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.
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?

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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

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></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

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

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Comparison – Forwards and Backs

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

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Scrumhaves 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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Comparison – Positional groups

**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)

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**Acceleration / Deceleration Forces**

<table>
<thead>
<tr>
<th></th>
<th>Acceleration / Deceleration Forces (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tight forwards</td>
<td>10 (N &gt;5G/min)</td>
</tr>
<tr>
<td>Loose forwards</td>
<td>11 (N &gt;5G/min, N &gt;8G/min)</td>
</tr>
<tr>
<td>Scrumhalves</td>
<td>9 (N &gt;5G/min)</td>
</tr>
<tr>
<td>Inside backs</td>
<td>7 (N &gt;5G/min)</td>
</tr>
<tr>
<td>Outside backs</td>
<td>11 (N &gt;5G/min)</td>
</tr>
</tbody>
</table>

# 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.
Results – Total distance per match period

Total distance covered

- Backs
- Forwards

Relative Distance (m/min)

1st Half

S | M | S | T | T | S | T | L
Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4
40 | 50 | 60 | 70 | 80 | 90

2nd Half

Relative Distance (m/min)

- * indicates significant difference between backs and forwards
- # indicates 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.
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.
The magnitude of difference in the physical outputs of forwards and backs increases during the middle periods of the match.

Results – Maximum speed and High-intensity impacts
Conclusions – fatigue profile

Backs and forwards demonstrate differing fatigue profiles.

- **Backs** maintain total and high-intensity distance, maximum speed, and high-intensity acceleration frequency for the majority of the match.

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

**Pacing profile**

<table>
<thead>
<tr>
<th></th>
<th>Forwards</th>
<th>Backs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Slow positive&quot;</td>
<td></td>
<td>&quot;Flat&quot;</td>
</tr>
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</table>

**Pacing strategies of rugby union forwards and backs**

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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!

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