# A multifactorial comparison of Australian youth soccer players' performance characteristics

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**ABSTRACT**

The current study aimed to investigate the performance characteristics that discriminate Australian youth soccer players according to their academy status. A total of 165 youth soccer players participated in this study and were sub-divided into either an early adolescence ($n$ = 92, age = 13.0 ± 0.6) or mid-adolescence ($n$ = 73 age = 14.8 ± 0.6 y) group. Players completed multifactorial assessments of anthropometry, motor competence, physical fitness, decision-making, and psychological traits. Statistical significance was set at $p \leq 0.05$. Multivariate analysis of variance identified dynamic balancing ability (both age groups), object manipulation (mid-adolescence), lateral jumping ability (both age groups), linear speed over 5m (both age groups), change of direction skill (mid-adolescence), intermittent aerobic endurance (mid-adolescence) and total response time on a decision-making assessment (early adolescence) to discriminate academy status. Interestingly, a binomial logistical regression showed that a 0.1 second decrease in sprint time (i.e. running faster) increased the odds of a player belonging to a tier one academy by 19% and 47% for early and mid-adolescent players, respectively. Overall, performance in the motor competence and physical fitness assessments were in favour of the tier one academy players. These findings are indicative of a potential selection bias in the Australian talent pool or a training effect whereby tier one academy programmes emphasise the development of physical attributes. However, future research is required to further substantiate this in a larger sample of youth soccer players from other playing regions within Australia.

**Keywords:** football, talent selection, talent development, motor competence, physical fitness

## INTRODUCTION

Talent identification and development in association football (soccer) is a complex and multifaceted process that involves numerous stakeholders which govern, but also implement strategies to assist promising youth players in their pursuit of future success (Vaeyens et al., 2008). Most of the recent research in talent identification and development examines the key characteristics of talented players – including their anthropometry, physical fitness, soccer-specific skills, perceptual-cognitive skills, and psychological traits – that likely contribute to the attainment of soccer expertise (Sarmento et al., 2018; Gledhill et al., 2017). Notably, longitudinal, and retrospective analyses of senior professional players associate their performance characteristics during adolescence with their current level of soccer expertise. Indeed, professional senior players demonstrate superior physical fitness, soccer-specific skills, and perceptual-cognitive skills during adolescence when compared with non-professionals. Specifically, these include: greater linear speed, explosive leg muscular power, intermittent aerobic endurance, dribbling, ball control, shooting, positioning, and decision-making (Deprez et al., 2015; Emmonds et al., 2016; Höner et al., 2017; Huijgen et al., 2009; Kannekens et al., 2011).

Most of these observational studies are completed in established football nations (e.g. Belgium, Germany, Netherlands etc.), which have highly structured talent pathways with large talent pools, high soccer participation rates, substantial financial and logistical support, and a strong domestic competition (Bennett et al., 2019b). In comparison, emerging football nations (e.g. Australia, Iceland, Panama) have less established talent pathways and smaller relative talent pools with lower soccer participation rates, less financial and logistical resources, and a weaker domestic competition. While all football nations exist somewhere on a continuum between emerging and established, it is difficult to substantiate whether the current approaches more established football nations' use for talent identification and development would be as effective in emerging football nations. As such, it is essential to further investigate emerging football nations' current talent identification and development programmes.

To date, few studies have comprehensively examined the talent identification and development programmes used in emerging football nations. One emerging football nation that has recently received more attention in talent identification and development research is Australia. Within Australia, the governing body – Football Federation Australia (FFA) – has created the 'Whole of Football Plan' and the 'National Football Curriculum' to assist with streamlining the pathway for promising youth players and defining the environment required for developing soccer success (Football Federation Australia, 2014; Football Federation Australia, 2015). A fundamental problem recognised in the 'National Football Curriculum' is the overreliance on physically gifted soccer players as opposed to those who are technically and tactically gifted. Current research in Australian soccer presents similar data to that collected in established football nations, with high-level players showing superiorities in most of their performance characteristics. Generally, high-level players (15 – 17 years old) are taller, possess greater linear speed, have a higher intermittent aerobic endurance capacity, better soccer-specific skills, and superior decision-making skill, when compared with those competing at lower-levels (Keller et al., 2016; Keller et al., 2018a; Keller et al., 2018b; O'Connor et al., 2016).

Although this information provides an insight into the performance characteristics of older youth soccer players (15 – 17 years old), determining whether these playing level differences extend to younger age groups will prove valuable for talent identification and development practice. It is suggested that selection biases within playing levels can significantly affect the size and quality of the talent pool (Bennett et al., 2019b). Therefore, the purpose of the current study was to implement a multifactorial design to determine if early and mid-adolescent high-level (tier one academy) youth soccer players exhibited superior performance characteristics (motor competence, physical fitness, decision-making, and psychological traits) when compared with those competing at lower levels (tier two academy). Using current talent identification and development data, it was hypothesised that the following performance characteristics would discriminate academy status: a) advanced anthropometry and superior physical fitness (Figueiredo et al., 2009); b) superior motor competence (Deprez et al., 2015; Vandorpe et al., 2011); c) greater response accuracy and faster response times in video-based decision-making task (Keller et al., 2018b; O'Connor et al., 2016; Vaeyens et al., 2007a); and d) a higher task than ego orientation (Zuber et al., 2015; Höner and Feichtinger, 2016).

