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Research article

Discriminating Talent Identified Junior Australian Footballers Using a Fundamental Gross Athletic Movement Assessment

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Abstract

Talent identification (TID) is a pertinent component of the sports sciences, affording practitioners the opportunity to target developmental interventions to a select few; optimising financial investments. However, TID is multi-componential, requiring the recognition of immediate and prospective performance. The measurement of athletic movement skill may afford practitioners insight into the latter component given its augmented relationship with functional sport specific qualities. It is currently unknown whether athletic movement skill is a discriminant quality in junior Australian football (AF). This study aimed to discriminate talent identified junior AF players from their non-talent identified counterparts using a fundamental gross athletic movement assessment. From a total of 50 under 18 (U18) AF players; two groups were classified a priori based on selection level; talent identified (n = 25; state academy representatives) and non-talent identified (n = 25; state-based competition representatives). Players performed a fundamental gross athletic movement assessment based on the Athletic Ability Assessment (AAA), consisting of an overhead squat, double lunge (left and right legs), single leg Romanian deadlift (left and right legs), and a push up (six movement criterions). Movements were scored across three assessment points using a three-point scale (resulting in a possible score of nine for each movement). A multivariate analysis of variance revealed significant between group effects on four of the six movement criterions (d = 0.56 – 0.87; p = 0.01 – 0.02). Binary logistic regression models and a receiver operating characteristic curve inspection revealed that the overhead squat score provided the greatest group discrimination (β(SE) = -0.89(0.44); $p < 0.05$), with a score of 4.5 classifying 64% and 88% of the talent identified and non-talent identified groups, respectively. Results support the integration of this assessment into contemporary talent identification approaches in junior AF, as it may provide coaches with insight into a juniors developmental potential.

Key words: Talent development, motor skill, motor competency.

Introduction

Given its integral role within the overall pursuit of sporting excellence, talent identification (TID; defined as the recognition of immediate and prospective performance potential) is an increasingly prominent area of research in the sport sciences (Vaeyens et al., 2008). This research is often oriented around the description of talent discriminating qualities, commonly quantified using performance outcome assessments (Reilly et al., 2000; Woods et al., 2016b). Such research designs enable the identification of performance qualities that may explain why some juniors excel within a particular sport. They also provide coaches with objective data of use for targeted training interventions designed to improve the development of prospective talent.

However, many of these performance testing research designs are mono-dimensional; being operationalised by physical fitness and/or anthropometric performance outcome assessments measured in isolation (Figueiredo et al., 2009; Hoare, 2000). Whilst providing insight into the physical and anthropometric qualities displayed by talent identified juniors, the efficacy of these designs is questionable. For example, physically-biased testing in pre-pubescent populations can provide misleading results given the myriad of maturational factors that may influence the development of such qualities (Cripps et al., 2016; MacNamara and Collins, 2011; Pearson et al., 2006). Additionally, a talented performance in team sports is often the result of multidimensional performance qualities (i.e., physical, technical, and perceptual skill), rather than one component in isolation (Launder, 2013). Thus, to gauge a holistic profile of performance qualities discriminant of talent in team sports, it has been recommended that multidimensional methodologies are implemented (Reilly et al., 2000).

In addressing such concerns, Woods et al. (2016b) established a multidimensional approach to TID in junior Australian football (AF) that consisted of physical, technical, and perceptual components. Results demonstrated that talent identified under 18 (U18) players possessed a distinctive set of multidimensional performance qualities specific to AF game-play when compared to their non-talent identified counterparts (Woods et al., 2016b). Further, the level of talent classification accuracy demonstrated in their study was greater than that previously reported in junior AF research, which had utilised more physically-oriented testing batteries (Woods et al., 2016b). Whilst of value, this multidimensional approach did not include measures of fundamental gross athletic movement skill – defined as competency while performing fundamental movements that commonly underpin more advanced athletic movements (Kritz et al., 2009; Woods et al., 2016a). The importance of including as-

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sessments of gross motor competency in TID has been described by Deprez et al. (2015). It was demonstrated that the assessment of gross motor competence (as measured using the Körperkoördinations Test für Kinder) was predictive of future dropout and adherence to an elite talent development program in 8 to 16 year old soccer players (Deprez et al., 2015). Supportive of their results, Parsonage et al. (2014) indicated a strong relationship between fundamental gross athletic movements and performance on common assessments of physical capacity used for TID in junior rugby union.

