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Dr Carl Woods, *James Cook University Australia*
Ashley Cripps, *The University of Notre Dame Australia*
Dr Luke Hopper, *Edith Cowan University*
Dr Christopher Joyce, *The University of Notre Dame Australia*

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Original research

A comparison of the physical and anthropometric qualities explanatory of talent in the elite junior Australian football development pathway

Carl T. Woods[a,*], Ashley Cripps[b], Luke Hopper[c], Christopher Joyce[b]

[a] Discipline of Sport and Exercise Science, James Cook University, Australia
[b] School of Health Sciences, The University of Notre Dame, Australia
[c] Western Australian Academy of Performing Arts, Edith Cowan University, Australia

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ABSTRACT

Objectives: To compare the physical and anthropometric qualities explanatory of talent at two developmental levels in junior Australian football (AF).
Design: Cross-sectional observational.
Methods: From a total of 134 juniors, two developmental levels were categorised; U16 ($n = 50$; 15.6 ± 0.3 *y*), U18 ($n = 84$; 17.4 ± 0.5 *y*). Within these levels, two groups were a priori defined; talent identified (U16; $n = 25$; 15.7 ± 0.2 *y*; U18 $n = 42$; 17.5 ± 0.4 *y*), non-talent identified (U16; $n = 25$; 15.6 ± 0.4 *y*; U18; $n = 42$; 17.3 ± 0.6 *y*). Players completed seven physical and anthropometric assessments commonly utilised for talent identification in AF. Binary logistic regression models were built to identify the qualities most explanatory of talent at each level.
Results: A combination of standing height, dominant leg dynamic vertical jump height and 20 m sprint time provided the most parsimonious explanation of talent at the U16 level (AICc = 60.05). At the U18 level, it was a combination of body mass and 20 m sprint time that provided the most parsimonious explanation of talent (AICc = 111.27).
Conclusions: Despite similarities, there appears to be distinctive differences in physical and anthropometric qualities explanatory of talent at the U16 and U18 level. Coaches may view physical and anthropometric qualities more (or less) favourably at different levels of the AF developmental pathway. Given these results, future work should implement a longitudinal design, as physical and/or anthropometric qualities may deteriorate (or emerge) as junior AF players develop.

1. Introduction

Specialised talent development programmes are becoming increasingly prominent within the sporting domain.[1–3] Fundamentally, these programmes aim to minimise performance 'gaps' between junior and senior competitions by exposing talent identified juniors to a higher calibre of coaching, sport science, medical intervention, and player welfare services.[4] Given this opportunistic learning environment, talent development programmes are often financially constrained; limiting the number of participants.[5] Thus, to optimise these financial investments, it is critical to ensure that the most 'talented' juniors are indeed identified, and invited to partake. Beyond subjective game-based observations, practitioners commonly utilise testing batteries to guide, and assist with, the identification of juniors who possess 'talented' qualities relative to their peers.[2]

Within Australian football (AF), talent development programmes are typically referred to as State Academies. There are two key development stages within these State Academies; the first of which occurs at the under 16 years (U16) level, and the second of which occurs at the U18 level. Thus, talent identification practices are integrated at both of these developmental levels, with these practices often involving the use of performance outcome assessments (e.g. sprint time or vertical jump height).[6] Acknowledging the financial importance of effective talent identification practices in junior AF, work has attempted to elucidate the talent discriminating qualities at the U18 level; driving the establishment of robust performance outcome testing batteries.[6] In conjunction with technical (e.g. handballing skill) and perceptual (e.g. decision-making skill) performance qualities, it has been reported that players iden-

* Corresponding author.
E-mail address: carl.woods@jcu.edu.au (C.T. Woods).

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tified as talented at the U18 level possessed superior (moderate to large effects) anthropometric (standing height and body mass), and physical fitness (20 m sprint time, dynamic vertical jump height, and maximal aerobic capacity) qualities when compared to their non-talent identified counterparts.[7,8] Although informative, it is important to note that this talent identification research has been primarily undertaken at the second developmental stage in AF; the U18 level. Subsequently, work is yet to compare the physical and anthropometric qualities explanatory of talent at both the U16 and U18 developmental levels in AF. Comparing the physical and anthropometric qualities explanatory of talent at both stages of the AF developmental pathway may uncover differences between age categories, providing further insight into the qualities deemed to be explanatory of talent.