## METHODS

### Participants

A total of 165 Australian male youth soccer players from two age groups (early-adolescence: $n$ = 92, age = 13.0 ± 0.6 y and mid-adolescence: $n$ = 73 age = 14.8 ± 0.6 y) were involved in this study. Players were sub-divided according to their academy status. The tier one academy (early adolescence: $n$ = 31 and mid-adolescence: $n$ = 32) contained players who were competing at the top-level for their age-group and were part of one Hyundai A-League club supported development programme. An internationally accredited technical director (i.e. Asian Football Confederation A Licence and Union of European Football Associations B Licence) supervised this academy’s development program. Players completed approximately 12 h of coach-led technical and tactical practice per fortnight, i.e. 8 × 1.5 h sessions) throughout the 48-week season. The tier two academy (early adolescence: *n* = 61 and mid-adolescence: *n* = 41) contained players who were part of two National Premier League club development programme. Both technical directors were nationally accredited (i.e. FFA C Licence). Players trained during 41 weeks of the year and completed approximately 7.5 h of coach-led technical and tactical practice per fortnight during the competition phase of the season (i.e. 5 × 1.5 h sessions) and 6.0 h during the (i.e. 4 × 1.5 h sessions) pre-season. Any player who was injured or unable to participate in bouts of high-intensity activity at the time of testing was excluded from the study. All players and their parents/legal guardians were informed of the aims and the requirements of this research. Players were advised that participation in this research was voluntary and would not impact on their position or future selection within the academy. The Institutional Ethics Research Committee approved this study.

**Procedures**

Anthropometry, biological maturity, motor competence, physical fitness, decision-making, and psychological traits assessments were conducted during the pre-season period at each academy's usual training facilities. A combination of artificial and natural grass surfaces was used to complete the assessments. No strenuous physical activity was completed for at least 24 hours before testing to allow players to provide a maximal effort in all physical assessments. Assessments were conducted in a strict order with sufficient recovery: a) psychological traits, b) decision-making, c) anthropometry, d) motor competence, and e) physical fitness. Players undertook a dynamic warm-up consisting of muscular activation and mobilisation drills, sprint builds, and acceleration/deceleration preparation before commencing any physical assessment.

*Anthropometry.* A university-trained sporting professional recorded players' stature (seca 217, seca, Germany), sitting height (Harpenden Sitting Height Table, Holtain, UK), and body mass (BF-522 Body Fat/Body Water Analyzer, Tanita, Japan). Leg length was calculated as the difference between stature and sitting height. Test-retest reliability and measurement accuracy of stature and sitting height measures were examined using a sub-test of 43 players. The intraclass correlation coefficient for stature was > 0.99 with a mean difference of -0.01 cm between measures. The intraclass correlation coefficient for sitting height was > 0.99 with a mean difference of 0.14 cm between measures. A maturity ratio equation estimated biological maturity (Fransen et al., 2018). Players' age at peak height velocity was calculated using their chronological age relative to their maturity ratio.

*Motor competence.* Overall gross motor coordination (i.e. dynamic balancing ability, object manipulation, and lateral jumping) was estimated using three subtests of the KörperkoordinationsTest für Kinder (i.e. balancing backwards, moving sideways, and jumping sideways) according to the test manual (Kiphard and Schilling, 1974; Kiphard and Schilling, 2007). The modified and original version of the KörperkoordinationsTest für Kinder shows substantial agreement in 6 – 14-year-old children (Novak et al., 2017). The KörperkoordinationsTest für Kinder is suggested to be a useful assessment in the talent pathway (O'Brien-Smith et al., 2019).

*Physical fitness.* Explosive leg power, maximal linear speed, change of direction skill, and intermittent aerobic endurance were assessed. Players completed a vertical jump assessment from a standing start (Vertec, Swift Performance Equipment, Australia) to determine their lower body muscular power. Standing height was recorded as the highest rotating vane they could displace without lifting their heels off the ground. Players' jump height was determined through two countermovement jumps with no restrictions. The greatest difference between standing and jump height was recorded as their final score. Maximal linear speed was assessed over a 30 m distance. Telemetric electronic timing cells (SmartSpeed Pro, Fusion Sport, Australia) were set at 0, 5 and 30m to record split times. Sprints were completed from a standing start, 0.5m behind the first timing gate with the best 5 and 30m splits from two trials recorded. Change of direction skill was quantified using a modified t-test protocol, with players completing one trial in each direction (Deprez et al., 2015). Two assessors recorded split times using hand-held stopwatches. Recording commenced when the player lifted their heel off the ground and ceased when the first part of the player's body passed through the virtual gate. The average time between assessors was recorded for analyses. The intraclass correlation coefficient for change of direction skill was 0.96 with a mean difference of -0.01 s between measures. Players' intermittent aerobic endurance capacity was determined using the established Yo-Yo Intermittent Recovery Test – Level 1 protocol (Krustrup et al., 2003).

