

Research article

Rugby game-related statistics that discriminate between winning and losing teams in IRB and Super twelve close games

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Abstract

The aim of the current study was to identify the Rugby game-related statistics that discriminated between winning and losing teams in IRB and S12 close games. Archival data reported to game-related statistics from 120 IRB games and 204 Super Twelve games played between 2003 and 2006. Afterwards, a cluster analysis was conducted to establish, according to game final score differences, three different match groups. Only the close games group was selected for further analysis (IRB $n = 64$ under 15 points difference and Super Twelve $n = 95$ under 11 points difference). An analysis to the structure coefficients (SC) obtained through a discriminant analysis allowed to identify the most powerful game-related statistics in discriminating between winning and losing teams. The discriminant functions were statistically significant for Super Twelve games (Chi-square = 33.8, $p < 0.01$), but not for IRB games (Chi-square = 9.4, $p = n.s.$). In the first case, winners and losers were discriminated by possessions kicked (SC = 0.48), tackles made (SC = 0.45), rucks and pass (SC = -0.40), passes completed (SC = 0.39), mauls won (SC = -0.36), turnovers won (SC = -0.33), kicks to touch (SC = 0.32) and errors made (SC = -0.32). The minus sign denotes higher values in losing teams. Rugby game-related statistics were able to discriminate between winners and losers in Super Twelve close games and suggest that a kicking based game supported by an effective defensive structure is more likely to win matches than a possession based one.

Key words: Game-related statistics, performance profiles, match analysis.

Introduction

Match analysis in Rugby is often used to evaluate and monitor team and individual performances. The game of Rugby is complex and chaotic, with circumstances changing from game to game, even from phase to phase, due to many varying conditions, including the weather, the strategies and tactics, the available personnel or the standing in the competition. This exposure to match volatility must be considered when establishing an observational and analysis system. However, despite the range of detailed analysis there is no obvious structure or progressive evolution to the development of analysis methods and there are still large gaps in the literature especially in the area of Rugby. In fact, empirical research investigating performance in Rugby union has generally been limited to studies exploring teams' patterns of play or physiological estimates of positional work rates of individual players

(Deutsch et al., 2007; Duthie et al., 2005; Hughes and White, 1996).

The current trend in video analysis is the development of performance profiles to describe individual or team patterns created from combinations of key performance indicators. This area is of great interest for research and training purposes (Hughes and Bartlett, 2002). In Basketball research, for example, the most discriminant game-related statistics between winning and losing teams have been identified allowing for a better understanding of game determinants (Sampaio and Janeira, 2003; Gómez et al., 2009; Sampaio et al., 2010a; Sampaio et al., 2010b). It was especially interesting to note that the differences between winning and losing teams could be detected even during close scoring matches. This shows that there are distinguishing features of Basketball play that can be identified when teams are evenly matched and are placed in high stress situations.

Although the current research and several previous studies have suggested that certain factors contribute to Rugby successful performances (Hughes & White, 1996; O'Donoghue & Williams, 2005) there has been scarce research into the creation of a model of Rugby union performance incorporating all aspects of this team sport. James et al. (2005) developed position specific key performance indicators and performance profiles for ten different Rugby positions. They found intra-positional variability and concluded that there is a need for more than one profile per playing position. Their conclusion was that there are many different playing styles within given positions, all of which can be equally effective for the team.

Bracewell (2003) has quantified the performance of individual Rugby players using multivariate analysis and modified control chart methodology. The results showed that individual Rugby player performance could be explained by contextual ratings on a game-by-game basis from match data using a combination of dimension reduction techniques and an adaptation of multivariate control methodology. In fact, the performance indicators do not necessarily relate directly to individual or team performance outcomes, but they may be related to various game strategies and structures.

Van Rooyen et al. (2005) performed a retrospective analysis of IRB statistics and used video analysis of match play to explain the performance of four teams in the 2003 Rugby World Cup. Differences were observed between the four teams in three performance variables:

number of penalty kicks and drop goals scored, and percentage possession. Another study has contrasted specifically winning and losing teams in Rugby Union games (Jones et al., 2004a), using twenty league matches from the domestic season of a professional male Rugby union team.

