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ABSTRACT

Purpose: To establish levels of association between physical fitness and match activity profiles of players within the Australian Football League (AFL) participation pathway. **Methods:** Players (n = 287, range 10.9 - 19.1 years) were assessed on 20-m sprint, AFL agility, vertical jump (VJ) and running VJ, 20-m multi stage fitness test (MSFT), and Athletic Abilities Assessment (AAA). Match activity profiles were obtained from global positioning system (GPS) measures; relative speed, maximal velocity, and relative high speed running (HSR). **Results:** Correlational analyses revealed moderate relationships between sprint (r = 0.32-0.57, $p \leq 0.05$), and jump test scores (r = 0.34-0.78, $p \leq 0.05$) and match activity profiles in Local U12, Local U14, National U16 and National U18s, except jump tests in National U18s. AFL agility was also moderate-to-strongly associated in Local U12, Local U14, Local U18, and National U16s (r = 0.37-0.87, $p \leq 0.05$), and strongly associated with relative speed in Local U18s (r = 0.84, $p \leq 0.05$). Match relative speed and HSR were moderate-to-strongly associated with 20-m multi-stage fitness test (MSFT) in Local U14, Local U18, and National U18s (r = 0.41-0.95, $p \leq 0.05$), and AAA in Local U12, and Local U18s (p = 0.35-0.67, $p \leq 0.05$). Match activity profile demands increased between Local U12 and National U16s then plateaued. **Conclusions:** Physical fitness relates more strongly to match activity profiles in younger adolescent and National level players. Recruiters should consider adolescent physical fitness and match activity profiles as dynamic across the AFL participation pathway.

Keywords: Talent identification, team sport, match analysis, physical fitness, sport development pathway

INTRODUCTION

Australian football (AF) is a dynamic team sport that requires players to display high levels of physical fitness in aerobic capacity, speed, agility, power, and strength.[1-3] The Australian Football League's (AFL) participation pathway consists of two streams; a) the local participation pathway, and b) the talent pathway.[3] The former includes teams from local competition, private schools, and school sport academies, while the latter comprises State/National Under (U) 16 and U18 squads.[4] Physical fitness of talent pathway players is tested annually at the AFL State and National U16 and U18 combines,[1,2,5] however testing is sporadic within local participation levels.[6,7] Considering physical fitness and match activity profile can influence a player's selection into the talent pathway from local participation levels, it is important to establish the existing differences between these variables across multiple levels of the AFL participation pathway.

In addition to physical fitness, match activity profiles are now commonly collected during competition in both junior talent squads and senior elite competition.[6,8-11] Typically obtained via global positioning system technology, a range of metrics have been reported, including total metreage, total game time, time/distance within speed zones (e.g. standing, walking, jogging, sprinting), relative speed, high intensity efforts, high speed running (HSR), and maximal velocity.[6,8-12] AFL athletes typically exhibit higher relative speeds and relative high intensity efforts than senior state level players (relative speed: +10 $m.min^{-1}$, high intensity efforts: +0.6 $efforts.min^{-1}$) and talent pathway levels (relative speed: +8-16 $m.min^{-1}$, high intensity efforts: +0.1 $efforts.min^{-1}$).[9,10] Within the local participation pathway levels (Local U11 to U19), incremental improvements in relative speed and HSR during a game is evident as players progress through competition levels, with early maturing players producing higher relative HSR (>10 $m.min^{-1}$) than late maturing players.[6] However, an understanding of the relationship between physical fitness and match activity profiles across the AFL participation pathways levels is also required. Such knowledge would establish specific physical tests coaches and talent scouts should or should not consider for talent identification at specific AFL participation pathway levels.

Any differences between match activity profiles of junior footballers is likely to be impacted by the interactions of three categories of constraints; organismic, task, and environmental.[13,14] Organismic constraints such as growth, maturity, and learning stages of individual players can influence their physical fitness, consequently affecting the stability of competition within local participation and talent pathway levels.[13] For example, a sudden growth spurt in an individual player can alter motor responses and create muscle asymmetries, leading to variation in fitness and skill level, which subsequently impacts their performance in the game (i.e., environment).[13] Furthermore, the variability of organismic constraints of the players may influence the performance environment across the AFL participation pathway, with fluctuations in game structure, and physical demands of players.[14] Rule differences between AFL participation pathway levels may also affect the physical demands of the game.[13,15] For example, Local U12s games are restricted to 15 min quarters, played on a smaller grounds, use a smaller football, with a choice between 15v15 or 18v18 players at the coaches discretion.[16] Furthermore, AFL match policy provides recommendations on training foci for local participation pathway levels, with minimal to no focus on physical fitness;[16] however, talent pathway levels are provided with fitness training, creating gaps in physical development between tiers of competition.[3] With differences in game play, skill level, game policies, and field size,[7,17] the interaction between physical fitness and match activity profiles at different levels of junior AF competition requires investigation.

