
EFFECT OF BREATHING EXERCISES COMBINED WITH AEROBIC TRAINING IN MILD-TO-MODERATE COPD

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ABSTRACT

Chronic obstructive pulmonary disease, often known as COPD, is a chronic respiratory disorder that is characterized by persistent airflow restriction, dyspnea, reduced exercise tolerance, and a worsened quality of life. Individuals who suffer from chronic obstructive pulmonary disease (COPD) can significantly improve their functional ability and respiratory symptoms thru the implementation of pulmonary rehabilitation, particularly cardiovascular training and breathing exercises. It is possible that the combination of these approaches will produce more advantages than any technique taken separately. When paired with aerobic training, breathing exercises have the potential to be an effective non-pharmacological therapy for improving functional and respiratory outcomes in persons who have mild to severe chronic obstructive pulmonary disease (COPD). Improvements in quality of life, increased exercise tolerance, and decreased dyspnea are all possible outcomes of the combined intervention program. Therefore, it is advised that more controlled studies be conducted with bigger sample numbers and longer follow-up periods in order to determine whether or not this combined rehabilitation technique is successful over the long run.

Keywords-COPD, Aerobic Training, BMI, PEFR

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a widespread respiratory disease characterized by the presence of symptoms and airway obstruction due to lung airways and/or alveolar dysfunction. This disease is usually progressive in nature and is accompanied by chronic inflammatory processes in the respiratory system. Such symptoms as shortness of breath, cough, sputum production, wheezing, tiredness, and decreased exercise tolerance are common. COPD has a strong impact on the person's capacity to conduct daily routine, as well as physical, psychological, and social well-being.

Long-term exposure to tobacco smoke, occupational dust, chemicals, indoor and outdoor air pollution, are the most common causes of COPD. Though COPD often appears later in life, it can appear sooner due to environmental, genetic, respiratory infection factors, etc. This disease has an immense burden for people and healthcare services due to repetitive symptoms, exacerbations, hospitalization, and reduced functional independence..

Physiological Changes and Exercise Limitation in COPD

The effects associated with COPD include the inability to take in air effectively. The narrowing of airways and loss of elasticity may also lead to air trapping and hyperinflation of the lungs. Exercise increases the need for ventilation, but the patient may have problems with breathing long before they can achieve maximal physical effort.

Lack of physical exercise will, in turn, lead to deconditioning and weakening of both peripheral and respiratory muscles. In this vicious circle, breathlessness leads patients to avoid exercises, while lack of exercise decreases their exercise capacity. Therefore, simple tasks such as walking, going up stairs, washing, or other house chores become problematic.

Importance of Pulmonary Rehabilitation

Pulmonary rehabilitation plays an important role in the management of COPD. In most cases, it includes exercise training, education, behavioral interventions, and various methods used to enhance both physical and psychological performance. Exercise therapy is meant to increase exercise tolerance, decrease symptoms, and increase participation in physical activities.

Aerobic exercise is one of the key aspects of pulmonary rehabilitation. Such activities as walking, cycling, and others can help enhance cardiovascular endurance and efficiency of muscles. Exercise may also help patients become more physically active despite COPD.

Role of Breathing Exercises in COPD

Breathing techniques are often used as an adjunct technique in respiratory rehabilitation. Exercises like diaphragmatic breathing and pursed lip breathing are aimed at improving control of breathing and reducing respiratory distress. For instance, pursed lip breathing can assist in controlling exhalation and reducing breathlessness during exercise.

Breathing exercises might also help in the development of better respiratory habits and give patients more confidence in controlling their breathing. Even though breathing exercises by

themselves might not be able to completely solve the problem, their combination with physical training can help COPD patients even further.

Role of Aerobic Training in COPD

Exercise training is a modality that aims to enhance physical stamina and improve the body's oxygen consumption capacity. Examples of exercises for people with COPD include walking, cycling on an exercise bike, treadmill training, and any other recommended forms of exercise.

Exercise training may result in improvements in exercise tolerance and reduced physiological strain during exercise. There might also be improvements in fatigue levels and involvement in normal activities. Exercise intensity and duration need to be properly modified depending on the patient's clinical status and exercise tolerance.

Combined Effect of Breathing Exercises and Aerobic Training

Using breathing exercises together with aerobic exercise could offer a more complete solution in addressing functional deficits of COPD patients. While the latter focuses on physical endurance and exercise tolerance, breathing exercises concentrate on breathing control and efficient breathing. Using the two techniques together could allow for better management of dyspnea while being physically active.

