Pacing characteristics of whole and part-game players in professional rugby union

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What is pacing?
What does pacing look like in team sports?

Fatigue in total and high-intensity running distance
(Waldron and Highton, 2014, Sports Med 44:12)

Distribution of energy resources

**Macro-pacing** (pre-match)
- hydration, fuel availability, motivation, temperature, opposition, whole-game/substitute

**Meso-pacing** (half time)
- homeostatic disturbance, opposition, scoreline

**Micro-pacing** (continuous)
- homeostatic disturbance, opposition, scoreline

Effect of bout duration

Bout duration

Playing intensity

What does this look like in collision sport?
Methods

19 professional players

Backs
- 49 matches
  - Whole game: 27 matches
  - Starters: 19 matches
  - Finishers: 3 matches

Forwards
- 51 matches
  - Whole game: 19 matches
  - Starters: 16 matches
  - Finishers: 16 matches

Measurement

SPI Pro GPS unit (GPSports, Canberra)

Match demand metrics
- Total distance
- High speed distance (>4 m.s\(^{-1}\))
- Acceleration count (>2.75 m.s\(^{-2}\))
- Impact count (> 5G)
All normalized to playing time and divided into quartiles

Statistics

Linear mixed models & Magnitude based decisions

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# Results – Bout duration effects

<table>
<thead>
<tr>
<th></th>
<th>Forwards (N = 51)</th>
<th>Whole game (N = 19)</th>
<th>Starter (N = 16)</th>
<th>Finisher (N = 16)</th>
<th>Whole game vs. Starter</th>
<th>Whole game vs. Finisher</th>
<th>Starter vs. Finisher</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time playing</strong></td>
<td>96 ± 12*</td>
<td>61 ± 11*</td>
<td>30 ± 13*</td>
<td>Most likely very large</td>
<td>Most likely very large</td>
<td>Most likely very large</td>
<td></td>
</tr>
<tr>
<td>(mins)</td>
<td></td>
<td></td>
<td></td>
<td>(−3.03 ± 1.03)</td>
<td>(−5.3 ± 1.5)</td>
<td>(−2.59 ± 0.95)</td>
<td></td>
</tr>
<tr>
<td><strong>Relative distance</strong></td>
<td>68 ± 6</td>
<td>66 ± 6</td>
<td>71 ± 9</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Unclear</td>
<td></td>
</tr>
<tr>
<td>(m·min⁻¹)</td>
<td></td>
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<tr>
<td><strong>High-speed distance</strong></td>
<td>10 ± 4</td>
<td>12 ± 5</td>
<td>17 ± 9*</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td></td>
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<tr>
<td>(m·min⁻¹)</td>
<td></td>
<td></td>
<td></td>
<td>(−0.32 ± 0.80)</td>
<td>(0.41 ± 0.70)</td>
<td>(−0.69 ± 0.65)</td>
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</tr>
<tr>
<td><strong>Acceleration frequency</strong></td>
<td>11 ± 20</td>
<td>10 ± 21</td>
<td>6 ± 10*</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>(min per acceler.)</td>
<td>8.3 ± 2.7</td>
<td>11.3 ± 2.5</td>
<td>12.8 ± 2.6</td>
<td>Other</td>
<td>Other</td>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Impact frequency (&gt;5G-min⁻¹)</strong></td>
<td>8.3 ± 2.7</td>
<td>11.3 ± 2.5</td>
<td>12.8 ± 2.6</td>
<td>Other</td>
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<th>Starter (N = 19)</th>
<th>Finisher (N = 3)</th>
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<th>Starter vs. Finisher</th>
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</thead>
<tbody>
<tr>
<td><strong>Time playing</strong></td>
<td>96 ± 8*</td>
<td>61 ± 14*</td>
<td>24 ± 9*</td>
<td>Most likely very large</td>
<td>Most likely very large</td>
<td>Most likely very large</td>
<td></td>
</tr>
<tr>
<td>(mins)</td>
<td></td>
<td></td>
<td></td>
<td>(−3.22 ± 0.93)</td>
<td>(−8.55 ± 1.96)</td>
<td>(−2.55 ± 0.99)</td>
<td></td>
</tr>
<tr>
<td><strong>Relative distance</strong></td>
<td>65 ± 4</td>
<td>71 ± 8</td>
<td>65 ± 15</td>
<td>Likely medium</td>
<td>Clear</td>
<td>Unlikely</td>
<td></td>
</tr>
<tr>
<td>(m·min⁻¹)</td>
<td></td>
<td></td>
<td></td>
<td>(1.01 ± 0.69)</td>
<td>(0.02 ± 0.59)</td>
<td>(0.53 ± 0.61)</td>
<td></td>
</tr>
<tr>
<td><strong>High-speed distance</strong></td>
<td>12 ± 3</td>
<td>16 ± 5</td>
<td>16 ± 2</td>
<td>Likely medium</td>
<td>Clear</td>
<td>Unlikely</td>
<td></td>
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<tr>
<td>(m·min⁻¹)</td>
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<td></td>
<td>(1.01 ± 0.69)</td>
<td>(1.44 ± 1.35)</td>
<td>(0.05 ± 0.59)</td>
<td></td>
</tr>
<tr>
<td><strong>Acceleration frequency</strong></td>
<td>5 ± 10</td>
<td>5 ± 9</td>
<td>4 ± 6</td>
<td>Clear</td>
<td>Unclear</td>
<td>Unlikely</td>
<td></td>
</tr>
<tr>
<td>(min per acceler.)</td>
<td>9.5 ± 3.1</td>
<td>9.6 ± 3.1</td>
<td>9.1 ± 6.4</td>
<td>Clear</td>
<td>Unclear</td>
<td>Unlikely</td>
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<tr>
<td><strong>Impact frequency (&gt;5G-min⁻¹)</strong></td>
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Notes: Data presented as mean ± SD. Role indicates whether a player completed the whole game (whole), started the game and was substituted (starter) or did not start the game and came on as a substitute (finisher). Acceleration frequency indicates how regularly players exceeded the acceleration threshold of 2.75 m·s⁻¹. Impact frequency indicates the number of time that player collision-forces exceeded 5G. * indicate significant difference from whole game and starters respectively (P < 0.05). Paired comparisons are a statement of the likelihood and magnitude of effects (Effect size ± 95%CI). Likelihood for substantial effects are described as possibly (25–75%), likely (75–95%), very likely (95–99.5%) and most likely (>99.5%).

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Forwards showed significant and practically meaningful reductions in running distance, high speed running distance and acceleration frequency over time.

Backs no change in playing intensity over time.
Results – Finishers vs Whole game players

For forwards there were significant and practically meaningful differences in all physical performance parameters vs. whole game players.

These differences diminished over time, but were still practically meaningful at the end of the game.
Practical implications

- Forwards reduce playing intensity of time, backs don’t.
- Load the bench with forwards!

- Plan the timing of substitutions carefully to maximise the bout effect.
- Players work harder if they know how long they will play for!

- Difference in playing intensity between whole game players and finishers is of concern.
- Investigate whether this is linked to injury risk!
Thanks for listening

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ORIGINAL ARTICLE

Pacing characteristics of whole and part-game players in professional rugby union

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