



RESEARCH ARTICLE

TO COMPARE THE EFFECTS OF ACAPELLA AND DIAPHRAGMATIC BREATHING  
EXERCISE IN COPD PATIENTS

\*Jayson, C.J., Vaishnavi, G., Tharani, G., Kamatchi, K. and Kirupa, K.

Faculty of Physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi  
Chennai-600077

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ABSTRACT

**Background of the Study:** Acapella an oscillatory positive expiratory pressure device used for the clearance of secretions in the COPD patients. It sends the vibratory signals into the lungs, shaking the mucus plugs that the patient cough and improve cough effectiveness and push out secretion. The diaphragm is the most efficient muscle of breathing and the diaphragmatic breathing helps to strengthen the diaphragm, decrease the work of breathing, useless effort and energy to breathe.

**Methodology:** It is an experimental and comparative study done at ACS MEDICAL HOSPITAL using 20 subjects of age group 40-60years only male sex included for about 8 weeks for those who had RR>30respiratory fatigue or failure. Materials Used couch, chair, foot stool, stopwatch, acapella device.

**Procedure:** 20 subjects were selected randomly by lottery method. Chits odd number in group and even number in group B. Group A- Acapella device Group B-Diaphragmatic breathing.

**Outcome Measures:** Pulmonary function test (PFT)

**Result:** The result was based on the statistical analysis of data collected and it revealed that both the groups showed improvement while group A comparatively better than group B on the basis of PFT.

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INTRODUCTION

COPD (Chronic Obstructive Pulmonary Disease) is a progressive lung disease which causes damage to the lungs and makes it harder to breathe. COPD is a combination of chronic bronchitis and emphysema. The airways of the lungs are usually damaged in the lungs and they produce an enormous amount of mucus production. This enormous amount of mucus production causes the airways to get inflamed and even narrows and blocks the airways thus leading to difficulty in breathing. The air sacs of the lungs get damaged in case of emphysema. In normal healthy individual the air sacs are seen in the balloon form when breathing occurs during inspiration and expiration they get bigger and smaller to push air into the lungs but in case of emphysema this does not occur because the air sacs loses the elasticity and hence they does not provide the normal mechanism of breathing. The pathophysiology of COPD comprises the following; Airway inflammation, Mucociliary dysfunction, Consequent airway structure changes. COPD is due to the inflammation of airways, lung tissues and pulmonary blood vessels. It is mainly due to the usage of tobacco.

The inflammatory mediators sustain the process of inflammation and leads to the damage of tissues and the system. Smoking and inflammation enlarges the mucus glands this cause the goblet cells metaplasia and leading to healthy cells being replaced. Inflammation with COPD causes damage to the mucociliary system which helps in clearing of the mucus. But in COPD the mucus secretion seems to be enormous and decreases the air flow limitation. The direct response of inflammation results in airway remodelling and narrowing of It .parenchymal dysfunction associated with long ling tissue elasticity this can be referred as the destruction. It also means that airway collapse during exhalation. The prevalence of COPD varies widely but the disparity is narrowing due to rising prevalence in low middle and high income countries. An estimated 300 million people worldwide suffer from COPD with 250,000 annual deaths attributed to deaths. The acapella is a vibratory PEP system is a single patient use device that provides positive expiratory pressure (PEP) therapy for patients who have various disorders associated with the lungs like cystic fibrosis, COPD, asthma and various lung secretion problems and patients with atelectasis. It sends the vibratory signals into lungs shaking the mucus plugs that the patient cough and improves the cough effectiveness and pushes out the secretion. The diaphragm is the main muscle responsible for breathing. It is a large dome

\*Corresponding author: Jayson, C.J.

Faculty of physiotherapy, Dr. M.G.R. Educational and Research Institute, Velappanchavadi .

shaped muscle which is located at the lungs. The diaphragmatic breathing exercise strengthen the diaphragm, decrease the work of breathing and oxygen demand, Useless effort and energy to breathe.

### Aim and Need of the Study

**Aim of the study:** The aim of this study is to investigate the effects of acapella and diaphragmatic breathing exercise in COPD patients.

**Need of the study:** The need of this study is to reduce the occurrence of COPD symptoms with the device acapella and the diaphragmatic breathing exercise.

### Hypothesis

**Null Hypothesis:** There is no significant difference between the effects of acapella and diaphragmatic breathing exercise.

