# FIELD TESTING TO PREDICT PERFORMANCE IN RUGBY UNION PLAYERS

**Brian Green[1], Catherine Blake[1] and Brian Caulfield[1]**

**School of Physiotherapy and Performance Science, Health Sciences Centre, University College Dublin, Dublin, Republic of Ireland**

The purpose of this study was to identify the relationships between various field tests for leg power, sprinting speed and agility in a group of rugby union players. A group of 26 semi professional rugby union players each completed a test protocol consisting of a unilateral horizontal triple jump, 10 and 30M linear speed sprint tests, a change of direction test and a reactive agility speed test. Simple correlation analysis revealed multiple strong relationships between measured variables, most notably between linear speed and reactive agility speed (r=0.72-0.83). Multiple regression analysis indicated that linear speed and change of direction speed could predict 81% of the variance in reactive agility speed.

**KEY WORDS:** performance, testing, agility, rugby, jump.

**INTRODUCTION:** Professionalism in Rugby union has placed emphasis on the strength and conditioning field as a key component for success. Strength and conditioning staff formulate physical development programs based around the specificity of rugby union, thus focusing on the critical components of performance in order to optimize outcomes.

Data from American football demonstrate a link between performance testing outcome and achievement on the field (Garstecki et al., 2004). It has also been observed that performance testing that replicate sport specific tasks are more effective in distinguishing players of varying skill and playing level (Gabbett et al, 2008). Rugby union is a complex game that requires frequent short duration sprints with changes in multiple directions in reaction to other player movements during play (Deutch et al., 2007). Therefore, it seems logical to incorporate anticipated and unanticipated change of direction components to test protocols in order to account for the cognitive and perceptual factors that contribute to agility performance (Sheppard & Young, 2006).
Indeed, in recent studies (Green et al Unpublished Data) we have demonstrated that reactive agility testing can be used in rugby union to distinguish between players at different levels of ability. However, rugby specific reactive agility speed testing is a complex procedure that requires the use of expensive timing gates with random triggering/signaling functionality. Therefore, identification of factors that could effectively predict reactive agility in rugby players would be advantageous to coaches and trainers. Several investigators have examined relationships between various field tests yet there is a need to establish relationships between simple field tests and reactive agility. The purpose of this study is to investigate potential relationships between measures of leg power, linear speed, and agility. Furthermore, we wish to determine whether triple jump (TJ) performance, linear speed (LS), change of direction speed (CODS) can be used to effectively predict reactive agility speed (RAS) in rugby union players.

**METHODS:** **Study design.** This was cross-sectional observational study based on comparison of TJ, LS, CODS, RAS performance in a group of semi professional rugby players.

**Participants.** Data was collected from 26 rugby union players who were members of All-Ireland League squads. The average (±SD) age, height and body mass of the subjects were 19.5 ± 1.5 years, 1.84 ± 0.07 m, and 96.2 ± 14.9 Kg, respectively. This is a professional development league immediately below full-time professional competitions. The study was approved by the institutional ethical review committee and written informed consent was obtained from each subject. Subjects completed a physical screening questionnaire, anthropometric measurements, a functional movement screen, and a structured warm-up. Inclusion criteria were (1) within the ages of 18-23, (2) healthy and physically active, (3) currently playing rugby union for a club participating in the All-Ireland League. Exclusion criteria included (1) a lower extremity injury within the past 3 months resulting in loss of participation for 3 consecutive practice sessions or games, (2) current spine, hip, knee or ankle pain, (3) history of lower extremity neurovascular symptoms.

**Procedures.** Each subject performed testing in a multi-station non-randomized format in the following order: a structured warm up, TJ, 10/30m LS, CODS, and RAS trials. Subjects were given a demonstration prior to 3 sub maximal practice attempts. All testing was performed in one session 4 weeks into the pre-season.

