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High-Intensity Interval Training Improves Functional Exercise Capacity and Ventilatory Efficiency in Moderate-to-Severe COPD

Background

Interval exercise training is increasingly used in COPD rehabilitation, but the optimal intensity and subgroup-specific effects remain unclear.

Methods

In this 1:1:1 randomized trial, 150 patients with moderate-to-severe COPD received 12 weeks of low- (40% peak, LII), moderate- (60%, MII), or high-intensity (80%, HII) interval training. Primary outcome was change in 6-minute walking distance (Δ6MWD). Secondary outcomes included peak VO_2, anaerobic threshold, oxygen pulse, VE/VCO_2 slope, dyspnea, and lactate. ANCOVA adjusted for baseline covariates, with prespecified subgroup analyses by GOLD stage and baseline 6MWD.

Results

Of 138 completers (46 per group), HII improved Δ6MWD most (LS mean 54.8 m, 95%CI 47.0–62.6), significantly greater than MII (37.9 m, 30.1–45.7; difference +16.9 m, 9.3–24.5; *p*<0.001) and LII (22.6 m, 14.4–30.8; difference +32.2 m, 24.5–39.9; *p*<0.001). Cardiopulmonary outcomes improved dose-dependently (all *p*<0.001). VE/VCO_2 slope reduction was significant only in HII vs. LII (–4.0 vs. –1.1, *p* = 0.002). Subgroup interactions were significant: HII–LII difference was larger in GOLD 3 (43.2 m) than GOLD 2 (25.8 m, P_{int} = 0.009), and in baseline 6MWD < 350 m (40.2 m) vs. ⩾350 m (29.3 m, P_{int} = 0.018). No serious adverse events occurred.

Conclusion

High-intensity interval training (80% peak) provides superior and clinically meaningful benefits in exercise capacity and ventilatory efficiency, especially in patients with severe disease or poor baseline function, supporting an intensity-escalation strategy in COPD rehabilitation.

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