Despite not yet being investigated in junior AF, work in other team invasion sports (namely soccer) has demonstrated differences between age categories when using physical assessments to identify talent within a developmental pathway.[9] Notably, Vaeyens et al.[9] showed that sprint time was most explanatory of talent at an U14 level, while maximal aerobic capacity was most explanatory of talent at the U16 level in a soccer development pathway. This led the authors to conclude that as junior soccer players progress through a development pathway, the influence of certain performance qualities on the talent identification process may deteriorate, while others emerge,[9] perhaps owing (in part) to variations in biological maturation.[10]

The practical utility of the aforementioned results for talent identification are important to consider. Specifically, they demonstrate that perceptions of 'talent' may change at differing stages of a developmental pathway in elite junior soccer. Further, they suggest that coaches (or those responsible for talent identification) in soccer may be adopting a 'snapshot' (i.e., isolating components of performance at a specific point in time) approach, neglecting the recognition of performance potential. In doing so, it could lead to the unsubstantiated identification of talent, resulting in the misclassification of juniors who possess disadvantageous performance qualities at a specific point in time.[11,12] Given these implications, it is envisaged that the results of this aforementioned work would be of considerable value to those responsible for talent identification in elite junior soccer.

To date, a comparison of the qualities explanatory of talent in the AF developmental pathway is yet to be undertaken. It is hypothesised that those responsible for talent identification in AF would innately adopt a 'snapshot' approach given the findings of Vaeyens et al.[9] with differences being evident when comparing the physical and anthropometric qualities explanatory of talent at the U16 and U18 levels. The aim of the current study was to identify, and then compare, the physical and anthropometric qualities explanatory of talent at the U16 and U18 level in junior AF.

2. Methods

All U16 ($n = 50$; 15.6 ± 0.3 *y*) and U18 ($n = 84$; 17.4 ± 0.4 *y*) players included in this study originated from the same state-based U16 and U18 competition. At each developmental level, two player groups were a priori defined based upon State Academy selection; non-talent identified (U16; $n = 25$; 15.6 ± 0.4 *y*; U18 $n = 42$; 17.3 ± 0.6 *y*; players not selected onto the State Academy at their respective developmental level), and talent identified (U16; $n = 25$; 15.7 ± 0.2 *y*; U18 $n = 42$; 17.5 ± 0.4 *y*; players selected onto the State Academy at their respective developmental level). The difference in sample size between the two developmental levels was due to the financial constraints affording a greater intake of players at the U18 level. At the time of data collection, all players were injury free and participating in regular training sessions. The relevant Human Research Ethics Committee provided ethical approval with all players and parents/guardians providing written informed consent prior to testing.

Following similar procedures to Woods et al.[8] players from both developmental levels performed a battery of seven physical and anthropometric assessments. Specifically, measurements of standing height, body mass, stationary countermovement vertical jump height, dynamic vertical jump height (performed following a five metre run up on both dominant kicking and non-dominant kicking legs), 20 m sprint time (quantified by timing gates positioned at the beginning and end of the sprint; Swift Performance Equipment, Lismore, Australia), and maximal aerobic capacity (estimated via the 20 m multistage fitness test) were acquired from all players. A Vertec jump device (Swift Performance Equipment, Lismore, Australia) was used to quantify the players stationary and dynamic vertical jump heights, with the highest vane displaced by the players inside hand being used as the criterion value for analysis. For both the jump and sprint tests, three trials were performed by all players, with the best of these three trials being used as the criterion values for analysis for those tests. This test battery was chosen owing to its widely accepted use for talent identification in junior AF,[7,8,13] increasing the practical utility and translation of the findings. Although the specific procedures for each of these assessments are provided in greater detail elsewhere,[8] a global description of the testing conditions is provided below.

