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Performance indicators that discriminate winning and losing in elite men's and women's Rugby Union

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Abstract

This study aimed to identify performance indicators that discriminate winning and losing in elite men's and women's Rugby Union during the latest World Cup competitions. The knockout stages of the men's 2015 Rugby World Cup (n = 8) and women's 2014 Rugby World Cup (n = 8) were compared. Findings suggest that in the men's game, winning teams kicked a greater percentage of possession in the opposition 22-50m with a view to gaining territory and pressuring the opposition (winners = 16%, losers = 7%). In the women's game successful teams adopted a more possession driven attacking approach in this area of the pitch. Successful women's teams appear more willing to attack with ball in hand following a kick receipt and adopt a more expansive game through attacking with wider carries in the outside channels. The percentage of lineouts won on the opposition ball was found to be an important performance indicator that discriminates winners and losers, regardless of sex (winners = 18%, losers = 11%). Findings suggest successful men's and women's teams adopt different tactical approaches to knockout competitions, this knowledge should be used as a basis for coaches to develop tactical approaches and training methods which are sex dependent.

1 **Introduction**
2
3 The observational study of teams and players has become an important factor when

4 applying effective coaching, training and selection in team sports (Hughes & Bartlett,

5 2002). Understanding factors that determine game success is crucial to enable coaches

6 to adopt effective tactical strategies, with Rugby Union benefiting significantly from the

7 introduction of performance analysis and the professional era leading to a drive to

8 maximize performance through improved scientific and analytic support (Vaz,

9 Mouchet, Carreras, & Morente, 2011). Seminal work primarily focused on patterns of

10 play (Eaves & Hughes, 2003; Eaves, Hughes, & Lamb, 2005) and the physiological

11 demands of the sport (Austin, Gabbett, & Jenkins, 2011; Cunniffe, Proctor, Baker , &

12 Davis, 2009; Deutsch, Kearney, & Rehrer, 2007). However, more recently the focus of

13 research has been to establish performance profiles for individuals or teams and

14 importantly to apply these to match outcome (Vaz et al., 2011). As such, several studies

15 have identified factors that discriminate successful and unsuccessful performance in the

16 elite game (Bishop & Barnes, 2013; Hughes et al., 2012; James, Mellalieu, & Jones,

17 2005; Jones, Mellalieu, & James, 2004; Ortega, Villarejo, & Palao, 2009).

18 Performance indicators may be defined as "a selection, or combination, of action

19 variables that aim to define some or all aspects of a performance" (Hughes & Bartlett,

20 2002, p.739). With the aim of informing tactical approaches to the game, previous

21 research has focused on identifying performance indicators that determine match

22 outcome (Bishop & Barnes, 2013; Bremner, Robinson, & Williams, 2013; Ortega et al.,

23 2009; Stanhope & Hughes, 1997; Van Rooyen, Diedrick, & Noakes, 2010; Vaz et al.,

24 2010). Those indicators previously related to winning include, lineout success (Jones,

25 Mellalieu, & James, 2004; Ortega et al., 2009; Vaz et al., 2010), turnovers conceded

26   (Ortega et al., 2009; Vaz et al., 2011), ruck speed (Bremner et al., 2013) and number of

27   kicks out of hand (Ortega et al., 2009; Stanhope & Hughes, 1997; Vaz et al., 2011). In

28   addition, winning teams have been found to be more effective at crossing the gain line

29   (Bremner et al., 2013; Diedrick & Van Rooyen, 2011), miss fewer tackles (Ortega et al.,

30   2009; Vaz et al., 2011), make more line breaks (Ortega et al., 2009) and make fewer

31   carries (Bishop & Barnes, 2013) than losing teams. Variation between studies in the key

32   performance indicators that relate to match outcome, may be the result of the sample

33   studied which was a mixture of domestic and international competitions, Northern and

34   Southern hemisphere and league and knockout competitions. Van Rooyen et al. (2010)

35   found differences in the performance indicators between the knockout and the pool

36   stages of the 2007 World Cup. This supports the notion that a team's tactical approach

37   may, indeed, be influenced by the format of the competition and the quality of

38   opposition.

