RESPIRATORY RESPONSES TO LOADED AND UNLOADED BREATHING DURING EXERCISE

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To characterize the ventilatory responses to resistive loading or unloading, we studied the effect of breathing 79% helium and 21% oxygen (He-O2), 79% argon and 21% oxygen (Ar-O2) and 79% SF6 and 21% oxygen (SF6-O2) on volume-time parameters, end-tidal partial pressure of CO2 (PETCO2),mouth pressure (PmI), work of breathing (WI), central inspiratory activity (dP/dtI) and electromyographic activity of parasternal inspiratory muscles (EMGps) in 10 normal subjects at rest and during short-time steady-state exercise. There were no significant changes in tidal volume (VT), breathing frequency (f), inspiratory (TI) and expiratory (TE) durations, minute ventilation (VE) and PETCO2 when air was replaced by He-O2 or SF6-O2 at rest. VE and PETCO2 were not significantly different after replacement of air by He-O2 during exercise. SF6-O2 breathing resulted to the same values of VE and increased values of PETCO2 compared with air during exercise. However inhalation of He-O2 reduced VT and increased f, whereas inhalation of SF6-O2 led to opposite effects compared with air during exercise. Both at rest and exercise, PmI, WI, dP/dtI and EMGps were significantly less during He-O2 breathing and higher during SF6-O2 breathing ($P<0.01$) from the first respiratory cycle after room air was replaced by He-O2 or SF6-O2. Ar-O2 breathing did not affect on time-volume parameters both at rest and during exercise compared with air. The increase in PmI, WI, dP/dtI was observed at Ar-O2 inhalation during exercise relatively to air conditions. We conclude that internal resistive loading (SF6-O2) or unloading (He-O2) breathing changes the neuromuscular output required to maintain constant ventilation. The mechanisms of load or unload compensation seem to be mediated by afferent impulsation from lung and respiratory muscle receptors as well as due to segmentary level reflexes and properties of the muscle fiber itself.