Physical fitness and match activity profiles of players within the AFL participation pathway may also be influenced by the quality of aerobic capacity, jump ability, speed, agility, and movement ability of team members and competitors.[15] The annual AFL Draft Combines at state and national level incorporates the physical fitness testing to assess these physical qualities in talent pathway players; 5-m, 10-m, 20-m sprint, AFL agility, vertical jump (VJ), running VJ (right and left leg), and the 20-m multi-stage fitness test (MSFT).[1,18] As a result, physical fitness tests have proven to be useful for tracking career progression, recruiting trends, and players' selection for specific positions into elite AFL competition.[1,2,5,18] The current AFL Draft Combine test battery has primarily been used to differentiate players based on physical fitness,[1,2,18] with movement screenings also employed to assess functional movement skills of players in talent pathways and elite levels.[4,19] However, grouping of players based on age does not take into consideration the variability of age chronology and biology, contributing to the relative age effect (RAE) in talent squads.[15] Considering AFL talent scouts partially rely on the AFL Draft Combine testing battery to determine physical potential of players, quantifying the magnitude in which physical fitness tests relate to match activity profiles between tiers of AFL participation levels would inform recruitment strategies.

The primary aim of this study was to establish the between-player physical fitness and match activity profile relationship at different competition levels within the AFL participation pathway. A secondary aim was to determine the extent to which these relationships differ between each of these competition levels, and how match activity profiles fluctuate as players' progress through the AFL participation pathway.

METHODS

This study was a cross-sectional analysis of the AFL participation pathway during the 2017 season, with each player assessed during one physical fitness session and one game. A total of seven AFL participation pathway levels were chosen for analysis, with four levels (Local U12, Local U14, Local U16, Local U18) from the local participation pathway, and three levels (National U16, State U18, National U18) from the talent pathway. Players that participated in Local, Private School, or School Sport Academy competitions were classified into the following groups based on their age; Local U12 (n = 50), Local U14 (n = 81), Local U16 (n = 37), and Local U18 (n = 15). Age limits were determined using the age grouping policies stipulated by the AFL [16], with players categorised by age between January 1st and December 31st of that competition year (e.g. Local U14 player ≤14 years on January 1st). If players competed in talent pathway levels during the testing year they were classified as National U16 (n = 45), State U18 (n = 37), and National U18 (n = 22) according to the age competition level they participated.

Physical fitness testing and match activity profile analyses of players across the AFL participation pathway were conducted between September 2016 and September 2017. The Physical tests were: 5-m, 10-m, and 20-m sprint (s), VJ and running VJ (cm), AFL planned agility test (s), 20-m MSFT (level achieved), and the Athletic Ability Assessment (AAA) score.[1,2,5,18] Physical fitness tests were conducted according the AFL Draft Combine testing protocols outlined in Woods et al. [2] Testing was conducted using the same equipment and testing staff across multiple venues to minimise errors across sessions. Physical fitness sessions for the National U18s were conducted by AFL Academy personnel with the assistance of the lead authors testing staff and equipment, with all data provided to the research team. Physical fitness and movement ability testing sessions followed a 10 min standardised warm-up.[2] All participants completed a familiarization trial of each physical fitness test prior to testing. The 5-m, 10-m, 20-m sprint, and AFL agility was collected using a timing gate system (Fusion Smartspeed, Fusion Sport, Australia). Anthropometric data including height (m) and body mass (kg) were collected prior to testing, with the order of testing randomised within each group with the exception of the 20-m MSFT, which was completed last by all players in accordance with AFL Draft Combine testing protocol.[2,18] A video was used to demonstrate and provide instructions for all AAA movements (i.e., overhead squat, lunge, push-up, chin-up, and singleleg Romanian deadlift), based on coding criteria provided in Woods, McKeown, Haff, Robertson [20], with all players recorded for movement coding. Four testers coded all AAA videos, with excellent inter-rater agreement between testers (intraclass correlation coefficient: 0.82).[21]

Match activity profiles for each player were measured for one, two, or three games within each participant's competitive season, with an average of 67±80 days between physical testing and game. Data was recorded using a GPS device (Optimeye S5, Catapult Innovations, Australia) worn on the back between the scapulae and recording at a sampling rate of 10 Hz.[8] Specific GPS measures of match activity profiles selected for analysis were relative speed (m.min^{-1}),[10,11,22] maximal velocity (m.sec^{-1}),[12] and relative high speed running (HSR) (m.min^{-1}).[8,10,11,22] High speed running was estimated by the amount of on-field time spent ≥14.4 km/h, as per previous GPS measures used for junior AFL players.[6] The mean GPS measures across multiple games were calculated for analysis. All match GPS data was collected and coded by the lead author, with the exception of the National U18 group which was provided by the AFL Academy personnel. Ethical approval was obtained from the Victoria University Human Research Ethics Committee, with informed consent provided by participants or their parent/guardian prior to participating in this research.

