

ORIGINAL ARTICLE

Effects of Controlled Breathing Maneuver on Exercise Tolerance in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Chronic obstructive pulmonary disease, which is usually caused by harmful particles or gases, is associated with persistent respiratory symptoms.

Aim: To determine effects of controlled breathing techniques for respiratory muscle strengthening and functional capacity.

Study Design: Randomized control trial.

Methodology: Study was conducted at Services Hospital Lahore for duration of 6months. Patients (n=48) were enrolled through convenient sampling. Participants were divided into two groups 24 in each group. Both groups A and B received baseline treatment for pulmonary rehabilitation. Pursed lip breathing technique was performed to group B, 20 minutes session for 4 days per week. Pre and post treatment readings were taken and the results were analyzed. Informed consent was taken. Data was evaluated by using SPSS vr 23. Before and after comparison was made using paired sample t test considering normality of data.

Results: Almost 18.75% were in the age range of (40-49 years), 16(33.33%) in (50-59), 10(20.83%) in (60-69) and 13(27.08%) in (70-75). The pre and post readings showed that there was a mean difference in 6MWT and AQ20 with significant p-value.

Conclusion: It was concluded that controlled breathing techniques have been found to be more effective to increase exercise tolerance in people with chronic obstructive pulmonary disease.

Keywords: chronic obstructive pulmonary disease, Exercise Tolerance, Controlled Breathing Maneuvers and Pulmonary Functions.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD), which is usually caused by harmful particles or gases, is associated with persistent respiratory symptoms and airflow limitations due to airway and/or alveolar defects¹. In physical therapy, the best way to control shortness of breath is to breathe with your lips pursed together. If you want to slow down your breathing, this is an easy way to do it². Using this breathing technique, Pulmonary ventilation is believed to be improved, air trapped in the lungs will be removed and the airways will remain open for longer and will facilitate breathing, the exhalation is extended for a slower breathing rate and the breathing patterns will be increased through the expulsion from old air from the lungs³.

Exercise is a non-invasive tool to assess the response of the cardiovascular system and exercise under carefully controlled conditions. Exercise is the most common physical stress and places great demands on the cardiopulmonary system⁴. The Exercise Tolerance Test (ETT) is an Electrocardiogram (ECG) recorded while exercising. The test tests how your heart works when you are working and your heart has to work hard. When you work, your heart needs a lot of blood and oxygen. Cardiovascular disease can be difficult to diagnose at rest, but exercise can help to reveal whether or not the condition exists⁵.

In patients who suffer from chronic obstructive pulmonary disease (COPD), respiratory training and sitting posture with a forward-leaning trunk has been promoted to eliminate dyspnea and improve pulmonary function⁶. Exercise Intolerance is a condition in which a person is unable or has a restricted capacity to operate physical activity at the extent or duration that is generally expected. It also includes post-exercise discomfort, exhaustion, nausea, vomiting or other negative symptoms that are especially severe. Exercise intolerance is not an illness or symptom in and of itself, but it can be caused by a number of conditions that show a decline in peak

Accepted on 06-01-2023

exercise performance as measured by cardiopulmonary exercise testing⁷. Patients often consume only 40% to 60% of their projected maximum oxygen consumption during peak exercise.

Dynamic inflation in patients with chronic pulmonary disease is one of the main causes of exercise reduction. Limitation of expiratory flow due to increased resistance and reduced lungs elasticity causes dynamic hyperinflation⁸. Expiratory time reduces during exercise, preventing the respiratory system from attaining its relaxation volume before the start of the workout. The increased mechanical strain on the inspiratory muscles results in higher labour of breathing and oxygen consumption to maintain ventilation; decreased diaphragmatic strength due to muscle fibre shortening; decreased tidal volume expansion; and compromised heart performance.

Controlled breathing maneuver comprises the pursed lip breathing (PLB) technique which is often employed on patients with chronic lung diseases in distress situations.⁹ Controlled breathing helps COPD patients to reduce dyspnea by minimizing dynamic rib cage hyperinflation and improved exchange of gas, enhancing breathing strength and endurance, and improving the pattern of thoracoabdomen. Breathing with bagpipes, leaning forward and inspiratory muscle formation in the treatment of dyspnea were useful¹⁰.

This study established the role of controlled breathing maneuvers to improve exercise tolerance among COPD patients. There is lack of data on role of pulmonary exercises and there is increased prevalence of COPD among out setups due to multiple factors hence present study was planned. Results of present study helped in improving health conditions of COPD sufferers through exercises.

