The purpose of the present study was to examine the contribution of blood flow (Q) into exercising muscles on pulmonary oxygen uptake (VO2) response to arm exercise, leg exercise, and combined arm and leg exercise, and in addition, to test our hypothesis that VO2 kinetics during combined arm and leg exercise would be slowed in comparison with those estimated from individual arm and leg exercises with the cause being attributed to the vasoconstriction resulting from an increase in the number of exercising limbs. Eight male and four female healthy young subjects performed an incremental arm exercise test until their limit of tolerance on an arm cranking at 60 rpm. Following the incremental exercise, the subjects performed 6-min arm exercise at 50% of maximum arm work capacity (ARMmax), light leg exercise (cycling) at about 10% of maximum leg work capacity, and combined arm and leg exercise in this order. They also carried out the same combined arm and leg exercise following a high-intensity arm exercise at 85% ARMmax. VO2, CO2 output (VCO2), and ventilation (VE) were determined breath-by-breath and heart rate (HR), stroke volume (SV) determined by an impedance method, and Q were also measured during a steady-state of exercise. To characterize the kinetics of VO2 response, a single exponential model was applied using a nonlinear least-squares fitting procedure. VO2, VCO2, and VE responses at steady state during combined exercise were the same as the sum of those during individual arm and leg exercises, while HR, SV, and Q responses during combined exercise were significantly less than the sum of those during individual arm and leg exercises. The time constant of VO2 kinetics in the combined exercises were significantly larger than that estimated by the time constants in the individual arm and leg exercises, whereas the slowed time constant of VO2 kinetics in the combined exercises was dramatically improved following 85% ARMmax arm exercise. These results suggest that combined arm and leg exercises could be an efficient method of doing aerobic exercise even though the response speed of VO2 kinetics at the onset of exercise could be slowed as a result of vasoconstriction.

Keywords: Oxygen Consumption, Circulation, Ventilation