Contracting muscle mass and inactive muscle effects on K^+ dynamics during exercise

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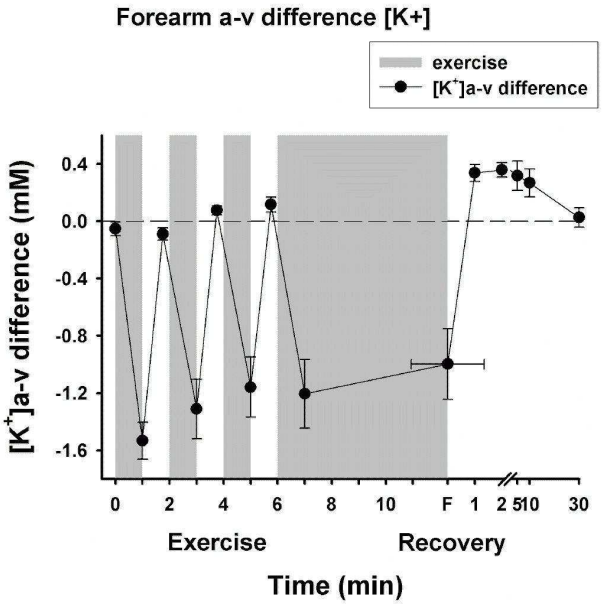
Little is known about contracting muscle mass and inactive muscle effects on K^+ dynamics during exercise. We investigated differences in arterial plasma [K^+] and in the arterio-venous [K^+] difference across the forearm, during small muscle mass exercise with the forearm finger flexors and large muscle mass exercise during two-legged cycling.

Eight healthy males gave written informed consent. Concentric, dynamic forearm finger flexor contractions were conducted on a custom-built ergometer and comprised three 1-min bouts, then a final bout to fatigue, at their peak incremental finger flexion workrate. After 2 h, subjects underwent two-legged cycling exercise comprising 10 min at each of 33% and 67% VO_2peak, then to fatigue at 90% VO_2peak. Radial arterial (a) and deep antecubital venous (v) blood was sampled simultaneously at rest, before and during each exercise bout and in recovery, for both exercise tests. Plasma [K^+] was analysed using a K^+-selective electrode.

During finger flexion exercise $[K^+]_a$ rose only 0.29 ± 0.03 mM to peak at 4.19 ± 0.07 mM at fatigue. The wide negative $[K^+]_{a-v}$ difference during exercise bouts reverted to resting levels post-exercise, and to a positive $[K^+]_{a-v}$ in recovery (see Figure). During leg exercise the rise in $[K^+]_a$ at fatigue was ~9-fold greater (2.69 ± 0.28 mM, $P<0.001$), but the peak of 6.66 ± 0.26 mM was only 59% greater than during finger flexion ($P<0.001$). A positive $[K^+]_{a-v}$ difference across the resting forearm occurred during leg exercise, being 0.39 ± 0.04, 0.70 ± 0.08 and 1.50 ± 0.15 mM, at 33%, 67% and 90% VO_2peak, respectively.



Thus despite a large net K^+ release from contracting muscle, $[K^+]_a$ barely rose above rest during small muscle mass exercise. During large muscle mass exercise, $[K^+]_a$ increased markedly, constrained by K^+ uptake into inactive muscle.

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