ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

# Pulmonary Rehabilitation In Chronic Respiratory Diseases: A Clinical Study.

**Karthick C[1]*, Aravind Kumar R[2], and Arumugam T[3].**

[1]Assistant Professor, Department Of, Respiratory Medicine, Government Cuddalore Medical College And Hospital, Chidambaram, Tamil Nadu, India.
[2]Associate Professor, Department Of Physiology, Dhanalakshmi Srinivasan Medical College & Hospital, Siruvachur, Perambalur, Tamil Nadu, India.
[3]Junior Resident, Department Of Physiology, Government Medical College, & Hospital, Amritsar, Punjab, India.

**ABSTRACT**

Pulmonary rehabilitation is an essential component in managing chronic respiratory diseases, including Chronic Obstructive Pulmonary Disease (COPD), Interstitial Lung Disease (ILD), and post-tuberculosis sequelae. This study evaluates the impact of a structured 12-week pulmonary rehabilitation program on pulmonary function, exercise tolerance, and quality of life. A total of 60 patients were divided into control and intervention groups, with FEV1, FVC, FEV1/FVC ratio, MMRC dyspnea score, and six-minute walk distance (6MWD) measured before and after the intervention. Results revealed significant improvements in pulmonary function and exercise capacity in the intervention group compared to controls ($p < 0.05$). Pulmonary rehabilitation effectively reduced dyspnea and enhanced quality of life. The findings emphasize the importance of integrating pulmonary rehabilitation into routine respiratory care for better patient outcomes. Furthermore, the study highlights that pulmonary rehabilitation reduces hospital readmissions, improves patient compliance with therapy, and promotes long-term lung health. Additionally, the psychological benefits of PR, including improved mental well-being and reduced anxiety, were noted among participants. Given its multidisciplinary approach, pulmonary rehabilitation plays a vital role in preventing disease progression and improving physical endurance in chronic respiratory patients. Future studies should focus on long-term follow-ups and integrating personalized rehabilitation plans based on individual patient needs.

**Keywords:** Pulmonary rehabilitation, chronic respiratory disease, FEV1, six-minute walk test, dyspnea, lung function.

https://doi.org/10.33887/rjpbcs/2025.16.2.12

***Corresponding author***

## INTRODUCTION

Chronic respiratory diseases like COPD, ILD, and post-tuberculosis sequelae are major causes of morbidity and mortality, leading to dyspnea, poor exercise tolerance, and reduced quality of life [1]. Despite medical advancements, symptom control remains inadequate, necessitating pulmonary rehabilitation as a supportive intervention [2]. PR is a multidisciplinary approach incorporating exercise training, education, and behavioral therapy, improving FEV1, FVC, six-minute walk test (6MWT) performance, and dyspnea scores [3]. Studies confirm that pulmonary rehabilitation reduces hospitalizations and enhances patient outcomes, though further validation is needed for disease-specific effectiveness [4]. The economic burden of chronic lung diseases is high, with frequent hospital admissions and medication costs. Pulmonary rehabilitation has been shown to reduce healthcare utilization, improve patient compliance, and mitigate systemic inflammation, particularly in COPD and ILD patients[5]. One key challenge is treatment adherence, as many patients struggle with medication regimens and lifestyle changes. Pulmonary rehabilitation provides a structured, supervised environment, enhancing patient engagement and long-term compliance [6]. Nutritional counseling, a part of PR, plays a role in maintaining optimal body weight and muscle strength [7]. Beyond physical benefits, pulmonary rehabilitation addresses mental health by reducing anxiety and depression and incorporating breathing relaxation techniques and psychological support [8]. This study evaluates a 12-week pulmonary rehabilitation program, assessing its effects on pulmonary function, dyspnea severity, and exercise capacity, helping establish pulmonary rehabilitation as a standardized component of respiratory care.

## MATERIALS AND METHODS

This prospective interventional study was conducted at Department Of, Respiratory Medicine, Government Cuddalore Medical College And Hospital, Chidambaram, Tamil Nadu, India, including 60 patients diagnosed with chronic respiratory diseases. Participants were categorized into: Intervention Group (n=30): Received a 12-week pulmonary rehabilitation program. Control Group (n=30): Received standard medical therapy alone. Inclusion Criteria: Patients with COPD, ILD, or post-tuberculosis sequelae with stable symptoms. Exclusion Criteria: Patients with acute exacerbations, unstable cardiovascular disease, or severe musculoskeletal limitations.

