CRANK FORE-AFT POSITION AFFECTS ECONOMY AND TECHNIQUE IN TRAINED RECUMBENT HANDCYCLISTS

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WHAT DO WE KNOW ABOUT CRANK FORE-AFT POSITION?

Attachable-Unit Handbike
Touring Handbike
Recumbent Racing Handbike

Arnet et al., 2014; Faupin and Gorce 2008; Litzenberger et al., 2016; Miller et al., 2004; van Drongelen et al., 2009
WHAT IS RECUMBENT HANDCYCLING?
HOW IS A RECUMBENT HANDBIKE SET-UP?

Crank fore-aft Position:
1. 10 cm range
2. 15 % range relative to arm length
WHAT DOES HANDCYCLING LOOK LIKE IN A SIMULATED TIME TRIAL?

- Cadence 94 ± 6 rpm
- Intensity 70% Peak Aerobic Power Output

![Graph showing relationship between peak aerobic power output and 16 km time trial performance. The correlation coefficient is R = -0.77.](image)
EXPERIMENTAL DESIGN

• Participants:
  o 15 trained recumbent handcyclists
  o 6 H3 and 9 H4
    o 10 SCI complete (T5 – L1)
    o 3 lower limb amputees
    o 2 cerebral palsy

• Manipulating crank fore-aft position by arm-length:
  1. 94%
  2. 97%
  3. 100%
  4. 103%
**EXPERIMENTAL PROTOCOL**

- **Exercise Intensity**
  - 50% and 70% $\text{PO}_{\text{Peak}}$
  - 90 ± 10 rpm

- **Variables:**
  - Handcycling Economy
  - Upper Limb Kinematics
  - Heart Rate
CRANK FORE-AFT POSITION AFFECTS HANDCYCLING ECONOMY

- Significant difference (P < 0.05) relative to:
  - * 97 %
  - # 100 %

- Same trend at 50% Peak Aerobic Power Output
CRANK FORE-AFT POSITION AFFECTS HANDCYCLING TECHNIQUE

97% 103%
CONCLUSION

• Crank fore-aft position influences economy and technique

• A crank fore-aft position equivalent to 97% - 100% of arm-length maximises economy

• Direct link between handbike configuration and handcycling technique.
THANK YOU FOR LISTENING
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean ± SD</th>
<th>Min</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td><strong>Handbike Configuration</strong></td>
<td></td>
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<tr>
<td>Crank Height (m)</td>
<td>0.51 ± 0.02</td>
<td>0.48</td>
<td>0.54</td>
</tr>
<tr>
<td>Crank Horizontal Position (m)</td>
<td>0.58 ± 0.04</td>
<td>0.53</td>
<td>0.64</td>
</tr>
<tr>
<td>Backrest Height (m)</td>
<td>0.41 ± 0.04</td>
<td>0.36</td>
<td>0.46</td>
</tr>
<tr>
<td>Crank Length (mm)</td>
<td>171 ± 2</td>
<td>170</td>
<td>175</td>
</tr>
<tr>
<td>Handgrip Width (m)</td>
<td>0.33 ± 0.02</td>
<td>0.31</td>
<td>0.36</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>14.3 ± 1.2</td>
<td>13.0</td>
<td>16.6</td>
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<tr>
<td><strong>Handbike-User Interface</strong></td>
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<tr>
<td>Crank Fore-aft Position (m)</td>
<td>0.68 ± 0.03</td>
<td>0.63</td>
<td>0.72</td>
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<tr>
<td>Shoulder Height (m)</td>
<td>0.33 ± 0.03</td>
<td>0.30</td>
<td>0.38</td>
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<tr>
<td>Eye-line Height (m)</td>
<td>0.54 ± 0.04</td>
<td>0.45</td>
<td>0.59</td>
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<tr>
<td>Crank Height vs Shoulder Height (%)</td>
<td>158.7 ± 12.8</td>
<td>136.8</td>
<td>170.0</td>
</tr>
<tr>
<td>Crank Fore-aft Position vs Arm length (%)</td>
<td>100.0 ± 4.0</td>
<td>95.5</td>
<td>109.2</td>
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<tr>
<td>Crank Length vs Arm Length (%)</td>
<td>25.3 ± 1.0</td>
<td>24.1</td>
<td>26.5</td>
</tr>
<tr>
<td>Handgrip Width vs Shoulder Width (%)</td>
<td>77.7 ± 3.9</td>
<td>73.4</td>
<td>86.6</td>
</tr>
</tbody>
</table>
THE ADJUSTABLE RIG