Original research

Physical qualities and activity profiles of sub-elit and recreational Australian football players

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A B S T R A C T

Objectives: To investigate the relationship between physical qualities and match activity profiles of recreational Australian football players.

Methods: Forty players from three recreational Australian football teams (Division One, Two and Three) underwent a battery of fitness tests (vertical jump, 10 and 40 m sprint, 6 m × 30 m repeated sprint test, YoYo intermittent recovery level Two and 2-km time trial). The activity profiles of competitive match-play were quantified using 10-Hz Global Positioning System units.

Results: Division One players possessed greater maximum velocity, Yo-Yo level Two and 2-km time trial performances than Division Two and Three players. In addition, Division One players covered greater relative distance, and relative distances at moderate- and high-intensities during match-play than Division Two and Three players. Division Two players had better 2-km time trial performances than Division Three players. Positive associations (P < 0.05) were found between 10 m acceleration, maximum velocity, Yo-Yo level Two and 2-km time trial performances and relative distance, and relative distances covered at moderate- and high-intensities during match-play. Moderate relationships were found between vertical jump and relative distance and high-intensity running.

Conclusions: Sub-elit Australian football players competing at a higher level exhibit greater physical qualities and match-play activity profiles than lesser-skilled recreational players. Acceleration and maximum velocity, 2-km time trial and Yo-Yo level Two performances discriminate between players of different playing levels, and are related to physical match performance in recreational Australian football. The development of these qualities is likely to contribute to improved match performance in recreational Australian football players.

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1. Introduction

Investigating relationships between physical qualities and physical activity profiles of team-sport competition provides coaches with an understanding of the aspects of physical fitness that may influence match performance. Research has found significant relationships between multiple physical qualities and physical activity profiles across a number of different sports including Australian football, soccer and rugby league.1-3 While the results differ from sport to sport due to the varying physical requirements, players with better-developed physical qualities have typically shown better physical activity profiles during competitive match-play.

Rampinini et al.1 found significant relationships between the peak speed reached in a modified Montréal track test and total distance, high-intensity running and very high-intensity running during soccer matches. A recent of rugby league players found positive relationship between maximal aerobic power and total collisions, and prolonged high-intensity intermittent running ability and time on the field, total distance and distances covered in low- and high-speed running. Collectively, these findings demonstrate the importance of selected physical qualities to physical activity profiles in team sport athletes.

Despite some studies investigating the physical activity profiles of elite Australian football players,5-6 only one has investigated the relationship between physical qualities and physical activity profiles in these athletes.7 Mooney and colleagues7 found that the Yo-Yo Intermittent Recovery level Two (Yo-Yo IR2) test performance was associated with the number of ball involvements...
during match-play, and was mediated by high-intensity activity performed. These findings suggest that players possessing better prolonged high-intensity running ability (as estimated from the Yo-Yo Intermittent Recovery test) have more ball possessions/disposals when they perform more high-intensity activity. To date, this is the only study to investigate the relationship between physical qualities and physical activity profiles in Australian football players, highlighting a large gap in the literature. It is unlikely that prolonged high-intensity intermittent running performance is the only physical quality related to match performance in Australian football. With the large total distances and high-intensity activity demands, coupled with the high number of maximal accelerations characteristic of Australian football, it is likely that maximal aerobic power, repeated-sprint ability and other physical qualities may be related to match performance in Australian football players.

The nature of team sports requires athletes to perform for extended periods of time. Australian football matches are played over four 20 min quarters. With matches potentially lasting up to and beyond 100 min, reductions in physical performance are expected. Aughey measured the physical activity profiles of Australian football players during match-play and found reductions in both high-intensity activity and maximal accelerations later in games, with no meaningful reductions in total distance and low-intensity activity. Veale and Pearce also found reductions in blood lactate concentration and time spent at near maximal heart rate in the second half in elite junior players during pre-season competition matches. Both of these findings suggest that players suffer from fatigue in the latter stages of competition.