39   The Rugby World Cup brings together the best players and international teams in the

40   world. Analysis of this competition allows an understanding of how the game is played

41   at the elite level and the tactics used by successful teams. Despite this, the game is

42   changing rapidly and research conducted on different competitions suggests the style of

43   play used by successful teams has evolved over time. Van Rooyen and Noakes (2006)

44   found successful teams adopted a more possession based approach to attacking when

45   studying the semi-finalists of the 2003 Rugby World Cup. However, at the 2007 World

46   Cup, all eight of the knockout matches were won by teams with a lower ruck frequency

47   (Van Rooyen et al., 2010). This suggests a more territory-based approach through

48   kicking and pressuring the opposition compared to a possession orientated strategy.

49   More recent evidence from the 2011 Rugby World Cup supports this notion with

50   winning teams making fewer carries (25 fewer) and completing fewer rucks (22 fewer)

51   than losing teams (Bishop & Barnes, 2013). These data suggest that in knockout rugby

52   at the highest elite level, winning teams favour a territory based rather than a possession

53   based approach to the game. However, since 2011 World Rugby have introduced

54   several new laws, many of which aim to increase the ball in play time, speed up the

55   game and make it a more attractive prospect for spectators (World Rugby, 2015). This

56   suggests that tactical approaches may also have developed overtime to meet the needs

57   of the modern game.   An up-to-date analysis is warranted to establish if styles of play

58   have changed since the 2011 Rugby World Cup and help to establish game based

59   knowledge and ensure coaching strategies and tactical approaches are current.

60

61   Although traditionally a male sport, the International Rugby Board included female

62   rugby within the union in 1994. In more recent years, women's rugby has seen a 90%

63   increase in participation levels since 2004 with over 15000 registered players in the

64   2013 season (England Rugby, 2013). At the elite level, many international teams now

65   have full-time professional players. Despite this, there is a clear lack of published

66   research on the women's game, how it is played, and what factors are important for

67   match success.). Elite female players have been found to travel less distance in a match

68   at a lower average speed than male players, as well as spending 10.5% less time in the

69   high intensity running or sprinting zones (Cunniffe et al., 2009; Suarez-Arrones et al.,

70   2014). In addition, a lower average number of impacts in the female game (n=704.8

71   impacts; Suarez-Arrones et al., 2014) compared with the male game (n=1274 impacts;

72   Cunniffe et al., 2009) have been reported. Although based on a small sample of eight

73   elite players (Suarez-Arrones et al., 2014), these initial findings suggest that the

74   women's game is played at a slower pace with fewer game related impacts. Physical

75   characteristics measured in male rugby players have been found to play a critical part in

76   performance behaviours associated with success (Smart, Hopkins, Kenneth, Quarrie, &

77   Gill, 2014). Smart et al. (2014) found player speed to correlate with line breaks, tackles,

78   breaks and tries scored during games, variables that have previously been shown to

79   relate to match success (Bremner et al., 2013; Diedrick & Van Rooyen, 2011; Ortega et

80   al., 2009; Vaz et al., 2011). In the women's game, a slower paced match with fewer

81   impacts associated with tackles, carries and rucks suggests the style of play adopted by

82   elite men's and women's teams may differ. Therefore, a comparison of men's and

83   women's competitions is warranted to help establish sex specific performance indicators

84   that discriminate winning and losing.

85   The aim of this study was to compare performance indicators in elite men's and

86   women's Rugby Union and identify those that discriminate winning and losing teams

87   based on the most recent World Cup competitions. An understanding of these factors

88   will help inform coaching methods and establish a basis from which tactical approaches

89   can be developed specific to both men's and women's Rugby Union.

