1

2

3   **Category of Manuscript:** Original Article

4

5   **Title:** The Positional Anthropometric and Performance Profile of Elite Gaelic Football

6   Players.

7

8   **Authors:** Aidan Shovlin[1] Mark Roe[1] Shane Malone[1,2] Kieran Collins[1]

9   1. Gaelic Sports Research Centre, Institute of Technology Tallaght, Tallaght, Dublin 24

10

11   2. The Tom Reilly Building, Research Institute for Sport and Exercise Sciences,

12   Liverpool John Moores University, Henry Cotton Campus, 15-21 Webster Street,

13   Liverpool L3 2ET

14

15   **Running Title:** Performance Profile of Elite Gaelic Football Players

16

17   Corresponding Author: Aidan Shovlin

18   c/o Gaelic Sports Research Centre, Institute of Technology Tallaght, Tallaght, Dublin 24

19   Email: shovlin94@hotmail.com Tel: (+353) 87-4151883

20

21   Abstract word count: 236

22

23   Word Count: 3507

24

25   Number of Tables and Figures: 1 Table, 1 Figure

26

27

1   **Abstract**

2   The aim of the current investigation was to evaluate the variation in the anthropometric and

3   performance characteristics of elite Gaelic football players with respect of position. One

4   hundred and forty-eight elite Gaelic footballers underwent anthropometric (height, body

5   mass, sum of seven skinfolds, % adipose tissue) and performance [counter movement jump

6   height (CMJ), CMJ peak power, CMJ relative peak power, squat jump height (SJ), SJ peak

7   power, SJ relative peak power, 5-, 10- and 20 m sprint times and Yo-Yo Intermittent

8   Recovery Test Level 2 (Yo-YoIRT2)] during 'the early in-season' phase. Data were split into

9   five positional groups (full-back, half-back, midfield, half-forward and full-forward). Higher

10   %AT was observed in full forwards when compared to the half backs ($p = 0.001$), midfielders

11   ($p = 0.035$) and half forwards ($p = 0.021$). Full forwards had significantly greater SJ ($p =$

12   0.036) and CMJ ($p = 0.013$) when compared to the midfielders with no other positional

13   differences observed. No significant variation in sprint times was observed across positions.

14   When Yo-YoIRT2 was considered, full forwards and full backs completed significantly

15   lower distances compared to the middle three positional lines of, half backs, midfielders and

16   half forwards ($p = 0.00$). The current study is the first to provide normative data for

17   anthropometric and performance values of elite Gaelic football players which in turn can be

18   utilised by coaches to generate appropriate training regimes to maximise position specific

19   preparation for competitive match-play.

20

21

22   Keywords: Adiposity; Intermittent Team Sport; Yo-Yo Performance; Gaelic football

23

24

25

26

27

28

29

30

Introduction

Gaelic football is one of two national sports of Ireland (30). The premier competition within the Gaelic football calendar is the All Ireland series that runs from May through to September (4). Elite matches are played across 70 minutes with 15 players on each team attempting to outscore one another over the course of the game (30). Players are amateur in nature with a profession ethos, generally completing three pitch sessions, two gym sessions along with other squad meetings and workshops throughout the course of a week, while attempting to balance a family and working life (4). Gaelic football is a multidirectional sport that requires players to undertake numerous unpredictable bouts of high intensity exercise that are interspersed by periods of low intensity exercise (6, 27). Throughout the periods of high intensity exercise, contact between players can be high, while both offensive and defensive skills need to be utilized at high speed (18, 30). These skills include both hand and kick passing, shooting, blocking, tackling and large amounts of player movement independent of which team controls possession (15, 30). High levels of performance are associated with increased fitness characteristics of players (7). It has been previously reported that Gaelic football players have similar fitness characteristics to professional soccer players (30), with estimated $\dot{V}O_{2max}$ values for both Gaelic football (58.8 mL·kg^{-1}·min^{-1}) and soccer (59.4 mL·kg^{-1}·min^{-1}) seen to be similar (34).

49

Recent advancement in technology have allowed for the appraisal of match play demands through the use of global positioning system (GPS) micro-technology (17,19,20). These investigations have observed position specific movement demands during match-play with the middle three positional lines, half backs (8700 m), midfielders (9523 m), and half forwards (8952 m) covering more distances than the other two respective positions, full backs (6892 m) and full forwards (7090 m) with 17% of match play covered at high-speed (>17 km·h^{-1}) (20). Positional variations in match play performance are understood and displayed in the aforementioned data. However, there is a scarcity of performance characteristic studies completed in Gaelic football. While previous studies have provided information regarding specific fitness and performance characteristics (23, 24, 28) there is no contemporary positional data with regard to elite Gaelic football players. An insight into the various

61   positional fitness considerations for Gaelic football would allow practitioners to effectively
62   design particular training regimes in order to potentially improve competitive performances.

