Salbutamol decreases potassium concentration during heavy rowing exercise but not immediately following recovery

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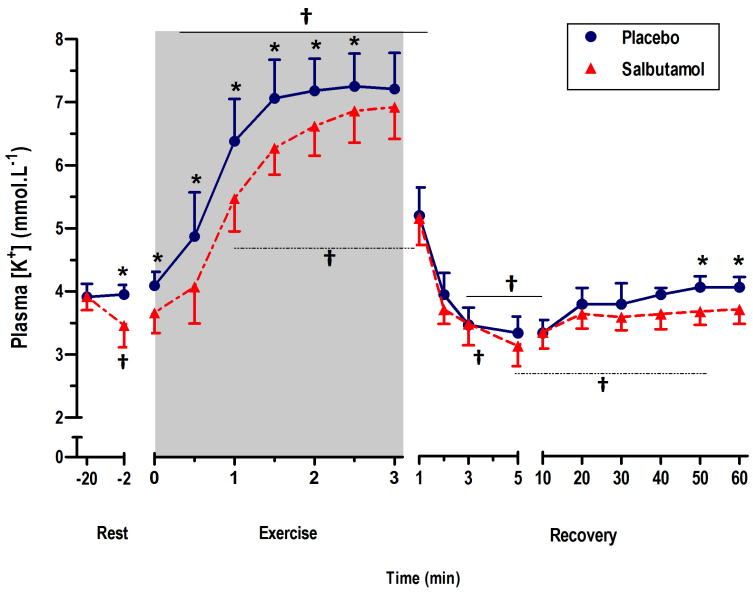
Intense exercise causes pronounced increases in plasma potassium (K^+), and often results in transient hypokalaemia during recovery. Skeletal muscle Na^+,K^+-ATPase plays a essential role in maintaining potassium homeostasis. Salbutamol has an stimulatory effect on skeletal muscle Na^+,K^+-ATPase and may thus affect potassium dynamics during exercise and in recovery. We investigated whether salbutamol lowered arterial plasma K^+ concentration ($[K^+]_a$) during intense exercise and in recovery. Radial plasma $[K^+]_a$ was measured during intense rowing exercise for 3 min in 11 healthy adults (age 30.6 ± 6.5 yr, height 1.81 ± 0.72 m, body mass 86.17 ± 10.90 kg, mean±SD) in a single-blinded randomised trial, either with or without 1000 µg salbutamol inhalation. Blood was sampled at baseline, during rowing exercise and for 60 min post-exercise and analysed for $[K^+]$, other electrolytes and acid-base.

Plasma $[K^+]_a$ revealed significant effects for time and condition (salbutamol) and time by condition interaction ($P < 0.05$). Arterial $[K^+]$ increased during exercise from baseline (-20 min) and pre-exercise (−2 min) reaching 7.06 ±0.61 mM at end exercise in placebo. In recovery, plasma $[K^+]_a$ decreased rapidly, falling below baseline ($P < 0.01$) and pre-exercise ($P < 0.001$) by 3 min. Salbutamol lowered plasma $[K^+]_a$ at rest by 0.45 mM and was increased to 6.92 ± 0.50 mM at end exercise in salbutamol ($P < 0.05$, The Figure). Following exercise plasma $[K^+]_a$ reached a nadir of 3.06 ± 0.31 mM by 3 min ($P < 0.05$) in salbutamol. In recovery, salbutamol inhalation did not further lower plasma $[K^+]_a$ immediately following exercise. At end-exercise, blood $[lactate]_a$ reached 12.52 ± 1.62 mM (placebo) and 11.99 ± 1.96 mM (salbutamol) ($P < 0.05$), pH_a decreased to 7.13 ± 0.07 (placebo) and 7.16 ± 0.07 (salbutamol) ($P < 0.05$).



The pronounced and sustained arterial $[K^+]$ during rowing reflects the high intensity exercise and large contracting muscle mass with the post-exercise decline in plasma $[K^+]_a$ to below baseline during recovery, likely due to continued Na^+,K^+-ATPase activity (Atanasovska, 2014). The lowering effect of plasma $[K^+]_a$ with salbutamol likely reflects increased skeletal muscle Na^+-K^+-ATPase activity due to beta-agonist stimulation, but this was not more pronounced immediately following exercise with salbutamol. This suggests no additive effects of salbutamol beyond normal exercise induced plasma K^+ lowering which may be a protective mechanism to prevent plasma $[K^+]_a$ falling to dangerous levels.

Atanasovska T, Petersen AC, Rouffet DM, Billaut F, Ng I, McKenna MJ. (2014) Plasma K^+ dynamics and implications during and following intense rowing exercise. *Journal of Applied Physiology* **117**, 60-68.