All testing was completed indoors on wooden flooring, with testing taking place at the end of the preseason training phase in an attempt to standardise the testing conditions between both developmental levels. Prior to the completion of the physical tests, all players undertook the same warm up, consisting of moderate intensity jogging and dynamic stretches. Standing height and body mass were the first two measurements obtained; with the players then completing the physical tests in a circuit manner in the following order: 20 m sprint, stationary vertical jump test, dynamic vertical jump test dominant foot; and dynamic vertical jump non-dominant foot. Players were randomly allocated to one of the four testing stations. The 20 m multistage fitness test was completed after all other physical fitness testing had concluded. For the physical fitness tests requiring multiple trials, approximately one minute was allocated between each trial, whilst approximately two minutes was allocated between each testing station. Players were provided with verbal encouragement for each physical fitness test that required a maximum effort.

Descriptive statistics (mean and standard deviation) were calculated for each assessment for both the talent identified and non-talent identified players at both developmental levels. For each developmental level, the effect size of status (two levels: talent identified, non-talent identified) on each assessment was calculated using Cohen's *d* statistic,[14] where an effect size of $d < 0.2$ was considered trivial, $d = 0.2–0.6$ small, $d = 0.6–1.2$ moderate, 1.2–2.0 large, and >2.0 very large.[15] All statistical analyses were performed using the *R* computing environment version 3.1.3,[23] with effect sizes and subsequent 95% confidence intervals (95% CI) being calculated in the *MBESS* package.[16]

Following this, binary logistic regression models were built to identify the physical and/or anthropometric assessments most explanatory of the main effect at each developmental stage. Thus, at each developmental stage, status was coded as the binary response variable (0 = talent identified, 1 = non-talent identified), and each physical and anthropometric assessment was coded as the explanatory variable. Model parsimony was found by reducing the full model using the 'dredge' function in the *MuMIn* package.[17] This function returns the best model using the Akaike information criterion (AICc). To ensure the strength of the model fit for each developmental level, a null model built and used as a comparator.

Table 1
Descriptive and effect size statistics (*d*) for the talent identified and non-talent identified U16 and U18 AF players.

Assessment	Talent identified	Non-talent identified	*d* (95% CI)
U18			
Standing height (cm)	184.9 ± 6.9	182.1 ± 6.7	0.42 (0.01, 0.85) 'small'
Body mass (kg)	79.7 ± 6.8	73.4 ± 7.5	0.93 (0.48, 1.38) 'moderate'
Stationary vertical jump (cm)	63.7 ± 6.0	62.6 ± 8.6	0.15 (−0.24, 0.58) 'trivial'
ND dynamic vertical jump (cm)	75.5 ± 7.0	73.6 ± 7.6	0.27 (−0.15, 0.70) 'small'
D dynamic vertical jump (cm)	71.0 ± 7.0	70.5 ± 7.7	0.07 (−0.35, 0.49) 'trivial'
20 m sprint (s)	2.99 ± 0.09	3.06 ± 0.11	0.78 (0.33, 1.22) 'moderate'
Multistage fitness test (level. shuttle)	12.05 ± 1.06	12.02 ± 1.05	0.31 (−0.11, 0.74) 'small'
U16			
Standing height (cm)	183.0 ± 9.7	176.3 ± 6.0	0.82 (0.24, 1.39) 'moderate'
Body mass (kg)	72.2 ± 7.8	67.8 ± 9.3	0.51 (−0.05, 1.07) 'small'
Stationary vertical jump (cm)	60.2 ± 5.2	57.8 ± 6.1	0.41 (−0.14, 0.97) 'small'
ND dynamic vertical jump (cm)	66.0 ± 7.3	61.0 ± 8.5	0.90 (0.31, 1.48) 'moderate'
D dynamic vertical jump (cm)	73.4 ± 8.1	66.7 ± 6.5	0.62 (0.05, 1.19) 'moderate'
20 m sprint (s)	3.04 ± 0.11	3.09 ± 0.10	0.41 (−0.14, 0.94) 'small'
Multistage fitness test (level. shuttle)	12.02 ± 1.03	11.08 ± 0.91	0.42 (−0.13, 0.98) 'small'

Note: 'D' dominant; 'ND' non-dominant; '*d*' effect size with 95% confidence interval and linguistic interpretation.