Collectively, these studies suggest that the integration of fundamental gross athletic movement assessments into multidimensional TID approaches may provide a valuable insight into a junior's longitudinal performance potential. Specifically, the acquisition of fundamental gross athletic movement skill may augment the development of functional capacities specific to the sport in which talent is to be identified; possibly informing a juniors continued developmental potential (Parsonage et al., 2014). Thus, when integrated with performance outcome assessments, coaches may be afforded insights into both immediate and prospective performance potential. However, to date, it is unknown whether fundamental gross athletic movement skill is discriminative of talent in junior AF.

The current study aimed to discriminate talent identified and non-talent identified U18 AF players based on their performance on a fundamental gross athletic movement assessment. Stemming from findings in other sports (Parsonage et al., 2014), it was hypothesised that talent identified U18 AF players would possess superior fundamental gross athletic movement skill comparative to their non-talent identified counterparts. The subsequent results of this work may provide initial justification for the integration of such an assessment into multidimensional designs proposed to be of assistance for TID in team sports; specifically AF.

Methods

Participants

Institutional ethics declaration was granted by the relevant Human Research Ethics Committee. From a total sample of 158 U18 AF players originating from the same state-based competition, two player groups were defined; talent identified (n = 25, 17.7 ± 0.4 y) and non-talent identified (n = 25, 17.5 ± 0.6 y). Talent was defined by a priori identification onto a state academy program (elite talent development program in AF), while the non-talent identified group consisted of a random selection of the remaining 111 non-state academy representatives. A sample size of 50 was used, as constraints dictated that only 25 players were selected onto the state academy program by the state academy coaching staff. Accordingly, a matched sample size was implemented for the non-talent identified players. To be eligible for inclusion, players were to be injury free (no pain while performing movements) and participating in regular training sessions for a minimum of four consecutive weeks at the time of data collection.

Procedures

Each player had their athletic movement assessed on one occasion at the conclusion of the 2015 preseason training phase in an attempt to standardise the assessment conditions between player groups. Further, to limit the potential training effect as a product of participation within the state academy, data was collected within seven days of the player's a priori classification. The athletic movements analysed were similar to those reported by Woods et al. (2016a), and consisted of an overhead squat, double lunge (both left and right leg), single leg Romanian deadlift (both left and right leg), and a push up, resulting in six movement criterions. This represented a minor modification to the initial Athletic Ability Assessment (AAA) proposed by McKeown et al. (2014) with these being chosen as they reflect the common fundamental athletic movements required to perform specific conditioning exercises in team ball sports (Parsonage et al., 2014). In line with the procedures described by Woods et al. (2016a), players performed each movement (with the exception of the push up) with a light-weight wooden dowel to assist with their anatomical positioning during the movements production.

A standardised warm up was completed by all players prior to undertaking the assessment, which consisted of moderate intensity jogging and dynamic stretches. While a detailed description of each movement's production protocol is presented elsewhere (Woods et al., 2016a), operational definitions and corresponding scoring criteria are shown in Table 1. Each movement was filmed using a standard two-dimensional camera (Sony, HDR-XR260VE) placed in the optimal position for assessment (frontal and sagittal). The scoring of each movement was performed retrospectively by one experienced rater (>4 years assessing athletic movement) using the video footage and the criteria described in Table 1. The total scores for each movement (maximum of nine) were used as the criterion variables for analysis. No feedback was provided to the players whilst they undertook the assessment in order to limit a potential scoring bias (Frost et al., 2015). However, players were provided with the same brief procedural description and demonstration of each movement prior to their performance.

Statistical analysis

The intra-rater reliability of the scores given were assessed specific to the target population. The athletic movements for 20 randomly chosen talent identified players were scored on two separate occasions using the video footage by the same experienced rater who assessed both player groups. Given the categorical nature of the scoring procedure, the level of agreement between the two scoring occasions was measured using the weighted kappa statistic (κ), with the level of agreement being defined as follows: <0 less than chance agreement, 0.01-0.20 slight agreement, 0.21-0.40 fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 substantial agreement and 0.81-0.99 almost perfect agreement (Landis and Koch, 1977).