**Alternate Hypothesis:** There is significant difference between the effects of acapella and diaphragmatic breathing exercise.

## METHODOLOGY

**Study Design:** Experimental study

**Study Type:** Comparative study

**Study Setting:** Out Patient Department, Faculty Of Physiotherapy, A.C.S Medical college and hospitals.

**Study Sample:** 20 Subjects

**Study Duration:** 8 weeks

### Inclusion Criteria

- Current smokers (40-60) years Males,
- Known history of COPD,
- Dyspnea on exertion,
- Persistent wheezing.

### Exclusion Criteria

- RR>30,
- Respiratory fatigue or failure,
- Altered mental status.

### Materials Used

- Couch
- Chair
- Foot stool
- Stopwatch
- Acapella

### Outcome Measures

Pulmonary function test (PFT).

### Procedure

The procedure of this study was based upon the randomized controlled study. 20 objectives were totally selected and they

are divided and allocated into two groups Group A and Group B. Group A: Consists of 10 subjects who received Acapella (PEP). The acapella consists of a dial which has the positive (+) and negative (-) rotator which decreases the resistance of the device. The patient should be able to exhale for 3-4secs while the device vibrates in case if the patient cannot maintain the exhalation for this length of time the dial can be adjusted in the clockwise direction. The clockwise direction increases the resistance of the vibrating orifice which will allow the patient to exhale at a lower flow rate. Selection of the proper resistance range produces the desired inspiratory to expiratory (I:E) ratio of 1:3 to 1:4. Once the proper range has been achieved the patient may be asked to exhale harder or softer according to the response the patient feels from the vibratory pressure. The patient must be well positioned in a comfortable and a supported way. Sitting can be the most comfortable position with the elbows resting on the table or half lying. The mouth piece should be tightly placed in the mouth during performing the exhalation. Take a deep breath and hold for 3secs exhale as much as possible and cheeks should be kept firm while exhale. The exhalation should last approximately for up to 3 to 4 times longer than inhalation. Perform 10-20 PEP breaths and perform 3 to 4 "huff" cough to raise the secretion

### Group B:

10 subjects are trained by doing the active Diaphragmatic breathing exercise. The diaphragm is the main muscle of breathing and it mostly does the working of breathing. In case of COPD the diaphragm does not work and increases the work of the neck and shoulder muscle. The air becomes trapped in the lungs pushing down on the diaphragm. This can lead to flattened and weakened the diaphragm muscle making it to work less efficiently. The diaphragmatic breathing generally strengthens the diaphragm, decrease the work of breathing, decrease the oxygen demand, use less effort and energy to breathe.

**Position of the patient:** The patient may be comfortably positioned with the adequate support. Lying on flat surface with knees bent and head supported. A pillow can be placed under the knee to support the legs.

The hand can be placed over the chest and the other below the rib cage this tends to feel the move of the diaphragm. Breathe in slowly and the stomach may push out against the hand and hand over the chest should remain the same. The stomach muscles are tightens and they fall inwards while exhalation happens. The exercise may be practiced 5-10 minutes about 3-4 times per day. The amount of time may be increased gradually.



