



# Progressive Combined Resistance and High-Intensity Cardiorespiratory Exercise for COPD and Interstitial Lung Diseases: A structured 12-week supervised program.



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## Background

Chronic respiratory diseases, particularly Chronic Obstructive Pulmonary Disease (COPD) and Pulmonary Fibrosis (PF), represent significant global health challenges characterized by progressive respiratory impairment

These conditions impose substantial physical, psychological, and social burdens on affected individuals, with physical inactivity emerging as both a consequence of and contributor to disease progression

These patients experience a self-perpetuating cycle of declining physical activity because of symptoms (mainly dyspnea), initiating a cascade of physiological deterioration: **Respiratory symptoms** → **Reduced mobility** → **Deconditioning** → **Worsening symptoms**

## Methods

Patients with COPD and PF from the metropolitan area of Patras were prospectively enrolled in a cardiopulmonary exercise rehabilitation program.

Program duration was 36 sessions (3 sessions/week; 1h/session)

Each participant underwent a cardiopulmonary exercise test (CPET) before and after the exercise intervention for physical activity evaluation

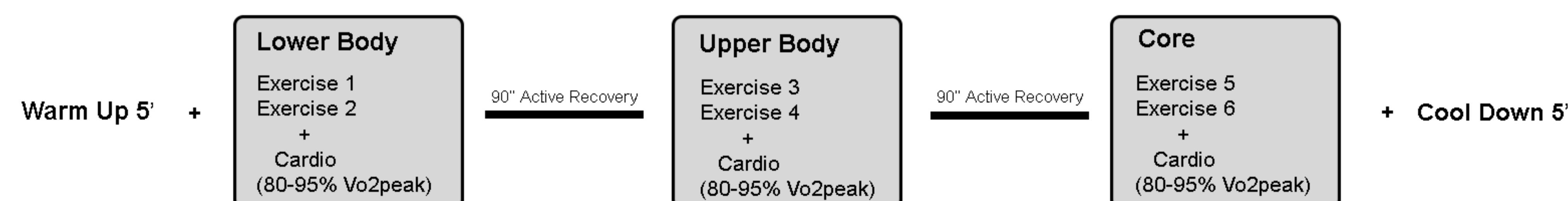
Details of the exercise intervention are shown in Fig. 1

### Program Constants

- \*15" Rest (Between exercises/sets)
- \*90" Active Recovery
- \*3 Rounds (Lower body - Upper body - Core)
- \*Cardio @ 80-95% Vo2Peak

### Program Variables

- \*Exercise Selection
- \*Exercise Duration
- \*Sets
- \*Cardio Duration



### Structural Progression of the Training Phases

- Phase 1: (25" Exercise+15" Rest)x2, 90" Cardio + 90" Active Recovery
- Phase 2: (35" Exercise+15" Rest)x2, 90" Cardio + 90" Active Recovery
- Phase 3: (35" Exercise+15" Rest)x2, 180" Cardio + 90" Active Recovery

## Results

Thirteen patients (age 73.2 ± 4.9 y, 15% female, BMI 27.36 ± 2.85 kg/m<sup>2</sup>, FEV<sub>1</sub> 59.67 ± 27.96, 8 ex-smokers) participated and completed the program

Ventilatory and cardiovascular parameters before and after the rehabilitation program are shown in **Table**. Ventilation at peak of CPET and O<sub>2</sub> pulse improved significantly

Changes in functional capacity parameters after the program are shown in **Fig 2**. VO<sub>2</sub> max and at anaerobic threshold (AT), duration of CPET and O<sub>2</sub> pulse were increased significantly after the rehabilitation program

