Point: Caffeine Does Improve Endurance Sports Performance

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Pavneet Dhanoa, Haaris Mahmood, Robert Nicol
Roadmap

1. Clinical & non-clinical caffeine use
2. Ergogenic Mechanisms
3. RDA and safe consumption
4. Evidence for ergogenic effects
5. Critique of counterpoint evidence
6. Conclusion
Hypothesis

• **Point:** Caffeine *does* improve endurance sports performance.

• **Counterpoint:** Caffeine *does not* improve endurance sports performance.
Normal Ergogenic Aid Use

• Treatment for premature babies with apnea (Laubscher et al, 1998)

• Treatment for migraine headaches (Lipton et al, 1998)

• Alleviates nausea and functional disability (Lipton et al, 1998)

• Improves attentional processes (Phillips and Ogeil, 2015)
Supplementary Oxygen ($F_iO_2$) at baseline, 24 hr, 7 days after caffeine

(Laubscher et al, 1998)
Mechanism of Action

• Caffeine possibly promotes glycogen sparing by increasing blood [epinephrine] (Davis et al, 2013).

• Caffeine reversibly \textbf{inhibits} adenosine. Thus, \textbf{opposite} \textbf{(excitatory)} effects are achieved (Snyder et al, 1981).
Recommended Daily Allowance (RDA)

- There is no RDA for caffeine
- No required daily intake of caffeine
Safe Use

• Overdose > 600 mg (Phillips and Ogeil, 2015).

• Overdose causes: restlessness, anxiety, and irritability (Phillips and Ogeil, 2015).

• No adverse side effects: 400 – 500 mg/day for healthy adults (Knight et al, 2004).
Evidence Caffeine Improves Endurance

- Assessed caffeine’s effect on cycling endurance

- Low or high dose caffeine significantly improved endurance performance *(P < 0.05)*

  (Desbrow et al, 2013).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean Improvement (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Dose Caffeine Vs. Placebo</td>
<td>164.3 ± 64.1*</td>
</tr>
<tr>
<td>High Dose Caffeine Vs. Placebo</td>
<td>110.8 ± 83.5*</td>
</tr>
</tbody>
</table>
Caffeine Improves Endurance Performance

- Caffeine’s effect on cycling endurance performance!

- Caffeine significantly *(P < 0.05)* Improved performance time, speed and power *(Wiles et al, 2006)*.

<table>
<thead>
<tr>
<th></th>
<th>Caffeine</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance time (s)</td>
<td>71.1 ± 2.0</td>
<td>73.4 ± 2.3*</td>
</tr>
<tr>
<td>Mean speed (km·h⁻¹)</td>
<td>50.7 ± 1.4</td>
<td>49.1 ± 1.5*</td>
</tr>
<tr>
<td>Mean power (W)</td>
<td>523 ± 43</td>
<td>505 ± 46*</td>
</tr>
<tr>
<td>Peak power (W)</td>
<td>940 ± 83</td>
<td>864 ± 107*</td>
</tr>
</tbody>
</table>

*Significantly different *(P<0.05)* from the caffeine trial.
Evidence Suggesting Caffeine Tolerance Decreases Ergogenic Effects

Research Findings
• Caf-induced ergogenic effects disappeared after 4 weeks of daily caffeine use

Criticisms
• Sample Population
• Self report measures

(Beatmont et al, 2016)
Evidence Suggesting Caffeine Does Not Improve Moderate & High Intensity Endurance Performance
(Hunter et al, 2002)

Research Findings

• No significant ergogenic effects on a 100km cycling time trial that included high intensity epochs

Figure 1 — Average power (W; top) and total time (mins; bottom) to complete familiarization (Famil; top only), placebo (Pl), carbohydrate (Cho), and caffeine 100-km cycle time trials.
4 Reasons Why Caffeine Did Not Elicit A Significant Ergogenic Effect

1. 7/15 subjects abandoned the single blinded study

2. Significant dehydration was observed in the Caf condition

3. pre-trial meals reduced glycogen stores

4. Potential Caffeine overdose
Evidence to Suggest Caffeine Causes GI Distress During a Triathlon

Table III. Spearman's rho correlations between nutrient intakes and GI distress experienced during the cycle and run (n = 53)

<table>
<thead>
<tr>
<th></th>
<th>Energy</th>
<th>Carbohydrate</th>
<th>Fibre</th>
<th>Fat</th>
<th>Protein</th>
<th>Caffeine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day before intake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle LGI</td>
<td>0.07</td>
<td>0.04</td>
<td>-0.18</td>
<td>0.08</td>
<td>0.00</td>
<td>0.13</td>
</tr>
<tr>
<td>Run LGI</td>
<td>-0.18</td>
<td>-0.13</td>
<td>-0.11</td>
<td>-0.09</td>
<td>-0.17</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Morning of intake</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycle UGI</td>
<td>0.28*</td>
<td>0.36**</td>
<td>0.20</td>
<td>0.04</td>
<td>0.09</td>
<td>0.06</td>
</tr>
<tr>
<td>Cycle LGI</td>
<td>0.22</td>
<td>0.20</td>
<td>-0.02</td>
<td>0.08</td>
<td>0.03</td>
<td>0.26</td>
</tr>
<tr>
<td>Run UGI</td>
<td>-0.11</td>
<td>-0.18</td>
<td>-0.10</td>
<td>0.05</td>
<td>0.05</td>
<td>0.17</td>
</tr>
<tr>
<td>Run LGI</td>
<td>0.07</td>
<td>-0.03</td>
<td>0.07</td>
<td>0.16</td>
<td>0.11</td>
<td><strong>0.30</strong>*</td>
</tr>
</tbody>
</table>

UGI was calculated by combining symptoms of nausea, regurgitation and stomach fullness (range = 0–30). LGI was calculated combining symptoms of lower abdominal cramps, flatulence and urge to defecate (range = 0–30). *P < 0.05; **P < 0.01.

(Wilson, 2016)
Alternative Explanations

1. Previous history of GI distress

2. Self report data for nutrient intakes

3. Correlation between nutrient intake and GI distress ranged from $p=0.28-0.36$, suggesting influence of non-dietary factors
Conclusion

Caffeine improves sports endurance performance
References


References


References