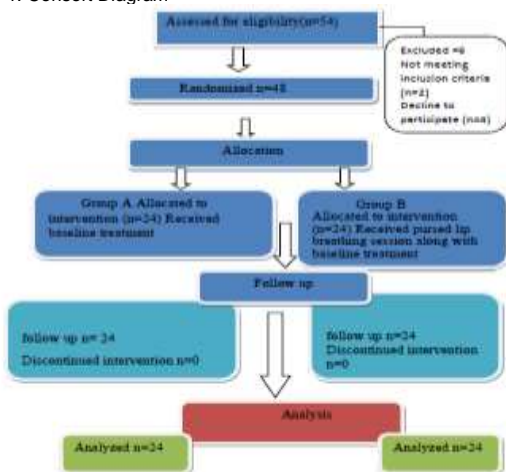
Objective of present study was to determine effects of controlled breathing techniques for respiratory muscle strengthening and functional capacity.

METHODOLOGY

Received on 02-09-2022

It was a randomized control trial conducted at Services Hospital Lahore for duration of 6 months after ethical approval. Patients (n=48) were enrolled through convenient sampling. Sample size was calculated by EPITOOL formula keeping the mean differences values from previously published study. Forty-eight patients aged between 40 to 75 years with history of COPD contributed in this study. Patients with medically unstable pneumonia ,tuberculosis and COPD patient with any other life threatening co morbidity like hypertension ,heart disease ,rib fracture were excluded from the study. Participants were divided into two groups 24 in each group. Both groups A and B received baseline treatment for pulmonary rehabilitation. Pursed lip breathing technique was performed to group B, 20 minutes session for 4 days per week. Pre and post treatment readings were taken and the results were analyzed. All the information was collected from standardized questionnaire Airway Questionnaire 20 and 6MWT (six-minute walk test) in both groups' patients. After 8 weeks, patients were examined and pre and post measures were taken. Informed consent was taken.

Figure-1: Consort Diagram

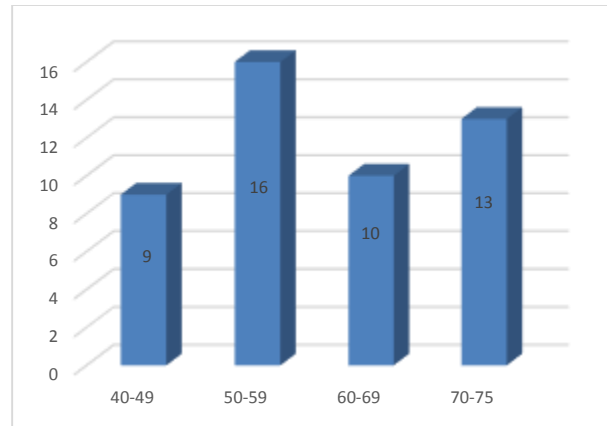


Statistical analysis: Data will be entered and analyzed in SPSS version 23.0. Before and after comparison was made using paired sample-t test considering the normality of data. At descriptive analysis, for categorical variables, frequency and percentages were figured like age and BMI. Mean and standard deviation were calculated for continuous variables.

RESULTS

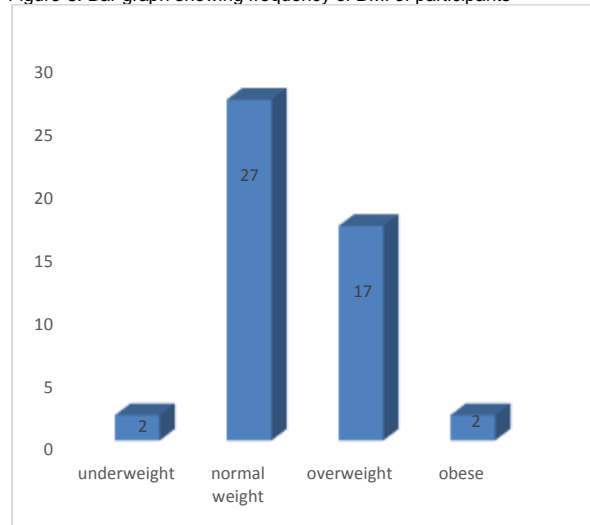
Out of 48 participants, 9(18.75%) were in the age range of (40-49 years), 16(33.33%) in (50-59), 10(20.83%) in (60-69) and 13(27.08%) in (70-75) as shown in figure-2.

