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Title: Metabolic outcomes of three types of pulmonary rehabilitation: Endurance, resistance and combined training in patients with moderate to severe chronic obstructive pulmonary disease (COPD) in Costa Rica

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Body: We compared three modalities of training in 20 patients with moderate to severe COPD (GOLD grade III and IV): endurance (aerobic), resistance (strength) and combined training (endurance +resistance) and compared them with a group of patients receiving regular COPD treatment without exercise intervention. The study was approved by the local ethics committee We evaluated clinical parameters, lung function, arterial blood gases (ABG) and metabolic exercise tests in all of them before and after the rehabilitation program of 12 weeks. We found no significant difference in terms of heart rate, oxygen saturation, spirometry, ABG, before and after the program.

Metabolic values pre and post (in brackets) the rehabilitation program. Median + SD

Groups	Age years	Height (cm)	Exercise time :min	VOmax L/min	Anaerobic Threshold	VE/VO2
Control n=5	65.0±7.0	168.0±6.0	7.0(7.0)**	16.4(15.9)	6.75(6.75)	34.2(34.5)
Aerobic n=5	64.2±7.0	170.0±5.0	8.0(12.0)	18.7(20.7)	5.25(9.0)*	34.7(27.6)
Resistance n=5	63.2±6.6	169.5±4.0	7.0(14.0)	10.2(18.6)	4.50(7.50)	35.0(37.3)*
Combined n=5	67.5±5.0	167.5±2.5	9.0(12.0)	16.7(23.9)	1.21(1.54)	36.9(29.4)

*significant difference with pre versus post and ** control versus the other three groups p<0.05

After the rehabilitation program there was a significant increase in the exercise time in all the rehabilitation groups compared with controls. There was a trend to increase in VOmax in all the groups but did not reach statistical significance. Anaerobic threshold was also significantly improved in the aerobic group. Our results support the importance of endurance and resistance training in COPD.