Data analysis

Descriptive statistics of physical fitness and match activity profiles for each AFL level are presented in Table 1. The relationships between the physical fitness tests and match activity profiles were analysed using the Pearson's product moment correlation coefficient (r), with the relationships between match activity profiles and the total AAA score analysed using the Spearman's rank correlation coefficient (p).[23] Correlations were performed for all seven AFL levels. Magnitude of effect based on the correlation coefficient was determined as small r =

0.10-0.29, medium: r = 0.30-0.79, or large: r >0.80.[24] Confidence intervals were set at 95% precision. All statistical analysis and figures were produced using RStudio® statistical computing software version 1.1.442 (RStudio, Boston, Massachusetts).

RESULTS

Descriptive data of each AFL level's physical fitness measures and match activity profiles are presented in Table 1.

Sprints. The magnitude of correlations between sprint (5-m, 10-m, and 20-m) times were largest for all match activity measures in the National U18, National U16, and Local U12 levels (r = 0.32-0.57, $p \leq 0.05$). However little variation in the size of correlations between 5-m and match activity profiles were observed between Local U14 and State U18 levels (Figure 1). A gradual decrease in the strength of relationships between 10-m and 20-m sprint and all match activity measures was evident in older Local competition age groups (see Figure 1). Larger magnitudes between all match activity measures and all sprint tests were observed for the National U16 and National U18 levels (r = 0.48-0.50, $p \leq 0.05$), with the exception of maximal velocity in National U18.

Jump tests. The relationship between VJ and all match activity measures did not vary substantially across the AFL participation pathways levels. Running VJ (left and right) had the largest magnitude with all match activity measures within the Local U12s and Local U14s (r = 0.34-0.78, $p \leq 0.05$), with smaller magnitudes observed for all other levels (Figure 1).

AFL Agility. The strongest associations between AFL agility and match activity measures were observed in Local U18 (r = 0.82-0.87, $p \leq 0.05$), followed by Local U12, Local U14, and National U16 (r = 0.37-0.63, $p \leq 0.05$). However, the magnitudes between AFL agility and match activity measures varied (r = 0-0.57, $p \geq 0.05$) across other levels of the AFL participation pathway.

20-m multi-stage fitness test (MSFT). The 20-m MSFT had the strongest association with match activity measures in the Local U14, Local U18, and National U18 levels (r = 0.41-0.95, p ≤ 0.05), with weaker relationships observed in Local U12, Local U16, National U16, and State U18s.

Athletic Abilities Assessment (AAA). The Local U18 level had the largest magnitudes for total AAA score and all match activity measures (p = 0.35-0.67, p ≤ 0.05), with moderate relationships also observed between relative HSR and relative speed in Local U12. Local U14s showed the weakest associations between total AAA score and match activity measures (Figure 1).

Match activity profiles. The AFL participation pathway levels showed a gradual increase in all match measures from Local U12 to National U16 level (see Figure 2). However, similar match activity measures were evident between Local U12 and Local U14 players for all three measures. All match activity measures plateaued once players reached the National U16, State U18, and National U18 levels (Figure 2). The National U18 group experienced the smallest variation in all match activity measures compared to other AFL participation pathway levels, with less variation in maximal velocity also observed in Local U18 and State U18 players. The largest variation within an AFL participation level was for relative HSR in the National U16 level. The highest match activity measures were recorded in the National U16 level for all three measures; with the lowest being all measures of the Local U14 level.

DISCUSSION

This study identified moderate-to-large relationships between fitness tests and match activity profiles across the AFL participation pathway. Physical fitness tests were more appropriate in relation to match activity profiles of early adolescent AFL players compared to older players within the local levels. Secondly, players within the talent pathway typically had stronger links between their fitness test scores and match activity profiles in the National levels, but not in State levels. Match demands increase as players progressed through the local participation pathway, with all measures plateauing once players entered the talent pathway. Relative HSR in the National U16 level had the largest disparity between players compared to other match activity measures, with all National U18 measures showing the least difference. Physical fitness tests while relevant for player selection into AFL talent pathways, may be important for selection into National junior teams.