*Decision-making skill.* A customised video-based decision-making assessment was performed on an iPad mini 2 (Model A1432, Apple Inc., United States of America). Players were shown 30 simulated attacking situations (2 vs. 1 = 4, 3 vs. 1 = 9, 3 vs. 2 = 6, 4 vs. 3 = 5, and 5 vs. 3 = 6) from a third-person perspective. Five familiarisation trials were provided prior to the commencement of the assessment. The assessment paused at the critical decision moment, which coincided with the player wearing the yellow bib (i.e. the key decision-maker) receiving the ball. All players were instructed to quickly select the interactive button that corresponded with the response (i.e. dribble, pass, or shoot) that would directly lead to a goal-scoring opportunity. Response time was recorded as the time between the occlusion of a video and the registration of a response action. Response accuracy was determined using previously established guidelines (Vaeyens et al., 2007a; Vaeyens et al., 2007b). This video-based decision-making assessment shows sufficient face and construct validity, but lacks discriminant validity, in a sample of Australian youth soccer players (Bennett et al., 2019a). It was deemed necessary to include this assessment within the current study as previous research in both individual (Novak et al., 2018b; Novak et al., 2018a) and team sports (O'Connor et al., 2016; Woods et al., 2016b) showed video-based decision-making assessment to contribute to multifactorial models of performance. Also, it was important to replicate previous research in older youth soccer players which detailed significant differences between playing levels (Keller et al., 2018b), despite a lack of information surrounding the validity of the assessment.

*Psychological traits.* Players' completed a paper-version of the Task and Ego Orientation in Sport questionnaire to determine their orientation towards sporting success (Duda, 1989). This questionnaire asks players to refer to the statement "I feel most successful in sport when …" and allocate a score between 1 and 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) based on the level of agreement with the question. Scores from questions 1, 3, 4, 6, 9, and 11 were averaged to quantify ego orientation, whereas scores from questions 2, 5, 7, 10, 12, and 13 were averaged to quantify task orientation.

**Statistical analysis**

A Kolmogorov-Smirnov test and visual inspection of the Q-Q plots and histograms were used to assess the assumptions of normality. Descriptive statistics were calculated for all variables and presented as mean ± SD. Dependent variables were sub-divided into motor competence (total points in balancing backwards, moving sideways, and jumping sideways), physical fitness (vertical jump height, 5m sprint time, 30m sprint time, t-test time and distance covered in the Yo-Yo), decision-making skill (total response accuracy and total response time) and psychological traits (ego orientation and task orientation). Sub-dividing the assessments based on their performance characteristics was appropriate as the assessments within each of the performance characteristics is more related than the assessments across other performance characteristics. Furthermore, moderate relationships between the dependent variables are recommended for Multivariate Analysis of Variance (MANOVA). Anthropometry (stature and body mass) was only included as a descriptive variable to contextualise the sample. The sample size fluctuated for the dependent variables due to the multifactorial nature of this study (i.e. missing data).

Four separate MANOVA were completed for each age group (early and mid-adolescence) to investigate academy status (tier one or tier two academy) differences in the dependent variables. No post hoc tests were required for comparisons between groups. Partial eta squared ($\eta_p^2$) effect sizes were used with the following cut-off scores: 0.01 (small effect), 0.06 (moderate effect) and 0.14 (large effect) (Cohen, 1988). The variables that significantly differed based on academy status were subsequently used as independent variables in a binomial logistic regression aimed at investigating the ODDS of belonging to a tier one or tier two academy. The grouping variable for the binomial logistic regressions were a player's pre-determined academy status (0 = tier two, 1 = tier one). A criterion alpha level of significance was set at $p < 0.05$. All statistical analyses were conducted using SPSS software (Version 24.0, IBM Corporation, United States of America).

## RESULTS

### Early adolescence

Significant strong multivariate differences between academies were evident for physical fitness (F (5, 73) = 12.35, $p < 0.001$, $\eta_p^2 = 0.46$). Follow-up univariate analyses identified that tier one players were significantly faster over a 5m distance ($p < 0.001$) when compared with their tier two counterparts (Table 1). No significant multivariate differences between academies were evident for motor competence (F (3, 77) = 2.58, $p = 0.06$, $\eta_p^2 = 0.09$), decision-making (F (2, 72) = 2.72, $p = 0.07$, $\eta_p^2 = 0.07$), or psychological traits (F (2, 63) = 1.30, $p = 0.28$, $\eta_p^2 = 0.04$). Follow-up univariate analyses identified that tier one players scored better for balancing backwards ($p = 0.03$) and jumping sideways ($p = 0.02$), but were slower at responding during the decision-making task ($p = 0.04$) when compared with tier two players. No other univariate differences were identified for decision-making or psychological traits.

** Insert Table 1 near here **

The logistic regression model ($\chi^2$ (4) = 24.38, $p < 0.001$) explained 43.5% (Nagelkerke $R^2$) of variance in academy status and correctly classified 75.8% (tier one = 75.0% and tier two = 76.5%) of cases. Of the four predictor variables, only 5m sprint was statistically significant (Table 2). A decrease in sprint time of 0.1 seconds increased the odds of belonging to a tier one academy by 19%.

