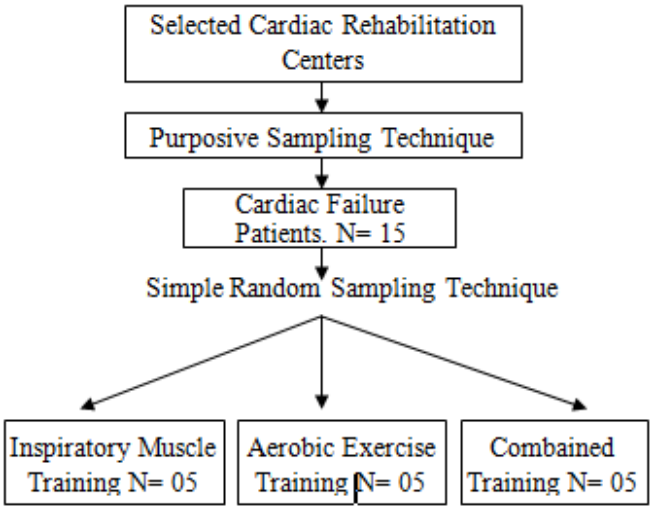

Figure 1: The Sampling Plan

8. Sampling Criteria

Inclusion Criteria: Heart failure patients who are:

- diagnosed as heart failure for more than 6 months.
- experiencing dyspnea within a range of 2-10 on Borg Dyspnea Scale.
- less than 80 years of age.
- willing to participate in the study.
- found to be physically fit following a physical assessment & 6 MWT.

Exclusion criteria: Heart failure patients who are

- with history of pulmonary disease .
- with history of current smoking.
- Suffering from angina pectoris.
- with recent myocardial infarction or cardiac surgery (< 6 months).
- with history of orthopedic or neurological diseases.
- under treatment with steroids.
- suffering from deep vein thrombosis.

9. Data Collection Instruments

The following instruments were used for the collection of data:

1. Demographic proforma
2. Inspiratory Muscle Trainer (Power Breath)
3. Borg Dyspnea Scale
4. Likert Scale opinionnaire

10. Development/Selection Of Data Collection Tools

The data collection tools were used for the study are, a demographic proforma that consists of age, sex, duration of illness, occupation, history of other respiratory illness and practice of regular exercises of heart failure patients undergoing interventional programmes. A Power Breath was used to measure the inspiratory volume and to give inspiratory muscle training. A Borg Dyspnea Scale was used for identifying severity of dyspnea and a Likert Scale Opinionnaire used for assessing acceptability of heart failure patients on interventional programmes.

10.1. Demographic Proforma

Content validity

Demographic proforma was prepared with six items, that is age, sex, duration of illness, occupation, history of other respiratory illness and regular exercises for heart failure patients and were given for validation to 7 experts along with letter seeking suggestion of experts to validate the tool, acceptance form for tool validation and criteria check list for validation of the tools. Experts were from the field of medicine, physiotherapy and nursing.

10.2. Inspiratory Muscle Trainer

Pre – testing and reliability

Inspiratory Muscle Trainer was administered to ten heart failure patients who were fulfilling the sampling criteria, for pre – testing. For establishing reliability, checked the calibration of the Inspiratory Muscle Trainer.

10.3. Borg Scale

Standardized Borg Dyspnea Scale with 11 items was used to assess severity of dyspnea.

10.4. Likert Scale Opinionnaire

The draft Likert Scale was given to seven experts to receive their suggestions and comments.

Reliability

The reliability was calculated by Cronbach alpha method, r (10) = .806.

11. Development of Training Programme

The protocols of the training programmes were developed by the researcher after undergoing certified training courses on aerobic exercise training and inspiratory muscle training from certified institutions. The protocols of the training programmes were given to the experts from the field of cardiology, pulmonary medicine and physiotherapy to seek their suggestions. This training programme was demonstrated and taught to the patients after considering their psycho-social factors.

11.1. Inspiratory Muscle Training Programme

Inspiratory exercise training programme in order to strengthen the inspiratory muscles by using threshold inspiratory muscle training device (Power Breath) for 4 weeks, 30 minutes, every alternative days, with an inspiratory load at 30% of maximal inspiratory muscle pressure (Pi max).

11.2. Aerobic Exercise Training Programme

In this study it refers to a supervised exercise programme with light music, performed 3 times per week, for 4 weeks with duration of 30 minutes including 5 minutes warm up and 5 minutes cool down periods.

1.1. Combined Training Programme

Combined Training Programme is with different exercise programmes, that is inspiratory muscle training by using threshold inspiratory muscle training device alternative days for 30 minutes and aerobic exercise training by using light music with supervised exercise steps on every alternate days for 30 minutes for a period of 12 weeks.