Most time–motion analyses have been conducted on athletes in professional or semi-professional competitions, via clubs and sports institutes who have the expertise and necessary equipment. However, this population comprises only a small percentage of the total participants in the sport, as the majority of players are amateurs, competing at lower levels. With this in mind, the purpose of this study was to (1) quantify the physical activity profiles and in game changes from quarter to quarter of sub–elite and recreational Australian football players competing at three different levels of competition; (2) investigate the physical qualities that discriminate sub–elite and recreational players competing in a recreational Australian football competition; and (3) determine the relationship between physical qualities and physical activity profiles of sub–elite and recreational Australian football players competing in sub–elite and recreational competitions.

2. Methods

Forty recreational Australian football players (mean ± SD age, 26.6 ± 4.5 years) underwent a battery of fitness tests. Each test was separated by between 48 and 120 h and conducted at the end of the pre-season training period. Players were instructed to wear football boots for testing (except for the 2-km time trial) and each session was preceded by a standardised 15 min warm-up. Global positioning system (GPS) data was collected for at least two games (mean ± SD, 2.8 ± 0.6, range = 2–4) per participant over the course of the season. A total of 28 participants were included in the GPS data analysis as a result of incomplete datasets or due to a lack of games played. Players were from three separate teams across two different leagues. Division One players (n = 14) were sourced from a North Eastern Australian Football League club. Division Two (n = 10) and Three (n = 16) players were sought from the senior grade and reserve grade teams from a South East Queensland Australian Football Division Two club. Whilst training loads were not quantified in this study, Division One players trained three sessions per week, whereas Division Two and Three players trained two sessions per week.

Australian football players are often required to perform repeated accelerations, change of direction and jumping efforts, and high velocity sprints in games. As such, the tests of physical qualities used in this study were chosen due to their relevance to the sport, and also their use in other studies of Australian football players.

Vertical jump height was assessed on a grass playing field using a Yardstick vertical jump device (Swift Performance Equipment, New South Wales, Australia). Three separate counter movement jumps (with arm swing) were performed. The best score from the three trials, separated by at least 60 s was recorded as the vertical jump height. No specific instructions were given on the speed or depth of each counter movement jump other than to jump from a standing start and to use the preferred arm for reaching. The vertical jump is considered a suitable estimate of lower limb muscular power with reasonable reliability and validity.

Speed was assessed using a 40 m sprint test measured on a grass playing field using dual-beam electronic timing gates (Swift Performance Equipment, New South Wales, Australia). The starting gate was aligned with the participant’s rear foot at 0 m, with further gates then positioned at 10, 30 and 40 m. Acceleration was calculated from the 0–10 m timing gates and the highest speed was calculated by dividing displacement over the last 10 m by the 30–40 m split time. The best of three attempts were recorded with each attempt separated by 5–10 min.

Repeated-sprint ability was assessed using a 6 m × 30 m repeated-sprint test adapted from Pyne et al. Participants started each sprint on a 20 s cycle. Warnings were provided at 5 s followed by a verbal and visual starting cue for the subsequent sprint starting from the end of the previous sprint. The test was filmed with two high-speed digital cameras attached to tripods recording at 120 frames per second. The cameras were placed in an elevated position in line with the finish line to capture all participants crossing the finish line. Video footage was analysed using SiliconCoach Pro (Siliconcoach, Dunedin, New Zealand) to digitally identify start and finish lines. Scores were recorded as total accumulated time. The intra-class coefficient and typical error of measurement for this test have been reported as 0.96% and 1.5% respectively.

Prolonged high-intensity intermittent running ability was assessed via the Yo-yo IR2test. Scores were recorded as the total distance covered at test completion. The test was performed on a grass playing field.

Time for a 2-km time trial was measured with a hand-held stopwatch. Participants completed the time trial in running shoes around the boundary line of the playing field. The distance along the boundary line was measured with a trundle wheel and participants completed the appropriate number of laps necessary to complete 2-km. The 2-km distance was selected as it was regularly performed by both clubs as part of their pre-season testing battery.