63   Comparisons of GAA players with other intermittent team sports such as soccer have
64   shown that VO_{2max} values to be similar to that of professional soccer players and rugby union
65   backs. However, sprint performance was greater in both professional codes (6, 34). Research
66   into the area of jump performance has provided some information regarding vertical jump
67   height this has been provided for the different positions however, this data is specific to
68   collegiate players and not elite players. Vertical jump performance was seen to vary from
69   backs (54-cm), midfielders (65-cm) and forwards (56-cm), with these results provided for
70   specific jump test (24). The normative values provided by McIntyre and Hall (24) fail to
71   account for the five positional lines within elite Gaelic football. The ever changing nature of
72   elite match-play has resulted in the middle three lines of a team having an increased
73   involvement in match-play (19). Understanding each specific line and their characteristics are
74   important for coaches to optimise the preparation of players for elite match-play. Although
75   there is an ever-growing interest worldwide in Gaelic football, research into positional
76   variations and the particular performance characteristics in elite players is deficient.
77   Therefore, the aim of the current study was to evaluate the anthropometric and performance
78   characteristics of elite Gaelic football players with respect of playing position. We
79   hypothesised that the transitional lines of half-back, midfield and half-forward would have
80   significantly different anthropometric and performance profiles when compared to other
81   positions of play.

82

83   **Methods**

84   *Experimental Approach to the Problem*

85   In order to better understand the anthropometric and performance characteristics of
86   elite Gaelic football players one hundred and forty-eight (*n* = 148) elite Gaelic football
87   players were recruited for the current investigation. All players underwent assessments of
88   anthropometry [height, body mass, sum of the seven skinfold and adipose tissue percentage
89   estimates (%AT)) and performance characteristics (counter movement jump height (CMJ)
90   CMJ peak power, CMJ relative peak power, squat jump height (SJ), SJ peak power, SJ
91   relative peak power, 5-, 10- and 20 m sprint times (s) and Yo-Yo Intermittent Recovery Test
92   2 (Yo-YoIRT2; m)]. Each individual player was categorised based on positional line (28 full

93   backs, 33 half backs, 24 midfielders, 33 half forwards, 30 full forwards). Prior to data

94   collection, 30 other subjects completed two identical testing sessions that were (separated by

95   one week), data from session one was compared with session two and intraclass correlation

96   coefficients (ICC's) were determined from the results. Data collection was undertaken

97   during the 'the early in-season' phase (June 2015) with a total of five teams assessed. Both

98   anthropometric and performance tests were carried out indoors to avoid any external

99   influences on data collection. All testing took place at a similar time of day (18.00-21.00)

100   across two testing days to avoid any circadian variation in performance (32). Participants

101   were advised to abstain from vigorous exercise for 24 hours prior to the commencement of

102   testing.

103   *Participants*

104   Following ethical approval by the local Research Ethics Committee and informed

105   consent. One hundred and forty-eight (n = 148) elite intercounty Gaelic football players

106   (mean ± SD age 26.6 ± 6 years, height 183.7 ± 5.9 cm and body mass 83.6 ± 8.3 kg) (28 full

107   backs, 33 half backs, 24 midfielders, 33 half forwards, 30 full forwards) participated in the

108   current investigation. All participants were competing in the All-Ireland Senior football

109   championship underwent measurements of anthropometric (height (cm), body mass (kg), sum

110   of the seven skinfold (mm) and adipose tissue percentage estimates (%AT)) and performance

111   characteristics (counter movement jump height (CMJ; cm) CMJ peak power (W), CMJ

112   relative peak power (W·kg^{-1}), squat jump height (SJ; cm), SJ peak power (W), SJ relative

113   peak power (W·kg^{-1}), 5, 10 and 20 m sprint times (s) and Yo-Yo Intermittent Recovery Test

114   Level 2 (Yo-YoIRT2; m). Each individual player was categorised into the line of the field in

115   which they play to allow comparison across different positions.

116   *Anthropometry*

117   Anthropometric measurements were made prior to the commencement of the

118   performance evaluation. Height and body mass measurements were taken using a Seca

119   Stadiometer and a weighing scales (Seca Instruments Ltd, Germany) respectively. Estimation

120   of adipose tissue mass was conducted by measurement in millimetres of seven skinfold sites

121   (triceps, bicep, subscapular, abdominal, supraspinale, thigh, calf) using Harpenden skinfold

122   callipers (Harpenden Instruments Ltd, England) following the standards of the International

123   Society for the Advancement of Kinanthropometry (ISAK) (21). The %AT was calculated

124   using the Reilly equation (30) and assessed by a Level 2 ISAK qualified tester. The error of

125 measurement was taken from all subjects and calculated for all anthropometric measurements

126 and was less than 3% which is an acceptable measurement error (1).

127   ***Figure 1 – Near Here***

128

129 *Performance*

130   CMJ and a SJ for maximal jump height were measured using a jump assessment

131 system (Optojump, Bolanzo, Italy). The CMJ and SJ peak power (PP) and relative peak

132 (RPP) was calculated using the equation of Sayers et al., (33). The sprint times (s) of each

133 participant was measured over 20 m with timing gates located at 5-, 10- and 20 m (Microgate,

134 Bolzano, Italy). Furthermore, players completed the Yo-Yo Intermittent Recovery Test (Yo-

135 YoIRT2) in order to assess an individual's ability to perform repeated bouts of high intensity

136 exercise with a high contribution from the body's anaerobic system and have been shown to

137 be a reliable measure of changes in performance (3, 25). The assessment of vertical jump

138 power and speed was conducted prior to the Yo-YoIRT2.

