



## LJMU Research Online

Fenner, J, Doncaster, G, McRobert, A, Ford, P, Iga, J and Unnithan, V

**A preliminary investigation into the evaluation of possession-based small-sided games and the influence of decision-making ability in identifying talented pre-pubertal soccer players**

<http://researchonline.ljmu.ac.uk/id/eprint/17349/>

### Article

**Citation** (please note it is advisable to refer to the publisher's version if you intend to cite from this work)

**Fenner, J, Doncaster, G, McRobert, A, Ford, P, Iga, J and Unnithan, V (2022) A preliminary investigation into the evaluation of possession-based small-sided games and the influence of decision-making ability in identifying talented pre-pubertal soccer players. *Apunts Sports Medicine*. 57 (214).**

LJMU has developed [LJMU Research Online](#) for users to access the research output of the University more effectively. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Users may download and/or print one copy of any article(s) in LJMU Research Online to facilitate their private study or for non-commercial research. You may not engage in further distribution of the material or use it for any profit-making activities or any commercial gain.

The version presented here may differ from the published version or from the version of the record. Please see the repository URL above for details on accessing the published version and note that access may require a subscription.

For more information please contact [researchonline@ljmu.ac.uk](mailto:researchonline@ljmu.ac.uk)

<http://researchonline.ljmu.ac.uk/>



# apunts

SPORTS MEDICINE

www.apunts.org



## ORIGINAL ARTICLE

## A preliminary investigation into the evaluation of possession-based small-sided games and the influence of decision-making ability in identifying talented pre-pubertal soccer players

Jonathan Fenner<sup>a</sup>, Greg Doncaster<sup>f,\*</sup>, Alistair McRobert<sup>b</sup>, Paul Ford<sup>c</sup>, John Iga<sup>b</sup>, Viswanath Unnithan<sup>d</sup>

<sup>a</sup> Medical and Exercise Science Department; Wolverhampton Wanderers Football Club

<sup>b</sup> Research Institute for Sport and Exercise Science, Liverpool John Moores University

<sup>c</sup> Research Institute for Sport and Exercise Science, Brighton University

<sup>d</sup> Institute of Clinical Exercise and Health Science, Division of Sport and Exercise, School of Health and Life Sciences, University of the West of Scotland, Hamilton, Scotland, UK

<sup>f</sup> Department of Sport and Physical Activity, Edge Hill University, Ormskirk, Lancashire, UK

Received 12 August 2021; accepted 17 December 2021

Available online 22 May 2022

### KEYWORDS

Training;  
Development;  
Possession;  
Talent identification;  
Youth sport

### Abstract

**Introduction:** The aims of this study were 1) to assess if talented players can be identified within possession-based small-sided games (SSG), and 2) to determine if, decision making, physical, and time-motion characteristics correlated to success in a possession-based SSG.

**Methods:** Eight, highly-trained U10 soccer players (Mean  $\pm$  SD; age:  $10.3 \pm 0.2$  years; stature:  $1.41 \pm 0.04$  m; body mass:  $35.2 \pm 3.3$  kg) participated in this study. Six 4 vs 4 possession based SSG's were played. Time-motion characteristics were measured using micromechanical devices (MEMS). Countermovement jump, 10m and 30m speed tests were conducted. Participants were presented with 28 video clips of 5 versus 5 match-play sequences to assess decision-making ability.

**Results:** The main finding of this study was a large significant relationship between Game Technical Scoring Chart (GTSC) and Total Points (TP) ( $r = 0.784$ ,  $P < 0.05$ ). There were no significant correlations between the decision-making test and GTSC and TP. A significant and largely inverse correlation between decision-making and countermovement jump ( $r = -0.737$ ,  $P < 0.05$ ) was observed.

**Conclusions:** Our results demonstrate that the more talented players were also the most successful players in the possession based SSG. The players' decision-making ability, however, did not influence their success in the SSG.

© 2021 FUTBOL CLUB BARCELONA and CONSELL CATALÀ DE L'ESPORT. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

\* Corresponding author.

E-mail address: [doncasg@edgehill.ac.uk](mailto:doncasg@edgehill.ac.uk) (G. Doncaster).