Figure-2: Bar graph showing frequency of age of participants



Only 2(4.17%) were underweight, 27(56.25%) were normal, 17(35.42%) were overweight and 2(4.17%) were obese. BMI distribution was presented as frequency in figure -3.

Figure-3: Bar graph showing frequency of BMI of participants



The pre and post readings showed that there was a mean difference in 6MWT and AQ20 as shown in table-1. This table shows that P value was 0.000 and was less than 0.05 in both groups so there was significant difference

Table-1: Paired Sample t test for 6 MET and AQ20 (N=48)

Parameters	Mean	SD	Std.ErrorMean	P-value
Pair 1 6MWT pre	384.583	7.0	9.6845	0.000*
6MWT post	455.83	9.0	12.9915	
Pair 2 AQ20 pre	3.083	2.6	0.09337	0.000*
AQ20 post	2.500	3.7	0.11532	

*Statistically significant

Table 1 showed that correlation between age of patients and their performance in 6MWT was significant as p value reported to be 0.002. There was no significant correlation between smoking status and 6 MWT values of patients.

Table-2: Correlation of age and smoking status with 6MWT

	6MWT pre	6MWT post
Age of patients Pearson correlation	-.435	-.431
Sig. (2-tailed)	.002	.002
Smoking status Pearson correlation	-.215	-.195
Sig. (2-tailed)	.142	.185

DISCUSSION

It is known that individuals with COPD who participate in pulmonary rehabilitation have higher levels of exercise tolerance, peripheral muscle power and health-related quality of life without experiencing any negative impacts on their pulmonary function or arterial blood gas levels^{11,12,13,14}.

When used by COPD patients, regulated breathing techniques such extended exhalation, prolonged belly breathing, and deep belly breathing provide the following therapeutic advantages: The 6MWT walking distance can be increased with PLB¹⁵ and it appears to improve gas exchange and dyspnea.¹⁶ Pursed Lip Breathing has also been demonstrated to improve physical performance and exertional dyspnea over time.¹⁷ Deep Breathing improves blood gases in COPD patients, although at the expense of increased inspiratory muscle stress.¹⁸ Numerous investigations have shown that COPD patients can consciously alter their breathing pattern to involve more abdominal movement and less thoracic excursion but no changes in ventilation distribution could be seen¹⁹.

The current study found that the lip respiratory maneuver in COPD patients increased exercise tolerance and improved the quality of daily fitness. One study concluded that the exercise of pursed lip breathing can help COPD patients maintain physiological parameters such as heart rate, respiratory rate and maximum expiratory flow²⁰.

Pursed lip breathing is a technique for making breathing more efficient by slowing it down and making it more deliberate. It helps achieve respiration which is beneficial for people with chronic pulmonary obstruction (COPD). Previous research has found that pursed lip breathing lowers dynamic hyperinflation and increases exercise tolerance at submaximal intensity in COPD patients with low PEF²¹.

In current study the relationship between age and exercise performance of patients is significant (p value <0.05). Capacity for exercise decreases with age. Patients with chronic diseases experience more extreme ageing with advanced muscle waste, which emphasizes the importance of producing age-specific normal values. The application of regular values makes it clinically useful that the results of walking tests are measured in terms of fitness and functional limitation for patients. Reporting ISWT results as normal values can provide a motivating tool for pulmonary rehabilitation, alerting patients to limits on their capacity for exercise and assigning cause rather than effect to disease²².

In order to explain an increase in the variance on 6MWT performance, we measured a number of additional variables that have not been previously studied. Current smokers were less able than ever smokers among elderly people. Although no difference existed in the physical activity among groups, a smoking combination was found. Current and ex-smoking people had lower average capacity than never-smokers as in previous research²³.

Limitations of study: The limitations included single centre study with limited resources, small sample size and finance.

CONCLUSIONS

It was concluded that controlled breathing techniques (pursed lip breathing) have been found to be more effective to increase exercise tolerance in people with chronic obstructive pulmonary disease (COPD). Further researches are also needed to be conducted to determine the long-term consequences of intervention by continuing follow-up sessions.

Author's contribution: SA&ZH: Overall supervision and Write up and literature review, AK&BA: Statistics application, analysis literature review, help in write up, **MZ&MG:** Literature review help in write-up.

Conflict of interest: None

Funding: None

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