Through a computerized behavioural analysis system, twenty-two performance indicators were recorded but only the lineouts won on the oppositions throw and tries scored were able to statistically distinguish winning from losing performances. Other performance indicators were deemed to have practical relevance when distinguishing between winning and losing, these include turnovers won from opposition possession. It was obvious to see winning teams having a greater number of tries than losing teams however, it was interesting to note that winning won a significant amount of possession through stealing the ball from an opposition lineout and at the breakdown situation. Turnovers and stolen lineouts are forms of possession where the opposition's defense can be caught by surprise. These data suggest that coaches should optimize their training sessions by teaching players how to compete on the opposition's lineout throw and how to compete effectively in contact situations when the opposition has the ball.

No study has contrasted winners and losers using a large sample of high-level games, neither have they controlled for differences in final game score. Therefore, the aim of this study was to analyze a large sample of Rugby matches from northern and southern hemisphere competitions, apply a measure to control for the differences in match scores and to determine if there are any game-related statistics that can discriminate between winning and losing teams.

Table 1. Results from cluster analysis according to game final score differences (close, balanced and unbalanced games).

Group	Cluster Group	Score Differences	Games (%)
IRB	Close Games	0 a 15 points	64 (53%)
	Balanced Games	16 a 34 points	46 (38%)
	Unbalanced Games	35 a 53 points	10 (8%)
S12	Close Games	0 a 11 points	95 (46%)
	Balanced Games	12 a 25 points	79 (39%)
	Unbalanced Games	26 a 43 points	30 (15%)

Methods

Sample and variables

Archival data was gathered from all International Rugby Board (IRB) competitions (n = 224 games) involving northern and southern hemisphere international teams (n=120, World Cup, 6 Nations and Tri Nations) and southern hemisphere regional teams (n = 204, Super 12 or S12) played between 2003 and 2006.

Data was collected by using a digital video analysis system (*Rugby Stats Fair Play Sports Analysis Systems V₂, Australia*) and *Rugby Match Analysis and Statistics (IRB - Computacenter/S.A.S, 2003)*. The game-related statistics that determine game outcome are dependent upon final score differences, therefore and following suggestions by the available literature (Sampaio and Ja-

neira, 2003), a cluster analysis was conducted to establish three different groups of games according to final score differences (see Table 1). The cluster analysis was performed separately to IRB and S12 data in order to preserve the competitions style of play. Results allowed assigning a range of point differences to the various groups, close, balanced and unbalanced games for both the IRB and S12 data. Only the close games clusters were selected for final analysis, the IRB group gathered 64 games with final score differences under 15 points and the S12 group gathered 95 games with final score differences under 11 points.

The variables gathered by the specialized data centres were the following: Scrums won and lost, Lineout's won and lost, Penalties conceded, Free kicks awarded, Ruck and drive, Ruck and pass, Mauls won and lost, Turnovers won on opposition possession, Passes completed, Possession kicked (not including penalties or free kicks that were kicked to touch), Errors from kicks, Kicks to touch, Tackles made and missed, Error made, Tries, Conversions, Penalty goals and Drop goals awarded. A random sample of 10 games was used to test inter-rater reliability (kappa coefficients) using two experienced analysts. The results had agreement coefficients of at least 0.91.

Data analysis

All data gathered were converted to z-scores and the differences between winners and losers were tested by repeated measures ANOVA. Following this procedure, discriminant analysis was performed in order to determine: i) which of the obtained variables are more useful in predicting game final outcome in close games either for IRB or S12 matches; ii) the mathematical equation that enhanced differences in variable means between winning and losing teams, and, iii) the accuracy of the equations. Assumptions on discriminant analysis were for independence amongst variables, multivariate normal distribution and equal variance-covariance across groups (Silva and Stam, 1995). The variables in our study are derived-rate variables and the discriminant analysis is considered to be robust with these variables (Norusis, 1993). Interpretation of the discriminant functions was based on examination of the structure coefficients greater than 0.30 (Pedhazur, 1982; Tabachnick and Fidell, 1989). In order to facilitate understanding, the data is presented as means \pm standard deviations and the statistical significance for all tests was set at 95%. The statistical analyses were performed using SPSS software release 15.0.

Results

Results from repeated measures ANOVA did not identify any statistically significant differences between winners and losers in the games from the IRB group (see Table 2).