139

140 *Data Analysis*

141   All data is reported as means and standard deviations (means ± SD) unless stated.

142 Data were calculated for all players with respect of positional group with 95% conference

143 intervals. All data was tested for normality and all data that did not pass tests was removed

144 from statistical analysis. A univariate analysis of variance (ANOVA) along with a Scheffe

145 post hoc test was performed to determine if there was variation in position (dependent vari-

146 able) present within any of the anthropometric and performance characteristics (independent

147 variables), with statistical significance was set at <0.05. Specifically, Hopkins reliability

148 spreadsheet was used to calculate for ICC's values for the specific performance tests used in

149 the profiling of the participants and followed on previous research for this statistical analysis

150 (2,14). The ICC's for test retest reliability were 0.96, 0.90, 0.92, 0.95, 0.95 and 0.90 for CMJ,

151 SJ, sprint time over 5-, 10-, 20 m and Yo-YoIRT2 respectively. All statistical analysis was

152 performed using the Statistical Package for Social Sciences software (SPSS Version 23.0,

153 Chicago, IL).

154

155 **Results**

156 *Anthropometric Characteristics*

157   The mean height and body mass for all players were 183.7 ± 5.9 cm and 83.6 ± 8.3 kg
158 respectively. There was a significant effect detected for positions when analysed for height
159 ($F_{4,143} = 2.940$; $p = 0.023$) but not for body mass ($F_{4,143} = 2.139$; $p = 0.079$) (Table 1). The
160 sum of the seven skinfold sites and adiposity were 81.3 ± 22.9 mm and 11.3 ± 1.7 % AT
161 respectively. Significant differences ($p < 0.05$) were detected across the individual positions
162 for both sum of skinfolds ($F_{4,143} = 4.890$; $p = 0.000$) and adiposity ($F_{4,143} = 6.581$; $p = 0.000$).
163 A Scheffe post-hoc analysis showed that both half backs (72.9 ± 14.8 mm; $p = 0.005$) and
164 half forwards (77.0 ± 17.1 mm; $p = 0.040$) possessed significantly lower sum of seven
165 skinfolds compared to full forwards (94.6 ± 30.2 mm). Significant differences were observed
166 in %AT across position. Half backs (10.5 ± 1.2 %AT; $p = 0.001$), midfielders (10.9 ± 1.2 %
167 AT; $p = 0.035$) and half forwards (10.9 ± 1.4 %AT; $p = 0.021$) showed a significantly lower
168 %AT to full forwards (12.3 ± 2.1 % AT). Half backs were also shown to have a significantly
169 lower adiposity level compared to the full backs (11.9 ± 2.0 %AT; $p = 0.040$).

170

171   ***Table 1 – Near Here***

172

173 *Performance Characteristics*

174   The mean values for all players for SJ height, SJ PP and SJ RPP were 36.1 ± 4.9 cm,
175 3923 ± 501 W, and 46.9 ± 3.6 W·kg^{-1} respectively. Significant differences across positions
176 was observed within SJ ($F_{4,143} = 3.113$; $p = 0.017$), SJ PP ($F_{4,143} = 2.449$, $p = 0.049$), and SJ
177 RPP ($F_{4,143} = 2.816$; $p = 0.028$) respectively. For SJ height, full forwards were shown to have
178 a significantly higher SJ height (37.5 ± 5.6-cm; $p = 0.036$) than midfielders (33.3 ± 3.7 cm).
179 The mean values for CMJ height, CMJ PP, CMJ RPP were 38.0 ± 5.1-cm, 4040 ± 510 W and
180 48.3 ± 3.7 W·kg^{-1} respectively. Significant differences were observed across individual
181 positions for the three variables of CMJ height ($F_{4,143} = 3.597$; $p = 0.008$), CMJ PP ($F_{4,143} =$
182 3.142; $p = 0.016$) and CMJ RPP ($F_{4,143} = 3.211$; $p = 0.015$). Full forwards (40.0 ± 5.8 cm; $p =$
183 0.013) were shown to have a significantly higher CMJ height compared to the midfielders
184 (35.0 ± 4.0 cm). Full forwards (49.6 ± 4.1 W·kg^{-1}; $p = 0.024$) were also shown to have a
185 significantly greater relative peak power for CMJ than the midfielders (46.2 ± 2.9 W·kg^{-1}).

186 The mean sprint times for 5-, 10-, and 20-m sprints for all players was 1.10 ± 0.11 s, $1.82 \pm$

187 0.12 s, and 3.09 ± 0.16 s respectively. A non-significant difference was observed across the

188 individual positions for each of the three sprint variables, 5- ($F_{4,143} = 1.665$; $p = 0.164$), 10-

189 ($F_{4,143} = 0.612$; $p = 0.655$) and 20-m ($F_{4,143} = 0.588$; $p = 0.672$). Figure 2 shows the Yo-

190 YoIRT2 with respect of position. The mean distance covered in the Yo-YoIRT2 for all

191 players was 1587 ± 298 m, with significant differences observed across positions ($F_{4,143} =$

192 15.999; $p = 0.000$).

193

194   ***Figure 2 – Near Here***

195 **Discussion**

196   The aim of the current investigation was to evaluate the variation in anthropometric

197 and performance characteristics of elite Gaelic football players with respect of playing

198 position. The data is the first to offer a full contemporary profile of anthropometric and

199 performance characteristics of elite Gaelic football players with regard to playing position.

200 Specifically, we observed that the three middle positional lines on the field have a greater

201 YoYoIRT2 performance compared to full backs and full forwards. Furthermore, full forwards

202 were shown to have a greater %AT compared to the three middle positional lines. Variations

203 in jump performance were observed between midfielders and full forwards, with the latter

204 having a significantly greater jump performance profile. The current data allows specific

205 trainings regimes to be measured against the current data set in order to best prepare players

206 for the demands of competitive match play.