For game monitoring, each player wore a specifically designed garment containing a MinimaxX GPS unit (S4, Catapult Innovations, Melbourne, Australia) sampling at 10 Hz in a pouch on the back of each participant located between the top of the scapulae during competitive matches. Each unit was capable of recording acceleration, velocity, distance and repeated high-intensity efforts. Data were categorised into (i) velocity bands, corresponding to low-intensity activity (0–1.94 m s⁻¹) moderate-intensity activity (1.95–4 m s⁻¹) and high-intensity activity (>4.01 m s⁻¹), (ii) maximum accelerations (>2.78 m s⁻²) and (iii) repeated high-intensity effort bouts. A repeated high-intensity effort bout was defined as 3 or more maximal accelerations or high speed efforts with less than 21 s recovery between efforts. Changes in physical activity profiles were also assessed from quarter to quarter across the duration of the match. The MinimaxX units have been shown to...
Table 1
Physical qualities and match activity profiles of division 1, 2 and 3 recreational Australian football players.

<table>
<thead>
<tr>
<th>Physical qualities</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>24.9±4.9</td>
<td>27.3±5.2</td>
<td>27.4±3.6</td>
<td>0.47</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>182.1±6.3</td>
<td>183.3±7.2</td>
<td>182.8±7.3</td>
<td>0.18</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>82.8±7.7</td>
<td>82.6±11.1</td>
<td>88.0±8.42</td>
<td>-0.03</td>
</tr>
<tr>
<td>10 m acceleration (m s⁻¹)</td>
<td>3.1±0.2</td>
<td>2.9±0.3</td>
<td>2.7±0.3</td>
<td>-0.84</td>
</tr>
<tr>
<td>Maximum velocity (m s⁻¹)</td>
<td>8.6±0.3</td>
<td>7.9±0.3</td>
<td>7.6±0.5</td>
<td>-1.51</td>
</tr>
<tr>
<td>40 m sprint (s)</td>
<td>5.5±0.2</td>
<td>5.7±0.2</td>
<td>5.9±0.3</td>
<td>1.32</td>
</tr>
<tr>
<td>Vertical jump (cm)</td>
<td>55±6</td>
<td>50±5</td>
<td>52±10</td>
<td>-0.90</td>
</tr>
<tr>
<td>Repeated-sprint ability (s)</td>
<td>28.9±12</td>
<td>28.2±0.7</td>
<td>28.7±1.9</td>
<td>-0.69</td>
</tr>
<tr>
<td>Yo-Yo IR2 (m)</td>
<td>880±260</td>
<td>476±83</td>
<td>408±128</td>
<td>-1.41</td>
</tr>
<tr>
<td>2-km time trial (s)</td>
<td>409±21</td>
<td>484±28</td>
<td>500±89</td>
<td>1.69</td>
</tr>
</tbody>
</table>

Activity profiles

| Time (min) | 99.8±6.0 | 102.3±8.4 | 75.4±5.2 | 0.35 | -1.79 | -1.76 |
| Relative distance (min⁻¹) | 129.8±10.2 | 106.5±13.4 | 101.6±16.5 | -1.40 | -1.41 | -0.32 |
| Low-intensity activity (min⁻¹) | 41.1±3.8 | 40.7±2.4 | 41.3±1.5 | -0.12 | 0.31 | 0.33 |
| Moderate-intensity activity (min⁻¹) | 52.7±5.6 | 43.8±9.7 | 37.7±9.3 | -0.09 | -1.38 | -0.69 |
| High-intensity activity (min⁻¹) | 35.8±8.5 | 20.6±4.9 | 21.1±7.8 | -1.47 | -1.34 | 0.00 |
| Accelerations (effort min⁻¹) | 0.4±0.1 | 0.4±0.3 | 0.4±0.1 | 0.06 | 0.01 | 0.05 |
| Repeat high intensity effort bouts (frequency min⁻¹) | 1 every 40.4 min | 1 every 90.2 min | 1 every 78.9 min | 0.95 | 0.91 | 0.21 |

Data are mean ± SD.