Table 2
Model summary for the physical and anthropometric assessments at both the U18 and U16 levels ranked according to AICc.

Predictors		*LL*	*df*	AICc	ΔAIC	w_i
U18						
–	Body mass + 20 m sprint	−52.50	3	111.27	<0.01	0.35
–	Standing height + body mass + 20 m sprint	−52.19	4	112.82	1.54	0.16
–	D DVJ + body mass + ND DVJ	−52.25	4	112.98	1.66	0.15
–	Body mass + ND DVJ + 20 m sprint	−52.47	4	113.38	2.11	0.12
Null (∼1)		−66.36	1	134.76	23.48	<0.01
U16						
–	D DVJ + standing height + 20 m sprint	−25.58	4	60.05	<0.01	0.07
–	Standing height + 20 m MSFT + 20 m sprint	−25.90	4	60.70	0.65	0.05
–	Standing height + 20 m MSFT	−27.11	3	60.74	0.69	0.05
–	D DVJ + standing height + 20 m MSFT	−26.00	4	60.82	0.84	0.04
Null (∼1)		−34.65	1	71.39	11.3	<0.01

Note: D, dominant; ND, non-dominant; DVJ, dynamic vertical jump; MSFT, multistage fitness test; *LL*, log likelihood; *df*, degrees of freedom; AICc, Akaike information criterion; ΔAIC, delta AIC; w_i, Akaike model weight.

3. Results

The descriptive statistics for each assessment relative to developmental level are presented in Table 1. As shown, the assessments exhibiting the largest relative effect on status at the U18 level were body mass (*d* = 0.93; 95% CI = 0.48–1.38), and 20 m sprint time (*d* = 0.78; 95% CI = 0.33–1.22). At the U16 level, the assessments exhibiting the largest relative effect on status were standing height (*d* = 0.82; 95% CI = 0.24–1.39), and dynamic vertical jump non-dominant leg (*d* = 0.90; 95% CI = 0.31–1.48).

Despite each assessment being included in the binary logistic regression model, the best reduced model at the U18 level retained measures of body mass and 20 m sprint time (Table 2). Comparatively, the best reduced model at the U16 level retained measures of standing height, dominant foot dynamic vertical jump height, and 20 m sprint time (Table 2).

4. Discussion

This study aimed to identify, and then compare, the physical and anthropometric qualities explanatory of talent at the U16 and U18 levels in AF. Given the work of others,[9] it was hypothesised that the qualities explanatory of talent at the U18 level would differ when compared to those explanatory of talent at the U16 level. Results partially supported the study hypothesis, with a combination of standing height, dynamic vertical jump height (dominant leg), and 20 m sprint time providing the greatest explanation of talent at the U16 level, while a combination of body mass and 20 m sprint time provided the greatest explanation of talent at the U18 level. Despite showing similarities, these findings demonstrate distinctive differences in the physical and anthropometric qualities explanatory of talent at two critical stages of the elite junior developmental pathway in AF. As suggested in other sports,[9] it is likely that these points of difference are indicative of the 'snapshot' approaches coaches innately employ when identifying talent at both developmental levels in junior AF.

Previous work describing the qualities explanatory of talent in AF at the U18 level has reported standing height to be a pertinent anthropometric assessment.[7,8] However, in the current study, standing height was found to be explanatory of talent at the U16 level, with body mass preferentially associated with talent at the U18 level. It has been postulated that athletes of greater physical stature are at likely performance advantage in AF due to the combative and aerial requirements of game-play[8]; ultimately being viewed more favourably by talent recruiters. Thus, the explanatory difference noted for standing height between the U16 and U18 levels in this study could be the product of a 'snapshot' approach employed by coaches at the U16 level, underpinned by variations in biological maturation.[4] Specifically, coaches perceptions could have been biased by the taller players at the U16 level appearing to have a greater impact during game-play. However, it is important to note that despite these findings, this is still speculation, as this study did not employ a longitudinal design. To comprehensively demonstrate the deterioration and/or emergence of physical and/or anthropometric qualities for talent identification, future work should look to progress this study by longitudinally monitoring U16 players as they progress through the development pathway in elite junior AF.