For the S12 group, several differences were identified (see Table 3). The winning teams made fewer rucks and pass movements, won more mauls and turnovers, completed fewer passes and made fewer errors ($p < 0.05$). They also kicked a greater amount of their possession (including kicks to touch) and made more tackles ($p < 0.05$).

Table 2. Game performance parameters in close games from the IRB Group (n = 64). Data are means (\pm SD).

Game-related statistics	Winners	Losers	F
Scrum won	10.7 (4.2)	10.0 (4.2)	.90
Scrum lost	1.0 (1.6)	.8 (1.3)	.72
Lineouts won	16.3 (4.5)	16.1 (4.9)	.05
Lineouts lost	2.3 (2.0)	2.8 (2.2)	1.87
Penalty conceded	10.5 (3.3)	11.1 (2.9)	.89
Free kicks	1.0 (1.2)	1.0 (1.0)	.00
Rucks and drive	22.0 (17.3)	19.8 (10.5)	.75
Rucks and pass	29.5 (15.3)	30.2 (14.2)	.06
Mauls won	24.1 (16.3)	23.8 (19.3)	.00
Mauls lost	4.9 (3.6)	4.9 (3.6)	.00
Turnovers won	12.1 (9.2)	12.4 (9.1)	.02
Passes completed	105.3 (36.5)	106.2 (37.6)	.01
Possession kicked	23.0 (9.4)	20.9 (8.9)	1.65
Errors from kicks	5.3 (3.2)	4.9 (3.1)	.48
Kicks to touch	10.6 (4.7)	10.5 (4.6)	.01
Tackles made	88.0 (27.6)	89.8 (37.8)	.09
Tackles missed	18.4 (13.8)	20.7 (14.7)	.86
Errors made	12.5 (7.9)	12.4 (7.9)	.01

No significant difference between the groups.

Accordingly, the discriminant function structure coefficients (SC) and test of statistical significance for game performance parameters was statistically significant for S12 (Chi-squared = 33.8, $p < 0.05$), but not for IRB games (Chi-squared = 9.4, $p = n.s.$). The winners and losers in the S12 group (Table 3), were discriminated by possessions kicked (SC = 0.48), tackles made (SC = 0.45), rucks and pass (SC = -0.40), passes completed (SC = 0.39), mauls won (SC = -0.36), turnovers (SC = -0.33), kicks to touch (SC = 0.32) and errors made (SC = -0.32). The final reclassification from the analysis was high (78%).

Table 3. Game performance parameters in close games from the S12 Group (n = 95). Data are means (\pm SD).

Game-related statistics	Winners	Losers	F
Scrum won	11.4 (4.3)	10.4 (3.4)	2.94
Scrum lost	.6 (.8)	.7 (1.0)	.10
Lineouts won	16.5 (5.4)	16.2 (5.1)	.18
Lineouts lost	2.9 (1.8)	3.4 (3.2)	1.93
Penalty conceded	9.7 (3.2)	9.7 (2.8)	.01
Free kicks	.9 (1.0)	.8 (1.2)	.13
Rucks and drive	21.6 (13.1)	24.6 (14.7)	1.99
Rucks and pass	22.3 (10.3)	26.4 (11.0)	6.44*
Mauls won	37.4 (13.9)	42.6 (16.5)	5.12*
Mauls lost	7.5 (7.4)	7.9 (6.7)	.11
Turnovers won	22.4 (4.9)	24.0 (5.7)	4.35*
Passes completed	80.8 (23.2)	89.9 (25.3)	6.25*
Possession kicked	15.7 (4.9)	13.6 (4.3)	9.33**
Errors from kicks	5.8 (3.1)	6.5 (3.3)	1.80
Kicks to touch	11.6 (4.2)	10.4 (3.9)	4.25*
Tackles made	112.7 (33.1)	99.4 (30.0)	8.01**
Tackles missed	36.6 (16.4)	33.8 (13.3)	1.56
Errors made	11.7 (4.3)	13.0 (4.4)	4.08*

* $p < 0.05$, ** $p < 0.01$.

Discussion

The aim of the current study was to identify if there were any Rugby game-related statistics that could discriminate

between winning and losing teams in IRB and S12 close scoring games. Globally, there were differences found, but these only reached significance with the S12 matches, even though these close matches were separated by fewer points (a maximum of 11 points for S12 vs. a maximum of 15 points for IRB matches) than the IRB games. These final score differences between the IRB and S12 matches may suggest that winning and losing teams score on average more points in international matches and that this is probably due to a higher skill level of the players but this should be a subject of further research.