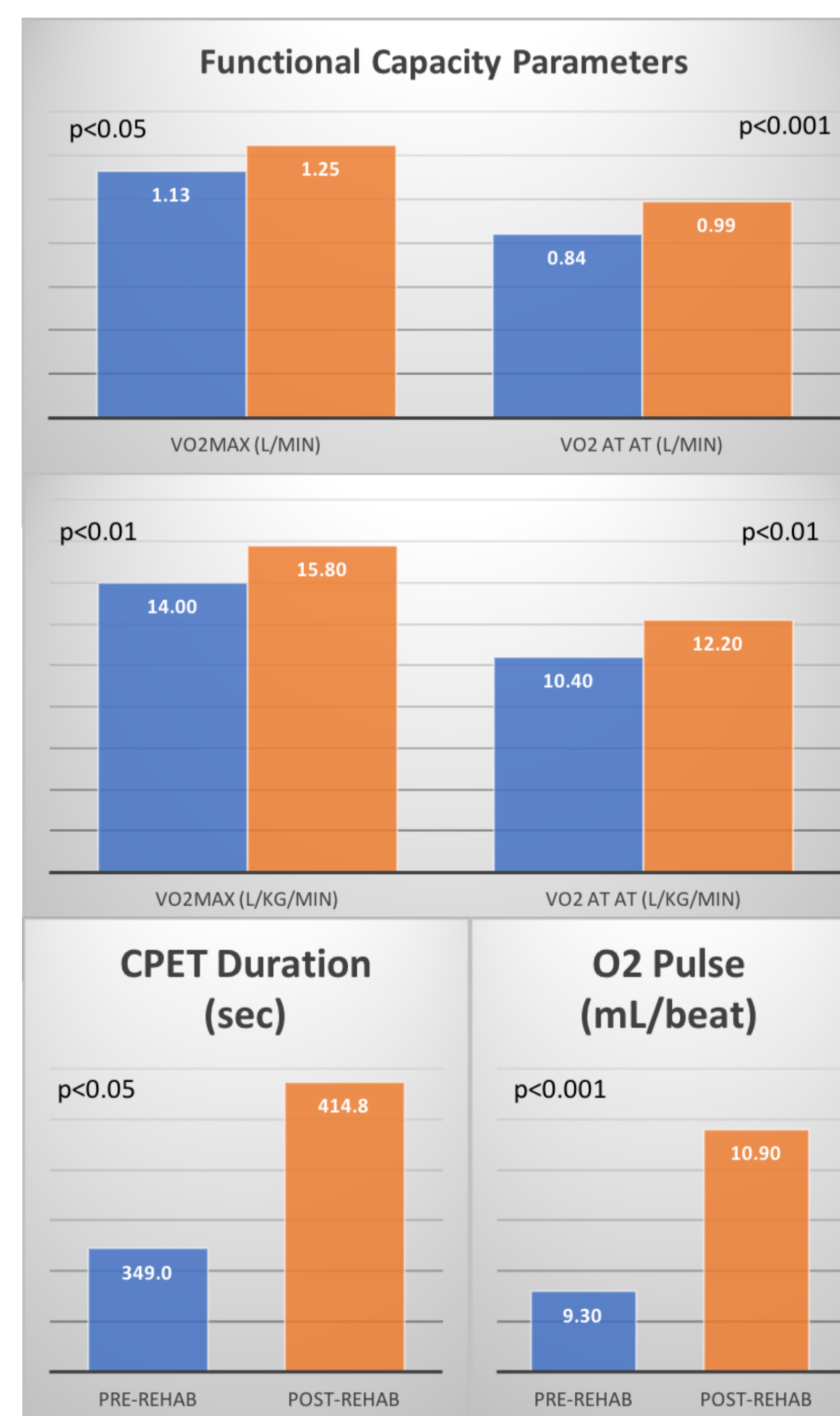


Table. Ventilatory and cardiovascular characteristics before and after rehabilitation program

Parameter	Pre-Rehab	Post-Rehab	Absolute Change	Percent Change (%)	Improved Patients (%)	p-value
VE at rest (L/min)	11.7 ± 3.7	13.3 ± 4.1	+1.6	+19.9%	69.2%	N/S
VE max (L/min)	46.7 ± 14.0	55.1 ± 17.2	+8.4	+16.7%	76.9%	<0.01
RRmax (breaths/min)	32.2 ± 4.1	33.8 ± 4.1	+1.6	+5.5%	61.5%	N/S
VE/VCO <sub>2</sub>	37.7 ± 8.4	38.4 ± 7.8	+0.7	+3.9%	46.2%	N/S
HR at rest (bpm)	71.0 ± 10.4	71.2 ± 10.6	+0.2	+0.7%	46.2%	N/S
HR max (bpm)	123.0 ± 18.1	128.2 ± 15.3	+5.2	+4.6%	61.5%	N/S
HRR	18.2 ± 9.0	21.1 ± 7.3	+2.9	+26.4%	61.5%	N/S
O <sub>2</sub> Pulse (mL/beat)	9.3 ± 2.5	10.9 ± 3.1	+1.6	+17.1%	84.6%	<0.001

## Conclusion

This pulmonary rehabilitation program demonstrated statistically significant improvements in exercise capacity and oxygen utilization efficiency

The significant increase in max ventilation suggests enhanced respiratory muscle function and/or improved ventilation-perfusion matching that need further investigation While our sample size is modest, the consistent improvements across multiple parameters suggest our exercise program may provide meaningful advantages over standard rehabilitation programs