The only consistent measure explanatory of talent at both U16 and U18 levels was 20 m sprint time. Interestingly, despite its common inclusion in test batteries utilised for talent identification in junior AF, its talent discriminant ability appears inconclusive, with several studies failing to discriminant talent using this assessment.[8,18,19] Specifically, Burgess et al.[20] demonstrated that sprint performance (in isolation) was a poor indicator of Australian Football League (AFL) draft success in comparison to other game-based physical measures. As such, the current study provides contrary evidence by showing that 20 m sprint performance is explanatory of talent at multiple developmental levels within the junior talent pathway. However, consideration should be taken when interpreting these results as both talent identified cohorts came from the same State Academy. It is possible that the coaches' at both levels were given similar directives to identify juniors with superior sprint capacities. Nonetheless, given the previously inconclusive nature of results surrounding sprint performance, further research should explore the link between sprint performance and talent identification in the junior AF talent pathway from a national perspective.

In soccer, talent identification has been shown to be dynamic process, with certain anthropometric and physical qualities considered more (or less) favourably at different developmental levels.[9] The current study presents data suggestive of a similar occurrence in the elite junior AF development pathway. These points of difference observed at each developmental level could be due to a number of factors. For instance, the physiological demands of game-play at both development levels may vary, as seen at various underage levels in soccer.[21] Subsequently, differing physiological requirements between developmental levels are likely to impact upon the qualities considered pertinent for talent identification at the respective levels if coaches employ a 'snapshot' approach. Additionally, it is possible that variances in the timing of growth and maturation impacted upon the qualities explanatory of talent at both developmental levels. Supportive of this, biologically mature junior AF players have been shown to possess superior physical and anthropometric qualities relative to their biologically immature peers.[22] Maturity related variance in anthropometric and physical performance qualities may therefore, in part, contribute to differences demonstrated between the two developmental levels in this study. Future work should explore this suggestion, and investigate differences in biological maturation between talent identified and non-talent identified juniors at different stages of the development pathway in AF.

Despite these promising findings, this study is not without limitations that require discussion. Specifically, it employed a mono-dimensional design, with measures of technical and perceptual skill being excluded. Given recent work has highlighted the importance of considering multi-dimensionality in talent identification in junior AF,[6] future work should compare the use of technical and perceptual tests for identifying talent at different stages of the AF development pathway. This may strengthen the results presented here by providing holistic insight into the performance qualities pertinent for talent identification in junior AF at multiple developmental levels. Additionally, future work should increase the sample size reported by including data from each State Academy across Australia, enabling a national comparison between the U16 and U18 levels, or through the inclusion of data from multiple seasons (years). Finally, despite these results presenting a robust basis for speculation, they cannot be used to comprehensively describe the (in)stability of physical and/or anthropometric qualities used for talent identification in elite junior AF given its cross-sectional design. Thus, there is a clear need for longitudinal design in talent identification research in elite junior AF.

5. Conclusions

The results of this study are the first to compare the physical and anthropometric qualities explanatory of talent at the two critical levels of the elite junior AF development pathway. Despite 20 m sprint being a consistent physical quality explanatory of talent at both developmental levels, there were distinctive points of difference between the two levels. These findings yield important practical implications, which will be discussed in the following section.

Practical implications

- Coaches in junior AF should consider developmental differences when attempting to identify talent, as certain qualities explanatory of talent at the U16 level may not necessarily remain at the U18 level.
- 20 m sprint time could be considered a developmentally consistent physical assessment of use for talent identification in junior AF. Thus, coaches could look to develop this quality (in conjunction with other technical and perceptual skills) in players at both developmental levels to increase their likelihood of being talent identified.
- These preliminary results provide coaches and sport scientists with a platform for which they can progress toward research that adopts a longitudinal design. The addition of such work will likely enable a comprehensive insight into the dynamicity of performance qualities commonly used to inform talent identification in the AF developmental pathway.

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