** Insert Table 2 near here **

**Mid-adolescence**

Significant strong multivariate differences between academies were evident for motor competence (F (3, 66) = 7.42, $p < 0.001$, $\eta_p^2 = 0.25$) and physical fitness (F (5, 50) = 8.43, $p < 0.001$, $\eta_p^2 = 0.46$). Follow-up univariate analyses identified that tier one players scored better for balancing backwards ($p < 0.001$), moving sideways ($p = 0.01$) and jumping sideways ($p < 0.001$) assessments, were faster over a 5m ($p < 0.001$) and 30m distance ($p < 0.001$), were faster at changing directions ($p = 0.02$) and covered more distance in the Yo-Yo ($p = 0.02$) when compared with tier two players (Table 3). No significant multivariate differences between academies were evident for decision-making (F (2, 57) = 0.44, $p = 0.65$, $\eta_p^2 = 0.02$) or psychological traits (F (2, 51) = 0.60 $p = 0.55$, $\eta_p^2 = 0.02$). No other univariate differences were identified for decision-making or psychological traits.

** Insert Table 3 near here **

The logistic regression model ($\chi^2$ (4) = 44.33, $p < 0.001$) explained 75.8% (Nagelkerke $R^2$) of variance in academy status and correctly classified 87.3% of cases (tier one = 75.0% and tier two = 94.3%). Of the six predictor variables, only 5m sprint was statistically significant (Table 4). A decrease in sprint time of 0.1 seconds increased the odds of belonging to a tier one academy by 47%.

**Insert Table 4 near here **

## DISCUSSION

The current study aimed to determine the performance characteristics that discriminate Australian youth soccer players (12 – 15 years) based on their academy status. The variables that discriminated early adolescent players based on their academy status were dynamic balancing ability (i.e. balancing backwards score), lateral jumping ability (i.e. jumping sideways), linear speed over 5m, total response time in the decision-making assessment. These performance characteristics, except for total response time, were better in the tier one academy players when compared with those in the tier two academy. In the mid-adolescence group, dynamic balancing ability, lateral jumping ability, object manipulation, linear speed over 5m, change of direction skill, and intermittent aerobic endurance significantly discriminated academy status. Tier one academy players scored better for all motor competence variables, were faster over 5 m and at changing directions, and covered more distance in the Yo-Yo.

The present study's results indicate that motor competence is a significant predictor of academy status in both younger (balancing backwards and jumping sideways) and older (balancing backwards, moving sideways, and jumping sideways) youth soccer players. This finding is in support of talent identification research demonstrating both overall and individual aspects of motor competence discriminate high and low-level athletes in gymnastics (Vandorpe et al., 2011) and soccer (Deprez et al., 2015). However, it is noted that the significance of dynamic balancing ability in the current study is an addition to the components of motor competence (i.e. moving sideways and jumping sideways) that Deprez et al. (2015) reported to discriminate high-level Belgian academy players from those who dropped out of a development programme. Together, these findings demonstrate that overall motor competence can discriminate between playing levels in youth soccer. However, it appears that it does not explain a considerable amount of the variance in academy status when part of a multifactorial model.

It was also identified that physical fitness characteristics could discriminate academy status, especially in mid-adolescent players. Furthermore, 5m sprint time explained a large portion of variance in academy status when part of a multifactorial model, with tier one players exhibiting significantly faster times. The present study's findings show support for high-level players to demonstrate superior physical fitness when compared with lower-level players (Vaeyens et al., 2006; Gil et al., 2014; Le Gall et al., 2010; Gonaus and Müller, 2012; Deprez et al., 2015; Coelho-e-Silva et al., 2010). The significant contribution of physical fitness variables to academy status might result from the commonly stated selection biases toward biologically advanced players in high-level academy programmes (Johnson et al., 2017). Although, it is acknowledged that age at peak height velocity – a frequently used measure to group maturation statuses – was similar between playing levels. Alternatively, the greater influence of physical fitness to academy status may result from more exposure to systematic training in the tier one academy when compared with the tier two academy.

One of the present study's findings that only partially agrees with previous research is the small contribution of decision-making performance to academy status. Previously, decision-making performance was reported to discriminate playing levels in Australian youth soccer players (Keller et al., 2018b; O'Connor et al., 2016). Similarly, greater decision-making performances are apparent in high-level Belgian youth soccer players when compared with those competing at lower-levels (Vaeyens et al., 2007a). Such findings are also evident in other team sports such as Australian Football, with talent-identified players showing greater decision-making performances than non-identified players in a video-based assessment (Woods et al., 2016a). Despite several studies reporting playing level differences in decision-making performance, there is limited understanding of the construct validity of many of the employed methodological designs. In addition, the task-representativeness of computerised video-based assessments are questionable, as altering the execution of a soccer-specific skill (e.g. clicking an iPad screen, verbalising a response, or circling the intended action using pen and paper) likely conceals true perceptual-cognitive and decision-making skill differences (Travassos et al., 2013). Future research should aim to develop task-representative designs to strengthen multifactorial models of players' performance characteristics.