7. Data Collection

A formal letter was sent to the Managing Director of Yenepoya Specialty Hospital, Kodiabail, Mangalore in seeking permission to conduct study among 10 cardiac failure patients with 5 in each of the experimental group on 18/12/13. Ten patients were selected for the study by using purposive sampling technique and selected samples were randomly assigned to three interventional groups. The informed consent was taken prior to the study from subjects and the nature of the study was explained.

The tools were administered to the samples and they took an average time of 30 minutes to complete all. i.e, 5 minutes for Demographic Proforma, 5 minutes for power breath to check inspiratory level, 5 minutes for Borg Dyspnoea Scale, 15 minutes for Minnesota Living with Heart Failure.

Subjects were undergone with assessment of other parameters like 6 MWT, Spo2, Temperature, Pulse, Respiration and Blood Pressure.

Followed by pretest subjects were demonstrated with exercise programmes. Aerobic exercise training took about 30 mts and inspiratory muscle training took about 20 mts for demonstration. Exercise training programmes were given every alternative day. i.e. patients were practicing Aerobic exercise training and inspiratory muscle training programmes 3 times in a week.

Exercise training programmes were given for 4 weeks and post test tools were administered at the end of 4 weeks. Likert Scale opinionnaire was administered to the patients at the end of exercise training programmes in order to find out their opinion on acceptability of exercise programmes and the tools are as found to be feasible and practicable.

8. Results

The data was analyzed using descriptive and inferential statistics.

1. Demographic proforma N = 15

Variables	*Demographic Data*	*Interventional Groups*						*Total frequency*	*Percentage*
		Aerobics		*Inspiratory muscle training*		*A+I*			
		frequency	*%*	*frequency*	*%*	*frequency*	*%*		
Age	a) 40 to 50	2	40	1	20	2	40	5	33.3
	b) 51 to 60	2	40	1	20	2	40	5	33.3
	c) 61 to 70	0	0	2	40	0	0	2	13.3
D1	d) 71 to 80	1	1	1	20	1	20	3	20
Sex	a) Male	3	60	3	60	2	40	8	53.3
D2	b) Female	2	40	2	40	3	60	7	46.7
	a) Professional	0	0	0	0	1	20	1	6.7
Occupation	b) Clerical,shop owner, farmer	3	60	1	20	0	0	4	26.7
	c) Skilled worker	0	0	0	0	0	0	0	0
D3	d) Unskilled worker	0	0	1	20	0	0	1	6.7
	e) Unemployed	2	40	3	60	4	80	9	60
Duration of	a) ≤ 1 year	1	20	1	20	1	20	3	20
illness	b) 1 to 3 years	2	40	4	80	3	60	9	60
	c) 3 to 5 years	2	40	0	0	1	20	3	20
D4	d) ≥ 5 years	0	0	0	0	0	0	0	0

Section 1: Demographic Profile

Variables		*Demographic Data*	*Interventional Groups*						*Total frequency*	*Percentage*
			Aerobics		*Inspiratory muscle training*		*A+I*			
			frequency	*%*	*frequency*	*%*	*frequency*	*%*		
D5 History of respiratory illness	1. COPD	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	15	100
	2.Asthma	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	15	100
	3.bronchitis	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	15	100
	4.Tuberculosis	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	15	100
D6 Regular Exercise	1. Yoga	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	5	100
	2. Walking	a) Yes	3	60	1	20	1	20	5	33.33
		b) No	2	40	4	80	4	80	10	66.67
	3.Jogging	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	5	100
	4.Dancing	a) Yes	0	0	0	0	0	0	0	0
		b) No	5	100	5	100	5	100	5	100

H_1: There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after inspiratory muscle training programme.

Parameter		*N*	*Minimum*	*Maximum*	*Mean*	*Mean Pre – post*	*Standard deviation*	*Wilcoxon signed rank test value*	*P value*	*Remarks*
Inspiratory volume	Pre	5	1	3	2	4.8	1.643	2.03	0.042	Sig
	Post	5	6	8	6.8					
Dyspnoea	Pre	5	6	8	7	4.2	1.095	2.06	0.039	Sig
	Post	5	2	4	2.8					

There was a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after inspiratory muscle training programme.

H_2: There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after aerobic exercise training programme.

Parameter		N	Minimum	Maximum	Mean	Mean Pre – post	Standard deviation	Wilcoxon signed rank test value	P value	Remarks
Inspiratory volume	Pre	5	2	6	3.80	3.2	.8367	0.041	0.042	Sig
	Post	5	6	8	7					
Dyspnoea	Pre	5	3	6	5	3.1	1.0247	2.04	0.041	Sig
	Post	5	1	3	1.9					

There was a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after aerobic exercise training programme.

H_3 : There will be a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after the combined training programme with inspiratory muscle training and aerobic exercise training programme.

