Using a Periodic Aerobic Threshold Test for Long-Term Performance Tracking and Training Prescription in Male University Rowers

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INTRODUCTION

• Aerobic Threshold (AerT) is the work intensity (wattage) at which an athlete elicits a 2 mM blood lactate concentration (BLa), which is taken to be the first increase in BLa above baseline levels (Faude, Kindermann & Meyer, 2009).

• Training at or above AerT in endurance sports is a widely utilized method of high-volume training in which improvements in cardiorespiratory and neuromuscular systems enhance oxygen delivery to exercising skeletal muscles (Jones & Carter, 2000).

• Currently, most rowing programs prescribe high-volume, low-intensity aerobic training wattage based off of 2000-meter rowing ergometer time trial results, where the average wattage on the time trial is taken to be 100%, and the aerobic training wattage is at about 45-50% of the average time trial wattage (Kleshnev, 2006). This system is widely used and somewhat effective, however it fails to take into account individual differences of fitness at a baseline level, and 45-50% of average time trial wattage is likely sub-AerT.

• By determining an accurate estimate of the average wattage at which rowers maintain a 2 mM BLa, indicative of their AerT, a more precise estimate of the ideal prescribed wattage for steady-state ergometer workouts can be achieved. Further, through analysis of other physiological variables such as heart rate (HR) and rating of perceived exertion (RPE), a model may be developed in order to prescribe and track AerT high-volume training with no need for periodic BLa testing.

RESULTS

Table 1. Correlation data (Pearson r coefficients) between all measured variables. Result is the best 2000 meter performance within the 6 months of testing.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std Err</td>
<td>Beta</td>
<td></td>
<td>95.0% Confidence Interval for B</td>
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<tr>
<td>(Constant)</td>
<td>41.454</td>
<td>17.690</td>
<td>2.474</td>
<td>0.040</td>
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<tr>
<td>Watts</td>
<td>0.334</td>
<td>0.048</td>
<td>0.672</td>
<td>0.287</td>
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<td>HR</td>
<td>0.263</td>
<td>0.108</td>
<td>0.222</td>
<td>0.246</td>
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<tr>
<td>MMOL</td>
<td>0.194</td>
<td>0.092</td>
<td>0.185</td>
<td>0.189</td>
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<tr>
<td>RPE</td>
<td>0.981</td>
<td>0.527</td>
<td>0.374</td>
<td>2.371</td>
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<tr>
<td>KG</td>
<td>4.152</td>
<td>0.112</td>
<td>0.412</td>
<td>0.412</td>
</tr>
</tbody>
</table>

Table 3. Means (+/- SD) of estimated HR and wattage at 2 mM for the population and Pearson correlations of these estimates to 2000 meter result.

Table 4. T-test results for the difference of means between estimated 2 mM wattage and 2000m-based prescribed splits with a 95% confidence interval (p = 0.05).

Table 2. Linear regression analysis results. Result = Watts(-.354) + HR(.263) + MMOL(.404) + RPE(.981) + KG(-.152) + 61.454.

CONCLUSIONS

• Estimated 2 mM wattage had a strong correlation (r = 0.872) to 2000 meter time trial average wattage. This demonstrates the value of using AerT testing to predict performance.

• At 20 strokes/minute, estimated 2 mM wattage was 7% higher (mean = 223.1) than the formerly used prescribed wattages based on 2000 meter test average wattage (mean = 208.5). Difference = 14.5; 95% Confidence Interval = 7.04 (p = 0.05). This indicates that the previous method of prescribing steady-state training intensity based only on 2000 meter test results was inducing sub-AerT training for this population.

• Based on our regression analysis, HR is a powerful indicator of AerT performance and may be used to track training or to potentially estimate athletes’ 2 mM wattages without the need for BLa testing.

• The protocol used here may be an effective tool for rowing programs in periodically assessing and tracking their athletes’ aerobic fitness, prescribing high-volume training intensity and predicting 2000 meter test performance.

• Further studies to validate these results and enhance the methodology are recommended.

METHODS

• 27 male University rowers underwent AerT testing on a monthly basis for 5 months.

• The test involved a standardized warm-up followed by a 20-minute workpiece at a prescribed wattage based on their most recent 2000-meter ergometer performance (for first test) or based on their previous test results from the AerT test the month previous.

• Variables measured included their body weight (Kg), average power output (watts), average stroke rate (strokes/min), average HR (beats/min), rating of perceived exertion (RPE 7-20 Borg Scale), and BLa immediately post-test (mM).

• Performance variables (body weight, RPE, BLa, average HR and average power output) were analyzed using SPSS statistical software. A linear regression was run to determine which variables best predict 2000-meter ergometer performance.

• The athletes’ 2 mM BLa wattage, representing AerT, was estimated and compared to the traditional 2000-meter performance-based prescriptions (Kleshnev, 2006).

REFERENCES


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