90

91   **Methods**

92   *Design and Sample*

93   The study compared teams from the men's 2015 Rugby World Cup and women's 2014

94   Rugby World Cup. Performance indicators were compared between winners and losers

95   to identify which may discriminate successful and unsuccessful performance. The

96   sample included the knockout games of the men's 2015 Rugby World Cup including the

97   3rd place play off (n = 8) and the games in the 1st-4th place play off and 5th-8th place play

98   off in the women's 2014 world cup (n = 8).

99   *Performance indicators*

100 Following a review of previous research (Bishop & Barnes, 2013; Bremner et al*.,* 2013;

101 Hughes et al*.,* 2012; James et al., 2005; Jones et al., 2004; Ortega et al., 2009; Vaz et al.,

102 2010, 2011) performance indicators were established. These were: tries, penalty kick

103 success, conversion success, drop goals lineout success, scrum success, ruck frequency

104 (by area of pitch), kick in play (by area of pitch), tackle completion, carries (categorised

105 as pick and go, carry off 9, carry off 10, support carry, kick return, other carry), breaks,

106 visit to opponents 22 (divided into points scored and no points scored), turnover

107 conceded (divided into unforced and forced), penalty conceded (by area of pitch). In

108 addition, total possession of the ball when in play was coded as a descriptive variable.

109 For those performance indicators that were expressed in terms of the area of the pitch,

110 the pitch was divided into four areas: the attacking team's dead ball line to the 22 m line,

111 the attacking team's 22 m line to halfway, the defensive team's halfway to the 22 m line

112 and the defensive team's 22 m line to the dead ball line.

113 *Procedure*

114 Games were analysed using the sports analysis software Sportscode Elite (Version 10.3,

115 Sportstec, Warriewood, Australia). Each match was analysed by the same experienced

116 analyst who had an in-depth knowledge of Rugby Union using an analysis template to

117 allow the coding of the performance indicators as well as a timeline for when the event

118 took place. Data were then exported to Microsoft Excel 2010 (Microsoft Corporation,

119 Washington, USA) for further analysis.

120 *System Reliability*

121 Intra-observer and inter-observer reliability were both assessed using two randomly

122 selected matches from each World Cup competition. Cohen's Kappa Coefficient (K)

123 was used as the measure of reliability (equation 1):

124

125 $K = (P_o - P_c)/(1 - P_c)$ (equation 1)

126

127 Where Po is the percentage value of agreement and Pc is the percentage value of

128 expected agreement by guessing.

129

130 For intra-observer reliability, two matches were re-analysed by the primary analyst.

131 Classification of Kappa values (Altman, 1991) showed that a very good level of

132 agreement across the range of KPI's coded (range, K =0.95-1.00). Inter-Observer

133 reliability was assessed by having two matches re-analysed by a secondary analyst. The

134 secondary analyst also had an in depth knowledge of Rugby Union and was an

135 experienced performance analyst. Again, a very good level of agreement was found

136 (range, K = 0.88- 0.98).

137

138 *Data Analysis*

139 Data analysis was completed using Microsoft Excel 2010 (Microsoft Corporation,

140 Washington, USA) and SPSS 23.0.0 (IBM Corporation, New York, USA). Using a

141 Shapiro Wilkes test, a large proportion of variables (91%) were found to be normally

142 distributed. Thus, parametric tests were used for statistical analysis. A Two-way mixed

143   ANOVA was used to identify statistical differences both between winning and losing

144   teams (within subjects factor) and between sexes (between subjects factor). Statistical

145   significance was accepted at the 95% level. In order to allow comparison between

146   groups, data was presented as descriptive statistics (mean and standard deviation).

147   Effect sizes (ES) were determined using Cohen's d (Cohen, 1969) where d less than or

148   equal to 0.20 represent a small ES, d greater than 0.20 but less than 0.80 a moderate ES

149   and d greater than or equal to 0.80 a large ES.

