The Effects of Carbohydrate Supplementation on Variable-Intensity Athletic Endurance

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Introduction

- During moderate to intense exercise
  - Anaerobic glycolysis is the main source of energy
    - Provides the most ATP in the shortest amount of time
    - Results in rapid blood glucose depletion and lactate accumulation

  - Hepatic glycogenolysis does not provide adequate glucose for glycolysis

  Results in shorter athletic endurance
Carbohydrate (CHO) Supplementation

- Significantly delays the onset of fatigue
  - Jentjens et al., 2004
    - Higher blood glucose availability for oxidation late in exercise
  - McConnell et al., 1994 and Febbraio et al., 2000
    - Increases glucose uptake into contracting muscles
    - Decreases the amount of pyruvate converted to lactate
Yaspelkis et al., 1993

- Variable-intensity cycling protocol
- Liquid CHO polymer
- The onset of fatigue was significantly delayed
  - Reduced dependency on muscle glycogen for glucose

Hypothesis

Administration of a CHO supplement during variable intensity exercise will increase athletic endurance.

- Maintain higher blood glucose (BG) concentration
- Maintain lower blood lactate (BL) concentration
- Increase time to fatigue
Methods

Initial $V_{O_2}$ max Determination

- Jaeger Oxycon Mobile
  - Oxygen consumption ($V_{O_2}$)
  - Respiration rate
  - Heart Rate

- Pedaled at maximal ability
  - Giant FCR Flatbar Roadbike

<table>
<thead>
<tr>
<th>$V_{O_2}$ max (%)</th>
<th>Time (min)</th>
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<tbody>
<tr>
<td>40</td>
<td>7</td>
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<tr>
<td>70</td>
<td>4</td>
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<tr>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>80</td>
<td>Until fatigue</td>
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</tbody>
</table>

Adapted from Yaspelkis et al., 1993
Prior to each trial, subjects (N=3) fasted and refrained from exercise for 12 hours.

**Control Trial**

- BG and BL levels recorded
  - Initial
  - Every 10 min during cycling regimen
  - At fatigue (final)

- Water available *ad libitum*

- Fatigue was self-reported

**Placebo Trial**

- BG and BL levels recorded
  - Initial
  - Every 10 min during cycling regimen
  - At fatigue (final)

- Artificially colored/sweetened placebo
  - 60 ml
  - Administered every 7 min
Performance Trial

- BG and BL levels recorded
  - Initial
  - Every 10 min during cycling regimen
  - At fatigue (final)

- 10.0% liquid CHO polymer
  - Performance by Shaklee
  - 60 ml administered every 7 min
Average Time to Fatigue

- Control
- Placebo
- Performance

Average Time to Fatigue (min)
Average BG Concentration

Average Blood Glucose Concentration (mg·dl⁻¹) vs. Time (min)

- Control
- Placebo
- Performance

Graph showing the average blood glucose concentration over time for different conditions.
Average BL Concentration

Average Blood Lactate Concentration (mmol\cdot L^{-1})

Time (min)

Control
Placebo
Performance
Discussion

During Control and Placebo trials

- Small spike in BG concentration at 30 and 40 minutes
  - Natural hepatic glucose production

- Higher average BL concentration
  - Low glucose availability → anaerobic conditions

- Shorter time to fatigue
During Performance trial

- Highest BG concentrations at 30 and 40 minutes
  - Released glucose stores and breakdown of CHO supplement

- Lowest BL concentration at 30 minutes
  - High glucose availability → aerobic conditions

- Decreased dependence on muscle glycogen for glucose

- CHO supplement significantly delayed onset of fatigue
Acknowledgments

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  • Performance Pure Hydration Drink (liquid CHO supplement)

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Literature Cited


