Effect of hypoxia on the dynamic response of leg blood flow during exercise

S. Green and J. Donnelly, Department of Physiology, University of Otago, Dunedin 9013, New Zealand.

Systemic hypoxia increases the muscle hyperaemic response during steady-state exercise. However, the effect of hypoxia on dynamic response characteristics of muscle blood flow is not known. To test this effect, eight subjects performed eight exercise trials while breathing a normoxic (F_IO_2 = 0.2094) or hypoxic (F_IO_2 = 0.105) gas mixture. Exercise consisted of five minutes of intermittent contractions of the left calf muscle (3s duty cycle) at a low intensity (20% MVC) during which leg blood flow (LBF) and mean arterial pressure (MAP) were measured between each contraction. Four sets of LBF responses were averaged for each subject under normoxia and hypoxia and fitted using a multiphasic exponential function. This enabled amplitudes and temporal parameters of a fast and slow growth phase, as well as a rapid decay phase, to be estimated. Hypoxia did not significantly affect MAP at rest but resulted in a 7% lower value by the end of exercise ($p < 0.05$). In contrast, hypoxia increased the change in LBF from the start to end of exercise by 13% ($p = 0.07$) and the amplitude of the rapid growth phase of the LBF response by 16% ($p < 0.001$). Hypoxia also increased the amplitude of the slow growth phase by 24% ($p = 0.08$) but it had no effect on the decay phase. These results suggest that the effect of hypoxia on exercise hyperaemia is targeted at rapid and slow phases of the response.