150

151   **Results**

152   Descriptive statistics of performance indicators between sexes are displayed in Table 1.

153   Inferential statistical results are displayed (Table 1) to demonstrate any interactions or

154   main effects present for each performance indicators, with significant findings

155   highlighted in bold.

156

157   INSERT TABLE 1 NEAR HERE

158   ***Tries and Possession***

159

160   Number of tries scored affected match outcome ($F_{(1, 14)} = 15.16$, $p = 0.002$, $d = 1.41$)

161   with winning teams (4.4 ± 2.8 tries) scoring more tries than losing teams (1.8 ± 1.1

162   tries). However, no differences were seen in total possession either between winners and

163   losers or between sexes (Table 1).

164

165 *Breaks*

166 A match outcome*Sex interaction was present for number of breaks ($F_{(1, 14)} = 7.22$,

167 $p = 0.018$) (Table 1). Winning women's teams had a higher number of breaks compared

168 to losing teams, whereas the number of breaks made by men's teams were consistent

169 between winners and losers. This was demonstrated by a main effect for sex ($F_{(1, 14)} =$

170 6.69, $p = 0.048$, $d = 0.65$), with women making more breaks (5.7 ± 3.2) than men (3.75

171 ± 2.6) irrespective of match outcome. A main effect for match outcome was also seen,

172 ($F_{(1, 14)} = 5.66$, $p = 0.032$, $d = 0.66$), with winning teams (5.7 ± 3.8) making more breaks

173 than losing teams (3.8 ± 1.7).

174

175 *Tackle Completion*

176 A match outcome*sex interaction for tackle completion was present ($F_{(1, 14)} = 5.22$,

177 $p = 0.038$). Losing teams completed fewer tackles than winning teams, but this was sex

178 dependent with women's teams displaying a greater difference in tackle completions

179 between winners and losers in comparison to men's team's. The importance of tackle

180 completion was demonstrated be a large effect size ($d = 1.94$) between winning and

181 losing women's teams. A main effect was shown for match outcome ($F_{(1, 14)} = 12.74$,

182 $p = 0.003$, $d = 1.24$) with winning teams having a higher tackle completion rate (92.3%

183 ± 3.9%) than losing teams (86.8% ± 4.9%).

184   INSERT FIGURE 3 NEAR HERE

185 *Carries*

186   A match outcome*sex interaction for the percentage of pick and go carries was present

187   ($F_{(1, 14)}$ = 13.15, p = 0.003). Losing teams had a higher use of pick and go carries

188   compared to winning teams, with women's teams having the greatest difference between

189   winners and losers compared to men. There was also a main effect displayed for match

190   outcome ($F_{(1, 14)}$ = 19.37, p = 0.001), with winning teams (11.6% ± 7.4%) using pick

191   and go carries less than losing teams (21.6% ± 13.9%). A main effect for sex ($F_{(1,14)}$ =

192   38.80, p = 0.001, d = 1.79) showed women's teams used more pick and go carries

193   (24.4% ± 11.9%) than men's teams (8.3% ± 4.2%). A main effect for sex on carries off 9

194   ($F_{(1, 14)}$ = 19.58, p = 0.001, d = 1.84) showed that men's team's had a higher percentage

195   of carries off 9 (38.5% ± 6.9%) than women's teams (24.9% ± 7.91%). Total carries,

196   pick and go, and kick return carries showed large effect sizes (d = 1.32-1.52) between

197   wining and losing women's teams.