207   Anthropometric characteristics such as height may vary from position to position due

208 tactical motives (9). The values obtained in the current study for stature show that Gaelic

209 football players are taller but leaner with regard to %AT than previously reported (24). It

210 must be noted that the game of Gaelic football has evolved in recent years, both the tactical

211 element and player development has increased greatly through the advent of strength and

212 conditioning programs making the comparison to the previous research difficult (29). Limited

213 variation was observed across each of the five positions in the present study with regard to

214 stature. These observations are in agreement with Collins et al. (9), who observed a relative

215 homogeneity within positions for stature of the players or body mass for elite hurling players.

216 Furthermore, half backs, midfielders and half forwards had lower %AT when compared to

217 the full forwards (Table 1). Interestingly our data is in contrast to previously reported

218   literature on Gaelic football players with the current %AT lower across positional lines than

219   previously reported (6, 23). Although %AT in the current study is lower than previous

220   literature the values reported are higher than observed for Australian football players (5), but

221   similar to elite soccer players (12). The lower levels of %AT in Australian football players

222   can be contributed to the professional nature of the sport compared to the amateur nature of

223   Gaelic football, with players tending to hold down a full time occupation outside of the sport

224   (4). The higher %AT for full forward players could potentially be attributed to the less

225   distance that is covered in a match compared to all other positional lines on the field of play

226   (20).

227   Gaelic footballers are required to contest numerous duels throughout a match that will

228   determine who gains possession with a large number of these potentially being aerial duels.

229   In both vertical jump assessments (CMJ and SJ), full forwards were observed to significantly

230   outperform the midfielders. Although a surprising finding, this may be related to a reduction

231   in one-on-one aerial duels for midfield players in match-play due to the advent of the short

232   kick-out (12). This in turn has resulted in an increase in direct aerial ball being played into

233   full-forward areas increasing the requirement of these players to possess such characteristics

234   for jump height. Similar results are evident in hurling, with backs and forwards out

235   performing midfielders during jump assessments (9). Both SJ and CMJ are methodologies

236   widely used to determine the jump performance in team sports, however a large majority of

237   the jumps that players conduct within a Gaelic football match will be preceded by an initial

238   run up to generate more height for aerial contests. This may question the suitability of such

239   tests for the assessment of lower limb explosive qualities within Gaelic football (11, 22, 35).

240   Future research should aim to assess the usefulness of such assessments within this

241   population given the intricacies of match-play jump performance in elite Gaelic football.

242   Our data showed that across velocity variables (5-, 10-, 20 m) there was a non-

243   significant differences between position. The current observation was expected and in-line

244   with match-play research that has shown that no significant differences exist between

245   positional lines for maximal velocity capabilities (19, 20). Furthermore, these results are in

246   agreement with velocity variables observed in hurling cohorts (9). The sport of Gaelic

247   football has been evolving from year to year with increasing demands for high-intensity

248   distance across all positional lines (9, 19, 20). These increased demands result in players

249   needing to be capable of repeating numerous high intensity bursts throughout match play (18,

250   19). Previously, Le Rossignol et al. (16), have shown that repeated sprint ability, along with

251   an adequate aerobic capacity are critical physical qualities for performance in match play

252   with the number of possessions gained related to improved performance in a 20 m sprint test.

253   Future research in elite Gaelic football should aim to assess the relationships between

254   performance tests and match-play involvements and outcomes in order to recommend best

255   practice with regard to a suitable testing battery for Gaelic football cohorts.

256   When intermittent exercise capacity was considered significant differences in Yo-

257   YoIRT2 performance across all positions were evident, with a bell-shaped curve for distance

258   observed (Figure 1). Interestingly, the intermittent exercise capacity of elite Gaelic football

259   players is similar to the observed match-play running performances of elite Gaelic football

260   players (19,23). When comparing Yo-YoIRT2 across sports, AFL players have a

261   considerably lower Yo-YoIRT2 profile (25). Given the similarities between both sports (30)

262   future research should aim to compare anthropometric and performance profiles of elite

263   Gaelic football and Australian football players. With regard to positional differences the

264   middle three positional lines, half backs (1682 ± 273-m), midfielders (1718 ± 251-m), half

265   forwards (1747 ± 243-m) were able to cover significantly greater distances than both full

266   backs (1428 ± 208-m) and full forwards (1352 ± 277-m). These findings can be related to

267   these positions being the transitional lines of play in Gaelic football resulting in these lines

268   covering increased distances in match-play and therefore requiring increased intermittent

269   exercise capacity in order to meet the requirements of match-play (19). The findings observed

270   here corresponded with conclusions from McIntyre and Hall (23), who found that midfielders

271   possessed a greater VO_{2max} characteristics when compared to backs and forwards. However,

272   the study failed to differentiate across the five positional lines of play. The current data

273   further endorses the need for certain players on the field of play to require greater intermittent

274   exercise capacity to deal with the particular demands associated with each position of play.

275   Performance characteristics, exercise capacity and running performance evaluations have

276   recently become increasingly popular in Gaelic football as part of player monitoring

277   throughout the course of the season. It has only been relatively recently that values within

278   elite Gaelic football have been published for the different positional lines of the field with

279   respect of match running demands (17). The current investigation builds on these data and

280   provides normative data with regard to the positional performance profile associated with

281   Gaelic football. Practitioners can now apply these data to develop the required training

282   regimen to best fit the performance profile of Gaelic football.