1 Significantly different (P<0.05) from 1.

* Significantly different (P<0.05) from 2.

Effect sizes of <0.2, 0.2–0.6, 0.61–1.2, 1.21–2.0, and >2.0 were considered trivial, small, moderate, large, and very large, respectively.

have acceptable validity and reliability for measuring movements commonly observed in team sports. Only active field time was analysed. Players were positionally matched across teams.

Differences in the physical activity profiles of match-play and physical qualities of the three playing levels were compared using traditional null hypothesis testing and by using a practical approach based on the real world relevance of the results. Firstly, differences in the physical qualities and the physical activity profiles of Division One, Two, and Three recreational players were analysed using a one-way ANOVA. A Tukey’s post hoc test was used to determine the source of any significant differences. The level of significance was set at P<0.05 and all data were reported as mean ± SD. Secondly, given the practical nature of the study, magnitude based inferential statistics were also used to determine any practically significant differences in physical activity profiles and physical qualities between groups. Differences among groups were analysed using Cohen’s effect size (ES) statistic, with values of <0.2, 0.2–0.6, 0.61–1.2, 1.21–2.0, and >2.0 considered trivial, small, moderate, large, and very large, respectively. Magnitudes of difference between the two groups were classified as a substantially greater or lesser effect when there was a >75% likelihood of the effect being equal to or greater than the smallest worthwhile change, estimated as 0.2 x between-subject standard deviation (small ES). Effects with less certainty were classified as trivial and where the ±90% CI of the ES crossed the boundaries of ES –0.2 and 0.2, the effects were reported as unclear. Pearson product moment correlation coefficients were used to determine the relationship between physical qualities and physical activity profile variables, with values of 0.10–0.29, 0.30–0.50, 0.51–0.70, and >0.71 considered small, moderate, large and very large, respectively.

3. Results

The physical qualities for each division are presented in Table 1. In general, Division One players had better developed physical qualities than Division Two and Three players. Large differences were observed between Division One players and Division Two and Three players for maximum velocity (ES ≥ 1.51), Yo-Yo IR2 (ES ≥ 1.41) and 2-km time (ES ≥ 1.46). Moderate differences were found between Division One players and Division Two and Three players for 10 m acceleration (ES ≥ 0.84) and vertical jump height (ES ≥ 0.63). Few meaningful differences were found between Division Two and Division Three players for physical qualities, although Division Two players had a faster (P<0.05, ES = 0.85) 2-km time than Division Three players. Trivial to moderate differences (P<0.05) were found among divisions for age (ES = 0.02–0.56), height (ES = 0.08–0.18), body mass (ES = 0.03 to 0.62), and repeated-sprint ability (ES = 0.22 to 0.69).

The playing time and physical activity profiles for each division are also presented in Table 1. In total, 81 files were analysed across the 28 players; 26 files from Division One, 23 files from Division Two, and 32 files from Division Three. The time between physical quality testing and GPS match analysis was between one week and four months. Division One players covered significantly greater (P<0.05, ES = 1.33) relative distance than Division Two and Three players. The greater relative distance in Division One players was achieved through greater relative distances (P<0.05) at moderate- (ES = 0.91) and high-intensities (ES ≥ 1.38). There were significant (P<0.05) differences between Division One and both Division Two (ES = 0.95) and Three (ES = 0.91) players for the frequency of repeated high-intensity effort bouts, with repeated high-intensity effort activity greater in Division One players. Moderate differences (P<0.05, ES = 0.67) were found between Division Two and Three players for the frequency of repeated high-intensity effort bouts. No differences were found for distances covered in maximal accelerations.