There were very few descriptors that showed a consistent trend between the IRB group and the S12 group. However, the data showed that winning international and regional matches during 2003 and 2006 consistently kicked away possession and were more effective at retaining the ball on their own lineout than losing teams.

It was also interesting to note that winning teams also made fewer passes and won fewer turnovers on their opposition's possession. This later finding contrast with the work of Jones et al. (2004a), who found that winning teams won more possession from their opposition at the breakdown situation. Explanations on this contrast may be related to sample size and type as Jones et al. (2004a) analyzed twenty league matches from the domestic season of a professional male Rugby union team.

Table 4. Discriminant Function Structure coefficients (SC) and test of statistical significance for Performance parameters in S12 group.

Game - Related Statistics	SC
Possessions kicked	.48*
Tackles made	.45*
Rucks and pass	-.40*
Passes	.39*
Mauls won	-.36*
Turnovers won	-.33*
Kicks to touch	.32*
Error made	-.32*
Scrum won	.27
Rucks and drive	-.22
Lineouts lost	-.22
Errors from kicks	-.21
Tackles missed	.20
Lineouts won	.06
Free kicks	.05
Mauls lost	-.05
Scrum lost	-.05
Penalty conceded	.01
Canonical correlation	.42
Chi-squared	33.8
Wilks Lambda	.81

* $p < 0.05$.

The general lack of significant differences between winning and losing teams for the analyzed games suggest the existence of different movement patterns, styles of play and performance profiles in Rugby teams. In the IRB group, winning and losing teams' performances in the analysed variables were very similar. In fact, it was not possible to get a different pattern for winners and losers in close games, which may further suggest that teams use several different ways to win.

This idea is supported because the IRB data consisted of a combination of Northern vs Northern, Southern vs Southern and Northern vs Southern hemisphere teams and previous work has shown differences between the playing styles of northern and southern hemisphere teams (Jones et al., 2004b).

The S12 group did elicit several discriminatory variables (see Table 4) that could distinguish between a winning and a losing team's game profile. This study found that kicking the ball away and making more tackles than the opposition were the two most influential factors in determining winning from losing teams. Although speculative, this therefore tends to suggest that the winning S12 teams are able to effectively kick possession away and defend the territorial gains that they have won through their ability to make more tackles. It is interesting to note that the losing teams lost more of their lineouts than the winning teams, indicating that winning teams can successfully steal the ball from the opposition's lineout and convert the resulting possession to points.

It is acknowledged that the differences between the lineouts lost for both winning and losing teams was not significant in this study as it was in the one by Jones et al. 2004a however, the location on the field where the lineout was lost might be of more significance than just the frequency of how many lineouts were lost. For example a lineout that was lost deep inside the defensive 22 is more likely to result in points being conceded than lineout ball that was lost in the midfield area, but this suggestion requires further research.

The other significant differences recorded during this study between the two groups of regional teams can simply be explained by different playing patterns, especially as this study shows that winning teams prefer to kick possession away for territorial advances than to play a more 'ball-in-hand' possession dominated style that requires more passes, rucks and mauls in order to win similar territorial gains to the winning teams.

Conclusion

In summary, this study shows that international competitions that include teams from all nations are unlikely to show statistically significant differences between winning and losing teams when the difference between the final score is 15 points or less. These differences either do not exist at this level of significance or these differences are being obscured by differences in playing style, especially when matches are played by a northern and southern hemisphere team, however further research is required to confirm this suggestion. Regional competitions do elicit significant differences between winning and losing teams and suggest that a kicking based game plan is a more effective style of play during the S12 competition than an open running possession dominated game. However it must be stressed that a kicking game must be supported by a well organised defense that is able to tackle well if the strategy is to be successful.

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Key points

- Winning teams made fewer passes and won fewer turnovers on their opposition's possession.
- International competitions that include teams from all nations are unlikely to show statistically significant differences between winning and losing teams when the difference between the final score is 15 points or less.
- Regional competitions do elicit significant differences between winning and losing teams and suggest that a kicking based game plan is a more effective style of play during the S12 competition than an open running possession dominated game.

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