The task constraints of fitness tests (i.e. aerobic, jumps, speed, agility, movement ability) in players within the National U16, National U18, and Local U12 levels has a greater relationship with match activity profiles than other AFL levels. Higher physical fitness within the talent pathway may be a result of the provision of specialist coaching and training, resulting in stronger relationships with match activity profiles.[13,14,16] Similar outcomes have been observed in rugby and soccer, with higher levels of physical fitness associated with greater player involvement in high-intensity match activities.[25,26] The stronger associations between physical fitness and match activity profiles in Local U12 players may be explained by the organismic constraints of growth, maturity, and learning stages.[13] While physical development was not assessed in this study, it may be assumed that players within the Local U12s are more homogenous in their stages of development as they have not yet entered, or are in the early stages of puberty compared with other participation pathway levels.[6] Furthermore, the Local U12 level is one of the entry levels into AFL competition, therefore players would be at similar stages of learning.[3,13] As such, players may rely more on their physical fitness, specifically speed and jump ability, in game situations because they have not yet developed their football and game sense skills.[6,7,13,15] Furthermore, the variability in organismic constraints and subsequent environmental constraints during a game may explain the weaker relationship between physical fitness and match activity profiles between the Local U14 and Local U18 levels.[3,6] Variation in the maturity and growth of players is likely to contribute to the heterogeneity in physical fitness and match activity profiles.

Sprint tests in this study showed the strongest relationships with match activity measures in Local U12, National U16, and National U18, however a smaller association was observed in all other levels. Previously, junior soccer and AFL talent pathway players who were faster over the 5-m to 30-m were more likely to be selected into higher levels of competition than non-talent pathway players.[1,18,27] Furthermore, all correlations between jump ability and match activity profiles were similar across the AFL participation pathway levels, with the exception of Local U12 running VJ (right). This outcome supports the assertion that VJ and running VJ does not clearly relate to career progression in drafted National U18 players, or contribute to a player's chance of selection into higher levels of competition within the talent pathway.[1,18] The strongest reported relationship was between the AFL agility test and relative speed in the Local U18 group, but this decreased once players entered the talent pathway levels. Other studies also reported that the AFL agility test does not clearly discriminate between AFL drafted and non-drafted players,[1,28] and similarly may not differentiate between talented players. However, running endurance and running speed discriminated between playing standards and career progression in State U18 and National U18 players;[29,30] however this study reported only moderate associations between 20-m MSFT and match activity measures in National U18s.

Movement screening has been popular in several court and field sports. While movement screenings have been used in AFL studies as an injury prevention [31] and talent identification tool,[20,32,33] the AAA was only associated with relative speed and relative HSR in Local U12 and Local U18 levels. Players require strong movement foundations that underlie sport-specific movements such as running, jumping, pushing and pulling.[19] While the AAA does not relate to match activity in talent pathway levels, a developing player's ability to perform functional movements correctly may translate to improved performance in local competitions. Sprint tests may be valid for talent selection into AFL National U16 and National U18 squads, but not State level. Furthermore, the AFL agility and 20-m MSFT tests may be useful for talent identification across talent pathway; however jump ability and AAA may not as important to base talent selection decisions.

The talent pathway players showed higher match activity profiles than local participation pathway levels, however all three match activity measures plateaued upon entering the talent pathway. This outcome may be attributed to the ground size, as local participation pathway games are not required to compete on a full size oval.[13,16] Consequently, talent pathway players are required to cover more ground than local participation pathway levels. Furthermore, the National U16 group exhibited the largest variation in match activity profiles. This is not surprising considering the National U16 age group is an entry point into the AFL talent pathway, therefore it is assumed players have had limited exposure to specialised coaching and fitness training.[3,34] Interestingly, the Local U14s showed the lowest measures of match activity profiles and not the Local U12s. This may be a result of difference in the organismic constrains in this age group. [13] A sudden growth spurt is more likely to occur in Local U14s as adolescent male athletes have been found to reach the Tanner 5 stage of maturity at 13.5 to 15.3 years, with Tanner 1-2 stages ranging from 11 – 13.8 years. [35] As such, a Local U14 player may be experiencing altered motor responses and muscle asymmetries caused by growth spurts, leading to variation in fitness and skill level, which subsequently impacts their match activity profile.[13] The development of AFL expertise requires players to master key physical, technical, and tactical elements, with time spent in competition being integral for game development.[36] Players in the State U18 and National U18 levels may be more efficient during games because they experience less variability in organismic and environmental constraints than local participation pathway and National U16 players.[13,14]

These players may have had the opportunity to develop their football/game skills and physical fitness leading to a higher standard of play from their team and opposition, which reduces congestion and yields higher match activity profiles than local participation pathway levels.