There was a significant (P<0.05, ES = −1.28) reduction in relative distance covered from the first to fourth quarter for Division One players (Fig. 1). This reduction was achieved through large reductions in moderate- (P<0.05, ES = −1.15) and high-intensity (P<0.05, ES = −1.13) activity. Similar patterns occurred for Division Two players. While there were no significant reductions in relative distance (P>0.05, ES = −0.65), there was a small decrease in moderate- (ES = −0.78) and a significant decrease in high-intensity activity (P<0.05, ES = −1.15) for Division Two players. There were only small differences between the first and fourth quarter for relative distance (ES = −0.39), moderate- (ES = −0.68) and high-intensity (ES = −0.77) activity for Division Three players. There were small to moderate increases in low-intensity activity from the first to fourth quarter for Division One (ES = 0.64) and Two (ES = 0.59) players.
There were small differences between Division One and both Division Two and Three players for percentage reductions in relative distance ($ES = -0.26$ and $-0.59$) and moderate-intensity activity ($ES = 0.37$ and 0.37) from the first to fourth quarter. There was a greater reduction in high-intensity activity distance ($ES = 0.60$) in Division One than Division Two players. Although there was an increase between the first and fourth quarter for low-intensity activity in all three playing groups, the differences between Division One and Division Two players ($ES = 0.44$) were small and non-significant. However, there was a significant difference ($P<0.05$) between Division One and Three players for low-intensity activity ($ES = -0.37$). The difference between Division Two and Division Three players for relative distance ($ES = 0.33$), moderate- ($ES = 0.09$) and high intensity ($ES = -0.34$) activity variables were small and non-significant.

The relationship between the tests of physical qualities and physical activity profiles are shown in Table 2. Generally, the tests of physical qualities were positively associated with physical activity profiles; players with greater Yo-Yo IR2 scores, faster 2-km times and higher maximal velocities spent more time on the field, covered greater relative distance and greater distances at moderate- and high-intensities. Age and body mass were found to be negatively associated with relative distance, moderate- and high-intensity activity distances.

**4. Discussion**

This study is the first to compare the physical activity profiles and physical qualities of recreational Australian football players across three different levels of competition. In addition, no previous study has investigated the relationship between physical qualities and physical activity profiles in senior community-level Australian football players. The results demonstrate that players competing at a higher level of competition possess greater physical qualities, and exhibit higher playing intensities than those competing in lower divisions. Furthermore, strong relationships were found between selected physical qualities and the amount of high-speed activity performed in competition. From a practical perspective, these findings emphasise the importance of well-developed physical qualities to both team selection and playing intensity in community-level Australian football players.

The physical qualities of Division One players were mostly greater than Division Two and Three players. These findings are in agreement with previous research which found that Yo-Yo intermittent recovery level one scores successfully distinguished between elite-junior Australian football players, sub-junior junior Australian football players, and an age matched general population control group.\(^1^5\) A number of possible explanations can be provided for the higher fitness of Division One players. Firstly, Division One players train and compete in a higher standard competition against stronger opposition, which may explain, at least in part, the better developed physical qualities in this group. Secondly, while no attempt was made to quantify training loads in this study, Division One players completed 30% more training time than that completed by lower division players. While it is unclear if the higher fitness levels of Division One players is the cause or the effect of training and competing at a higher playing standard, the present results clearly demonstrate that higher level competition is associated with better developed physical qualities.

Division Two and Three players were sought from the senior and reserve grade sides of the same club. It is likely that due to this homogeneity, players received the same training stimulus. As a result, the lack of difference between Division Two and Three players for all tests but the 2-km time trial may be expected. Previous research has also found a moderate difference in 3-km time trial performances between selected and non-selected professional Australian football players.\(^1^3\) The lack of difference between Division Two and Three players for the remaining tests of physical qualities and the findings of previous researchers,\(^1^3\) highlights the relevance of a long distance (2- or 3-km) time trial to Australian football performance.

