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Isolated quadriceps training restores whole body exercise capacity in CHF

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Patients with Chronic Heart Failure (CHF) are commonly characterized by exercise limitation. The benefit of isolated (i.e., small muscle mass) muscle training and its potential translation to whole body exercise in patients CHF has been recognized, however the mechanisms responsible for this positive outcome remain poorly understood. To study oxygen (O_2) transport and metabolism at maximal cycle (whole body) and knee extensor (KE, small muscle mass) exercise in this pathological condition, eight healthy controls and six patients with CHF with reduced ejection fraction commenced 8 weeks of KE training (both legs, separately). Before and after training, they underwent cycle and KE maximal exercise studies. Pre-training cycling and KE exercise peak leg O_2 uptake (VO_2) were 17% and 15% lower, respectively, in the patients compared to controls. Although KE training did not alter cardiac output at maximal KE or cycle exercise, it increased O_2 delivery (by 54%), arterial-venous O_2 difference (by 10%), and muscle O_2 conductance (by 39%) at maximal KE exercise, yielding an increase in peak single leg VO_2 of 53%, which exceeded untrained control subject values. Post-training, during maximal cycling, O_2 delivery (40%), arterial-venous O_2 difference (15%), and muscle O_2 conductance (DMO_2) (52%) all increased, yielding a 40% greater peak leg VO_2, matching that of the controls. Small muscle mass exercise training-induced improvements in both peripheral convective and diffusive O_2 transport and subsequent O_2 utilization were the main mechanisms responsible for the increased whole body exercise capacity in patients with CHF. Such clear improvements in these factors and exercise capacity support the efficacy of small muscle mass training as a powerful approach to promote a metabolic reserve and maintain physical function in the face of continuing central limitations associated with CHF.

Keywords

Adapted physical activity, training, exercise testing, exercise limitation