198   ***Rucking***

199   Rucking in the opposition 22-50 showed a match outcome*sex interaction ($F_{(1,14)}$ =

200   25.98, p = 0.001), winning men's teams had a greater proportion of rucks in the

201   opposition 22-50 (51.1% ± 12.1%) compared to losing (43.8% ± 8.5%) teams, while

202   winning women's teams had fewer rucks in this area (34.1% ± 8.5%) compared to

203   losers (48.25% ± 7.4%). A match outcome*sex interaction for Ruck own 22-50 was

204   present $F_{(1, 14)}$ = 7.71, p = 0.015. A number of other effects were seen, such as winning

205   teams having increased ruck percentage in the opposition 22 compared to losing teams

206   and sex effecting rucking percentage in the opposition 22 (Table 1). Finally rucks in

207   their own 22 was affected by sex, with men's teams having an increased proportion of

208   their rucks in this area (10.5% ± 6.8%) compared to women's teams (4.42% ± 3.11%).

209 *Kicking*

210 Total number of kicks was affected by Sex ($F_{(1, 14)} = 13.25$, $p = 0.003$), with men's teams

211 kicking (23.6 ± 7.1) more than women's teams on average (13.8 ± 4.6). An interaction

212 for the proportion of kicks made in opposition 22-50 was present ($F_{(1, 14)} = 8.24$, $p =$

213 0.012) with winning men's teams kicking more in this area of the pitch than losing

214 teams, while winning women's teams kicked less in this area than losing teams. A main

215 effect for match outcome for kicks in their own 22-50m ($F_{(1, 14)} = 8.84$, $p = 0.010$),

216 showed winning teams made more of their kicks in this area ($48.5\% \pm 10.7\%$) compared

217 to losing teams($41.4\% \pm 8.4\%$).

218

219

220

221 *Penalties*

222 Total penalties and penalty success did not affect match outcome, sex or match

223 outcome*sex interaction (all $p > 0.05$). A match outcome*sex interaction was present

224 for penalties in own 22 ($F_{(1,14)} = 7.15$, $p = 0.018$). Percentage of penalties in own 22

225 increased for women's losing teams ($41.2\% \pm 16.7\%$) compared to winning ($18.7\% \pm$

226 15.4%), whereas men's teams percentage of penalties conceded were similar between

227 winning ($23.3\% \pm 13.7\%$) and losing ($18.5\% \pm 15.1\%$) teams.

228 *Line Out and Scrums*

229 There was a main effect for match outcome for lineout success on the opposition ball

230 ($F_{(1, 14)} = 12.38$, $p = 0.042$).Winning teams won a higher percentage of opposition

231 lineout ball ($18.4\% \pm 10.91\%$) than losing teams ($11.3\% \pm 9.1\%$), irrespective of sex.

232   The large effect size ($d = 1.03$) suggests this variable to be important in discriminating

233   winning (17.4.% ± 12.8%) and losing teams (7.4 ± 5.0%) in the men's game. In

234   addition, a large effect between winners and losers ($d = 0.97$) was seen for lineout

235   success on their own ball in the men's game, with winners successfully securing a

236   higher percentage (92.6 ± 5.7%) than losers (82.6 ± 12.9%). No differences in scrum

237   success on their own ball or the opposition ball were observed between winners and

238   losers, regardless of sex.

239

240   **Discussion**

241   The aim of this study was to compare performance indicators in elite men's and

242   women's Rugby Union and identify those that discriminate winning and losing teams.

243   In the women's competition a range of performance indicators discriminated winning

244   and losing teams, in contrast, fewer performance indicators discriminated match

245   outcome for the men's competition. An example of this was that the number of breaks

246   influenced match outcome, however, this was dependent on sex. Breaks in the women's

247   World Cup showed winners to have on average five more breaks per game than losers,

248   whereas, the number amount of breaks in the men's World Cup were similar regardless

249   of match outcome. This increased number of breaks for winning women's teams could

250   be attributed to tackle completion rates, with losers having a lower percentage of tackle

251   completions (84.9%) compared to winners (93.9%). This supports the notion that losing

252   women's teams missed a larger number of tackles which resulted in more line breaks

253   and the potential for increased scoring opportunities. However, these data do not

254   provide evidence of the attacking and defensive strategies that may have resulted in

255 these observed differences between winners and losers. In line with previous research,

256 similar tackle completion rates and number of breaks were seen between winners and

257 losers in the men's game (Bishop & Barnes, 2013; Jones et al., 2004), suggesting missed

258 tackles and any resulting breaks could not be related to success.