While it has previously been reported that repeated-sprint time was a significant discriminator of selected and non-selected players in a professional Australian football team,\(^2^3\) recent research has found that repeated-sprints occur infrequently in Australian football match-play.\(^2^4\) The present study found no
differences between any of the three divisions for repeated-sprint ability. Moreover, repeated high-intensity effort bouts occurred infrequently (on average one bout every 40 min for Division One players) during match-play. These findings suggest that the importance of repeated-sprint ability for sub-elite and recreational Australian football players may have been overstated, or that the test used does not adequately discriminate this ability in this sample population.

Consistent with findings between elite and sub-elite players, Division One players were exposed to more demanding match intensities than Division Two and Three players. Division One players covered the greatest relative distance, moderate- and high-intensity activity distances, and had a greater repeated high-intensity effort frequency than Division Two and Three players. Furthermore, Division Two players covered greater relative distance, and performed more moderate- and high-intensity activity than Division Three players. Division One players performed almost double the amount of relative high-intensity activity of Division Two and Three players.

Physical activity profile comparisons were also made from quarter to quarter for all three divisions. There was a large, significant reduction in relative distance from the first to fourth quarter in Division One players. However, there were only small to moderate differences in relative distance between the first and fourth quarter for Division Two and Three players. It has previously been reported that elite players may be more fatigue resistant than those at lower levels of competition, although others have shown that the magnitude of reductions in performance across the course of a match are related to the intensity of the first half and first quarter. The increased intensity of the first quarter in Division One players compared to the first quarter of Division Two and Three players may explain the greater reduction in performance in these players. However, while the percentage reduction in relative distance from the first to fourth quarter was higher in Division One players, the relative distance covered by Division One players in the fourth quarter was still greater than that covered in the first quarter for Division Two and Three players. The reduction in relative distance can be explained by declines in moderate- and high-intensity activity for all divisions. Research into elite senior and junior soccer players has shown that reductions in high-intensity activity from the first to second halves are common. Similar observations have been made in professional Australian football players. The higher physical qualities of Division One players may assist in maintaining higher levels of match intensity compared to Division Two and Three players irrespective of the fatigue-induced reduction in playing intensity.

While not statistically different, the moderate difference between Division One players and both Division Two and Three players suggest that there is a practical difference in lower limb power between higher and lower division Australian football players. The moderate positive relationship between vertical jump, relative distance and high-intensity activity demonstrates the importance of lower limb force production as a useful assessment tool for Australian football. Large to very large relationships were found between the highest speed achieved in the 40 m sprint, Yo-Yo IR2 scores, and 2-km time-trial performances and the relative distance covered in match-play. Previous researchers have demonstrated that physical assessments of high-intensity running ability were associated with physical performance in team based field sports such as soccer, rugby league and Australian football. Although others have investigated the relationship between Yo-Yo IR2 performance and high-speed activity in Australian football, a novel aspect of this study was the investigation of relationships between multiple physical qualities and match physical activity profiles. There was a clear positive relationship between Yo-Yo IR2 performances and measures of relative distance, moderate- and high-speed activity. These findings are consistent with those of Mooney et al. However, consistent with our hypothesis, physical qualities other than prolonged high-intensity intermittent running ability were also related to match physical activity profiles.

While this study contributes to the body of knowledge in Australian football, the study is not without limitations. Firstly, while our primary purpose was to investigate players competing at a recreational level, inclusion of elite players may have provided better comparisons with previous literature and current elite competition. Secondly, the number of games analysed per player was also limited due to the high number of competing teams and access to a limited number of GPS devices. Finally, it is reasonable to expect that the physical qualities tested during pre-season would change over the course of a competitive season. Unfortunately, in some participants there was a delay of up to four months between physical quality testing and the final GPS data collection. Given that physical qualities could change in this period, the relationships between physical qualities and physical activity profiles would likely be stronger earlier in the season when players were in peak physical condition. However, due to the limited recovery time between games and the exhausting nature of some of the field tests it was not possible to repeat testing in-season. There still remains a large gap in the literature for investigating the relationships between multiple physical qualities and physical activity profiles in elite Australian football players.