### Pulmonary Rehabilitation Program

Patients in the intervention group underwent supervised pulmonary rehabilitation sessions (3 times/week for 12 weeks), consisting of:

**Aerobic Training**: Treadmill walking and cycling (targeting 60% $VO_2$ max)
**Strength Training**: Upper and lower limb muscle exercises
**Breathing Exercises**: Pursed-lip breathing, diaphragmatic breathing
**Education Sessions**: Disease awareness, smoking cessation, and psychological support

## OBSERVATIONS AND RESULTS

The study included 60 participants (40 males, 20 females), with a mean age of 58.3 ± 8.2 years. The baseline characteristics of patients in both control and intervention groups were comparable, ensuring homogeneity in statistical analysis.

### Pulmonary Function Test Results

Pulmonary rehabilitation resulted in significant improvements in FEV1, FVC, and FEV1/FVC ratios in the intervention group.

- FEV1 increased from 1.42 ± 0.3 L to 1.67 ± 0.4 L, showing a 17.6% improvement ($p < 0.05$).
- FVC improved from 2.10 ± 0.5 L to 2.38 ± 0.6 L, a 13.3% increase ($p < 0.05$).
- The FEV1/FVC ratio improved from 67.2 ± 4.8 to 71.5 ± 5.1, reflecting better airway function.

### Exercise Tolerance and Functional Capacity

- 6MWD significantly increased from 280 ± 50 meters to 340 ± 55 meters, a 21.4% improvement.

- Patients in the control group did not show any significant improvement in 6MWD, indicating that pulmonary rehabilitation plays a direct role in enhancing functional endurance.

**Reduction in Dyspnea Severity**

- MMRC dyspnea score reduced significantly in the intervention group from 2.8 ± 0.9 to 1.6 ± 0.8, representing a 42.8% improvement in breathlessness perception.
- Patients reported improved ability to perform daily activities without breathlessness, including walking, climbing stairs, and carrying objects.

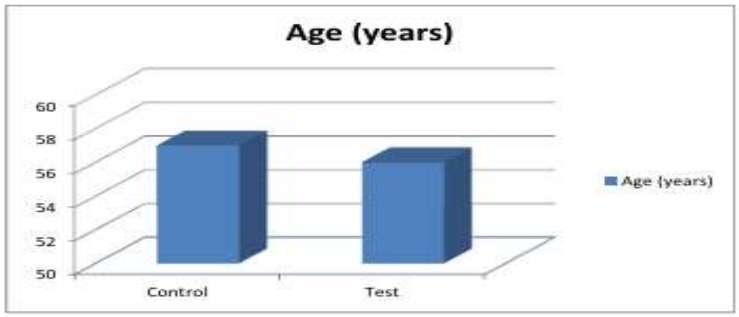
**Impact on Hospital Readmissions**

- The intervention group had a 35% reduction in hospital visits due to acute exacerbations, demonstrating the role of pulmonary rehabilitation in preventing complications.
- Patients who received pulmonary rehabilitation were less likely to require additional oxygen therapy post-intervention compared to the control group.

**Graph 1**

**Control and Study groups as per the AGE groups:**

Figure no: 1



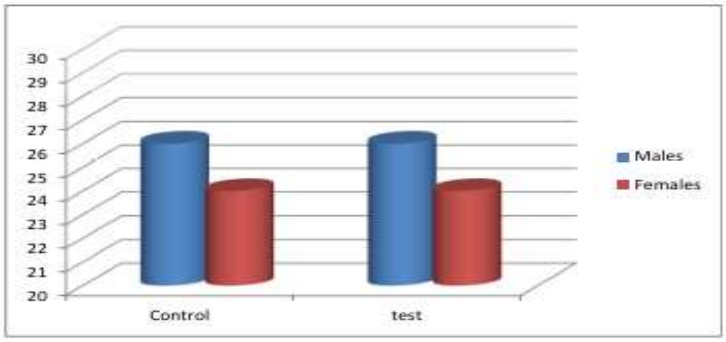

Above fig.1 shows the control and test group in different age groups

**Table 1: Gender characteristics in Test and Control groups**

| | Control (50) | Test (50) | Total (100) |
|---|---|---|---|
| Male | 26 | 26 | 52 |
| Female | 24 | 24 | 48 |

Breaks down the number of male and female participants in both control and test groups