**Unilateral Horizontal Triple Jump.** Jumping distance was measured for 3 trials of left and right foot TJ. Subjects stood on the test leg and jumped forward on the same leg, landing on both feet after the third jump. Arm movement was allowed. A measurement from the back of the heel closest to the starting line was taken using a T-square aligned perpendicular to the tape measure. Subjects had 2 minutes rest between trials.

**10/30 Meter Linear Speed.** 3 trials of LS over 0m-10m-30m were measured using electronic timing gates (Fusion Sport Smart Speed, Brisbane, Australia). The starting line was placed 0.7m behind the starting. Subjects performed a standing start and sprinted to cones that were placed 5m beyond the 30m timing gate. No hopping or backward movement was allowed prior to the start. Subjects were given 3 minutes rest between trials.

**Change of Direction Speed Test.** CODS was measured using electronic timing gates (Fusion Sport Smart Speed, Brisbane, Australia). White tape and cones were placed on the floor to guide and facilitate a sharp $45^0$ degree cut. Subjects sprinted forward 5m then changed direction in order to pass through either the left or right finish gate placed 5m away. Each subject performed 3 cutting trials to the left and right, respectively with 2 minutes rest between trials.

**Reactive Agility Speed Test.** RAS was measured using electronic timing gates arranged in the same fashion as the CODS test. A timing gate was placed 0.5m from the start gate triggering either the left or right finish gates to flash. The subject would react to the flashing gate and change direction $45^0$ to run through the finish gate. Each subject performed 6 trials (3 left, 3 right) in a random order with 2 minutes rest between trials.

**Data analysis and Statistical Testing.** Means for all variables were first calculated for each subject. In the case of LS measures the average of 3 trials was calculated whereas in the case of all other variables an average was calculated from 6 (3 left and 3 right) trials. To establish relationships between individual pairs a simple correlation analysis was performed by calculating Pearson's correlation coefficient (R). The level of significance was calculated using a t-test. Relationships of $R > 0.6$ were considered 'strong' (Swinscow, 1997). Following this, we performed a multiple regression analysis in order to explain the relationships between separate sets of independent variables and RAS (the dependent variable). Significance was established in each case using an ANOVA F-test.

**RESULTS:** The results of the simple correlation analysis are outlined in Table 1. Strong relationships were observed between most of the measured variables. The strongest relationships existed between measures of LS, CODS and RAS. The relationships between TJ and 10m LS and RAS were only moderate in nature.

Multiple regression statistics are outlined in Table 2. LS measures taken alone were good predictors of RAS ($R^2$=0.72, $P$<0.0001). Further analysis revealed a stronger relationship when LS and CODS were used to predict RAS ($R^2$=0.81, $P$<0.0001). Addition of TJ to the multiple regression process did not improve the strength of the prediction, when taken alone with measures of LS or with measures of LS and CODS.

**Table 1. Simple Correlation Analysis**

| | *TJ* | *10M LS* | *30M LS* | *CODS* | *RAS* |
|---|---|---|---|---|---|
| TJ AVG | 1.00 | | | | |
| 10M LS AVG | -0.47 | 1.00 | | | |
| 30M LSAVG | -0.66* | 0.95* | 1.00 | | |
| CODS | -0.54 | 0.81* | 0.79* | 1.00 | |
| RAS | -0.69* | 0.72* | 0.83* | 0.78* | 1.00 |

Value denotes Pearson's correlation coefficient indicating strength of relationship between opposing variables. Correlation coefficients greater than 0.6 have been shaded in grey in order to highlight areas where relationship between variables is strong. * indicates statistically significant Pearson's correlation coefficient as determined using a t-test at $P$<0.05) level.