A limitation of this study is that it did not investigate state senior or elite level AFL players; therefore, comparison with junior talent level players was not conducted. However, at the junior talent level, match activity measures that show significant positive correlations with a National U18 player's earlier draft selection into elite AFL are relative game speed, HSR distance and HSR percent of game time.[37] While game performance at the senior level was not included in this study, future research is recommended to provide elite-level talent selectors and coaches greater insight into the physical requirements needed for players to successfully transition into an elite AFL career. Another potential limitation is the tendency for GPS devices to underestimate distance and speed measures during straight line running, multi-directional changes, and variable movement patterns found in team field sports (coefficient of variation between 2 and 35%).[38,39] It is important that practitioners understand this limitation of GPS technology when interpreting the results, despite it being one of the most practical and time-efficient methods for match activity analysis.[38] Furthermore, the number of games recorded for match activity profiles is another limitation of this study as the data may not be representative of match outputs produced over the duration of a football season. For example, winning margin and match result influences physical outputs during a match at the elite level, with higher outputs reported in losses.[40] It is not known whether this extends to other AFL participation pathway levels, as other contextual factors such as playing position, player orientation, match objective, ground size, and team/opposition skill levels also possible influencers of match activity profiles.[13,14,41] Future research should focus on incorporating these contextual factors and how they influence match activity profiles across the football seasons for each level of the

AFL participation pathway. Finally, this study is an observational study and therefore causal links between physical fitness and match activity profiles cannot be made.

PRACTICAL APPLICATIONS

- The relationship between fitness and match activity profiles of players across the AFL participation pathway is dynamic. Talent recruiters, coaches, and conditioning staff should focus on long-term development of adolescent players instead of cross-sectional talent selection methods.
- Selection and development policies should include multiple selection time points as opposed to annual testing for selection into the talent pathways to account for changes in the organismic, environmental, and task constraints that influence a player's physical fitness and match activity profiles at key stages across the AFL participation pathway.
- The validity of jump and movement tests as a talent identification tool in AFL is unclear; therefore coaches and talent scouts should focus on sprint, agility and aerobic endurance performance when considering a player's future career progression.

CONCLUSIONS

Fitness and match activity profiles in adolescent AFL players are dynamic as they move through the development pathway. Fitness is more strongly related to match activity profiles in younger players, and those in National talent competitions. Sprint, agility and aerobic endurance tests should be useful for talent selection into National talent competition. Furthermore, match activity demands do not increase once players reach the talent pathway levels. Some physical fitness tests may be limited for player selection into AFL talent pathways, but others are useful for selection into junior National teams. Finally, talent scouts and coaches should focus on long-term physical fitness and match activity profiles in adolescent players during their development, instead of talent selection based on cross-sectional assessments.

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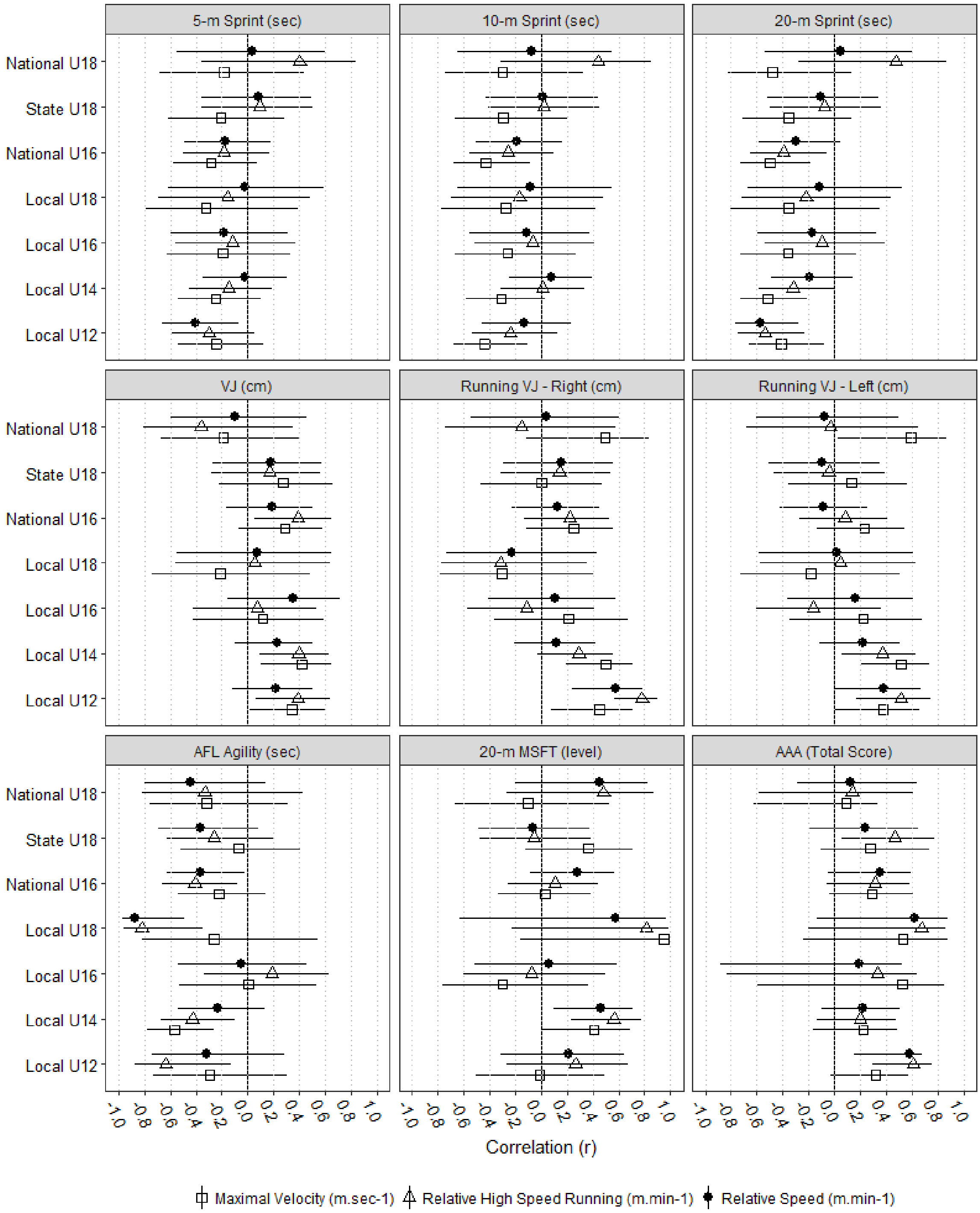