Parameter		N	Minimum	Maximum	Mean	Mean Pre – post	Standard deviation	Wilcoxon signed rank test value	P value	Remarks
Inspiratory volume	Pre	5	1	6	3	3.8	1.4832	2.03	0.042	Sig
	Post	5	5	8	6.8					
Dyspnoea	Pre	5	3	9	6	3.6	1.1402	2.03	0.042	Sig
	Post	5	1	4	2.4					

There was a significant increase in the mean inspiratory muscle strength and a decrease in the mean dyspnea scores of heart failure patients after the combined training programme with inspiratory muscle training and aerobic exercise training programme.

H_4 : There will be a significant difference between the three experimental groups on inspiratory muscle strength and severity of dyspnea after the exercise training programmes.

parameter	*groups*	*mean*	*Standared deviation*	*Change %*	*Wilcoxon signed rank test value*	*P value*	*Remarks*
Inspiratory volume	I	3.2	.8367	84	2.08	0.247	NS
	II	4.8	1.6432	240			
	III	3.8	1.4832	126			
Dyspnoea	I	3.1	1.0247	62	2.138	0.343	NS
	II	4.2	1.0954	60			
	III	3.6	1.1402	60			

There was no significant difference between the three experimental groups on inspiratory muscle strength and severity of dyspnea after the exercise training programmes.

H_5 : There will be a significant association between pretest scores of inspiratory muscle strength and severity of dyspnea with selected variables that is age, sex, duration of illness, occupation, history of other respiratory diseases and regular exercises.

Fisher's Exact test was used to determine significant association. There was no significant association between pretest scores of inspiratory muscle strength and severity of dyspnea and selected variables that is age, sex, duration of illness, occupation, history of other respiratory diseases and regular exercises.

Changes in other physiological parameters

	Parameter	Group	Mean	Std. Deviation	change (%)	Kruskal wallis test value	p value
Pre - Post	INSPIRATORY VOLUME	A	3.2000	.8367	84.21	2.800	.247
		I	4.8000	1.6432	240.00		NS
		A + I	-3.8000	1.4832	126.67		
	DBP	A	4.0000	8.9443	4.65	1.389	.499
		I	10.0000	7.0711	10.42		NS
		A + I	4.0000	11.4018	4.76		
	DYSPNEA	A	3.1000	1.0247	62.00	2.138	.343
		I	4.2000	1.0954	60.00		NS
		A + I	3.6000	1.1402	60.00		
	MINNESOTA	A	55.2000	5.7619	68.66	2.079	.354
		I	60.2000	5.6745	70.82		NS
		A + I	59.6000	9.2087	71.81		
	Pulse	A	2.4000	8.6487	2.86	.317	.854
		I	5.6000	6.5422	6.51		NS
		A + I	10.0000	17.3781	10.33		
	Respiration	A	6.4000	3.2863	21.62	.509	.775
		I	6.8000	2.2804	21.52		NS
		A + I	5.6000	3.2863	18.92		
	SBP	A	8.0000	4.4721	6.25	3.739	.154
		I	32.0000	25.8844	19.75		NS
		A + I	14.0000	20.7364	10.14		
	Spo2	A	-8.4000	1.8166	9.29	1.987	.370
		I	-9.0000	1.0000	10.18		NS
		A + I	-8.2000	3.2711	9.15		

d.f = 2

There was a significant improvement in other parameters like Spo2, respiratory rate, pulse rate and blood pressure after the exercise programmes. But there is no significant difference on these improvements among three experimental groups.

Likert Scale Opinionnaire to assess the acceptability of exercise programmes.

All the patients given good comment on exercise programmes.

Opinion total

Group	N	Minimum	Maximum	Mean	Std. Deviation	Median
A	5	51	65	56.20	5.541	54.00
I	5	53	61	57.20	3.633	56.00
A + I	5	50	63	55.00	5.701	52.00
Total	15	50	65	56.13	4.764	55.00

Score range is 0 – 65.

9. Conclusion

The findings of the study revealed that aerobic exercise training and inspiratory muscle training programmes are effective in improving inspiratory muscle pressure and reduction of dyspnoea. All the three groups have shown equal improvement in inspiratory volume and severity of dyspnoea after the exercise programmes and which do not have any association with selected variables like age, sex, duration of illness, occupation, history of other respiratory diseases and practice of regular exercises. Though there was some hesitation shown by the patients in the beginning of exercise programmes, all the patients had shown full satisfaction and given good commends at the end regarding exercise programmes.

10. Future Scope

- The findings of the study will help to utilize inspiratory muscle training and aerobic exercise training as an adjuvant therapy for improving inspiratory muscle strength and dyspnea in heart failure.
- The findings of the study will help heart failure patients to perform physical activities more easily and improve their overall health related quality of life.

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