<https://doi.org/10.1016/j.apunsm.2021.100378>

2666-5069/© 2021 FUTBOL CLUB BARCELONA and CONSELL CATALÀ DE L'ESPORT. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Traditional research in talent identification tends to utilise a cross-sectional approach to predict success in adult competition, by measuring current performance of youth players on a combination of physiological, anthropometric and technical abilities independently of one another to predict adult performance.<sup>1</sup> This approach is problematic as it does not represent real-world tasks indicative of soccer competition. Determinants of successful soccer performances are wide-ranging and complex, with the distinguishing factors that produce elite soccer players being multi-factorial.<sup>2</sup> The predictive value of a cross-sectional approach in team sports is diminished as excellence in team sports is not achieved with a standard set of skills or physical attributes; it can be achieved through an individual or unique way using a combination of skills and physical attributes.<sup>1</sup> This compensation phenomenon suggests that deficiencies in one area may be compensated by strengths in other areas.

Creating a model for talent identification within soccer is difficult and an interconnected, multidimensional approach that utilises real-world tasks will likely increase the efficacy of a talent identification model. Small-sided games (SSG's) could play a crucial role in future talent identification models, as SSG's primary benefits are that they replicate movement demands (i.e. physical intensity, tactical awareness and technical demands) of competitive match play but more frequently than is encountered in an 11-a-side match.<sup>3</sup> Recent literature has attempted to use SSG's to identify talented soccer players at a post-pubertal age<sup>4</sup> and pre-pubertal age.<sup>5</sup> Both papers employed a 4 vs 4 SSG model in an attempt to identify the most talented players, with results suggesting that it is possible to identify the most talented player, according to a coach's subjective score, by examining which player won the most amount of games.<sup>5</sup> Consequently, an SSG model for objective talent identification may be an ecologically valid and novel means in which players can demonstrate their ability, leading to the identification of talented players.

Team performances and the match result do not necessarily correlate, as a team can play poorly and win and vice versa. A popular performance indicator in soccer is possession of the ball, with research suggesting a correlation between the ability to retain possession for long periods of match-play and success.<sup>6</sup> Indeed, there are significantly more shots per possession within longer possession sequences than short possession sequences in successful teams with evidence suggesting that a goal is scored every 10 shots.<sup>7</sup> Given the association between ball possession and success,<sup>8</sup> the expectation is that the more talented players retain possession more frequently and link more effectively with team-mates for longer periods of time. Overall, there is a paucity of research regarding ball possession within youth soccer, particularly with regards to talent identification, with most of the literature focusing on elite senior soccer match-play. As ball possession is highly associated with successful performance in adult soccer, it is unusual that there is a lack of evidence with respect to the physical and technical requirements of youth soccer players during possession based SSG's.

Skilled perception is an important determinant of soccer expertise,<sup>9</sup> as players are constantly confronted with a

complex and rapidly changing environment, in which they need to make rapid decisions and enact these, with the intention to gain or maintain possession.<sup>10</sup> Players must pick up information from the ball, team-mates, and opposition before deciding on the most appropriate response.<sup>9</sup> It is well documented that expert soccer players demonstrate superiority over less skilled players in their ability to anticipate and make decisions during match-play.<sup>11</sup> In comparison to a traditional fitness testing approach (i.e. sprint, jump and agility testing), possession-based SSG's mimic match-play more closely as there is a greater cognitive element as well as a physical and technical element to the practice. Furthermore, coaches can employ rule modifications within SSGs, thus manipulating the context and increasing SSG intensity and the perception of effort that is likely to be a result of increased cognitive load required of players.<sup>3</sup> Therefore, the use of possession based SSG's and the influence of decision-making ability within pre-pubertal highly trained soccer players may be a viable alternative for talent identification.

The use of decision-making testing protocols to discriminate between levels of soccer players is not a new concept. Roca et al.<sup>11</sup> reported that highly skilled players were more accurate in their anticipation and decision-making judgements compared to low skilled players. Indeed, international and national soccer players outperformed regional level soccer players in a football-specific decision-making test.<sup>12</sup> Although all three groups in this study were reasonably well matched in relation to the amount of playing experience, the more elite players outperformed their regional counterparts and at adolescence there appears to be a distinctive difference in decision-making ability between high and low skilled players. Whether, this is applicable for pre-pubertal soccer players is unknown and as such, the age-appropriateness of such testing requires further investigation. Furthermore, possession-based games represent a real-world task that is indicative of successful soccer performance. Possession-based SSG's may increase cognitive load and therefore this may be the discriminating factor between successful and unsuccessful performance. Consequently, the aim of this study, was, 1) to assess if talented players can be identified within a possession-based SSG, and 2) to determine if decision making skills, physical attributes, and time-motion characteristics correlated to success in a possession-based SSG.

