Effects of Cold Water Immersion on Competitive Female Dancers During 3 days of Unaccustomed Training

Jessica R. Woelfel, Katie J. Schwab, Jacob L. Helmer, Andrea M. Tobias, Donald V. Fischer, & Mary C. Stenson
College of Saint Benedict/Saint John's University Department of Exercise Science and Sport Studies

Introduction
- Athletes training multiple times per day require fast, effective recovery methods. Cold water immersion (CWI) is commonly used by athletes to speed recovery and attenuate muscle soreness, edema, and inflammation\(^1\) in order to maintain performance during subsequent exercise bouts.
- The purpose of this study was to investigate the effects of post-exercise CWI during three days of unaccustomed intense training on fatigue, perceived muscle soreness (PMS), flexibility, thigh circumference, vertical jump, agility, and anaerobic capacity in competitive female dancers.

Results
- No significant differences were found between groups for changes in vertical jump, thigh circumference in two areas, PMS, fatigue, flexibility, anaerobic capacity, or agility.
- CWI attenuated increases in sprint times compared to the control (Figure 1). This is consistent with previous research showing performance gains in athletes.\(^2\)
- The CWI group increased hamstring flexibility more than the control group over time (Figure 2).
- CWI attenuated mid-thigh circumference increase, as compared to the control group (Figure 3), which is consistent with previous research showing attenuated swelling and inflammation.\(^3\)

Discussion
- Although not statistically significant, results may have practical implications:
  - Maintained flexibility with CWI may enhance dance performance
  - Attenuated inflammation and swelling by vasoconstriction and hydrostatic pressure may limit muscle stiffness and further muscle damage.\(^4,5\)
  - CWI is not detrimental to recovery or performance.\(^1\)
  - Greater immersion depth and a larger sample size may enhance the effects seen in the present study.\(^1\)
  - Measurements of creatine kinase or myoglobin would be useful to quantify extent of muscle damage.

Conclusion
- Although CWI did not provide statistically significant changes in performance or recovery variables over 3 days, there may be greater practical implications for performance.

Materials and Methods
- Subjects: 12 female dancers
  - Based on initial testing, the control and treatment groups were statistically similar (Table 1).
  - Practices were held 3 times daily, from 9:00am to 11:00am, 2:00pm to 5:00pm, and 7:00pm to 8:00pm. Measurements were performed at 7:00am, 11:15am, and 5:15pm. CWI for treatment group was performed immediately after measurements following the morning practice.

<table>
<thead>
<tr>
<th></th>
<th>CWI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>166.47 ± 4.39</td>
<td>165.63 ± 6.27</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>67.02 ± 10.55</td>
<td>63.94 ± 5.40</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>23.91 ± 5.36</td>
<td>23.83 ± 4.59</td>
</tr>
<tr>
<td>Days per week</td>
<td>3.79 ± 1.65</td>
<td>4.58 ± 1.46</td>
</tr>
<tr>
<td>Min per day</td>
<td>72.86 ± 21.96</td>
<td>66.67 ± 28.93</td>
</tr>
</tbody>
</table>

Table 1. Descriptive characteristics of subjects.

Figure 1. Mean 300 yard shuttle test times (seconds) pre- and post-training.

Figure 2. Hamstring flexibility (degrees), measured three times daily during three days of unaccustomed training.

Figure 3. Changes in mid-thigh swelling, as compared to baseline mid-thigh circumference (cm).

Table 2. Changes in mid-thigh circumference (cm)

<table>
<thead>
<tr>
<th></th>
<th>CWI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>7:15</td>
<td>11:15</td>
</tr>
<tr>
<td>Day 2</td>
<td>7:15</td>
<td>11:15</td>
</tr>
<tr>
<td>Day 3</td>
<td>7:15</td>
<td>11:15</td>
</tr>
<tr>
<td>Day 4</td>
<td>7:15</td>
<td>11:15</td>
</tr>
</tbody>
</table>

Acknowledgments
We would like to thank the College of St. Benedict Dance Team for their participation and cooperation.

Literature Cited