The Effects of Active Vs. Passive Recovery on Blood Lactate Levels

Introduction

★ Anaerobically intense exercise is correlated to a rise in blood lactate and to the fall in muscle pH which have a large effect on fatigue.

★ During anaerobic metabolism, glycogen and glucose are broken down to produce energy (ATP), and its byproducts are hydrogen ions and lactate.
The rapid accumulation of hydrogen ions and the inability of the body’s tissues to clear lactate from the bloodstream will lower the muscle pH and as a result affect muscular function.

The removal of lactate from the blood would assist athletes to perform longer during strenuous exercise at high intensity.
Lactate Threshold

★ Exercise intensity increases = sudden rise in lactate
★ Slow and fast twitch fibers
Aim & Hypothesis

Aim: Determine which type of recovery clears La from the bloodstream at a faster rate.

Hypothesis: It was hypothesized that active recovery will accelerate the clearance of La compared to passive recovery.
Methods

★ 11 male CSUSM students
★ Met at Clarke Gym
★ Filled out Consent Form & Health Questionnaire
★ Pre-Circuit
  ○ Sit for 5 minutes
★ Warm-Up
  ○ 5 minutes Using the Elliptical
Full-body Resistance Training Circuit

- 2 Sets
  - 1st Set - 10 repetitions
  - 2nd Set - As many Repetitions possible until Fatigue
- 5 Exercises:
  - Bench Press
  - Alternating Lunges with Dumbbells in Each Hand
  - Crunches on Declined Bench with Added Weight
  - Lateral Pulldowns
  - Leg Extensions
Methods (Cont.)

★ Active vs. Passive Recovery (15 minutes)
  ○ Active - Using the Elliptical
  ○ Passive - Sitting

★ Post-Circuit Exercise
  ○ 6 minute Jog on Treadmill
Fingerpricks/Lactate levels recorded:
- Pre-Circuit (Prior to Warm-Up on Elliptical)
- After 2nd Set of Crunches
- After 2nd Set of Leg Extensions
- 5th, 10th & 15th minute of Recovery
- End of Post-Circuit Jog

Total: 7 blood samples
Statistical analysis:
- Data was reported as mean ± standard deviation
  - Analyzed using IBM SPSS software Version 20.0.
- A two-way ANOVA was performed and significance was established using the Tukey ad hoc procedure.
  - A difference was considered significant if $p < 0.05$. 
Results

Test 5 (10 minutes of recovery)
active: 7.48 ± 2.32 mmol/L
passive: 10.46 ± 3.26 mmol/L

Test 6 (15 minutes of recovery)
active: 5.90 ± 1.57 mmol/L
passive: 9.19 ± 3.05 mmol/L

p < 0.05
Results

Statistical Analysis Used:

- SPSS: 2-Way Anova
  - Results portrayed a P-Value of <0.05 for time, recovery and recovery*time.
- Tukeys Post Hoc Test: Significant difference between bouts 5 & 6.
<table>
<thead>
<tr>
<th>Subject #</th>
<th>Age (yrs)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI</th>
<th>Days/week of exercise</th>
<th>Length of weekly exercise (min)</th>
<th>Exercise type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>170.18</td>
<td>59.87</td>
<td>20.7</td>
<td>7</td>
<td>30-90</td>
<td>WL, soccer</td>
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<td>2</td>
<td>29</td>
<td>185.42</td>
<td>83.00</td>
<td>24.19</td>
<td>2-3</td>
<td>60-120</td>
<td>Run, swim, WL</td>
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<tr>
<td>3</td>
<td>23</td>
<td>170.18</td>
<td>77.11</td>
<td>26.68</td>
<td>3-4</td>
<td>60</td>
<td>WL, run, hike, basketball</td>
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<tr>
<td>4</td>
<td>22</td>
<td>177.80</td>
<td>92.99</td>
<td>29.48</td>
<td>3</td>
<td>90</td>
<td>WL</td>
</tr>
<tr>
<td>5</td>
<td>23</td>
<td>180.34</td>
<td>86.12</td>
<td>26.56</td>
<td>3-6</td>
<td>60-120</td>
<td>WL, basketball,</td>
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<tr>
<td>6</td>
<td>27</td>
<td>193.04</td>
<td>102.09</td>
<td>27.45</td>
<td>5</td>
<td>60-120</td>
<td>WL, basketball, MMA</td>
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<tr>
<td>7</td>
<td>23</td>
<td>175.26</td>
<td>70.31</td>
<td>22.94</td>
<td>5</td>
<td>180-300</td>
<td>Baseball, WL</td>
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<tr>
<td>8</td>
<td>21</td>
<td>187.96</td>
<td>86.18</td>
<td>24.45</td>
<td>5</td>
<td>180-300</td>
<td>WL, baseball</td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td>170.18</td>
<td>77.11</td>
<td>26.68</td>
<td>4-5</td>
<td>90</td>
<td>WL</td>
</tr>
<tr>
<td>10</td>
<td>22</td>
<td>172.72</td>
<td>81.65</td>
<td>27.43</td>
<td>3-5</td>
<td>60-120</td>
<td>WL, soccer</td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td>172.72</td>
<td>73.48</td>
<td>24.68</td>
<td>3-5</td>
<td>180-300</td>
<td>WL, cardio</td>
</tr>
<tr>
<td>Mean &amp; STDEV</td>
<td>23.45 ± 2.42</td>
<td>177.80 ± 7.95</td>
<td>80.90 ± 11.37</td>
<td>25.57 ± 2.46</td>
<td>4.5 ± 1.05</td>
<td>212.00 ± 333.31</td>
<td>_______</td>
</tr>
</tbody>
</table>
Restating Hypothesis: La removal is facilitated at a greater rate during active recovery rather than during passive recovery.