An unexpected finding was that a higher task orientation did not contribute to the playing level differences between the tier one and two academy players. These findings are different to Reilly et al. (2000) and Zuber et al. (2015) who showed higher task orientation in successful youth soccer players. However, the current study's findings support Huijgen et al. (2014) who showed no differences in task or ego orientation between selected and deselected Dutch youth soccer players. From the view of the current study, it is noted that a higher task orientation was more prevalent than ego orientation in each academy and age group. While playing level differences in goal orientation differ across studies, it remains difficult to ascertain whether these variables mediate or directly influence talent development and whether the influence changes over time (Gledhill et al., 2017).

Collectively, this study's findings provide further insight into Australian youth soccer players' performance characteristics. Tier one academies likely favour those players who are physically advanced and/or emphasise training methodologies that develop these capacities. However, it is evident that these players also have superior motor competence, which is proposed as a foundation for future sport-specific skill. Without valid assessments of soccer-specific and decision-making skill, it is difficult to ascertain whether the tier one players are more 'talented' than the tier two players or if they have greater chance of achieving future playing success. From an emerging football nations' perspective, the size and quality of the talent pool must be maximised. Unequivocally, if players are selected into tier one academies based on superior physical variables, there is an increased likelihood that players who develop outside of these academies will have a lower chance of later identification or selection (i.e. side-entry). Less opportunities for side entry are concerning, as an early systematic bias towards physically superior players will create a rather homogenous talent pool later in development without identifying players with the most future playing potential. Therefore, other initiatives must be implemented to provide access to high-quality coaching support and appropriate development environments. An example currently underway within Australia is the 'Talent Support Programs' which provide players outside of tier one academies with additional training support and competitive matches to further supplement their development.

When interpreting the current study's findings, there are some limitations to consider. The present study was only a cross-sectional representation of a cohort of youth soccer players from two playing regions within Australia. As a result, players were divided into two *a-priori* playing levels based on the selection processes that the academy programme used to recruit players. Consequently, it is only possible to infer these performance characteristics are indicative of their current talent identification practice. Future research should extend on longitudinal and retrospective investigations (Emmonds et al., 2016; Deprez et al., 2015; Höner et al., 2017) and determine which performance characteristics distinguish between players in Australia who sign a professional contract and develop career success, and those who do not. While many performance characteristics were measured, no indication was given to players' soccer-specific skill. With more task representative assessments of soccer-specific skill available (Bennett et al., 2017), future research should aim to include such data as part of a multifactorial design.

Overall, specific components of players' motor competence and physical fitness differed significantly between academies in two age groups of youth soccer in Australia. Australia needs to minimise any potential playing level differences based on physical superiorities to provide younger players who develop outside tier one academies – who may possess superior soccer-specific and decision-making skills - with an opportunity to contest selection into older talent squads. Subsequently, this approach will assist with increasing the size and quality of the available talent pool. However, future research is needed to extend on the current study's findings and to determine the performance characteristics that contribute to future success in soccer.

## PRACTICAL APPLICATIONS

There are several practical implications derived from this study. First, coaches and sporting professionals need to be aware of the prevalence and impact of physical biases in tier one academy programmes. It is recommended that coaches and sporting professionals place more of an emphasis on assessments of motor competence, perceptual-cognitive skills, soccer-specific skills and psychological traits when assessing a player's talent status. Second, coaches and sporting professionals should reduce the focus on talent identification to maximise the size and quality of the available talent pool. Currently, it appears that players within tier one academies are either physically gifted or are exposed to more systematic training that focuses on the development of physical capacities. Finally, national governing bodies and sporting organisations should maximise the developmental opportunities for players competing outside of the tier one academies.

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## REFERENCES

Bennett KJM, Novak AR, Pluss MA, et al. (2019a) Assessing the validity of a video-based decision-making assessment for talent identification in youth soccer. *Journal of Science and Medicine in Sport* 22: 729-734.

Bennett KJM, Novak AR, Pluss MA, et al. (2017) The use of small-sided games to assess skill proficiency in youth soccer players: A talent identification tool. *Science and Medicine in Football*: 1-6.

Bennett KJM, Vaeyens R and Fransen J. (2019b) Creating a framework for talent identification and development in emerging football nations. *Science and Medicine in Football* 3: 36-42.

Coelho-e-Silva MJ, Figueiredo A, Simões F, et al. (2010) Discrimination of U-14 soccer players by level and position. *International Journal of Sports Medicine* 31: 790-796.

Cohen J. (1988) *Statistical power analysis for the behavioural sciences,* Hillsdale, NJ: Lawrence Earlbaum Associates.

Deprez DN, Fransen J, Lenoir M, et al. (2015) A retrospective study on anthropometrical, physical fitness, and motor coordination characteristics that influence dropout, contract status, and first-team playing time in high-level soccer players aged eight to eighteen years. *Journal of Strength and Conditioning Research* 29: 1692-1704.