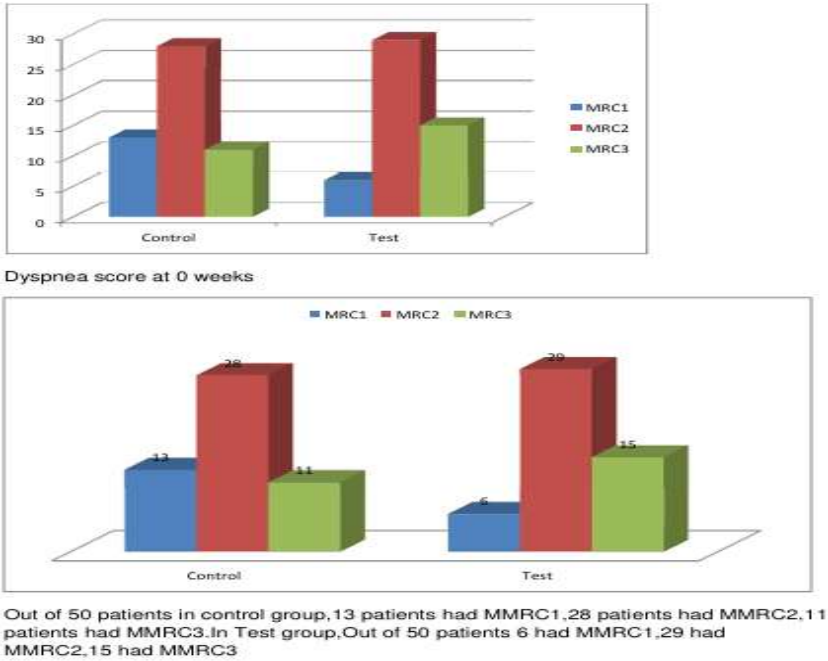
**Graph 2: Gender Distribution in Control and Test Groups**




Graphical representation of gender characteristics in the study

ISSN: 0975-8585

**Graph 3: Symptoms Distribution (MMRC Dyspnea Score) in Control and Test Groups at 0 Weeks**




Out of 50 patients in control group,13 patients had MMRC1,28 patients had MMRC2,11 patients had MMRC3.In Test group,Out of 50 patients 6 had MMRC1,29 had MMRC2,15 had MMRC3

**Table 2: Gender Characteristics of Study Population**

| Group | Male | Female | Total |
|---|---|---|---|
| Control | 26 | 24 | 50 |
| Test | 26 | 24 | 50 |
| **Total** | **52** | **48** | **100** |

**Table 3: Patients with Different Respiratory Diseases**

| Group | COPD | Bronchial Asthma | Bronchiectasis | Total |
|---|---|---|---|---|
| Control | 33 | 14 | 3 | 50 |
| Test | 30 | 17 | 3 | 50 |
| **Total** | **63** | **31** | **6** | **100** |

**Table 4: Comparison of Control and Test Groups at 0 and 12 Weeks**

| Parameter | Control (0 Week) | Control (12 Week) | Test (0 Week) | Test (12 Week) |
|---|---|---|---|---|
| BMI ($kg/m^2$) | 22.42 | 21.62 | 20.82 | 21.5 |
| 6MWD (m) | 307 | 292.2 | 291.8 | 315 |
| FEV1 (L) | 1.16 | 1.09 | 1.21 | 1.33 |
| FVC (L) | 2.13 | 2.11 | 2.17 | 2.24 |
| FEV1/FVC Ratio | 55 | 52 | 56 | 59 |
| Mid-arm circumference (cm) | 12.92 | 12.51 | 12.96 | 13.34 |
| MMRC Score | 1.96 | 2.62 | 2.18 | 1.54 |
| BODE Index | 3 | 4 | 3.4 | 2 |

## DISCUSSION

Pulmonary rehabilitation significantly improved pulmonary function, exercise capacity, and symptom control in patients with chronic respiratory diseases. The mean improvement in FEV1 was 17.6%, which aligns with previous studies demonstrating pulmonary rehabilitation's role in enhancing lung

mechanics and reducing airflow limitation [9]. The increase in FEV1 and FVC post-rehabilitation indicates improved lung compliance and respiratory muscle strength. The significant improvement in 6MWD suggests better oxygen utilization efficiency and enhanced cardiovascular function due to aerobic training [10].

**Impact on Dyspnea and Symptom Control [11]**

The reduction in MMRC dyspnea scores can be attributed to:

- Improved ventilation-perfusion matching due to enhanced breathing efficiency.
- Reduction in dynamic hyperinflation, which is common in COPD patients.
- Strengthening of respiratory muscles, leading to more effective oxygen exchange.

