Predicting the Expenditure of Anaerobic Work Capacity (AWCexp) based on Changes to the Torque-Velocity Curve

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Background

- Some cancer risks can be reduced by physical activity, but assessment is often self-reported and imprecise.
- Must establish individuals' objective, quantitative, and predictive measures for non-invasive means of activity levels.

Proposed Model

Cycling is an effective model for activity assessment and this study is to demonstrate how 3 tests can determine an individual's Anaerobic Work Capacity (AWC), the threshold between heavy and severe exercise known as Critical Power (CP), and the correlation between AWC expended (AWCexp) and changes to the torque-velocity curve (T-v).

Methods

- Subjects: Male (n=10) and female (n=2) subjects, regularly trained cyclists or triathletes. Age (37.8 ± 11.6). Weight (72.7 ± 16.2)

- Exercise at increasing powers until exhaustion.

- Exercise for a set time at "all-out" power. CP=last 30 second average, AWCexp=area under the curve.

- 3 Separate T-v sprints, each at a different AWCexp fatigue levels based on predicted 6-min exhaustive power (CP6).

- Figure 1 represents the protocol used for the second day of testing. Literature has shown that an individual's CP can be determined by a 3 min all-out sprint.

- Figure 2 represents the novel protocol used for the third day of testing. We predicted that using an individual's CP6 for a fatigue interval power, 100% AWC would be expended.

Results

- Figure 3 represents the actual T-v curve. Each line is representative of the torque and velocity data for the corresponding sprint throughout the protocol.

- Figure 4 represents the correlation between AWCexp and T/Tmax, V/Vmax, and the area under the T-v curve.

Conclusion

- Our protocols can individualize exercise prescription by determining the threshold between moderate and vigorous exercise.

- Potentially, at any moment in time, changes to the T-v curve during a 6-second sprint could determine a subject's state of fatigue or remaining AWC.

- Protocol to Determine Changes to the Torque Velocity Curve above Critical Power while Cycling (Kelly Humes)

- Comparison of Threshold Determination between Blood Lactate Samples and Near Infrared Spectroscopy (NIRS) (Kristine Knowles)

- Modeling of real-time power output based on wearable, non-invasive NIRS device (Clemson Univ.)

References


- Kelly Ann Humes, Kristine Knowles, Kelly Humes, Gibson Klapthor, Dr. Scott Murr, Dr. Ray Moss

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