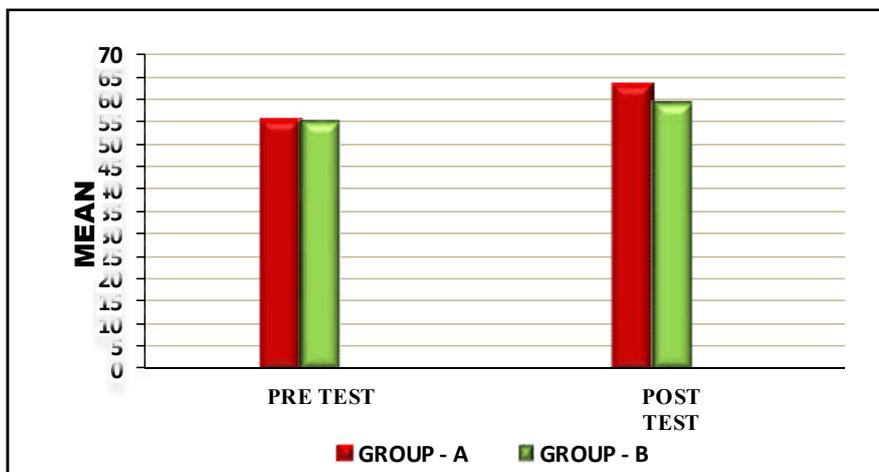
Fig. 1. Acapella Device

### Data Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics.

Table 1. Comparison of fev1 between group – a and group - b in pre and post test

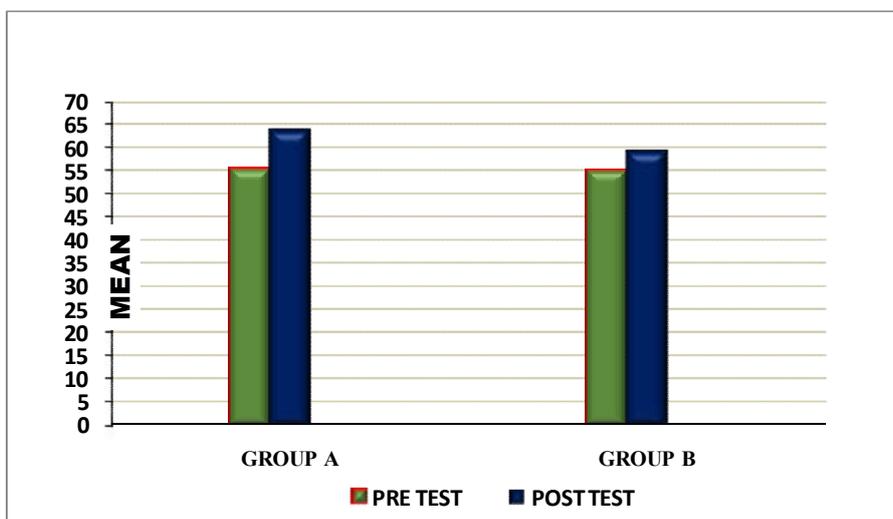
#FEV1	#Group – A		#Group – B		t - Test		
	Mean	S.D	Mean	S.D	df	Significance	
Pre test	55.70	3.68	55.30	3.30	.256	18	.801*
Post test	63.90	1.91	59.40	3.47	3.59	18	.000***



Graph 1. Comparison of fev1 between group – a and group - b in pre & post

Table 2. Comparison of fev1 within group – a & group – b between pre & post test values

#FEV1	PRE TEST		POST TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	55.70	3.68	63.90	1.91	-7.43	.000***
GROUP- B	55.30	3.30	59.40	3.47	-17.57	.000***



Graph 2. Comparison of fev1 within group – a & group – b between pre & post test values

All the parameters were assessed using statistical package for social science (SPSS) version 24. Paired t-test was adopted to find statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find statistical difference between the groups.

**RESULTS**

On comparing mean value of GROUP-A and GROUP-B on Fev1 shows significant increase in the post test means with acapella device (GROUP-A) shows (63.90) higher mean value is more than the diaphragmatic breathing exercise (GROUP-B) (59.40) at  $P \leq 0.001$ .

**DISCUSSION**

The acapella device showed improvements in the COPD symptoms which assessed the Fev1 value by using the PFT and. The reduction of symptoms was seen with the acapella along with. This demonstrates the oscillatory PEP device shows potential benefit in COPD patients. This study used acapella device for the COPD Patients. This is evident from the mean value of Pre- test (55.70) GROUP-A and Post-test(63.90).Group A showed a significant differences. Similarly the evident of mean value of Pre-test value (55.30) Group B and Post-testvalue (59.40) Group B. The study also reveals the PFT values between Group A Pre test mean value

(55.70) and Post test mean value (63.90) showed a significant difference. Similarly the mean value of PFT values between Group A Pre test(55.70) and Group B Pre test (55.30) doesn't showed any significant difference. At the end of the treatment session group A Post test mean value (63.90) shows a marked difference than group B Post test mean value(59.40). On comparing Group A Post-test the type of PEP positive expiratory pressure technique with acapella device and group B diaphragmatic breathing exercise .Group A shows significant increase in the expiratory volume (63.90). After 8 weeks the patients are evaluated for the results. Mean and standard deviation are obtained and results are provided below. In this study Group A ( $P \leq 0.001$ ) is effective than the Group B ( $P > 0.05$ ) that showed a significant difference at the end of the study.

## Conclusion

This study reveals that there is significant difference in the post test value of Group A acapella than Group B diaphragmatic breathing exercise. Group A showed more significant difference than Group B. Hence null hypothesis was rejected and alternate hypothesis was accepted.

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