Metabolic and Performance Effects of Different Warm-up Protocols on Aerobic Exercise in Physically Active Adults

Chris M. Blanco, Julian R. Brown, Torrian M. James and Chris D. Mojock
CURS Summer Scholars Program, Georgia Regents University, Augusta, Georgia

INTRODUCTION

- Pre-competition warm-up (WU) routines have long been prescribed as necessary components to optimize performance.  
- Traditionally, WUs have consisted of moderate duration, moderate intensity exercise aimed to prime the system for competition. Benefits have been attributed to enhanced metabolic, neuromuscular and psychological responses.  
- WUs may increase aerobic efficiency and reduce substrate depletion, oxygen deficit and glycolytic rate. This would prove most effective prior to short-duration, high-intensity exercise.  
- The current research project addressed gaps in knowledge through a focus on longer duration, high-intensity exercise.

PURPOSE

The purpose of the present investigation was to identify the extent to which WU of varied intensity, moderate vs. vigorous, prior to completion of a high-intensity time-to-exhaustion (TTE) exercise bout influences aerobic and anaerobic metabolism and performance in physically active adults.

METHODS

Participants

Healthy, active (exercise ≥ 30 min/d for 3 d/wk) adults (18 – 44 years) participated in a randomized, crossover protocol. The Georgia Regents University Institutional Review Board approved this study and all participants completed an informed consent and medical history questionnaire prior to commencement. Participants reported to the laboratory following a three-hour fast and had their resting blood pressure, heart rate and body fat measurements performed.

Exercise Testing

On three separate visits (± 24 hr rest), maximal aerobic capacity, ventilatory threshold and time-to-exhaustion tests were performed.

Ventilatory Threshold

Time-to-Exhaustion (TTE) Testing

Following a 15 minute rest, participants pedaled through workloads of varied intensity. The TTE test began at a workload equal to 100% of their ventilatory threshold (VT) power for 3 minutes then increased to 110% of their VT power for 1 minute. This pattern continued until total exhaustion.

Statistics

Descriptive statistics (mean ± SD) were performed on demographic, performance and anthropometric variables.

RESULTS

Table 1. Descriptive characteristics of the participants.

<table>
<thead>
<tr>
<th>WU</th>
<th>ID</th>
<th>Age (yr)</th>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m²)</th>
<th>Body Fat (%)</th>
<th>VO₂max (mL/kg/min)</th>
<th>VT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WU1</td>
<td>24</td>
<td>1.75</td>
<td>7.13</td>
<td>21.2</td>
<td>19.7</td>
<td>40.8</td>
<td>70.7</td>
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<tr>
<td>WU2</td>
<td>27</td>
<td>1.75</td>
<td>6.84</td>
<td>22.3</td>
<td>13.8</td>
<td>50.3</td>
<td>69.7</td>
<td></td>
</tr>
<tr>
<td>WU3</td>
<td>22</td>
<td>1.75</td>
<td>9.30</td>
<td>30.4</td>
<td>23.2</td>
<td>29.5</td>
<td>69.3</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Ventilation (VE) vs. oxygen uptake (VO₂) during maximal exercise.

Figure 2. Oxygen uptake (VO₂) vs. workload during maximal exercise.

Figure 3. Time-to-exhaustion performance following moderate and vigorous intensity warm-up protocols.

CONCLUSIONS

The moderate intensity warm-up was more effective than a vigorous warm-up to increase time to exhaustion when performed prior to high intensity aerobic exercise. Further research is needed to determine the metabolic and neuromuscular changes that contribute to the difference in performance.

REFERENCES


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