**Table 2. Multiple Regression Analysis between TJ, LS, CODS (independent variables) and RAS**

| *Variables* | $R^2$ | *Level of Significance* |
|---|---|---|
| 10m LS + 30m LS | 0.72 | P< 0.0001 |
| 10m LS, 30m LS +TJ | 0.72 | P< 0.0001 |
| 10m LS, 30m LS, CODS | 0.81 | P< 0.0001 |
| 10m LS, 30m LS, TJ, Agility | 0.81 | P< 0.0001 |

**(dependent Variable)**

**DISCUSSION:** In this study we have identified strong relationships between measures of LS, TJ, CODS, and RAS. In particular, we have established that relatively simple field tests of LS and CODS can be used to effectively predict RAS in rugby union players, accounting for 81% of the variance in RAS. This is an important finding in light of our previous work that identified that RAS is a strong indicator of playing level in rugby union players.

The only previous attempt to establish relationships between measures of LS, CODS and RAS was performed by Gabbett et al. (2008) who performed an analysis of relationships between LS, CODS and RAS in 42 rugby league players. They demonstrated statistically significant relationships between 10 and 20m sprint times and reactive agility speed. However, the strength of relationship was not strong with Pearson's correlation coefficients of $r$ = 0.41 and 0.51 respectively. In our study, we have observed much stronger relationships between LS and RAS, with Pearson's correlation coefficients of 0.72 and 0.83 describing the relationship between RAS and 10 and 30M LS respectively. Differences in results may be related to differences in the test protocol for RAS testing. The Gabbett protocol involved reaction to the movement of another player whereas our protocol was based on reaction to a light that was timed to illuminate at a fixed delay from the starting point and could be considered to be less complex in nature.

Several investigators have examined horizontal jumping tests and their relationship to LS. Maulder and Cronin (2005) performed various horizontal and vertical jumping tests and investigated their relationship to 20m linear speed. Unilateral horizontal triple jump demonstrated the highest correlation to linear speed ($r$ = -0.86 P<0.001). Our results are not as strong as this with Pearson's correlation coefficients of $r$ = -0.47 and -0.66 explaining the relationship between TJ and 10m and 30n LS respectively. It is possible that differences in outcome could be related to differences in athlete training and body type profiles. Nesser et al. (1996) reported that the 5 step alternating bound for distance test highly correlates ($r$ = -0.810) to 40m LS. Taken alone, TJ in our study was strongly related to 30M LS and RAS performance and can be considered to account for 43 and 47% its variance.

**CONCLUSION:** The objective for field-testing is to place a player in a sports specific environment in order to identify skill level and measure training effects. Identifying relationships between performance variables allows strength and conditioning staff to choose appropriate tests in order to maximize time and equipment. These results suggest that LS, TJ, and CODS field tests can identify potential for performance on more complex sport specific tasks (RAS).

**References**:


Duetsch, M.U., Kearney, G.A., and Rehrer, N.J. (2007). Time-motion analysis of professional rugby union players during match-play. *Journal of Sport Sciences*, 25, 461-472.

Gabbett, T.J., Kelly, J.N., and Sheppard, J.M. (2008). Speed, change of direction speed, and reactive agility of rugby league players. *Journal of Strength and Conditioning Research,* 22, 174-181.

Garstecki, M.A., Latin, R.W., and Cuppett, M.M. (2004) Comparisons of selected physical fitness and performance variables between NCAA division I and II football players. *Journal of Strength and Conditioning Research*, 18, 292-297.

Green, B., Blake, C., and Caulfield, B. Comparisons of linear speed, change of direction speed and reactive agility speed in rugby union players of varying skill level. Submitted for publication.

Maulder, P., and Cronin, J. (2005). Horizontal and vertical jump assessment: reliability, symmetry, discriminative and predictive ability. *Physical Therapy in Sport*, 6, 74-82.

Nesser, T.W., Latin, R.W., Berg, K., and Prentice, E. (1996). Physiological determinants of 40-meter sprint performance in young male athletes. *Journal of Strength and Conditioning Research,* 10, 263-267.

Sheppard, J.M., and Young, W.B. (2006). Agility literature review: classifications, training and testing. *Journal of Sport Sciences*, 24, 919-932.

Swinscow, T.D. (1997). *Statistics at square one* (9$^{th}$ edn). University of Southhampton, UK: BMJ Publishing Company.