To address the study aim, descriptive statistics (mean and standard deviation) for each player group

Table 1. The fundamental gross athletic movement skill assessment as adapted from McKeown et al. (2014) and Woods et al. (2016a).

Movement and purpose	Assessment Points	3	2	1
OH SQT Assesses shoulder/thoracic control and LB mobility	Upper Quadrant	Perfect hands above head/feet	Hands above head/feet	Unable to achieve position
	Triple Flexion	Perfect SQT to parallel	SQT to parallel (compensatory)	Unable to achieve position
	Hip Control	Neutral spine throughout	Loss of control at end of range	Excessive deviation
DL Assesses hip mobility/trunk stability/motor control	Hip, Knee, Ankle	Alignment during movement	Slight deviation	Poor alignment
	Hip Control	Neutral hip position	Slight deviation	Excessive flex/ext
	Take off Control	Control	Jerking	Excessive deviation
Push Up Assesses the ability to move/control bodyweight	TB control	Perfect control/alignment	Perfect control/alignment for some	Poor body control for all reps
	Upper Quadrant	Perfect form/symmetry	Inconsistent	Poor scap. positioning for every rep
	x30 reps	Hits target count	Hits target count	< x 30
SL RDL Assesses hip/lumbar spine motor control	Hip Control – Frontal	Maintain neutral spine	Slight flex/ext through hips	Excessive flex/ext on SL stance
	Hip Control – Sagittal	No rotation	Slight rotation at end of range	Excessive rotation
	Hinge range	Achieves parallel	Can dissociate but not reach parallel	Cannot dissociate hips from trunk

OH SQT, overhead squat; LB, lower body; DL, double lunge; SL RDL, single leg Romanian deadlift; scap, scapula; flex, flexion; ext, extension.

(talent identified, non-talent identified) were calculated for each movement. A multivariate analysis of variance (MANOVA) tested the main effect of status (two levels: talent identified, non-talent identified) on each movement, with the type-I error rate set at $\alpha < 0.05$. The effect size of status on each movement was calculated using Cohen's d statistic, where an effect size of d = 0. 01 – 0.20 was considered small, d = 0.21 – 0.50 moderate, d = 0.51 – 0.80 large, and d ≥0.80 very large (Cohen, 1988). All between group mean comparisons were undertaken using the SPSS software (version 22, SPSS Inc., USA).

Following this, binary logistic regression models were built in the R computing environment version 3.1.3 (R Core Team) to identify which movements were most associated with the main effect. Thus, status was coded as the response variable (0 = talent identified, 1 = non-talent identified), and the movements that significantly differed as identified by the MANOVA were coded as the explanatory variables. The models were fit using the 'glm()' function with a binomial distribution in the MuMIn package (Burnham and Anderson, 2002).

The pROC package (Robin et al., 2011) was used to build receiver operating characteristic (ROC) curves for significant explanatory variable(s) as resolved by the binary logistic regression analysis. A ROC curve plots the true positive rate (sensitivity) against the true negative rate (specificity) to produce an area under the curve (AUC). An AUC of 1 (100%) represents perfect discriminant power; thus, in this instance, the point in which the AUC is maximised was considered the score at which a 'cut-off' might be acceptable for discriminating talent based on the score obtained for certain movements.

Results

As shown in Table 2, the intra-rater reliability for the assessment of each movement reflected "substantial" to "almost perfect" agreement between scoring sessions. According to the Pillai's Trace (V), the MANOVA revealed a significant effect for status (V = 0.32, $F(6, 43) = 3.39$, $p < 0.05$). Follow up univariate analysis revealed a significant effect on the score obtained for the overhead squat, Romanian deadlift performed on the right leg, and the double lunge performed on both left and right legs (Table 3), where the talent identified group performed these movements (on average) with a greater level of competency. Further, these four movements reflected the largest respective effect sizes (Table 3).

Table 2. The intra-rater reliability of the scoring criteria.

Movement	Level of Agreement (κ)
Overhead Squat	0.91 "almost perfect"
Double Lunge (L)	0.82 "substantial"
Double Lunge (R)	0.81 "substantial"
Single Leg Romanian Deadlift (L)	0.77 "substantial"
Single Leg Romanian Deadlift (R)	0.74 "substantial"
Push Up	0.71 "substantial"

R, right leg; L, left leg

Table 3. Between group effects for each gross athletic movement. Data are means (±SD).