259 Previous research on analysis of attacking parameters of men's rugby have

260 demonstrated winning teams make fewer carries and completed fewer rucks than losing

261 teams (Bishop & Barnes, 2013; Van Rooyen et al., 2010;). However, the present study

262 suggests that in the men's game both total carries and ruck frequency were similar

263 between winners and losers. Nevertheless, in the women's World Cup, a trend was

264 noted towards a higher number of total carries by winners (98.1 carries) compared to

265 losers (72.9 carries; $d = 1.32$). Further analysis of carry type revealed that at the

266 women's World Cup, losers made more pick and go carries (32.9%) compared to

267 winners (15.8%) ($d = 1.42$), while winning teams completed more carries off 9

268 ($d = 0.86$), support carries ($d = 1.0$) and carries following kick receipt ($d = 1.52$) than

269 losing teams. These findings suggest that successful women's teams appear more

270 willing to attack with ball in hand following a kick receipt and adopt a more expansive

271 game through attacking with wider carries in the midfield and outside channels.

272 Whereas, losers in the women's game had more pick and go carries, which may be

273 reflective of a limited game plan lacking width, or as a result of the defending team

274 effectively slowing the ball down at the breakdown resulting in an organised defence

275 and fewer opportunities to move the ball wide.

276 The total number of kicks per match did not affect match outcome. In the men's World

277 Cup, winners kicked away more possession in the opposition 22-50 m than losers

278 (winners = 16.3%, losers = 7.3%), while in the women's World Cup, winning teams

279   kicked less in the opposition 22-50 m than losers (winners = 9.3%, losers = 19.2%).

280   These findings suggest that in the opposition half, successful women's teams favoured a

281   possession driven strategy using phase play to break down a defence, while successful

282   men's teams opted to kick and apply pressure to the opposition with the hope of forcing

283   a turnover, leading to an attacking field position from which points can be scored.

284   Winners kicked away more possession in their own 22-50 m area of the pitch than

285   losers (winners = 51.9%, losers = 42.3%), regardless of sex. This finding supports the

286   notion that winning teams favoured a more territory based approach in this area (own

287   22-50 m) through kicking for territory and pressuring the opposition.

288   The total number of penalties conceded by winning and losing teams was similar for

289   men and women, this is in line with previous research (Bishop & Barnes, 2013; Jones,

290   et al., 2004; Vaz et al., 2010). For the men's World Cup, no differences were seen in the

291   distribution of these penalties on the pitch between winner and losers. However, in the

292   women's competition, winning teams conceded fewer penalties in their own 22 m than

293   losing teams (22% less). Conceding penalties in this area will increase the chance of the

294   opposition scoring points through penalty goals or from gaining an optimum attacking

295   field position. These findings suggest that pitch location of penalties conceded

296   influenced match outcome with winning teams being awarded more penalties in

297   attacking positions than losing teams. It is suggested that the ability of the winning

298   teams to apply more pressure and force more penalties in attacking positions was

299   indicative of success at the 2011 Rugby World Cup (Bishop & Barnes, 2013), a theory

300   supported by differences between winners and losers at the most recent women's World

301   Cup. However, this may also suggest better discipline by winning teams when

302   defending in their own 22 m given the increased likelihood of a scoring opportunity

303   from a penalty.

