Unilateral leg strength: relevant to Rugby League speed?

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- Doctoral research.
Rugby League: Speed

Total number of high intensity accelerations 79.5±8, Gabbett (2013)

67.5% Sprints are between 6m and 20m Gabbett (2012)

Mean maximum velocity 9.0±1.03m/s for backs and 8.47±0.7m/s, McLellan and Lovell (2013)

Gabbett (2012) total sprints per game as, 36.5±9.3
Rugby League: Strength

Higher in elite RL players compared to sub-elite, (Baker and Newton, 2008) Related to tackle success and tackle success under fatigue, (Gabbett, 2008), Speranza et al. (2015)
Strength and Linear Speed

Strong correlations between 1RM BS and 10m (r = -0.94), Wisløff et al. (2004).

Significant increases were observed in changes in absolute and relative strength (p<0.001), Comfort et al. (2012), Keiner et al. (2014).

Strength gains correlated with sprint performance (r = 0.6 – 0.78), Styles et al. (2016).
Strength and Change of direction speed

Leg Strength  COD Time

(1RM BS (Bourgeois li et al., 2014), 3RM BS (McCormick et al., 2014), IMTP (Spiteri et al., 2014, Thomas et al., 2018),
Stronger Players = Better players

Tackle

Change direction

Sprint
Unilateral leg strength: relevant to Rugby League speed?

• *It was hypothesized that unilateral leg strength would correlate with performance in sprint and CODS measures.*
Experimental approach

• Unilateral Leg strength (asymmetry)
  • Rear foot elevated split squat (RFESS) five repetition maximum (5RM)
  • Validated by McCurdy et al (Strength) and Helme et al (asymmetry) (Under review)

• Linear Speed
  • Standing 20m sprint (0-10m, 10m-20m Splits)
  • Time, mean velocity, momentum

• Change of direction speed
  • Modified 5-0-5 test
    • Time, change of direction deficit
Participants

- With institutional ethical approval, 78 subjects were recruited from three RL teams. When exclusion criteria were applied (free from injury for six weeks prior to testing and available to attend both test dates) 28 were removed and 50 subjects were retained for testing.
- Post-hoc power analysis (G*power) found a 68% probability for an effect size of 0.5 and alpha level of error of 0.05, for this sample size.

<table>
<thead>
<tr>
<th></th>
<th>Elite academy (n=32)</th>
<th>Semi-professional (n=18)</th>
<th>Whole Group (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>17.3 ± 1</td>
<td>25.3 ± 5.3</td>
<td>20.71 ± 5.1</td>
</tr>
<tr>
<td>Mass (kg)</td>
<td>85.6 ±11.5</td>
<td>92.7 ±9.6</td>
<td>88.2 ±11.2</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.81 ± 0.1</td>
<td>1.83 ± 0.1</td>
<td>1.82 ± 0.1</td>
</tr>
</tbody>
</table>
Rear Foot Elevated Split Squat 5RM

• Review of the validity and reliability of the RFESS 5RM as a measure of leg strength symmetry
  • Paper currently under review (JSCR)

• Bar loads between test and re-test conditions a most likely very large positive correlation (r =0.93, CL 0.88-0.96) and an excellent level of reliability was found (ICC = 0.93 CL 0.88-0.96).

<table>
<thead>
<tr>
<th>Mean symmetry (all trials)</th>
<th>Standard error of the mean</th>
<th>Mean symmetry (test 1)</th>
<th>Mean symmetry (test 2)</th>
<th>ICC (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>102.15± 7.95%</td>
<td>1.29%</td>
<td>99.67 ±18.77%,</td>
<td>102.84 ± 6.35%</td>
<td>0.73, 0.39-0.89</td>
</tr>
</tbody>
</table>
Comparison of the effect sizes for correlation between 5RM RFESS using the mean of both legs and Linear speed performance

<table>
<thead>
<tr>
<th>Performance Variables</th>
<th>Effect Size (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean momentum 10-20m (kg.m/s)</td>
<td>Possibly Small Positive Correlation.</td>
</tr>
<tr>
<td>Mean Velocity 10-20m (m/s)</td>
<td>Unclear Association.</td>
</tr>
<tr>
<td>Mean momentum 0-10m (kg.m/s)</td>
<td>Unclear Association.</td>
</tr>
<tr>
<td>0-10m Sprint Time (s)</td>
<td>Unclear Association.</td>
</tr>
<tr>
<td>Mean Velocity 0-10m (m/s)</td>
<td>Unclear Association.</td>
</tr>
<tr>
<td>10-20m Sprint Time (s)</td>
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</tr>
</tbody>
</table>

No correlation

p > 0.05
Comparison of the effect sizes for correlation between 5RM RFESS using the mean of both legs and change of direction speed performance

Likely Moderate Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.
Likely Small Negative Correlation.

Effect Size (95% CI)
-1 -0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8 1

Performance Variables
- Mean change of direction deficit (s)
- Change of direction deficit, right side (s)
- Change of direction deficit, left side (s)
- Mean modified 5-0-5 time, (s)
- Modified 5-0-5 time, right side (s)
- Modified 5-0-5 time, let side (s)

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Modified 50-5 mean (s)
Modified 50-5 right (s)
Modified 50-5 left (s)
Change of direction deficit right (s)
Change of direction deficit mean (s)
Change of direction deficit left (s)

Almost Certainly Moderate Negative Correlation**
Almost Certainly Moderate Negative Correlation**
Almost Certainly Moderate Negative Correlation**
Most Likely Moderate Negative Correlation*

-1.5 -1.3 -1.1 -0.9 -0.7 -0.5 -0.3 -0.1 0.1 0.3 0.5 0.7 0.9 1.1 1.3 1.5

Magnitude Based inference
Performance Variables

Comparison of the effect sizes for correlation between 5RM RFESS, relative to body mass, using the mean of both legs and change of direction speed performance
Comparison of the effect sizes for correlation between 5RM RFESS, relative to body mass, using the mean of both legs and linear speed performance.
The relationship between body mass and mean unilateral leg strength, relative to body mass.

Almost Certainly Large Negative Correlation, $p = >0.01$

Mean relative strength $1.01 \pm 0.17$

@markhelme1
Conclusions and applications

• Absolute unilateral strength was not found to be associated with either linear or CODS.
• Relative unilateral leg strength is associated with improved CODS and linear sprint speed.
• Momentum was negatively linked to relative strength
  • Lighter people were stronger.
• Elite players are heavier than sub-elite and academy players.
• Heavier players (forwards) need to increase relative strength, to that of or greater than lighter (backs) players
  • Reduce fat mass
  • Increase lean tissue
  • Increase absolute strength.
Future directions and research
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References


References