Results showed significantly higher La level in passive recovery and lower La level in active recovery at bouts 5 and 6.

Our hypothesis is supported due to the differences in La levels between active and passive recovery existing.
Corder et. al (2000) - active recovery clears lactate blood concentration

<table>
<thead>
<tr>
<th>Condition</th>
<th>Prewarmup</th>
<th>Postset 2</th>
<th>Postset 2&lt;sup&gt;ac&lt;/sup&gt;</th>
<th>Postset 4&lt;sup&gt;ac&lt;/sup&gt;</th>
<th>Postset 6&lt;sup&gt;abc&lt;/sup&gt;</th>
<th>Postset 6&lt;sup&gt;abc&lt;/sup&gt;</th>
<th>Post-MRP set&lt;sup&gt;abc&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>1.3 ± 0.1</td>
<td>4.9 ± 0.4</td>
<td>5.4 ± 0.4</td>
<td>6.7 ± 0.5</td>
<td>7.6 ± 0.6</td>
<td>7.7 ± 0.7</td>
<td>9.0 ± 0.5</td>
</tr>
<tr>
<td>25%-OBLA†</td>
<td>1.4 ± 0.1</td>
<td>4.6 ± 0.3</td>
<td>4.5 ± 0.4</td>
<td>5.7 ± 0.4</td>
<td>6.5 ± 0.5</td>
<td>6.2 ± 0.5</td>
<td>8.1 ± 0.4</td>
</tr>
<tr>
<td>50%-OBLA</td>
<td>1.2 ± 0.1</td>
<td>4.7 ± 0.3</td>
<td>5.1 ± 0.4</td>
<td>6.2 ± 0.5</td>
<td>6.9 ± 0.5</td>
<td>7.1 ± 0.6</td>
<td>8.4 ± 0.4</td>
</tr>
</tbody>
</table>

* Within a measurement, superscript a refers to a significant difference between the passive and 25%-OBLA conditions; superscript b refers to a significant difference between the passive and 50%-OBLA conditions; and superscript c refers to a significant difference between the 25%-OBLA and 50%-OBLA conditions (p ≤ 0.05).
† OBLA = onset of blood lactate accumulation.
Menzies et. al (2010) - indication that passive and active recovery both reduce, but active recovery reduces faster.

Figure 2
Physiological Explanations

★ Choi and Colleagues (1994) - La levels decreased in active recovery due to La being oxidized to fuel recovery activity. La during passive recovery was not needed for fuel, leading to contribution to resynthesis of glycogen.

★ Menzies et. al (2010) - Low intensity during active recovery recruiting Type I muscle fibers, heavily saturated with mitochondria, utilizing free La as an energy substrate event. converting into glucose then into ATP. Type I - leads to large incr. blood La disappearance; explaining active recovery being more substantial than passive recovery.
Physiological Explanations cont.

★ Menzies et. al (2010) - Passive recovery incorporated sitting, not influencing blood La disappearance. Type I fibers become inactive in removing blood La due to non-movement. Indication of lower blood La disappearance and lower rate of blood lactate clearance.

★ Gisolfi et. al (1966) - Increased clearance rate of La during active recovery was a possible result of more rapid distribution of La to the liver for oxidation or re-conversion of glycogen.
Limitations

- Small Sample Sizes (limited to Male Subjects)
- Subjects not following Guidelines
- Maximum Output during Fatigue Stage
- Exercise equipment availability
- Blood Lactate Analyzer error
- Lactate Sample itself
Implications

★ La levels during passive and active recovery in individuals of the same physique and ethnicity
★ La levels during passive and active recovery in athletes involved with same sport
★ La level comparison between female and male during passive and active recovery
References


Conclusion

Our hypothesis was supported due to differences in La levels between active and passive recovery existing. Therefore, in terms of real application, a cool down is beneficial for athletes since it assists the body in returning to homeostasis.