283   To conclude, the current investigation supplies for the first time, normative data on
284   elite Gaelic football players with regard to positional anthropometric and performance
285   characteristics. Observations were made regarding significant differences in both
286   performance and anthropometric characteristics with respect to position. Intermittent exercise
287   capacity differences are seen to be present in the middle three lines of the field within this
288   cohort compared to the full backs and full forwards, further outlining the need for specific
289   training regimes in elite Gaelic football. Along with variations in performance characteristics,
290   differences have been observed in other areas of player evaluation which in turn will allow
291   coaches to adequately prepare players for match-play based on the positional characteristics.

292

Practical Applications

294   The normative data presented in the current study can be utilised by coaches evaluat-
295   ing both anthropometric and performance characteristics of elite players in the sport of Gaelic
296   football. The main findings from the study show differences in %AT, sum of skinfolds (mm),
297   Yo-YoIRT2 and jump performance measures across positions in Gaelic football. With regard
298   to aerobic performance a positional hierarchy was present with the middle three 'transitional
299   line' having the highest performance. Therefore, the information provided within the current
300   study can help prepare coaches assess their teams anthropometric and performance character-
301   istics. Combining all the knowledge that is now available within the sport, coaches and prac-
302   titioners should have a greater understanding on how to prepare their players for the impend-
303   ing competition demands across each distinctive position using specific training and drills for
304   positional differences. The information provided in the study can be exploited by those with
305   ambitions to play elite level Gaelic football, the normative values can be seen at values that
306   they may strive to achieve to 'break in' to the elite panel. Applied practitioners can assess and
307   evaluate Gaelic football players based on the normative data provided by this study. Coaches
308   should be aware of the specific positional profiles present across Gaelic football cohorts and
309   use this information to plan training appropriately in order to maximise training adaptations
310   through the implementation of the most effective training plans.

311

312

313

314 **References**

315 1. Atkinson, G, Reilly, T, Marfell-Jones, M. What is this thing called measurement
316   error. In *Kinathropometry VIII: Proceeding of the 8th International Conference of*
317   *Kinathropometry (ISAK)* (pp. 3-13). 2013.

318 2. Atkinson, G., & Nevill, A. M. Statistical methods for assessing measurement error
319   (reliability) in variables relevant to sports medicine. *Sports medicine*, *26*(4), 217-238,
320   1998.

321 3. Bangsbo, J, Iaia, FM, Krustrup, P. The Yo-Yo intermittent recovery test. *Sports*
322   *Med*, *38*(1), 37-51, 2008.

323 4. Beasley, KJ. Nutrition and Gaelic football: review, recommendations, and future
324   considerations. *Int J Sport Nutr Exerc Metab,* 25(1), 1-13, 2015.

325 5. Bilsborough, JC, Kempton, T, Greenway, K, Cordy, J, Coutts, AJ. Longitudinal
326   Changes and Seasonal Variation in Body Composition in Professional Australian
327   Football Players. *Int J Sports Physiol Perform*, 1-21, 2016.

328 6. Brick, N, O'Donoghue, P. Fitness profiles of elite players in hurling and three football
329   codes: Soccer, rugby union and Gaelic football. *Science and Football V*, 172, 2005.

330 7. Castagna, C, Impellizzeri, F, Cecchini, E, Rampinini, E, Alvarez, JCB. Effects of
331   intermittent-endurance fitness on match performance in young male soccer players. *J*
332   *Strength Cond Res*, 23(7), 1954-1959, 2009.

333 8. Cohen, J. Statistical power analysis for the behavioral sciences Lawrence Earlbaum
334   Associates. *Hillsdale, NJ*. 20-26, 1988.

335 9. Collins, DK, Reilly, T, Morton, JP, McRobert, A, Doran, DA. Anthropometric and
336   Performance Characteristics of Elite Hurling Players. *J Athl Enhancement 3*:*6*, 2014.

337 10. Collins, DK, Solan, B, Doran, DA. A preliminary investigation into high-intensity
338   activity during elite Gaelic football match-play. *J Sports Ther,* (1), 10, 2013.

339 11. Cronin, JB, Hansen, KT. Strength and power predictors of sports speed. *J Strength*
340   *Cond Res*, 19(2), 349-357, 2005.

341 12. Daly, D. A performance analysis of kick-out distribution and effectiveness in the
342   Ulster Senior Gaelic Football Championship 2010. Unpublished thesis, University of
343   Ulster, Antrim, 2011.

344 13. Gerosa-Neto, J, Rossi, FE, Buonani-Silva, C, Zapaterra-Campos, E, Araujo-
345   Fernandes, R, Forte-Freitas, JI. Body composition analysis of athletes from the elite of
346   Brazilian soccer players. *Motricidade*, 10(4), 105-110, 2014.

347 14. Johnston, R. J., Watsford, M. L., Pine, M. J., Spurrs, R. W., Murphy, A. J., & Pruyn,
348   E. C. The validity and reliability of 5-Hz global positioning system units to measure
349   team sport movement demands. *J Strength Cond Res 26*(3), 758-765, 2012.