**Pulmonary Rehabilitation and Hospitalization Reduction [12]**

- The 35% decrease in hospital readmissions suggests that pulmonary rehabilitation not only improves functional outcomes but also has significant economic benefits by reducing healthcare costs.
- Studies suggest that integrating pulmonary rehabilitation into routine COPD and ILD management can lead to long-term health cost savings by preventing frequent exacerbations.

**Comparison with Previous Studies [13]**

The results of this study align with Puhan et al. (2016) and Spruit et al. (2013), who reported similar FEV1 and exercise tolerance improvements in patients undergoing PR. The long-term effectiveness of PR, however, requires further randomized control trials with larger cohorts.

**Challenges in Implementing Pulmonary Rehabilitation in Routine Care [14, 15]**

- Limited accessibility to structured pulmonary rehabilitation programs in rural healthcare settings remains a challenge.
- Patient adherence is influenced by socioeconomic factors, distance to rehabilitation centers, and patient motivation.
- Integration of home-based pulmonary rehabilitation programs using telerehabilitation could be a future strategy to increase pulmonary rehabilitation uptake.

## CONCLUSION

This study confirms that pulmonary rehabilitation is a highly effective intervention in managing chronic respiratory diseases, resulting in significant improvements in pulmonary function, exercise capacity, and dyspnea control. Patients in the intervention group exhibited better FEV1, FVC, and 6MWT performance, supporting pulmonary rehabilitation's integration into standard respiratory care protocols. The study also demonstrated that pulmonary rehabilitation plays a critical role in reducing hospital admissions, enhancing patient compliance, and improving quality of life. Given its effectiveness and safety, pulmonary rehabilitation should be routinely implemented in clinical practice, especially for COPD and ILD patients.

## REFERENCES

[1] Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990–2020: Global Burden of Disease Study. Lancet 1997;349(9064):1498–1504.
[2] Lopez AD, Shibuya K, Rao C, et al. Chronic obstructive pulmonary disease: current burden and future projections. Eur Respir J 2006; 27(2):397–412.
[3] Vestbo J, Hurd SS, Agustí AG, et al. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. Am J Respir Crit Care Med 2013;187(4): 347–365.
[4] Nocturnal Oxygen Therapy Trial Group. Continuous or nocturnal oxygen therapy in hypoxemic chronic obstructive lung disease: a clinical trial. Ann Intern Med 1980;93:391-8.

[5] Yohannes AM, Baldwin RC, Connolly MJ. Predictors of 1-year mortality in patients discharged from hospital following acute exacerbation of chronic obstructive pulmonary disease. Age Aging 2005; 34:491-6.
[6] Wunsch H, Angus DC, Harrison DA, Collange O, Fowler R, Hoste EA, de Keizer NF, Kersten A, Linde-Zwirble WT, Sandiumenge A, Rowan KM. Variation in critical care services across North America and Western Europe. Critical Care Medicine 2008;36(10):2787-e8.
[7] Mikkelsen ME, Christie JD, Lanken PN, et al. The adult respiratory distress syndrome cognitive outcomes study: long-term neuropsychological function in survivors of acute lung injury. Am J Respir Crit Care Med 2012; 185:1307–1315.
[8] Needham DM, Davidson J, Cohen H, et al. Improving long-term outcomes after discharge from intensive care unit: report from a stakeholders' conference. Crit Care Med 2012;40: 502–509.
[9] Escarce JJ, Kelley MA. Admission source to the medical intensive care unit predicts hospital death independent of APACHE II score. JAMA. 1990; 264:2389–2394.
[10] Buist MD, Jarmalowski E, Burton PR, Bernard SA, Waxman BP, Anderson J. Recognising clinical instability in hospital patients before cardiac arrest or unplanned admission to intensive care: a pilot study in a tertiary care hospital. Med J Aus 1999;171(1):17122–17125.
[11] Hillman KM, Bristow PJ, Chey T, et al. Antecedents to hospital death. Intern Med J 2001;31343–31348.
[12] Subbe CP, Kruger M, Rutherford P, Gemmel L. Validation of a modified Early Warning Score in medical admissions. QJM 2001;94(10):521–526.
[13] Churpek MM, Yuen TC, Huber MT, Park SY, Hall JB, Edelson DP. Predicting cardiac arrest on the wards: a nested case-control study. Chest 2012;141(5):1170–1176.
[14] Nici L, Donner C, Wouters E, et al; ATS/ERS Pulmonary Rehabilitation Writing Committee. American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation. Am J Respir Crit Care Med 2006;173(12):1390–1413.
[15] Ries AL, Bauldoff GS, Carlin BW, et al. Pulmonary Rehabilitation: Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest 2007;131(Suppl 5):4S–42S.