THE EFFECTS OF BICYCLE WARM UP ON MAXIMAL EXERCISE PERFORMANCE

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Introduction

Warm up is widely used in athletic events. Warm up is primarily used to increase performance through increasing muscle and core temperature. The increase in muscle and core temperature is thought to increase blood flow throughout the body, and therefore increase oxygen delivery to the exercising muscles (Bishop et al., 2002). Warm up also acts to reduce muscle and joint stiffness, increase transmission rate of nerve impulses, and change the force velocity relationship (Bishop, 2003).

The effectiveness of warm up has been supported in events lasting <10 seconds. Warm up increases performance during short-term events mainly through reducing the initial oxygen deficit. A thought to increase performance in intermediate (>10 sec but <5 min) and long-term (>5 min) events through reducing the initial oxygen deficit. A reduction in the initial oxygen deficit is thought to leave more anaerobic capacity for later in the event.

Purpose

The purpose of this study was to determine if warming up using a bicycle ergometer would increase performance during a maximal oxygen consumption exercise test (VO2max) conducted on a treadmill.

Methods

Subjects
- 5 University of Texas at Arlington students
- 3 males, 2 females
- Physically active

Instrumentation
- SensorMedics metabolic cart w/treadmill
- Polar heart rate monitor
- Monark cycle ergometer
- Stopwatch

Protocol
Each subject performed two Bruce protocol maximal exercise tests. One test was performed with a 10 warm up on a cycle ergometer at 60% of their age predicted HRmax, and the other was performed without a warm up. The order of testing, warm up or warm up, was randomized. Each subject performed the tests for 10 minutes before a VO2max test. Although there was a small increase in all categories measured, there were no statistical differences between VO2max test with warming and without warming. The test was performed with a 10 warm up on a cycle ergometer at 60% of their age predicted HRmax, and the other VO2max test was performed without warming.

Statistical analysis
Significance of the data was determined using a paired sample t-test. All data was analyzed using Microsoft Excel 2011.

Results

Subject Demographics

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Body Fat %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>28 ± 8</td>
<td>174 ± 8</td>
<td>79.6 ± 9</td>
</tr>
</tbody>
</table>

Results (cont’d)

Table 2: The comparison of HRmax, VO2max, RPE, & time to exhaustion with warm up and without warm up

<table>
<thead>
<tr>
<th>HRmax  (bpm)</th>
<th>VO2max(L/min)</th>
<th>VO2max(mL/kg/min)</th>
<th>RPE</th>
<th>Time to exhaustion (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No warm up</td>
<td>182 ± 17</td>
<td>3.034 ± 0.78</td>
<td>38.02 ± 8</td>
<td>17 ± 0.7</td>
</tr>
<tr>
<td>Warm up</td>
<td>188 ± 13</td>
<td>3.263 ± 0.66</td>
<td>40.8 ± 5</td>
<td>18 ± 1.0</td>
</tr>
<tr>
<td>p value</td>
<td>0.098</td>
<td>0.186</td>
<td>0.180</td>
<td>0.089</td>
</tr>
</tbody>
</table>

Conclusions

Despite the increase in HRmax, VO2max, RPE, and time to exhaustion, the results indicate that warming up before maximal exercise will not increase performance in those categories.

Studies on this topic have indicated that the warm up must be of sufficient intensity (>40% VO2max) and include a rest period of no longer than 5 minutes in order for performance to be increased. Similar guidelines were followed in this study, and performance was slightly increased. Although there was an increase in performance, the difference was not significant. The possible reasons why warm up did not significantly increase performance, include insufficient rest period and wrong intensity level.

Future studies
- Increasing the number of subjects
- Comparing the effectiveness of different warm up intensity levels
- Including various warm up methods
- Example: jogging, calisthenics, swimming, etc.