This combination could also interrupt the vicious circle of physical inactivity and deconditioning through increasing exercise tolerance and confidence. Increased breathing control while exercising could allow for increased comfort while performing aerobic exercises.

Effect on Dyspnea and Quality of Life

Dyspnea is one of the most vital symptoms that are present in patients with COPD. Dyspnea can lead to fear of physical activity and, as a result, to social isolation, anxiety, and decrease in the quality of life. Rehabilitation based on exercises and breathing can be useful for managing dyspnea and for performing everyday activities.

In this case, increased exercise tolerance can be helpful for greater independence in social and recreational activities. Therefore, assessment of quality of life should be considered in addition to physiological parameters while assessing effectiveness of rehabilitation programs.

OBJECTIVE

1. To assess the pulmonary function of patients with mild-to-moderate COPD before the intervention in the experimental and control groups.
2. To assess the pulmonary function of patients with mild-to-moderate COPD after the intervention in the experimental and control groups.

RESEARCH METHODOLOGY

Research design

In the current investigation, a quasi-experimental design with a pre-test and post-test control group was established. The researcher is guided through the process of preparing each stage of the inquiry, including participant selection, intervention, data collecting, and statistical analysis since a research design serves as the general blueprint for conducting a study and assists the researcher in planning each stage. The current study was classified as a quasi-experimental study since, unlike a genuine experimental design, it did not use complete randomization of participants. As a result, the study was not considered to be strictly experimental. Within the scope of the research were two different groups. In the experimental group, breathing exercises were paired with aerobic training, and they were also given routine medical treatment. On the other hand, the control group was just given normal medical management. Prior to the beginning of the intervention, both groups had their pulmonary function evaluated, and then their pulmonary function was evaluated once again after the intervention period had ended. To establish whether or not the intervention was successful in improving pulmonary function in patients with mild-to-moderate chronic obstructive pulmonary disease (COPD), the data from the pre-test and post-test were compared both within each group and between the two groups involved.

Sample Size

Patients who had been diagnosed with mild to moderate Chronic Obstructive Pulmonary Disease and who had supplied written informed consent to participate in the study were included in the sample. These patients had also met the inclusion criteria. The inquiry comprised a total of sixty individuals, with thirty of them being allocated to the experimental group and thirty of them being assigned to the control group so that the total number of participants was sixty. It was determined that the sample size was sufficient to test the efficacy of breathing exercises in conjunction with aerobic training on pulmonary function and to

enable statistical comparisons that were relevant between the two groups that were being studied. Every single participant was required to do both the pre-test and the post-test evaluations in accordance with the protocol for the research.

Sampling Technique

The process of selecting participants from the target population in such a manner that they appropriately represent the features of the group that is being studied is referred to as the sampling technique. For the purpose of taking part in this investigation, a method known as non-probability purposive sampling was utilized to pick the participants. During the course of the trial, patients who had been diagnosed with mild to moderate Chronic Obstructive Pulmonary Disease (COPD) and who met the eligibility requirements were recruited from the hospitals that were chosen. Because it allowed the investigator to include individuals who possessed the particular clinical features that were necessary for the research, purposeful sampling was deemed to be an appropriate method of sampling. Participants who were eligible for the study were assigned to either the experimental or control group in accordance with the protocol of the study after they had provided their informed permission. The selected sample strategy permitted simple recruitment of participants and guaranteed that the intervention was provided solely to persons who could safely do breathing exercises paired with aerobic training.

RESULT

Demographic Variable

In the next section, we will discuss the correlation that exists between the individuals in the experimental group's post-test pulmonary function and some demographic characteristics. After the completion of breathing exercises in conjunction with aerobic training, an analysis was conducted to determine the association between post-test pulmonary function and demographic factors such as age, gender, Body Mass Index (BMI), smoking status, duration of COPD, and GOLD stage. The purpose of this analysis was to determine whether or not these characteristics had any significant influence on the outcomes of the treatment. The Chi-square test was utilized in order to investigate the degree of correlation that existed between the classified post-test lung function scores and the demographic factors that were chosen. In order to be declared statistically significant, a significance threshold of $p < 0.05$ was utilized.