Measurement	Talent identified	Non-talent identified	*d*
Overhead Squat*	5.2 (1.7)	4.0 (.5)	.87
Double Lunge (L)*	5.5 (1.0)	4.4 (1.4)	.86
Double Lunge (R)*	5.7 (.9)	4.6 (1.1)	.86
Single Leg Romanian Deadlift (L)	4.8 (1.1)	4.1 (1.2)	.50
Single Leg Romanian Deadlift (R)*	4.8 (1.1)	4.2 (1.1)	.56
Push Up	6.3 (.9)	6.1 (.8)	.17

R, right leg; L, left leg, * $p < 0.05$

The total score obtained on these four movements were then included as explanatory variables in the binary logistic regression models. The best model retained only the score on the overhead squat as significantly explanatory of status (Table 4). Thus, a ROC curve was built for this movement, with the AUC being maximised at a score of 4.5 (out of a total of nine) (Figure 1). Of the 25 talent identified players, 16 (64%) scored greater than 4.5 on the overhead squat, while of the 25 non-talent identified players, 3 (12%) scored greater than 4.5 on the overhead squat. The ROC curve successfully detected 64% of the true positives (talent identified players) and 88% of the true negatives (non-talent identified players).

Table 4. Model parameter estimates for the binary logistic regression analysis

Measurement	β (SE)	LCI	UCI	*P*
Overhead Squat	-.89 (.44)	-1.92	-.16	.04
Double Lunge (L)	-.15 (.49)	-1.14	.84	.76
Double Lunge (R)	-.50 (.52)	-1.60	.51	.33
Single Leg Romanian Deadlift (R)	-.36 (.31)	-1.00	.24	.24

β is the beta coefficient, SE is the standard error, LCI is lower confidence interval, UCI is upper confidence interval, R is right leg, L is left leg,

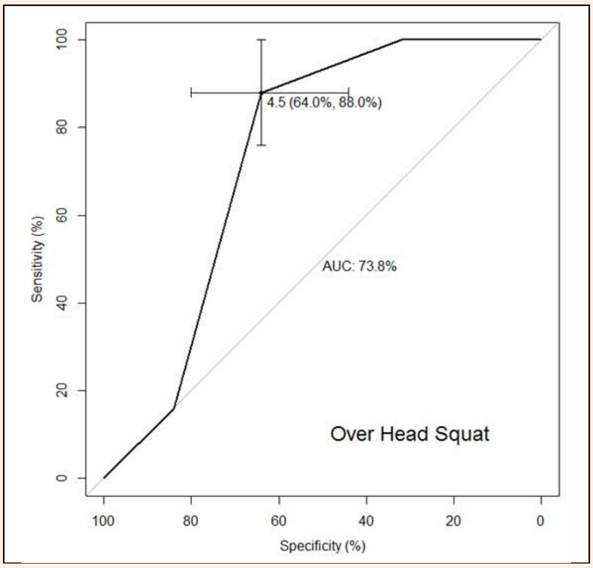

Figure 1. The ROC curve for the total score obtained on the overhead squat showing the point in which the greatest between group discrimination occurred

Discussion

This study aimed to discriminate talent identified and non-talent identified junior AF players using scores acquired from a fundamental gross athletic movement assessment. It was hypothesised that the talent identified players would possess superior athletic movement qualities relative to non-talent identified counterparts. In part, the results were in agreement with this, with the score obtained on four of the six movement criterions demonstrating between group mean differences in favour of the talent identified players. However, from these four movements, it was the score obtained on the overhead squat that reflected the greatest explanation of status; successfully detecting 64% and 88% of the talent identified and non-talent identified players, respectively. Thus, elements of the movement assessment described in this study may be of use to the TID process in junior AF, and may consequently be integrated into contemporary multidimensional approaches established in the literature (Woods et al., 2016b).