304   Results from the present study found the percentage of lineouts won on the opposition

305   ball to be an important performance indicator that discriminates winners and losers,

306   regardless of sex. Winning teams stole more line outs than losing teams, this was

307   particularly the case in males where winners stole an average of 17.4% of lineouts per

308   game compared to 7.4% for losers. In addition, winners in the men's game were more

309   successful at securing their own ball ($92.6 \pm 5.7\%$) than losers ($82.6 \pm 12.9\%$). These

310   findings support previous research which has established success at the lineout to be a

311   key indicator that discriminates winning and losing teams (Jones et al., 2004; Ortega et

312   al., 2009; Vaz et al., 2010, 2011). Therefore, regardless of sex, teams should place a

313   significant emphasis on the lineout and development of a successful attacking lineout

314   which minimises the chances of losing the ball as well focusing on defensive lineout

315   strategies which can increase the chances of stealing possession.

316   The current study has supplemented existing research identifying performance

317   indicators that discriminate winning and losing teams in elite Rugby Union. It is

318   important that the findings of the current study are interpreted cautiously as the results

319   are only based on performances from the 2015 Rugby World Cup knockout stages and

320   the 2014 Women's Rugby World Cup top eight playoffs, therefore they cannot be

321   generalised to lower playing levels or different competition formats. Future work should

322   focus on non-knockout competition formats, particularly in the women's game. This will

323   help direct tactical approaches and methods of coaching across female Rugby Union.

324   An important consideration when interpreting these results was the clear difference in

325   how balanced the matches were in the two different competitions. The women's Rugby

326   World Cup games had an average point's difference of 24 points per game where as in

327   the men's competition this was 15 points. Vaz et al. (2011) suggested a general profile

328   of performance indicators could be created in unbalanced games (16-34 points), but

329   found no performance indicators discriminated winning and losers teams in a sample of

330   close international games. This supports the findings of the present study which found

331   few performance indicators discriminated winners and losers in the elite men's game.

332   However, the larger average points difference in the women's games could account for

333   the wider range of performance indicators found to influence match outcome. A further

334   limitation relates to the interpretation of the findings based on conducting numerous

335   ANOVAs on multiple variables which inflates the likely hood of a type 1 error in the

336   analysis.

337

338

339   **Conclusion**

340   In conclusion, these findings identify performance indicators discriminating winning

341   and losing in the knockout stages of the most recent men's and women's World Cup

342   competitions. Findings demonstrated that a small number of performance indicators

343   were able to discriminate winning and losing teams in the knockout stages of the men's

344   Rugby World Cup, with lineout success on opposition ball appearing crucial. Hence,

345   teams should place an emphasis on the development of a successful attacking lineout

346   which minimises the chances of losing the ball as well as focusing on defensive lineout

347   strategies which can increase the chances of stealing possession. In the women's Rugby

348   World Cup, successful teams favoured a more possession based strategy through

349   attacking with wider carries in the midfield, outside channels and following kick receipt.

350   Results from the men's competition were found to be similar to findings of Bishop and

351   Barnes (2013) from the 2011 world cup which found a territory based approach to be

352   the most effective strategy for success. The findings reaffirm previous knowledge and

353   further support the use of this tactical approach for success in the men's game at the

354   elite level. These differences in game strategy between sexes provide a basis for tactical

355   support to help maximise success in both the men's and women's game. Importantly,

356   coaches should consider these strategies when designing appropriate coaching and

357   training tools which are sex dependent

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Table 1. Descriptive statistics of performance indicators between winners and losers and between sexes.