Figure 1. Relationship between fitness measures and match activity measures for AFL participation pathway levels. Data points represent the Pearson's Correlation Coefficient (*r*) between each test variable, with Total AAA data representing the Spearman's Rank Correlation Coefficient (*p*). Data is presented with 95% confidence intervals.

AFL: Australian Football League, U: Under, VJ: Vertical Jump, MSFT: Multi-stage fitness test, AAA: Athletic Abilities Assessment

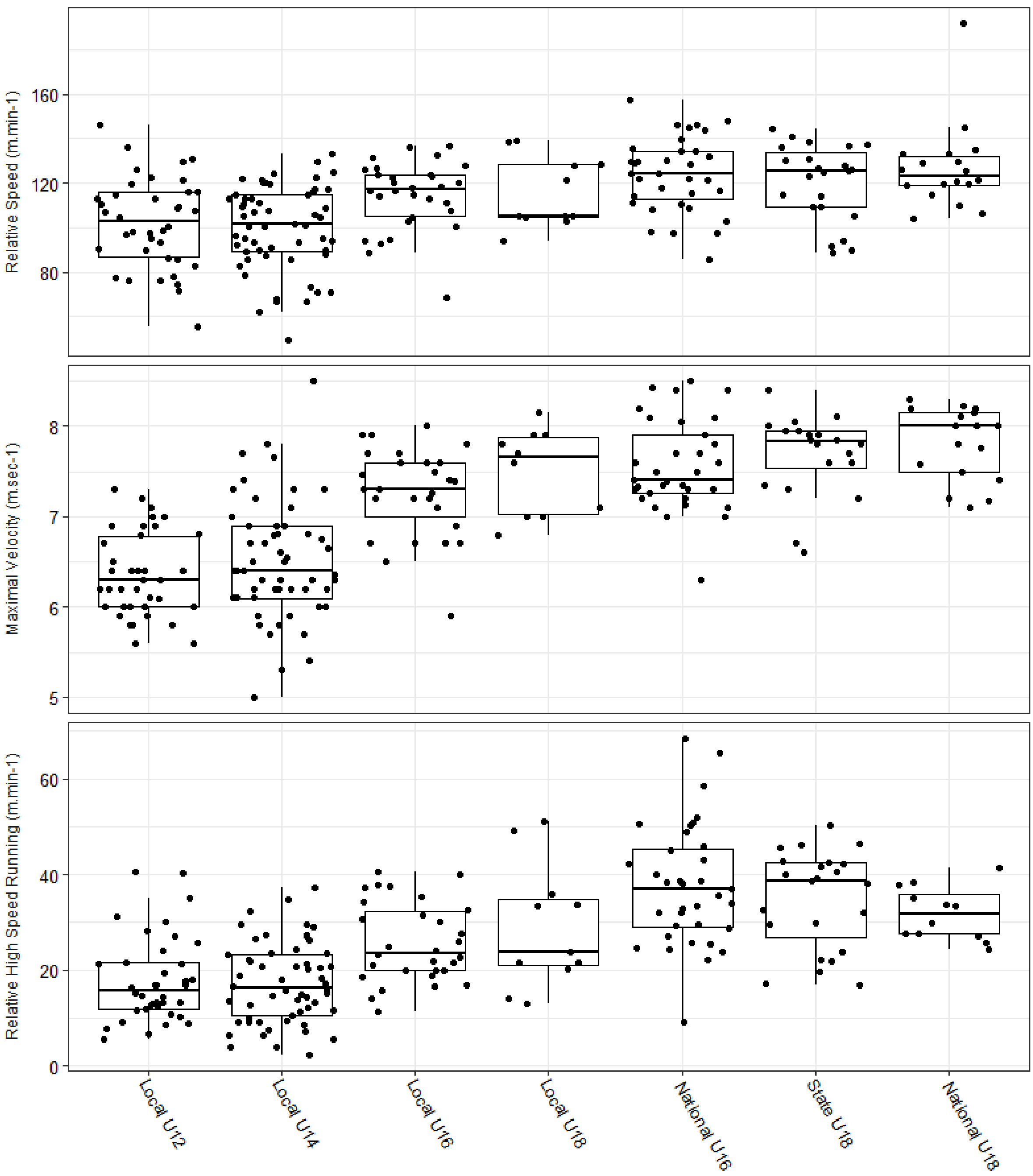
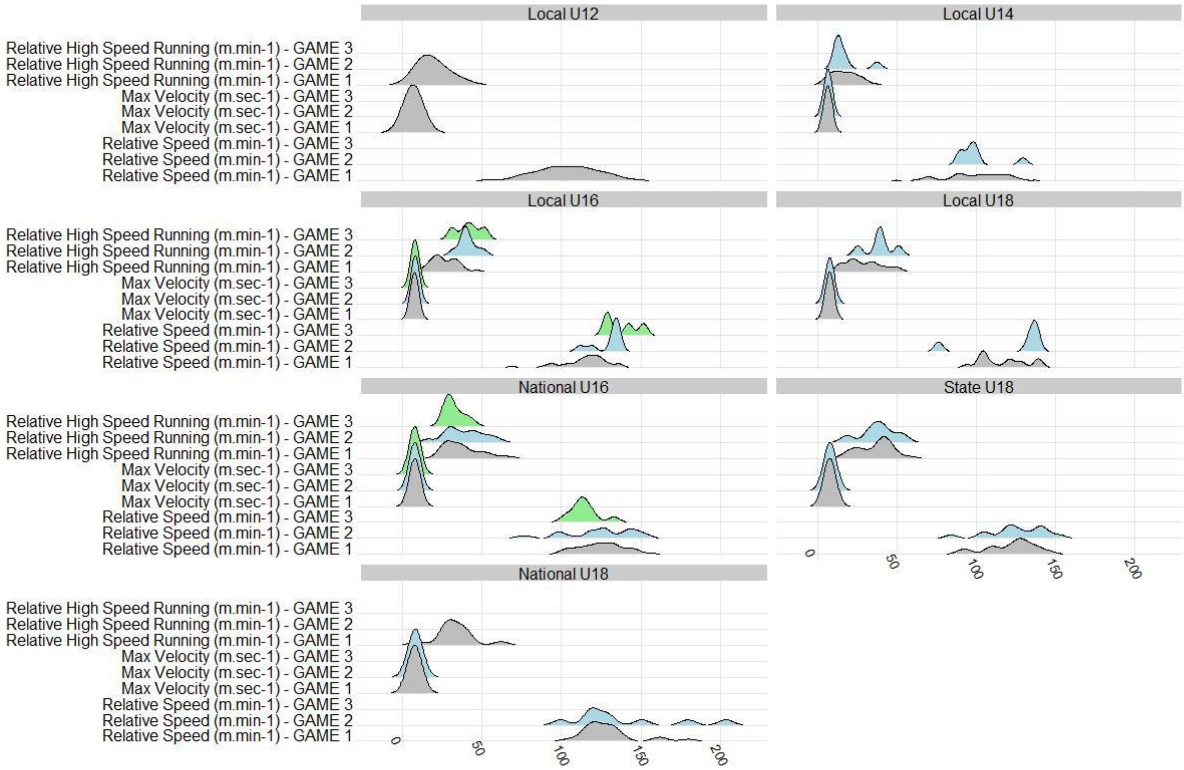


Figure 2. Match activity profiles of junior AFL players grouped by AFL participation pathway level. Game measures are represented as relative speed ($m.min^{-1}$), maximal velocity ($m.sec^{-1}$), and relative high speed running ($m.min^{-1}$).
U: Under

“Relationships Between Physical Testing and Match Activity Profiles Across the Australian Football League Participation Pathway” by Haycraft JAZ, Kovalchik S, Pyne DB, Robertson S
International Journal of Sports Physiology and Performance



GPS plot for responses to reviewers. The figure shows the distributions of match activity measures comparing multiple games for each AFL participation pathway level.