Performing the overhead squat requires an athlete to possess a range of athletic qualities, such as hip mobility, trunk and lumbar stability / mobility, and shoulder integrity (Butler et al., 2010; Kritz et al., 2009). These athletic qualities (amongst others) are also required during sprinting and jumping actions (Gamble, 2004), as well as during marking and tackling actions specific to AF gameplay. Subsequently, the level of talent discrimination this movement demonstrated suggests that talent identified U18 AF players may possess superior functional physical capacities, namely sprinting and jumping actions, when compared to their non-talent identified counterparts. This is supported by the findings of Robertson, Woods and Gastin (2015) and Woods et al. (2015) who demonstrated that talent identified U18 AF players obtained superior 20 m sprint times, stationary and dynamic vertical jump heights, and pre-planned change of direction times when compared to their non-talent identified counterparts. When viewed in conjunction with the current study, it could be suggested that the superior functional capacities demonstrated by the talent identified players described in the aforementioned studies were mediated, in part, by the superior athletic movement qualities manifested via the overhead squat movement. This association has been shown in other sports, with Parsonage et al. (2014) indicating that bilateral squat competency was explanatory of both countermovement jump height and linear sprint time in talent identified U16 rugby union players. Subsequently, those responsible for TID in team sports, such as AF, could consider assessing the fundamental gross athletic movement qualities manifested through the production of squatting variants, as this may provide insight into a junior's continued physical capacity. Pertinently, the assessment protocol described here may provide less experienced coaches with an appropriate and specific tool for which the production of the overhead squat can be objectively quantified.

Despite the level of successful talent discrimination demonstrated by the overhead squat, of additional interest were the three non-talent identified players and nine talent identified players who were misclassified. This finding demonstrates the importance of accounting for multidimensionality when examining talent discriminating qualities in team sports given the likely occurrence of the 'compensation phenomenon' (Tranckle and Cushion, 2006). It is possible that despite possessing comparable fundamental gross athletic movement qualities manifested through the production of the overhead squat, the three misclassified non-talent identified players possessed considerably poor performance qualities that were not assessed here (i.e., technical or perceptual skill), leading to their a priori classification. Concomitantly, the misclassified talent identified players may have possessed superior technical and/or perceptual qualities that offset their relatively poor fundamental gross athletic movement skill. Thus, practitioners should accommodate for compensatory aspects of performance when attempting to identify talent in team sports via the use of multidimensional approaches, which integrate the assessment of fundamental gross movement skill.

Irrespective of the talent discrimination noted, it should be highlighted that both groups performed each fundamental gross athletic movement poorly relative to the senior Australian Football League (AFL) players described by Woods et al. (2016a). The largest of these differences is demonstrated via the single leg Romanian deadlift; where the AFL players reported by Woods et al. (2016a) were shown to have an average score (on both their left and right legs) of greater than seven, while the players from both groups in the present study did not score greater than five. Globally, this is developmentally concerning given the incidence of hamstring injury in the AFL (Orchard, Seward, & Orchard, 2013). The Romanian deadlift is a foundational athletic movement primarily prescribed to develop posterior thigh and lumbar strength / motor control via eccentric loading (Brooks et al., 2006). Further, AF players frequently bend at the hip to obtain possession of ground-balls, a movement requiring trunk and pelvic mobility; fundamental qualities manifested through the Romanian deadlift. The assessment of gross athletic movement qualities, such as those underpinning the production of the single leg Romanian deadlift, may therefore provide practitioners with an insight into a juniors potential injury predisposition. However, prior to conclusions being drawn surrounding the value of this assessment for injury diagnostics, continued research is required.

Conclusion

This study demonstrates the utility of a fundamental gross athletic movement assessment for TID in junior AF. Despite significant between group differences noted on four of the six movement criterions, it was the production of the overhead squat that provided the greatest level of talent discrimination. Thus, there are two primary practical applications to result from this work. Firstly, coaches in junior AF should consider integrating fundamental gross athletic movement skill assessments into current TID practices. This may provide a deeper insight into a juniors developmental potential when coupled with traditional performance outcome assessments commonly used for TID in junior AF. Secondly, the integration of this movement assessment may afford coaches with the opportunity to rectify inefficient movement patterns in juniors prior to their entrance into elite senior environments. This may assist with the elite junior-to-senior developmental transition.

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Key points

- On average, talent identified junior AF players possess superior athletic movement qualities relative to their non-talent identified counterparts.
- The integration of this gross athletic movement assessment into contemporary multidimensional approaches to talent identification may enable insight into a juniors developmental potential.
- The athletic qualities underpinning the production of the overhead squat movement could augment functional physical qualities in junior Australian footballers.
- Assessing movement competency in junior contexts may afford practitioners with the opportunity to rectify inefficient fundamental movement patterns prior to entrance into elite senior ranks.

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