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Movement, Impact and Pacing Characteristics of South African Professional Rugby Players

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Professional Rugby Union

Rugby Union is characterised by short-duration, high-intensity efforts, interspersed by longer low-intensity periods of standing, walking and jogging.

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Diversity of Physical Requirements

The **game demands differ for players in different positions.**
(Deutsch *et al.*, 2007, J Sport Sci 25:4)

**Groupings**
- Forwards vs. Backs
- Tight forward, loose forward, scrumhalf, inside backs, outside backs

**Research Aim**

Understand how the physical challenges of the game differ for players in different positions
- What is the difference in movement and impact characteristics of players in different positions?
- What is the influence of match period and position on movement patterns?
Methods

19 players from a professional South African Rugby team volunteered to take part. Mean age 25.5 ± 2.4 years; Body mass 101.5 ± 12.2 kg, Stature 1.86 ± 0.07m

Players wore GPS devices in 24 competitive matches through the 2013 rugby season – 105 match participations were recorded.

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Methods – Global Positioning System (GPS)

Variables measured

- Playing time
- Relative distance (m.min\(^{-1}\)) in speed zones

**Speed bands**

- **Low intensity running 0-4m.s\(^{-1}\)**
  (Standing, walking and jogging)
- **High intensity running >4m.s\(^{-1}\)**
  (Striding and sprinting)

**Accelerometer**

- Total impacts >5G
- High intensity impacts >8G

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SPI Pro GPS unit
(GPSports, Canberra)
mass = 76g;
size = 87 x 48 x 20 mm
5Hz GPS Tracking
100Hz Tri-axial Accelerometer

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## Results

**Typical physical performance characteristics of a professional rugby union player**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean</th>
<th>% time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Distance (m.min(^{-1}))</td>
<td>69 ± 9</td>
<td>100%</td>
</tr>
<tr>
<td>Maximum Speed (m.sec(^{-1}))</td>
<td>8.3 ± 1.2</td>
<td>-</td>
</tr>
<tr>
<td>Low intensity running (m.min(^{-1}))</td>
<td>57 ± 7</td>
<td>96 ± 13%</td>
</tr>
<tr>
<td>High intensity running (m.min(^{-1}))</td>
<td>12 ± 5</td>
<td>4 ± 2%</td>
</tr>
<tr>
<td>Impacts &gt;5G (N.min(^{-1}))</td>
<td>10 ± 3</td>
<td></td>
</tr>
<tr>
<td>Impacts &gt;8G (N.min(^{-1}))</td>
<td>1 ± 0.5</td>
<td></td>
</tr>
</tbody>
</table>

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**Comparison – Forwards and Backs**

There is **no difference** in the **relative distance** covered or exposure to **acceleration forces** between forwards and backs.
Comparison – Forwards and Backs

Low and high intensity distance

<table>
<thead>
<tr>
<th></th>
<th>Forwards</th>
<th>Backs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Intensity</td>
<td>53</td>
<td>51</td>
</tr>
<tr>
<td>High Intensity</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

However, there are significant differences in the distances covered in low- and high-intensity speed zones.

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Due to their lower maximum speed, forwards are required to work relatively harder than backs throughout match play.

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Scrumhalves cover the most relative distance, and outside backs are the fastest position group.
Comparison – Positional groups

Low and high intensity distance

Tight forwards cover the most **low-intensity** distance, and the **least high-intensity** distance.

Scrumhalves cover the **most high-intensity** distance

**No difference** in movement requirements of **loose forwards and inside backs**

# indicates different from tight forwards, θ indicates scrumhalves different from all other groups

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Inside backs experience less total and high-intensity acceleration forces per minute than other positions.

BUT

Accelerometer recording do not reflect the actual number of contact (tackle/ruck) events

McLellan et al., (2011) JSCR 29(15)

# indicates different from tight forwards, loose forwards and outside backs; θ indicates different for outside backs only
Methods – Pacing strategies for different positions

102 match participations

Whole game players (n = 46)

1st half (27 backs, 19 forwards)

2nd half (27 backs, 19 forwards)

4 quartiles

4 quartiles

Statistics
• Factorial ANOVA
• Paired and independent sample t-tests
• Cohen’s effect size

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Results – Effect of half on total and high-intensity distance

* indicates significant difference from 1st half. T, S, M, L and VL indicate effect sizes trivial (≤0.2), small (0.2-0.5), medium (0.5-0.8), large (0.8-1.2) and very large (>1.2) respectively.

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Results – Total distance per match period

Total distance covered

- Backs
- Forwards

* indicates significant difference between backs and forwards, # indicated significant different from all other match periods. T, S, M, L and VL indicate effect sizes trivial (<0.2), small (0.2-0.5), medium (0.5-0.8), large (0.8-1.2) and very large (>1.2) respectively.

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Results – High-intensity distance per match period

High-intensity distance covered

* indicates significant difference between backs and forwards, # indicates significant different from match period 2nd half Q4. T, S, M, L and VL indicate effect sizes trivial (<0.2), small (0.2-0.5), medium (0.5-0.8), large (0.8-1.2) and very large (>1.2) respectively.
Results – Maximum speed and High-intensity impacts

The magnitude of difference in the physical outputs of forwards and backs increases during the middle periods of the match.
Conclusions – fatigue profile

Backs and forwards demonstrate differing fatigue profiles.

<table>
<thead>
<tr>
<th>Pacing profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forwards</td>
</tr>
<tr>
<td>“Slow positive”</td>
</tr>
</tbody>
</table>

Forwards progressively total and high-intensity distance, maximum speed, high-intensity acceleration frequency.

Backs maintain total and high-intensity distance, maximum speed, and high-intensity acceleration frequency for majority of match.
For the coach - Take home message

• The composition of workloads and rates of fatigue for players in different positions varies, and physical conditioning programs should reflect this.

• Players with greater proximity to the ball (forwards and scrumhalf) jog more, while players in wider positions sprint more often.

• Scrumhalves have unique positional requirements, and carry the greatest workload.

• Loose forwards and inside backs exhibit similar running requirements and can be grouped together for training.
Thank you for listening!

Acknowledgements
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