## Methods

### Subjects

Eight highly trained pre-pubertal U10 soccer players (Mean  $\pm$  SD; age; 10.3  $\pm$  0.2 yrs; stature: 1.41  $\pm$  0.04 m; body mass: 35.2  $\pm$  3.3 kg) were recruited from a category 1 youth soccer academy, in England. Participants were considered physically active based upon a physical activity questionnaire (8  $\pm$  1.3 hours a week) and had 3 sessions of technical and tactical training a week (7  $\pm$  0.5 hours a week) with one competitive match a week. Players had trained at the club for a minimum of 1 full season prior to the start of this study (2  $\pm$  0.2 yrs) and were training for 45 weeks a year. This amount of systematic training classifies these players as

highly trained when compared to a recreational soccer player. The players consisted of a mixture of positions with 2 midfielders, 4 attackers and 2 defenders. Prior to the start of the study, the academy manager, coaches, players and parents of the players had an opportunity to discuss all aspects of the study with the primary investigator. Written informed consent and written assent was obtained from the parents and players, respectively. Each participant also completed a medical questionnaire and a training diary prior to the commencement of the study. Ethical approval was obtained from a local university ethics committee, which included approval from the academy manager at the respective academy.

### Possession SSG protocol

The possession SSG's were played outdoors on natural turf at the squad's allocated training time of 18:00, which is the squad's usual training time, venue and surface. A multi-ball system was applied (i.e. balls were placed around the perimeter of the pitch) so that the game was continuous. No verbal encouragement or feedback was allowed from coaches throughout the session. Only referee decisions, the number of passes in the current possession, and the score was provided during the game. Prior to the initiation of the multiple SSG's, video-based match analysis of 4 competitive matches preceding this study, was conducted with the players. The average number of consecutive passes leading up to a goal scored was three, from a sample of 25 goals scored across four matches. Therefore, three consecutive passes were chosen as the number of passes to determine a goal (point) within this possession based SSG protocol. To score a goal, a team had to perform 3 consecutive passes without the opposing team touching the ball. If the opposing team intercepted or gained possession, the pass count was reset to zero. Participants were separated into two teams of 4 players. All players participated in a 15-minute standardised warm up prior to starting the possession SSG. Each team played six, 4 vs. 4 matches, which were 5 minutes in duration, with 3 minutes of passive recovery, with pitch dimensions set at 18.3m x 23m, replicating previous research using SSG with U10 players.<sup>5</sup> The players were reorganised into different combinations after each game, so no player played with the same three team-mates on two occasions.

### Game technical scoring chart (GTSC) and total points (TP) protocol

During each individual game of the 4 vs 4 SSG protocol, each player was awarded points (TP) for the outcome of each match, 4 points for a win, 2 points for a draw and 0 points for a loss. Players were also awarded one point each for their team scoring (i.e. via 3 connected passes), regardless of result. This points award system closely mimics the structure of points awarded in competitive football, however for the data to maintain an interval level measurement, we had to ensure the spacing between the points was even. The inclusion of providing a point to each player, for each goal that was scored, was to ensure that players were rewarded for maintaining possessions (e.g. continually scoring). Similarly, goal difference in competitive football can be a deciding

factor on league position, so competitive football teams look to score as many goals as they can, to give themselves an advantage in final league position.

Two coaches with F.A. qualifications (level 1) technically evaluated the players throughout the games using a game technical scoring chart (GTSC), both coaches had previous experience using the GTSC. The GTSC is a tool that mimics the perception of a coach or scout when they are identifying talented players or making a decision on whether to retain or release a player.<sup>5</sup> All players' performance was evaluated on 8 football elements, with a score between 0 and 5 being given for each element. Each point described the players' performance using the following criteria: 1- poor, 2 – below average, 3- average, 4- very good, and 5- excellent. The criteria in the GTSC were: *Cover/support, Communication, Decision making, Passing, First touch, Control, One vs. One, and Marking*. For example, if a player was perceived by the coach rating them to be a poor passer of the ball during that SSG they would be given a score of 1 in the *passing* element.

