

Blood Volume, Haemoglobin Mass, and Aerobic Capacity in Male and Female Junior Rowers

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Purpose: To compare total blood volume (BV), haemoglobin (Hb) mass, and aerobic capacity in male and female elite junior rowers.

Methods: Competitive academic rowers (25 males and 14 females) of the Lithuanian junior rowing national team were recruited for the study. Mean age in males and females was 18.4 ± 2.4 and 17.0 ± 1.9 years, height – 1.92 ± 0.50 and 1.77 ± 0.70 m, body mass – 89.26 ± 4.72 and 74.17 ± 11.25 kg, respectively. They completed gradually increasing workload on rowing ergometer (Concept 2), during which pulmonary gas exchange was measured on a breath-by-breath basis using the portable analyser Met-aMax 3B (Cortex, Germany). BV and Hb mass were determined using the CO rebreathing method.

Results: Hb concentration (males – 149.5 ± 9.5 vs females – 134.1 ± 6.9 g/L), absolute Hb mass ($1,082.6 \pm 90.7$ vs 720.2 ± 49.3 g), and relative to body mass Hb mass (12.17 ± 1.07 vs 9.86 ± 1.20 g/kg) values were higher in male rowers compared to female rowers ($p < 0.01$). However, Hb mass relative to fat-free mass (FFM) did not differ between genders (13.68 ± 0.96 vs 13.04 ± 1.21 g/FFM kg; $p > 0.05$). Absolute plasma volume (PV) was higher in male rowers ($3,948.7 \pm 531.9$ vs $3,174.3 \pm 359.4$ ml; $p < 0.01$), although PV relative to FFM was higher in female rowers (49.94 ± 6.53 vs 57.23 ± 4.79 ml/FFM kg; $p < 0.01$). PV relative to body weight did not differ between genders ($p > 0.05$). Absolute BV ($7,270.0 \pm 716.8$ vs $5,388.1 \pm 470.8$ ml) and relative to body weight BV (81.62 ± 8.44 vs 73.51 ± 8.34 ml/kg) was higher in male rowers ($p < 0.01$), but BV relative to FFM (91.92 ± 8.39 vs 97.35 ± 7.57 ml/FFM kg) did not differ between genders ($p > 0.05$). Absolute maximum oxygen uptake ($\dot{V}O_{2\max}$) (6.278 ± 0.400 vs 4.478 ± 0.288 L/min) and relative to body mass $\dot{V}O_{2\max}$ (70.17 ± 5.58 vs 61.28 ± 7.28 ml/kg/min) during graded exercise test was higher in male rowers compared to female rowers ($p < 0.01$). However, $\dot{V}O_{2\max}$ relative to FFM (79.43 ± 5.31 vs 81.12 ± 7.25 ml/FFM kg/min) did not differ between genders ($p > 0.05$).

Conclusion: Absolute and relative to body mass total BV, Hb mass, and aerobic capacity variables are higher in elite junior male rowers compared to females, but similar when adjusted for fat-free mass. In contrast, plasma volume relative to fat-free mass is higher in elite junior female rowers compared to males.