Table 1: Association of Post-test Pulmonary Function with Selected Demographic Variables in the Experimental Group

Demographic Variable	Category	χ^2 Value	df	P-value	Significance
Age (Years)	40–50, 51–60, 61–70	5.18	2	0.075	NS
Gender	Male, Female	0.86	1	0.354	NS
Body Mass Index (BMI)	Underweight, Normal, Overweight	2.94	2	0.230	NS
Smoking Status	Current, Former, Never	6.87	2	0.032	S*
Duration of COPD	1–2 Years, 3–5 Years, >5 Years	8.21	2	0.016	S*
GOLD Stage	Mild, Moderate	5.42	1	0.020	S*

NS = Not Significant ($p > 0.05$); S = Significant ($p < 0.05$)*

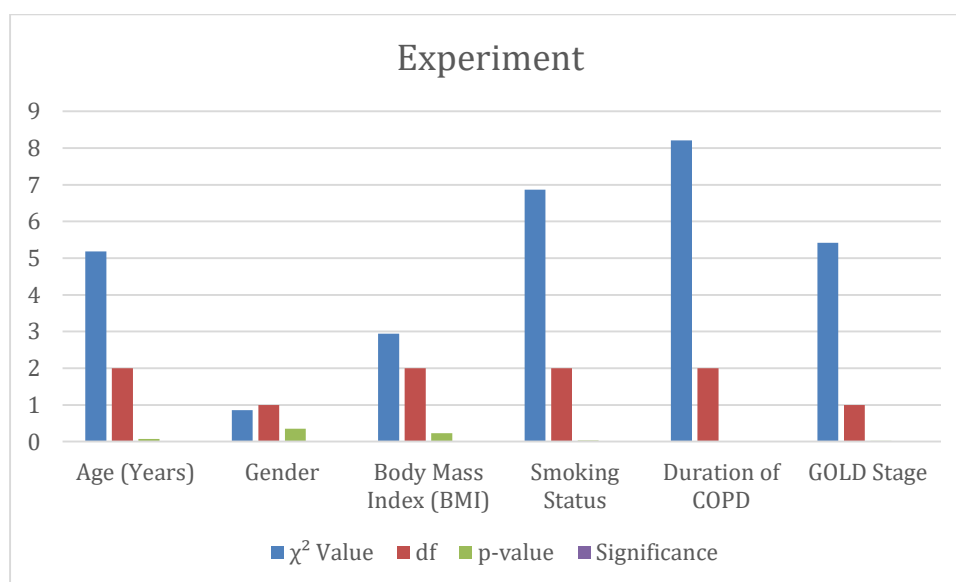


Fig 1.1 Association of Post-test Pulmonary Function with Selected Demographic Variables in the Experimental Group

Table 4.24 illustrates the correlation between post-test pulmonary function and several demographic factors among individuals in the experimental group after engaging in breathing exercises with aerobic training. The Chi-square analysis revealed that age did not have a significant correlation with post-test pulmonary function ($\chi^2 = 5.18$, $p = 0.075$), suggesting that individuals from all age categories exhibited similar enhancements after the intervention. Similarly, gender did not exhibit a statistically significant correlation with post-test pulmonary function ($\chi^2 = 0.86$, $p = 0.354$), indicating that both male and female subjects reacted comparably to the breathing exercise and aerobic training regimen. In a similar vein, Body Mass Index (BMI) exhibited no significant correlation with post-test pulmonary function ($\chi^2 = 2.94$, $p = 0.230$), suggesting that variations in nutritional status did not markedly affect the treatment results in this investigation.

Nonetheless, statistically meaningful correlations were identified between post-test pulmonary function and specific clinical attributes. The smoking status shown a notable correlation with pulmonary function ($\chi^2 = 6.87$, $p = 0.032$), indicating that individuals with diverse smoking backgrounds displayed differing levels of enhancement post-intervention. In a similar vein, the length of COPD was markedly correlated with post-test lung function ($\chi^2 = 8.21$, $p = 0.016$), suggesting that those with a briefer disease duration had somewhat larger enhancement than those with a prolonged duration of the illness. Moreover, the GOLD classification of COPD had a notable correlation with post-test pulmonary function ($\chi^2 = 5.42$, $p = 0.020$), suggesting that the severity of the illness affected the extent of enhancement attained with breathing exercises coupled with aerobic training.

Overall, the findings indicate that clinical variables such as smoking status, duration of COPD, and disease severity (GOLD stage) showed significant associations with treatment outcomes. This is in contrast to demographic variables such as age, gender, and body mass index (BMI), which did not have a significant influence on post-intervention pulmonary function. The clinical profile of patients with mild-to-moderate COPD may have an influence on the efficiency of breathing exercises combined with aerobic training, according to these findings, which show that the effectiveness of such a combination may vary. It was shown that participants who had a less severe condition, a shorter duration of the disease, and a smoking history that was more favorable tended to display higher gains in pulmonary function after the intervention. When it comes to establishing pulmonary rehabilitation programs for patients with COPD, these findings underline how important it is to take into account the particular clinical features of each patient. This will allow for the greatest possible therapeutic advantages and an improvement in respiratory outcomes.

