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Abstract

W' following exhaustion: a two-phase exponential recovery affected by aerobic fitness

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1. Introduction

he W'BAL model presumes that the recovery of W' occurs in a mono-exponential way. However, recent data suggests that the reconstitution after exhaustive exercise might follow a two-phase kinetic response. The purpose of this study was twofold: [1] to model the temporal profile of W' recovery over a wide range of recovery times and [2] to investigate if the W' recovery was influenced by individual differences in aerobic fitness or muscle fiber type.

2. Methods

On a cycle ergometer, twenty-one young men (25 ± 2 yr, 54.4 ± 5.3 mL.min-1.kg-1) performed a ramp incremental exercise test, three to five critical power tests and eight experimental trials to assess the W' recovery. The experimental trials consisted of two identical constant load work bouts to exhaustion, interspersed with a recovery interval that was varied in duration between 30 s and 15 min. The actual (W'ACT) and model-predicted (W'BAL) W' recovery were calculated and fitted by one-phase and two-phase exponential modelling. At the end of the study, muscle biopsies were collected from the M. Vastus Lateralis and immunohistochemically analyzed to determine muscle fiber type.

3. Results

W'BAL was lower than W'ACT for all recovery times between 30 s and 5 min ($P < 0.002$), but higher than W'ACT in the 15 min recovery condition ($P = 0.019$). The W'BAL model produced a □ of 524 ± 41 s and was associated with a large RMS of 18.6% in predicting W'ACT. One-phase exponential fitting of W'ACT revealed a RMS of 7.1% (□ = 136 s) and two-phase exponential fitting demonstrated a RMS of 1.8% (□□ = 10 s, □□ = 240 s, □□= 32.4%). Mean W' recovery was correlated with $\dot{V}$O2peak ($R = 0.62$, $P = 0.003$) and with CP ($R = 0.44$, $P = 0.044$).

4. Conclusion

This study demonstrated that the reconstitution of W' after exhaustive exercise follows a two-phase exponential time course exhibiting a fast and a slow recovery component. Furthermore, it was shown that a higher aerobic fitness is associated with faster W' recovery kinetics.