350 15. Keane, S, Reilly, T, Hughes, M. Analysis of work rates in Gaelic football. *Aus J*
351   *Sports Sci*, 25, 100-102, 1993.

352 16. Le Rossignol, P, Gabbett, TJ, Comerford, D, Stanton, WR. Repeated-sprint ability
353   and team selection in Australian football league players. *Int J Sports Physiol*
354   *Perform*, 9(1), 2014.

355 17. Malone, S, Collins DK, McRobert, AP, Doran, DA. A comparison of work rate
356   displayed by elite and sub elite hurlers during match play. Paper presented at the
357   annual congress of the British Association of Sport and Exercise Sciences. December,
358   Burton, England, 2014.

359 18. Malone, S, Roe, M, Doran, DA, Gabbett, TJ, Collins, K. High chronic training loads
360   and exposure to bouts of maximal velocity running reduce injury risk in elite Gaelic
361   football. *J Sci and Med in Sport*, 20(3), 250-254, 2017.

362 19. Malone, S, Solan, B, Collins, K. D, Doran, DA. Positional Match Running
363   Performance in Elite Gaelic Football. *J Strength Cond Res*, 30(8), 2292-2298, 2016.

364 20. Malone, S, Solan, B, Collins, K. The running performance profile of elite Gaelic
365   football match-play. *J Strength Cond Res*, 31(1), 30-36, 2017.

366 21. Marfell-Jones, M, Stewart, AD, de Ridder, JH. International standards for
367   anthropometric assessment, 2012.

368 22. McGuigan, MR, Cormack, S, Newton, RU. Long-term power performance of elite
369   Australian rules football players. *J Strength Cond Res*, 23(1), 26-32, 2009.

370 23. McIntyre, MC, Hall, M. Physiological profile in relation to playing position of elite
371   college Gaelic footballers. *Br J Sports Med*, 39(5), 264-266, 2005.

372 24. McIntyre, MC. A comparison of the physiological profiles of elite Gaelic footballers,
373   hurlers, and soccer players. *Br J Sports Med*, 39(7), 437-439, 2005.

374 25. Mooney, M, O'Brien, B, Cormack, S, Coutts, A, Berry, J, Young, W. The relationship
375   between physical capacity and match performance in elite Australian football: a
376   mediation approach. *J Sci Med Sport*, 14(5), 447-452, 2011.

377 26. Oberacker, LM, Davis, SE, Haff, GG, Witmer, CA, Moir, GL. The Yo-Yo IR2 test:
378   physiological response, reliability, and application to elite soccer. *J Strength Cond*
379   *Res*, 26(10), 2734-2740, 2012.

380 27. O'Donoghue, PG, Donnelly, O, Hughes, L, McManus, S. Time–motion analysis of
381   Gaelic games. *J Sports Sci*, 22, 255-256, 2004.

382 28. Reeves, S., & Collins, K. The nutritional and anthropometric status of Gaelic football
383   players. *Int J Sport Nutr Exerc Metab*, *13*(4), 539-548, 2003.

384 29. Reilly, B, Akubat, I, Lyons, M, Collins, DK. Match-play demands of elite youth
385   Gaelic football using global positioning system tracking. *J Strength Cond Res*, 29(4),
386   989-996, 2015.

387 30. Reilly, T, Collins, K. Science and the Gaelic sports: Gaelic football and hurling. *Eur J*
388   *Sport Sci*, 8(5), 231-240, 2008.

389 31. Reilly, T, George, K, Marfell-Jones, M, Scott, M, Sutton, L, Wallace, JA. How well
390   do skinfold equations predict percent body fat in elite soccer players? *Int J Sports*
391   *Med*, 30(8), 607-613, 2009.

392 32. Reilly, T. Brooks, GA. Exercise and the circadian variation in body temperature
393   measures. *Int J of Sports Med*, 7(06), 358-362, 1986.

394 33. Sayers, SP, Harackiewicz, DV, Harman, E, Frykman, PN, Rosenstein, MT. Cross-
395   validation of three jump power equations. *Med Sci Sports Exerc*, 31(4), 572-577,
396   1999.

397 34. Strudwick, A, Reilly, T, Doran, D. Anthropometric and fitness profiles of elite players
398   in two football codes. *J Sports Med Phys Fitness*, 42(2), 239, 2002.

399 35. Young, W, Cormack, S, Crichton, M. Which jump variables should be used to assess
400   explosive leg muscle function. *Int J Sports Physiol Perform*, 6(1), 51-7, 2011.

401

402 **Legend of Tables and Figures**

403

404 **Table 1 -** The positional anthropometric and performance characteristics of elite Gaelic
405 football players. Data presented as mean ± SD (95% conference intervals)

406 **Figure 1** – Schematic of testing battery running order during the initial testing period.

407 **Figure 2 -** Yo-YoIRT2 distance in elite Gaelic football with regard to position (means ± SD).