Duda JL. (1989) Relationship between task and ego orientation and the perceived purpose of sport among high school athletes. *Journal of Sport and Exercise Psychology* 11: 318-335.

Emmonds S, Till K, Jones B, et al. (2016) Anthropometric, speed, and endurance characteristics of English academy soccer players: Do they influence obtaining a professional contract at 18 years of age? *International Journal of Sports Science and Coaching* 11: 212-218.

Figueiredo AJ, Gonçalves CE, Coelho-e-Silva MJ, et al. (2009) Characteristics of youth soccer players who drop out, persit or move up. *Journal of Sports Sciences* 27: 883-891.

Football Federation Australia. (2014) *About the curriculum: From 'fightball' to 'football'* Available at: http://www.ffacoachingresource.com.au/about-the-curriculum/from-fightball-to-football/.

Football Federation Australia. (2015) *Whole of football plan: We are football*. Available at: http://www.wholeoffootballplan.com.au/.

Fransen J, Bush S, Woodcock S, et al. (2018) Improving the prediction of maturity from anthropometric variables using a maturity ratio. *Pediatric Exercise Science* 30: 296-307.

Gil SM, Zabala-Lili J, Bidaurrazaga-Letona I, et al. (2014) Talent identification and selection process of outfield players and goalkeepers in a professional soccer club. *Journal of Sports Sciences* 32: 1931-1939.

Gledhill A, Harwood C and Forsdyke D. (2017) Psychosocial factors associated with talent development in football: A systematic review. *Psychology of Sport and Exercise* 31.

Gonaus C and Müller E. (2012) Using physiological data to predict future careeer progression in 14- to 17-year-old Austrain soccer academy players. *Journal of Sports Sciences* 30: 1673-1682.

Höner O and Feichtinger P. (2016) Psychological talent predictors in early adolescence and their empirical relationship with current and future performance in soccer. *Psychology of Sport and Exercise* 25: 17-26.

Höner O, Leyhr D and Kelava A. (2017) The influence of speed abilities and technical skills in early adolescence on adult success in soccer: A long-term prospective analysis using ANOVA and SEM approaches. *PLOS one* 12: e0182211.

Huijgen BCH, Elferink-Gemser MT, Lemmink KAPM, et al. (2014) Multidimensional performance characteristics in selected and deselected talented soccer players. *European Journal of Sport Sciences* 14: 2-10.

Huijgen BCH, Elferink-Gemser MT, Post WJ, et al. (2009) Soccer skill development in professionals. *International Journal of Sports Medicine* 30: 585-591.

Johnson A, Farooq A and Whiteley R. (2017) Skeletal maturation status is more strongly associated with academy selection than birth quarter. *Science and Medicine in Football* 1: 157-163.

Kannekens R, Elferink-Gemser MT and Visscher C. (2011) Positioning and deciding: key factors for talent development in soccer. *Scandinavian Journal of Medicine and Science in Sports* 21: 846-852.

Keller BS, Raynor AJ, Bruce L, et al. (2016) Technical attributes of Australian youth soccer players: Implications for talent identification. *International Journal of Sports Science and Coaching* 11: 819-824.

Keller BS, Raynor AJ, Bruce L, et al. (2018a) Physical and anthropometrical attributes of Australian youth soccer players *International Journal of Sports Science and Coaching*: 1-7.

Keller BS, Raynor AJ, Iredale F, et al. (2018b) Tactical skill in Australian youth soccer: Does it discriminate age-match skill levels? *International Journal of Sports Science and Coaching*: 1-7.

Kiphard EJ and Schilling F. (1974) *Körperkoordinationstest für Kinder,* Weinheim: Beltz Test.

Kiphard EJ and Schilling F. (2007) *Körperkoordinationstest für Kinder 2, überarbeitete und ergänzte Aufgabe,* Weinheim: Beltz Test.

Krustrup P, Mohr M, Amstrup T, et al. (2003) The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine and Science in Sports and Exercise* 35: 697-705.

Le Gall F, Carling C, Williams AM, et al. (2010) Anthropometric and fitness characteristics of international, professional, and amatuer male graduate soccer players from an elite youth academy. *Journal of Science and Medicine in Sport* 13: 90-95.

Novak AR, Bennett KJM, Beavan A, et al. (2017) The applicability of a short form of the Körperkoordinationstest für Kinder for measuring motor competence in children aged 6 to 11 years. *Journal of Motor Learning and Development* 5: 227-239.

Novak AR, Bennett KJM, Fransen J, et al. (2018a) A multidimensional approach to performance prediction in Olympic distance cross-country mountain bikers. *Journal of Sports Sciences* 36: 71-78.

Novak AR, Bennett KJM, Fransen J, et al. (2018b) Predictors of performance in a 4-h mountain-bike race. *Journal of Sports Sciences* 36: 462-468.

O'Brien-Smith J, Tribolet R, Smith MR, et al. (2019) The use of the Körperkoordinationstest für Kinder in the talent pathway in youth athlets: A systematic review. *Journal of Science and Medicine in Sport* 22: 1021-1029.