Pre-testing

Before the administration of breathing exercises combined with aerobic training, this section gives the results of an evaluation of the pulmonary function parameters of patients who were diagnosed with mild to moderate Chronic Obstructive Pulmonary Disease (COPD). A pre-test evaluation was carried out in both the experimental group and the control group in order to ascertain the baseline pulmonary function status and to guarantee that the two groups were comparable prior to the intervention. Among the pulmonary function measures that were evaluated were the Forced Expiratory Volume in one second (FEV₁), the Forced Vital Capacity (FVC), the Peak Expiratory Flow Rate (PEFR), the Oxygen Saturation (SpO₂), and the Chest Expansion. The Independent t-test was utilized in order to make a comparison between the experimental group and the control group with regard to the pre-test lung function parameters.

Table 2: Comparison of Pre-test FEV₁ Between Experimental and Control Groups

Group	n	Mean	SD	Mean Difference	t-value	p-value
Experimental	30	1.62	0.28			
Control	30	1.59	0.30	0.03	0.40	0.691 (NS)

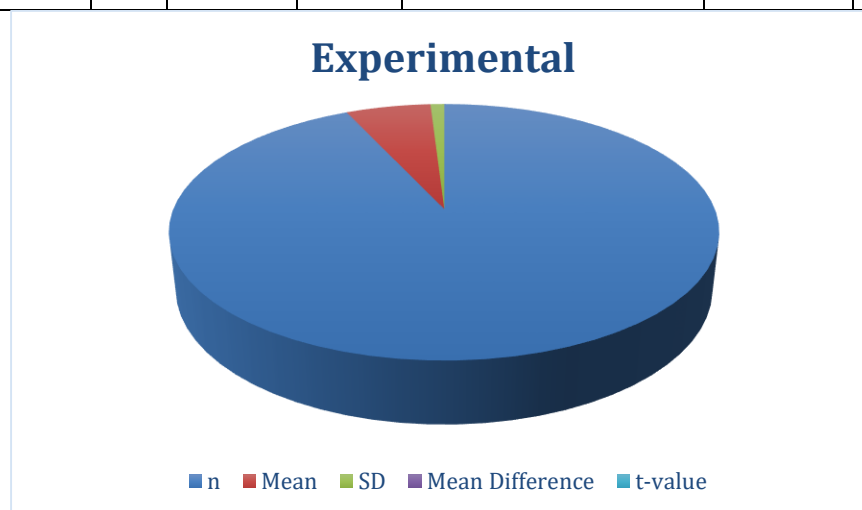


Fig 2 Comparison of Pre-test FEV₁ Between Experimental and Control Groups

A comparison of the pre-test Forced Expiratory Volume in one second (FEV1) between the experimental group and the control group is presented in Table 4.9. The experimental group had a mean FEV1 score of 1.62 ± 0.28 L, whereas the control group had a mean score of 1.59 ± 0.30 L. This difference in FEV1 scores was seen before the test. According to the results of the independent t-test, which showed a t-value of 0.40 and a p-value of 0.691, there was not a statistically significant difference between the two groups prior to the intervention.

Post-Test

The purpose of this part is to give a comparison of the post-test lung function parameters between the experimental group and the control group after the intervention period has been completed. Following the administration of breathing exercises in conjunction with aerobic training to the experimental group and regular care to the control group, pulmonary function parameters were reevaluated in order to determine the efficacy of the intervention. Through the utilization of the Independent t-test, a comparison was made between the two groups in terms of the post-test values of Forced Expiratory Volume in one second (FEV1), Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), Oxygen Saturation (SpO2), and Chest Expansion.

Table 3: Comparison of Post-test FEV₁ Between Experimental and Control Groups

Group	n	Mean	SD	Mean Difference	t-value	p-value
Experimental	30	1.91	0.31			
Control	30	1.64	0.29	0.27	3.47	0.001 (HS)