Table 1

Anthropometric Characteristics	Total n=148	Full Backs n=27	Half Backs n=33	Midfielders n=24	Half Forwards n=33	Full Forwards n=30
Height (cm)	183.7 ± 5.9 (182.7,184.7)	182.2 ± 6.9 (179.5, 184.8)	181.9 ± 4.3 (180.4, 183.4)	186.6 ± 4.6 (184.6, 188.5)	184.1 ± 5.6 (182.1, 186.1)	184.3 ± 6.9 (181.8, 186.9)
Body Mass (kg)	83.6 ± 8.3 (82.2, 84.9)	84.0 ± 6.3 (81.5, 86.4)	81.8 ± 8.0 (79.0, 84.6)	84.2 ± 5.8 (81.8, 86.7)	81.6 ± 6.0 (79.5, 83.7)	86.9 ± 12.6 (82.2, 91.6)
Sum of 7 skinfolds (mm)	81.3 ± 22.9 (77.6, 85.1)	86 ± 25.6 (76.1, 95.9)	72.9 ± 14.8 (67.7, 78.2)	77.0 ± 17.1 (69.5, 84.5)	77.0 ± 17.1 (70.9, 83.0)	94.6 ± 30.2 (83.3, 105.8)
Adiposity (% AT)	11.3 ± 1.7 (11.0, 11.6)	11.9 ± 2.0 (11.1, 12.7)	10.5 ± 1.2 (10.1, 10.9)	10.9 ± 1.2 (10.4, 11.4)	10.9 ± 1.4 (10.4, 11.4)	12.3 ± 2.1 (11.5, 13.1)
Performance Characteristics						
SJ (cm)	36.1 ± 4.9 (35.3, 36.9)	35.8 ± 4.7 (33.9, 37.6)	36.2 ± 4.6 (34.6, 37.9)	33.3 ± 3.7 (31.7, 34.8)	37.0 ± 4.7 (35.4, 39.6)	37.5 ± 5.6 (35.4, 39.6)
SJ PP (W)	3923 ± 501 (3841, 4004)	3920 ± 453 (3744, 4096)	3851 ± 445 (3693, 4008)	3779 ± 287 (3658, 3900)	3887 ± 465 (3722, 4052)	4158 ± 692 (3900, 4416)
SJ RPP (W·kg⁻¹)	46.9 ± 3.6 (46.3, 47.5)	46.6 ± 3.4 (45.3, 47.9)	47.1 ± 3.6 (45.8, 48.4)	44.9 ± 2.7 (43.8, 46.1)	47.5 ± 3.5 (46.3, 48.8)	47.8 ± 3.9 (46.4, 49.3)
CMJ (cm)	38.0 ± 5.1 (37.2, 38.9)	37.9 ± 4.8 (36.0, 39.8)	37.7 ± 4.9 (36.0, 39.4)	35.0 ± 4.0 (33.4, 36.7)	38.9 ± 4.8 (37.1, 40.6)	40.0 ± 5.8 (37.8, 42.1)
CMJ PP (W)	4040 ± 510 (3957, 4122)	4051 ± 447 (3877, 4224)	3939 ± 458 (3776, 4101)	3887 ± 295 (3672, 4012)	4000 ± 474 (3832, 4168)	4306 ± 689 (4049, 4564)
CMJ RPP (W·kg⁻¹)	48.3 ± 3.7 (47.7, 48.9)	48.2 ± 3.5 (46.9, 49.5)	48.2 ± 3.8 (46.8, 49.5)	46.2 ± 2.9 (45.0, 47.4)	48.9 ± 3.5 (47.7, 50.2)	49.6 ± 4.1 (48.0, 51.1)
Sprint - 5m (sec)	1.10 ± 0.11 (1.08, 1.11)	1.13 ± 0.19 (1.06, 1.21)	1.09 ± 0.08 (1.07, 1.12)	1.11 ± 0.07 (1.08, 1.14)	1.07 ± 0.10 (1.03, 1.10)	1.08 ± 0.07 (1.06, 1.11)
Sprint - 10m (sec)	1.82 ± 0.12 (1.80, 1.84)	1.83 ± 0.21 (1.75, 1.91)	1.82 ± 0.9 (1.78, 1.85)	1.84 ± 0.05 (1.82, 1.86)	1.80 ± 0.09 (1.76, 1.83)	1.82 ± 0.09 (1.79, 1.85)
Sprint - 20 m (sec)	3.09 ± 0.16 (3.06, 3.11)	3.09 ± 0.24 (3.00, 3.18)	3.11 ± 0.16 (3.05, 3.16)	3.10 ± 0.08 (3.07, 3.14)	3.05 ± 0.14 (3.00, 3.10)	3.08 ± 0.13 (3.04, 3.13)

Figure 1

Day 1

| Height & Body Mass | → | Sum of Seven Skinfolds & % Adipose Tissue | → | Jump Performance (CMJ / SJ) |