O'Connor D, Larkin P and Williams AM. (2016) Talent identification and selection in elite youth football: An Australian context. *European Journal of Sport Sciences* 16: 837-844.

Reilly T, Williams AM, Nevill AM, et al. (2000) A multidisciplinary approach to talent identification in soccer. *Journal of Sports Sciences* 18: 695-702.

Sarmento H, Anguera MT, Pereira A, et al. (2018) Talent identification and development in male football: A systematic review. *Sports Medicine* 48: 907-931.

Travassos B, Araújo D, Davids K, et al. (2013) Expertise effects on decision-making in sport are constrained by requisite response behaviours - A meta-analysis. *Psychology of Sport and Exercise* 14: 211-219.

Vaeyens R, Lenoir M, Williams AM, et al. (2007a) The effects of task constraints on visual search behaviour and decision-making skill in youth soccer players. *Journal of Sport and Exercise Psychology* 29: 147-169.

Vaeyens R, Lenoir M, Williams AM, et al. (2007b) Mechanisms underpinning successful decision making in skilled youth soccer players: An analysis of visual search behaviours. *Journal of Motor Behavior* 39: 395-408.

Vaeyens R, Lenoir M, Williams AM, et al. (2008) Talent identification and development programmes in sport: Current models and future directions. *Sports Medicine* 38: 703-714.

Vaeyens R, Malina RM, Janssens M, et al. (2006) A multidisciplinary selection model for youth soccer: The Ghent Youth Soccer Project. *British Journal of Sports Medicine* 40: 928-934.

Vandorpe B, Vandendriessche J, Vaeyens R, et al. (2011) Factors discriminating gymnasts by competitive level. *International Journal of Sports Medicine* 32: 591-597.

Woods CT, Raynor AJ, Bruce L, et al. (2016a) Discriminating talent-identified junior Australian football players using a video-based decision-making task. *Journal of Sports Sciences* 34: 342-347.

Woods CT, Raynor AJ, Bruce L, et al. (2016b) The application of a multi-dimensional assessment approach to talent identification in Australian football. *Journal of Sports Sciences* 34: 1340-1345.

Zuber C, Zibung M and Conzelmann A. (2015) Motivational patterns as an instrument for predicting success in promising young football players. *Journal of Sports Sciences* 33: 160-168.

**Table 1.** The effect of academy status on early adolescent youth soccer players' motor competence, physical fitness, decision-making, and psychology traits (mean ± SD)

| | Academy status | | Academy Status Effect | |
|---|---|---|---|---|
| | Tier one | Tier two | *F* | $\eta_p^2$ |
| Chronological age (y) | 12.9 ± 0.6 | 13.1 ± 0.6 | - | - |
| Age at peak height velocity (y) | 13.8 ± 0.6 | 13.8 ± 0.8 | - | - |
| Anthropometry | *n* = 30 | *n* = 57 | | |
| Stature (cm) | 156.4 ± 8.7 | 157.5 ± 10.1 | - | - |
| Body mass (kg) | 43.9 ± 7.3 | 46.8 ± 10.0 | - | - |
| Motor competence | *n* = 30 | *n* = 51 | | |
| Balancing backwards (points) | 57.0 ± 11.2 | 51.4 ± 10.8 | 4.92* | 0.06 |
| Moving sideways (points) | 58.9 ± 7.7 | 56.3 ± 7.6 | 2.33 | 0.03 |
| Jumping sideways (points) | 95.3 ± 13.4 | 89.1 ± 8.7 | 6.17* | 0.07 |
| Physical fitness | *n* = 28 | *n* = 51 | | |
| Vertical jump (cm) | 41.3 ± 5.3 | 41.9 ± 7.4 | 0.16 | < 0.01 |
| 5m sprint (s) | 1.10 ± 0.05 | 1.16 ± 0.07 | 22.98** | 0.23 |
| 30m sprint (s) | 4.84 ± 0.16 | 4.90 ± 0.35 | 0.75 | 0.01 |
| T-test (s) | 8.35 ± 0.30 | 8.41 ± 0.36 | 0.66 | < 0.01 |
| Yo-Yo (m) | 964.3 ± 403.6 | 924.7 ± 299.2 | 0.25 | < 0.01 |
| Decision-making | *n* = 29 | *n* = 46 | | |
| Total response accuracy (%) | 86.2 ± 6.9 | 84.2 ± 8.4 | 1.13 | 0.02 |
| Total response time (s) | 1.35 ± 0.57 | 1.12 ± 0.38 | 4.20* | 0.05 |
| Psychological traits | *n* = 30 | *n* = 36 | | |
| Ego orientation (/5) | 2.9 ± 0.9 | 2.6 ± 0.8 | 1.59 | 0.02 |
| Task orientation (/5) | 4.4 ± 0.4 | 4.3 ± 0.6 | 1.64 | 0.03 |

Note: * $p < 0.05$, ** $p < 0.01$. F = F statistic, $\eta_p^2$ = Partial Eta Squared.

