The purpose of this study was to compare sweat rate (SR) and sweat electrolyte concentration between competitive (CP) and matched control (MC) athletes. The study involved twenty-four (12 CP; 12 MC) competitive and recreational male athletes aged 13.5 to 24 years old, with a mean body mass of 75.0 kg, mean body fat of 13.9%, and mean age of 21 years. Each matched pair of athletes participated in an identical exercise regimen for a given session.

METHODS

• Testing performed in a climate controlled location or at assigned practice facility
• Pre-exercise body mass assessed using a standard scale
• Right proximal forearm cleaned using 70% isopropyl alcohol and allowed to dry
• Sterile gauze pad placed on forearm and covered with transparent dressing
• Exercise regimen identical for each matched pair of athletes for a given session
• Exercise body mass measured
• SR = (pre-exercise body mass - post-exercise body mass + fluid consumed) / exercise duration
• Following exercise, gauze removed and centrifuged to extract sweat
• Sweat-electrolyte concentrations (mEq·L⁻¹) determined using ion-specific electrode analysis
• EasyLyte Plus Na/K/Cl Analyzer (Medica Corporation, Bedford, MA)
• Data analyzed by independent t-tests (α = .05), receiver operating characteristic (ROC) analysis

RESULTS

• One CP and one MC removed due to MC outlier sweat [Na⁺] (>2 SID above group mean)
• Independent t-test results:
  • No significant difference between groups for SR (p=.398) or sweat [K⁺] (p=.865)
  • CP significantly greater than MC in terms of sweat [Cl⁻] (p=.040)
• Dichotomized univariable analysis results:
  • Group membership (CP vs. MC) associated with SR, sweat [Na⁺], and sweat [Cl⁻]
  • CP approximately 8 X more likely than MC to have SR ≥ 2.13 L·h⁻¹
  • CP 15 X more likely than MC to have a sweat [Na⁺] ≥ 29.38 mEq·L⁻¹
  • CP 15 X more likely than MC to have a sweat [Cl⁻] ≥ 24.13 mEq·L⁻¹

CONCLUSIONS

• The results suggest that increased sweat [Na⁺] and sweat [Cl⁻] predispose athletes to cramps
• Sweat-electrolyte concentration strongly discriminates CP athletes from MC athletes
• SR appears to have less predictive power for identification of recurrent muscle cramps
• NaCl supplementation may attenuate recurrent exercise-associated muscle cramps

REFERENCES


Table 1. Participant Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>CP</th>
<th>MC</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>21.8</td>
<td>21.8</td>
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<tr>
<td>% Body Fat</td>
<td>13.5</td>
<td>3.5</td>
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<tr>
<td>Body Mass (kg)</td>
<td>94.7</td>
<td>20.5</td>
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Table 2. Means and Standard Deviations

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<thead>
<tr>
<th>Variable</th>
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<th>MC</th>
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<tbody>
<tr>
<td>SR (L·h⁻¹)</td>
<td>1.23</td>
<td>1.23</td>
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<tr>
<td>Na⁺ (mEq·L⁻¹)</td>
<td>39.28</td>
<td>39.28</td>
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<tr>
<td>Cl⁻ (mEq·L⁻¹)</td>
<td>24.13</td>
<td>24.13</td>
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Table 3. Results of Univariable Analyses

<table>
<thead>
<tr>
<th>OR 95% CI</th>
<th>(mEq·L⁻¹)</th>
<th>(mEq·L⁻¹)</th>
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</thead>
<tbody>
<tr>
<td>Na⁺</td>
<td>≥ 15.00</td>
<td>83.3%</td>
</tr>
<tr>
<td>Cl⁻</td>
<td>≥ 24.13</td>
<td>83.3%</td>
</tr>
</tbody>
</table>

Figure 1. Sweat patch

Figure 2. ROC Curve