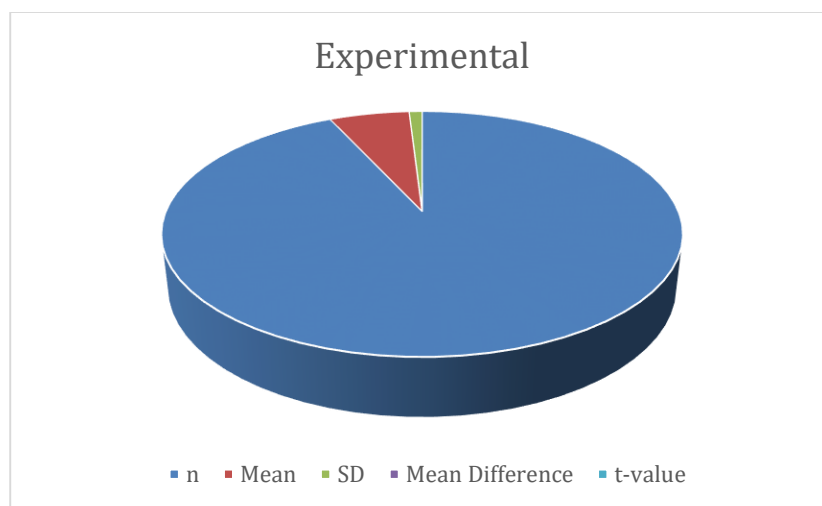


Fig 3 Comparison of Post-test FEV₁ Between Experimental and Control Groups

The results of the comparison of the experimental group and the control group's FEV₁ after the test are presented in Table 4.19. A mean forced expiratory volume in one second (FEV₁) of 1.91 ± 0.31 L was observed in the experimental group, while the control group had a mean value of 1.64 ± 0.29 L. The results of the independent t-test showed that there was a very significant difference between the two groups after the intervention. The t-value was 3.47, and the p-value was 0.001, suggesting that the correlation was strong

DISCUSSION

The current quasi-experimental research aimed to assess the impact of integrating breathing exercises with aerobic training on lung function in individuals with mild-to-moderate Chronic Obstructive Pulmonary Disease (COPD). The results indicated that the intervention led to notable enhancements in pulmonary function metrics, such as Forced Expiratory Volume in one second (FEV₁), Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), Oxygen Saturation (SpO₂), and Chest Expansion. These advancements suggest that the integrated treatments successfully augmented respiratory efficacy and general lung function in individuals with COPD. The findings endorse the fulfillment of the study's aims and substantiate the integration of respiratory exercises and aerobic training into standard physiotherapy practices.

The demographic traits of the participants indicated that the experimental and control groups were similar in terms of age, gender, Body Mass Index (BMI), smoking habits, duration of COPD, and severity of the condition. Statistical examination indicated no notable disparities

in demographic factors between the two cohorts prior to the intervention, affirming the uniformity of the research population. This resemblance within groups bolstered the internal validity of the research and confirmed that the noted post-intervention enhancements were due to the intervention itself, not variations in participant traits.

The evaluation of initial pulmonary function also validated that both cohorts were similar prior to the intervention. The pre-test evaluation revealed no statistically significant disparities in FEV₁, FVC, PEFR, Oxygen Saturation, or Chest Expansion between the experimental and control cohorts. Establishing a similar baseline of pulmonary function was crucial as it offered a dependable basis for assessing the efficacy of breathing exercises in conjunction with aerobic training during the post-test evaluation.

The results of the current research indicate that integrating breathing exercises with aerobic training enhances lung function in individuals with mild-to-moderate COPD. Marked enhancements were noted in all assessed pulmonary function metrics, and the intervention demonstrated superior efficacy compared to standard treatment alone. The research endorses the implementation of integrated respiratory and aerobic exercise regimens as a scientifically validated physiotherapy approach for COPD rehabilitation. These results augment the expanding corpus of data endorsing non-pharmacological interventions designed to enhance respiratory function, physical performance, and general health in patients with COPD.

CONCLUSION

The current research aimed to assess the impact of integrating breathing exercises with aerobic training on lung function in individuals with mild-to-moderate Chronic Obstructive Pulmonary Disease (COPD). The results indicate that the intervention led to notable enhancements in lung function and respiratory efficacy. Individuals who engaged in the organized breathing exercises and aerobic training had superior respiratory results compared to those who underwent standard physiotherapy only. The enhancements noted in the experimental cohort suggest that integrating breathing exercises with aerobic training offers a holistic rehabilitation strategy that proficiently tackles the respiratory constraints frequently encountered by those with COPD. The research revealed statistically substantial enhancements in all chosen pulmonary function metrics, encompassing Forced Expiratory Volume in one second (FEV₁), Forced Vital Capacity (FVC), Peak Expiratory Flow Rate (PEFR), Oxygen Saturation (SpO₂), and Chest Expansion. These results suggest that the intervention improved airway functionality, lung capacity, respiratory muscle efficacy, thoracic flexibility, and oxygen levels. Enhanced

pulmonary function allows patients to breathe more effectively, alleviates the physiological strain linked to airway blockage, and promotes superior overall respiratory health. The notable enhancements in post-test results within the experimental group unequivocally demonstrate the efficacy of the integrated intervention.

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