5. Conclusion

This study compared the physical activity profiles and physical qualities of recreational Australian football players across three different levels of competition. In addition, the relationships between

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Table 2

<table>
<thead>
<tr>
<th></th>
<th>Time</th>
<th>RD</th>
<th>LIA</th>
<th>MIA</th>
<th>HIA</th>
<th>Acc</th>
<th>RHIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.15</td>
<td>-0.57**</td>
<td>0.05</td>
<td>-0.52</td>
<td>-0.45*</td>
<td>0.05</td>
<td>0.31</td>
</tr>
<tr>
<td>Height</td>
<td>0.03</td>
<td>-0.18</td>
<td>0.51</td>
<td>-0.28</td>
<td>-0.38</td>
<td>-0.14</td>
<td>-0.17</td>
</tr>
<tr>
<td>Body mass</td>
<td>-0.27</td>
<td>-0.47**</td>
<td>0.31</td>
<td>-0.57*</td>
<td>-0.40*</td>
<td>-0.28</td>
<td>0.15</td>
</tr>
<tr>
<td>10 m acceleration</td>
<td>0.52*</td>
<td>0.36</td>
<td>0.19</td>
<td>0.31</td>
<td>0.27</td>
<td>-0.00</td>
<td>-0.12</td>
</tr>
<tr>
<td>Maximum velocity</td>
<td>0.47</td>
<td>0.58**</td>
<td>-0.07</td>
<td>0.55*</td>
<td>0.57*</td>
<td>-0.00</td>
<td>-0.29</td>
</tr>
<tr>
<td>Vertical jump</td>
<td>-0.08</td>
<td>0.42*</td>
<td>-0.01</td>
<td>0.33</td>
<td>0.43*</td>
<td>-0.17</td>
<td>-0.36</td>
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<tr>
<td>Repeated-sprint ability</td>
<td>-0.04</td>
<td>-0.07</td>
<td>-0.26</td>
<td>-0.09</td>
<td>-0.04</td>
<td>-0.23</td>
<td>0.14</td>
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<tr>
<td>Yo-Yo IR2</td>
<td>0.39</td>
<td>0.72*</td>
<td>-0.09</td>
<td>0.59*</td>
<td>0.75*</td>
<td>0.06</td>
<td>-0.48</td>
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<tr>
<td>2-km time trial</td>
<td>-0.52*</td>
<td>-0.68**</td>
<td>0.01</td>
<td>-0.63*</td>
<td>-0.58**</td>
<td>0.03</td>
<td>0.33</td>
</tr>
</tbody>
</table>

RD = relative distance; LIA = low-intensity activity; MIA = moderate-intensity activity; HIA = high-intensity activity, Acc = accelerations; RHIE = repeat high-intensity effort bouts.

* Denotes significance at P < 0.05.
** Denotes significance at P < 0.001.

Correlations of 0.10–0.29, 0.30–0.50, 0.51–0.70, and >0.71 were considered small, moderate, large and very large, respectively.
these physical qualities and match physical activity profiles were investigated. The results of this study demonstrate that players competing at a higher level of competition possess greater physical qualities, and exhibit higher playing intensities than those competing in lower divisions. Furthermore, strong relationships were found between selected physical qualities, relative distance, and distances covered in moderate- and high-intensity activity performed in competition. From a practical perspective, these findings emphasise the importance of well-developed physical qualities to both team selection and playing intensity in recreational Australian football players.

6. Practical implications

- Speed, Yo-Yo IR2 performance and 2-km time trial results differ between levels of competition in recreational and sub-elite Australian football.
- Appropriate training intensities can be prescribed to recreational Australian footballers based on the physical activity profiles of match-play.
- Improving maximum speed, prolonged high-intensity running ability and endurance of recreational Australian football players may result in greater relative distances covered, and more distance covered at moderate- and high-intensities, which may improve the physical activity profiles in matches.

Acknowledgements

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References