	Men				Women				Interaction	Sex	Outcome
	Winning		Losing		Winning		Losing				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	*p*	*p*	*p*
Tries	3.63	2.20	1.38	1.30	5.13	3.27	1.38	0.92	0.347	0.339	**0.002**
Possession (%)	51.1	8.3	48.9	8.3	54.4	6.3	45.6	6.3	0.392	1.000	0.157
Breaks	3.6	3.1	3.9	2.2	7.8	3.3	3.6	1.3	**0.018**	0.048	**0.032**
Tackle Completion (%)	90.8	4.5	88.8	2.6	93.8	2.6	84.9	6.0	**0.038**	0.780	**0.003**
Total Carries	100.5	15.8	98.0	32.5	98.1	16.8	72.8	21.1	0.241	**0.049**	0.157
Carries- kick return (%)	9.6	2.9	10.2	4.3	11.2	4.7	8.3	3.3	0.206	0.892	0.110
Carries- off 10 (%)	17.2	3.7	18.2	5.1	14.6	5.0	17.7	2.5	0.454	0.360	0.165
Carries- off 9 (%)	38.2	7.0	38.8	7.2	26.6	9.1	23.1	6.7	0.335	**0.001**	0.517
Carries- other (%)	21.2	6.1	18.1	4.7	22.5	8.8	12	6.2	0.131	**0.007**	0.317
Carries- pick and go (%)	7.4	4.2	9.2	4.3	15.8	7.8	32.9	8.7	**0.003**	**0.001**	**0.001**
Carries- support carry (%)	6.3	3.4	5.6	3.1	9.2	5.1	5.9	2.0	0.289	0.246	0.099
Total Rucks	77.6	19.4	78.1	26.7	77.0	17.2	68.4	17.0	0.591	0.403	0.632
Ruck opposition 22 (%)	17.6	4.9	14.3	6.1	24.3	6.8	18.8	4.7	0.485	**0.033**	**0.012**
Ruck opposition 22-50 (%)	51.1	12.1	43.8	8.5	34.1	8.5	48.3	7.4	**0.030**	0.233	0.736
Ruck own 22 (%)	8.3	6.6	12.8	6.7	4.0	3.7	4.8	2.7	0.172	**0.019**	0.1052
Ruck own 22-50 (%)	18.9	8.7	26.4	6.4	28.7	9.8	23.3	6.6	**0.015**	0.307	0.686
Total Kicks	24.9	7.9	22.3	6.5	14.8	3.1	12.8	5.9	0.829	**0.003**	0.126
Kick in opposition 22 (%)	1.3	1.9	0.8	2.4	2.2	4.2	0.0	0.0	0.385	0.980	0.178
Kick in opposition 22-50 (%)	16.3	8.2	7.3	7.8	9.3	8.6	19.2	7.7	**0.012**	0.316	0.894
Kick in own 22 (%)	36.9	10.6	51.3	10.2	37.1	9.3	38.6	13.3	0.141	0.105	0.073
Kick in own 22-50 (%)	45.5	8.9	40.6	6.4	51.5	12.0	42.3	10.4	0.377	0.379	**0.010**
Total Penalties conceded	10.0	3.4	9.1	3.8	8.0	2.9	9.3	3.1	0.418	0.386	0.885
Penalty Success (%)	79.4	20.9	86.5	19.9	83.3	25.8	70.0	27.4	0.322	0.461	0.864
Pen opposition 22 (%)	14.6	7.3	11.8	11.7	19.3	14.1	13.7	13.2	0.743	0.438	0.336
Pen opposition 22-50 (%)	28.2	16.0	26.9	12.7	17.3	17.4	17.7	13.2	0.852	0.123	0.926
Pen own 22 (%)	23.3	13.7	18.5	15.1	18.7	15.5	41.2	16.7	**0.018**	0.133	0.105
Pen own 22-50 (%)	33.9	12.6	42.8	19.9	44.7	28.9	27.4	15.4	0.088	0.746	0.565
Lineout Success opposition ball (%)	17.4	12.7	7.4	5.0	19.3	10.9	15.2	10.8	0.358	0.222	**0.042**
Lineout Success own ball (%)	92.6	5.7	82.6	12.9	84.8	11.9	80.7	10.9	0.358	0.222	0.042
Scrum Success opposition ball (%)	6.8	9.6	6.7	12.9	7.6	12.6	3.3	6.4	0.496	0.908	0.524
Scrum Success own ball (%)	93.3	12.9	93.2	9.9	96.7	6.1	92.4	11.3	0.629	0.690	0.612