Day 2

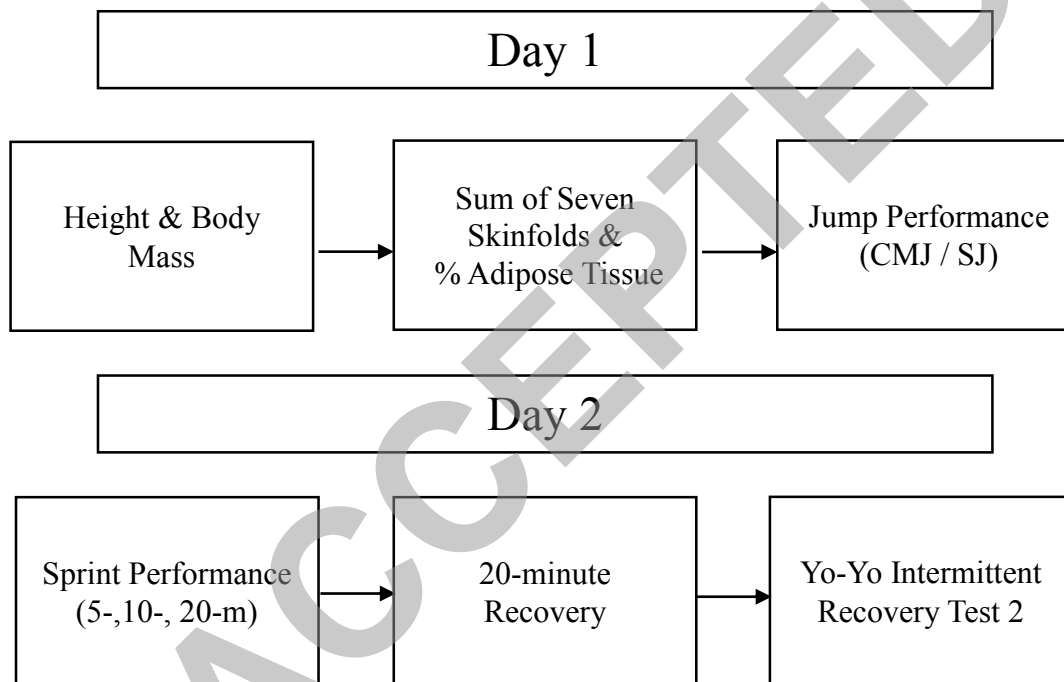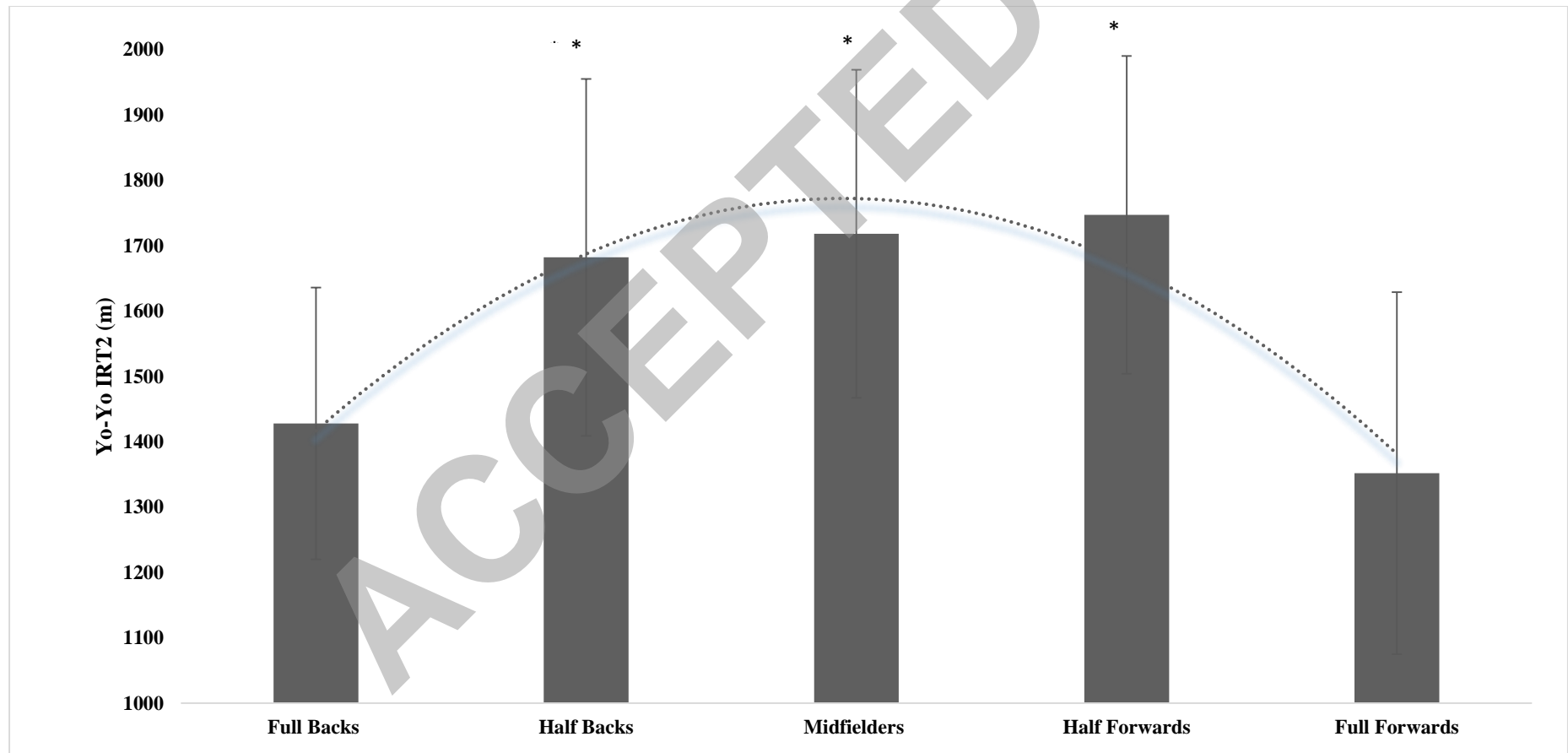| Sprint Performance (5-,10-, 20-m) | → | 20-minute Recovery | → | Yo-Yo Intermittent Recovery Test 2 |

Figure 2

*Significantly different from full backs and full forwards (p < 0.05)