**Table 2.** Logistic regression predicting the likelihood of tier one academy status in early adolescent youth soccer players based on balancing backwards, jumping sideways, 5m sprint, and total response time.

| | *B* | SE | Wald | *df* | *p* | OR | OR 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Balancing backwards (points) | 0.03 | 0.03 | 0.76 | 1 | 0.382 | 1.027 | 0.967 | 1.092 |
| Jumping sideways (points) | 0.04 | 0.03 | 1.53 | 1 | 0.216 | 1.041 | 0.977 | 1.109 |
| 5m sprint (s) | -2.07 | 0.59 | 12.40 | 1 | < 0.001 | 0.127 | 0.040 | 0.400 |
| Total response time (s) | 0.78 | 0.73 | 1.14 | 1 | 0.286 | 2.181 | 0.520 | 9.145 |
| Constant | 17.16 | 6.71 | 6.55 | 1 | 0.011 | - | - | - |

Note: *B* = *B* coefficient, CI = confidence interval, *df* = degrees of freedom, OR = odds ratio, *p* = p-value, SE = standard error.

**Table 3.** The effect of academy status on mid-adolescent youth soccer players' motor competence, physical fitness, decision-making, and psychology traits (mean ± SD)

| | Academy status | | Academy Status Effect | |
|---|---|---|---|---|
| | Tier one | Tier two | *F* | $\eta_p^2$ |
| Chronological age (y) | 15.0 ± 0.6 | 14.7 ± 0.5 | - | - |
| Age at peak height velocity (y) | 13.7 ± 0.6 | 13.8 ± 0.6 | - | - |
| Anthropometry | *n* = 31 | *n* = 41 | | |
| Stature (cm) | 172.0 ± 6.4 | 171.0 ± 7.7 | - | - |
| Body mass (kg) | 61.1 ± 9.2 | 57.5 ± 9.0 | - | - |
| Motor competence | *n* = 30 | *n* = 40 | | |
| Balancing backwards (points) | 59.0 ± 8.0 | 49.9 ± 10.5 | 15.82** | 0.19 |
| Moving sideways (points) | 64.2 ± 7.1 | 59.6 ± 8.1 | 6.30* | 0.09 |
| Jumping sideways (points) | 101.1 ± 11.6 | 92.4 ± 8.5 | 13.17** | 0.16 |
| Physical fitness | *n* = 20 | *n* = 36 | | |
| Vertical jump (cm) | 52.0 ± 6.7 | 49.6 ± 6.5 | 1.78 | 0.03 |
| 5m sprint (s) | 0.98 ± 0.05 | 1.08 ± 0.07 | 39.24** | 0.42 |
| 30m sprint (s) | 4.28 ± 0.18 | 4.52 ± 0.22 | 16.34** | 0.23 |
| T-test (s) | 7.85 ± 0.25 | 8.05 ± 0.31 | 6.34* | 0.11 |
| Yo-Yo (m) | 1624.0 ± 395.4 | 1301.4 ± 487.1 | 6.29* | 0.10 |
| Decision-making | *n* = 28 | *n* = 32 | | |
| Total Response accuracy (%) | 85.8 ± 7.8 | 86.4 ± 9.1 | 0.07 | < 0.01 |
| Total Response time (s) | 1.18 ± 0.48 | 1.06 ± 0.48 | 0.88 | 0.02 |
| Psychological traits | *n* = 31 | *n* = 23 | | |
| Ego orientation (/5) | 2.9 ± 0.8 | 2.8 ± 0.9 | 0.22 | < 0.01 |
| Task orientation (/5) | 4.2 ± 0.5 | 4.1 ± 0.6 | 1.08 | 0.02 |

Note: * $p < 0.05$, ** $p < 0.01$. F = F statistic, $\eta_p^2$ = Partial Eta Squared.

**Table 4.** Logistic regression predicting the likelihood of tier one academy status in mid-adolescent youth soccer players based on balancing backwards, moving sideways, jumping sideways, 5m sprint, t-test, and Yo-Yo.

| | *B* | SE | Wald | *df* | *p* | OR | OR 95% CI | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Balancing backwards (points) | 0.12 | 0.07 | 3.23 | 1 | 0.071 | 1.129 | 0.990 | 1.287 |
| Moving sideways (points) | 0.07 | 0.09 | 0.54 | 1 | 0.464 | 1.069 | 0.894 | 1.280 |
| Jumping sideways (points) | -0.04 | 0.07 | 0.30 | 1 | 0.581 | 0.964 | 0.846 | 1.098 |
| 5m sprint (s) | -6.43 | 2.24 | 8.23 | 1 | 0.004 | 0.002 | 0.000 | 0.130 |
| T-test time (s) | 0.28 | 0.22 | 1.63 | 1 | 0.201 | 1.320 | 0.862 | 2.021 |
| Yo-Yo (m) | 0.00 | 0.00 | 0.07 | 1 | 0.792 | 1.000 | 0.998 | 1.003 |
| Constant | 35.97 | 18.40 | 3.82 | 1 | 0.051 | - | - | - |

Note: *B* = *B* coefficient, CI = confidence interval, *df* = degrees of freedom, OR = odds ratio, *p* = p-value, SE = standard error.