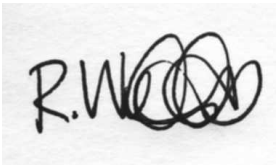
Investigation of metabolic responses to exercise in adolescents and adults during high intensity exercise and recovery

Submitted by Rebecca Willcocks to the University of Exeter as a thesis for the degree of Doctor of Philosophy by Research in Sport and Health Sciences, May 2011.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.



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Abstract

Children and adolescents are thought to use oxidative metabolism to a greater extent than adults during high intensity exercise. The studies reported in this thesis examine the nature and implications of age-related differences in muscle metabolism during high intensity exercise and recovery. Chapter 4 concluded that during heavy intensity exercise, phosphocreatine (PCr) kinetics did not differ with age or sex, while Chapter 5 revealed that during very heavy intensity exercise, the fundamental τ was slower and slow component amplitude greater in men compared with adolescent boys, indicating that exercise intensity might play a role in determining age-related differences in muscle metabolism. In Chapter 6, two bouts of very heavy intensity exercise were completed, and prior exercise reduced the PCr slow component amplitude in men but not boys. Deoxyhaemoglobin (HHb) kinetics was faster in adolescents compared with adults during both heavy and very heavy intensity exercise, indicating that matching of oxygen delivery to oxygen utilisation is less precise at the onset of exercise in adolescents compared with adults. PCr recovery from high intensity exercise was faster in boys than men, but not different in girls and women, as described in Chapter 7. The speed of PCr recovery was correlated with maturity in adolescents, but was not correlated with end-exercise [PCr] or pH. Two different tests to measure mitochondrial capacity in adolescents were evaluated in Chapter 8, and a fitted curve and gated test were both used to determine PCr recovery kinetics. Finally, in Chapter 9, age-related differences in muscle metabolism and oxygenation during fatiguing exercise were examined; a strong trend for greater fatigue in adults compared with adolescents was accompanied by greater metabolic perturbation in adults. Overall, these data show that muscle metabolism and oxygenation differs between adolescents and adults during and following very high intensity exercise.

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