

Cardiac, vascular and metabolic changes during recovery from resistance effort

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The aim of the present project was to characterize cardiovascular changes combined with O₂ utilisation during and after resistance efforts, such as weight-lifting, in young subjects. **PURPOSE:** to collect, combine and analyze respiratory, cardiac and peripheral vascular data before, during and after a high-intensity knee-extension exercise (EXE). **METHODS:** 9 male healthy subjects (mean±SD: 27±5 years; 75±7 Kg, 177±7 cm) performed repeated strength exercise at 70% MVF on a single leg extension machine. The subjects moved their right knee angle from 90° to 180° and back at angular velocity 45° s⁻¹ (concentric) and 30° s⁻¹ (eccentric). The resulting exercise at 0.2 Hz without pauses lasted 120 s. Metabolic (V'O₂, V'CO₂, R - breath by breath metabolimeter), cardiac (arterial pressure, HR, SV, and CO - finger photo-plethysmographic system and modelflow algorithm), and femoral artery blood flow (FBF - Doppler ultrasound) data were measured before, during exercise and up to 6 min recovery. **RESULTS** (mean±SD at baseline and peak exercise): *Metabolic:* V'O₂ from 4.9±0.3 to 9.2±0.2 ml/min/kg (+88%); V'CO₂ from 5.2±0.3 to 9.2±0.2 l/min (+77%), R from 0.77±0.01 to 0.93±0.01. *Cardiac:* HR from 74±1 to 99±2 bpm (+33%); SV from 77±1 to 67±2 ml (-13%); CO from 5.0±0.1 to 6.0±0.1 l min⁻¹ (+20%). *Peripheral vascular:* FBF from 94±8 to 202±51 (+62%). During recovery we observed a further increase in V'O₂ (10.6±0.1 (+116%)), V'CO₂ (10.4±0.1 (+100%)) by 20 s recovery, and R (1.18±0.001) after 80 s. HR immediately recovered, returning to baseline in 10-20 s. SV rebounded after the effort, up to 89±4 ml (+16%) at 10 s recovery. During the effort CO increased, because of tachycardia, despite the fall in SV; after its cessation an additional light increase lead CO to 7.0±0.1 l/min (+40%) in 20 s. FBF showed a sharp increase within 20 s recovery, up to 752 ± 17 ml/min (+495%); afterwards it declined progressively, however not reaching base levels after 6 min. **DISCUSSION:** even with such a short duration, the kind of exercise proposed was of sufficient intensity as to induce large changes in metabolic and circulatory parameters. During the recovery, when the transmural pressure exerted by isometric contractions vanishes, a considerable oxygen deficit is unmasked, leading to further increases in V'O₂ and V'CO₂. The femoral flow increases only slightly during the effort, but rises by almost 5 times during recovery as a consequence of reactive hyperaemia; in this phase, the systolic backflow characterizing the femoral flow waveform is completely abolished. The large increase in FBF is sustained by a much larger stroke volume.