"Relationships Between Physical Testing and Match Activity Profiles Across the Australian Football League Participation Pathway" by Haycraft JAZ, Kovalchik S, Pyne DB, Robertson S
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Table 1. Descriptive statistics of physical tests and match activity profile measures for all AFL levels. Measures reported as mean ± standard deviation (SD).

Physical Test	All AFL Levels (n = 287)	Local U12 (n = 50)	Local U14 (n = 81)	Local U16 (n = 37)	Local U18 (n = 15)	National U16 (n = 45)	State U18 (n = 37)	National U18 (n = 22)
Age (year)	15.1 ± 1.9	12.4 ± 0.4	13.7 ± 0.5	16.2 ± 0.5	17.5 ± 0.4	16.0 ± 0.2	17.7 ± 0.7	16.4 ± 0.3
Height (cm)	174.2 ± 13.4	160.7 ± 11.3	165.9 ± 10.2	180.7 ± 7.9	180.4 ± 6.3	183.5 ± 6.6	184.2 ± 8.4	187.0 ± 6.9
Mass (kg)	64.5 ± 14.6	50.7 ± 13.0	55.0 ± 10.8	69.1 ± 7.3	72.7 ± 7.9	73.2 ± 6.6	79.4 ± 9.5	75.9 ± 6.9
20-m MSFT (level)	11.4 ± 2.1	8.4 ± 1.9	10.1 ± 1.7 □Δ•	12.0 ± 1.3	12.9 ± 1.4 □	12.9 ± 0.8	12.7 ± 1.0	12.8 ± 1.3
Vertical Jump (cm)	51.6 ± 12.2	40.4 ± 7.7 □Δ	41.9 ± 8.4 □Δ	59.1 ± 7.9	57.3 ± 8.9	62.7 ± 7.0 Δ	59.5 ± 5.6	60.2 ± 7.0
Running VJ - Right (cm)	60.8 ± 16.4	49.3 ± 14.2 □Δ•	47.9 ± 13.9 □	66.6 ± 10.6	63.2 ± 10.6	70.8 ± 12.9	74.1 ± 6.7	69.3 ± 13.0
Running VJ - Left (cm)	63.0 ± 15.5	50.6 ± 13.3 □Δ•	51.1 ± 10.6 □Δ	71.4 ± 7.5	68.8 ± 11.9	76.1 ± 9.7	69.3 ± 7.3	69.6 ± 21.7 □
5-m sprint (sec)	1.14 ± 0.08	1.18 ± 0.08 •	1.16 ± 0.08	1.06 ± 0.07	1.09 ± 0.07	1.14 ± 0.05	1.14 ± 0.04	1.09 ± 0.05
10-m sprint (sec)	1.94 ± 0.17	2.05 ± 0.15□	2.05 ± 0.22	1.82 ± 0.08	1.86 ± 0.10	1.88 ± 0.07 □	1.88 ± 0.07	1.83 ± 0.05
20-m sprint (sec)	3.28 ± 0.24	3.51 ± 0.21 □Δ•	3.46 ± 0.19 □Δ	3.12 ± 0.14	3.13 ± 0.15	3.14 ± 0.12 □Δ	3.13 ± 0.10	3.08 ± 0.10
AFL Agility (sec)	9.05 ± 0.60	9.52 ± 0.65 Δ	9.62 ± 0.51□Δ	8.91 ± 0.31	8.98 ± 0.36 Δ•	8.63 ± 0.35 Δ•	8.64 ± 0.30	8.74 ± 0.39
Athletic Ability Assessment (Total Score)	41.4 ± 8.2	40.4 ± 8.7 Δ•	37.8 ± 8.5	43.4 ± 5.8	38.1 ± 6.4 Δ•	41.9 ± 7.1 •	48.2 ± 5.7 Δ	43.8 ± 5.9
Relative Speed (m.min-1)	112 ± 21	102 ± 20	100 ± 19	114 ± 15	116 ± 16	124 ± 17	120 ± 17	127 ± 19
Maximal Velocity (m.sec-1)	7.0 ± 0.8	6.4 ± 0.5	6.5 ± 0.7	7.3 ± 0.5	7.5 ± 0.5	7.6 ± 0.5	7.7 ± 0.5	7.8 ± 0.4
Relative High Speed Running (m.min-1)	26 ± 13	18 ± 9	17 ± 8	26 ± 8	29 ± 13	38 ± 13	35 ± 10	32 ± 6

AFL = Australian Football League, U = under, MSFT = Multi-stage fitness test, VJ = vertical jump.
□ Significant relationship ≤ 0.05 between test and maximal velocity ($m.sec^{-1}$).
Δ Significant relationship ≤ 0.05 between test and relative high speed running ($m.min^{-1}$).
• Significant relationship ≤ 0.05 between test and relative speed ($m.min^{-1}$).