Reliability of GTSC has been previously established in the literature, with an inter-tester reliability of 0.83 and 0.782 for Cronbachs alpha between a highly qualified coach (F.A. B licence) and two research assistants with coaching qualifications (F.A. level 1).<sup>5</sup> Furthermore, construct validity of the GTSC has previously been demonstrated by our research group.<sup>5</sup>

### Time motion analysis

To assess players' physical performance during the SSG's, micromechanical devices (MEMS) (MinimaxX, S4, Catapult Innovations, Melbourne, Australia) were used. The MEMS contain a 10Hz global positioning satellite (GPS) chip that was used to record time-motion data. Total distance covered (TDC, metres) and high-speed running distance covered (HSRD, metres) were used as measures of locomotor activities. High speed running distance covered was defined as any distance covered above 60% of the individual player's maximum velocity attained during the SSG; this threshold was used in accordance with Harley et al.,<sup>13</sup> who suggest 'speed zones' should be normalized relative to the individuals speed capabilities, especially in prepubertal soccer players. Data was included if the number of satellites exceeded 6 and there was a horizontal displacement of positioning (HDOP) that was less than 1.5. During data collection the number of satellites was 7 and HDOP was 1.02 which met these requirements.

In addition, the MinimaxX S4 contains a tri-axial piezoelectric linear accelerometer (Kionix: KXP94) sampling at a frequency of 100 Hz. PlayerLoad™ (anterior-posterior PlayerLoad, medial-lateral PlayerLoad and vertical PlayerLoad) was recorded using this accelerometer. PlayerLoad™ is expressed in arbitrary units and can be provided as an absolute or relative measure (au). Relative PlayerLoad™ (PlayerLoad™ per metre) was a ratio of PlayerLoad™ divided by total distance covered, this was used to account for inter-individual variation in distance covered within games. PlayerLoad™ (PL) alongside the locomotor activities was analysed using the Catapult software (Sprint 5. 9. 2, Catapult Sports, Melbourne, Australia).

## Decision-making testing

Prior to the start of the decision-making test, all players were provided with standardised verbal instructions on the test film and were given the opportunity to ask any questions about what they were going to do. The players had been previously exposed to this test protocol in a pilot study to investigate if the testing procedures were appropriate. As a result, all players had previous experience of the testing protocol. The decision-making test was conducted prior to training a week before the possession SSG was performed. The first 4 clips of the filming were familiarisation clips and were not included in the data analysis. There were four sets of 7 clips, making a total of 28 clips. After each set, players were given 2 minutes rest before playing the next set of clips. At the start of each clip, the image was frozen with a team-mate in possession of the ball, the ball was then passed to the camera and at the point of receiving the ball, the image was occluded. At this point the players had 3 seconds to select an action from the following; pass left, pass right, pass centre, dribble, or shoot. The players' score was derived from the number of correct actions they specified on their answer sheet. The correct actions had previously been decided by a panel of two qualified (UEFA - A licenced coaches) coaches.

## Test film

This methodological approach was developed by two of the co-authors. Participants were presented with a video sequence involving dynamic, 5 vs 5 soccer situations filmed and viewed from the perspective of a central defender. The sequences were filmed on an indoor AstroTurf pitch, with a high definition digital video camera (Canon XH A1 s, Tokyo, Japan) positioned on a tripod at the halfway line. This filming perspective enabled the entire width of the pitch to be seen. A panel of two qualified coaches (UEFA. A licence coaches) determined that the contents of the video clips represented realistic patterns of play. The filming was conducted with adult skilled players in full kit, playing a 5 vs 3 (A goalkeeper was included in the opposition team, the goalkeeper from the filming team was not included and the perspective was of the 4<sup>th</sup> outfield player). The film clips were projected onto an interactive whiteboard 1.59m X 1.27m (Interactive Education Pro Digital Whiteboard) via a projector (Mitsubishi Electric projector XL6U 60Hz). Participants sat centrally to the screen evenly spaced apart so they could not see each other's answers.

## Physical testing

Physical testing was conducted two weeks after the SSG protocol, as part of the clubs periodic testing battery procedures, with all tests completed during one session lasting 90 min. Testing was completed at the same time of day as the SSG to control for circadian variation in performance.<sup>14</sup> The testing was conducted on an indoor 3G artificial pitch to ensure weather conditions did not affect the testing battery. The players followed a standardised warm up lasting 15 minutes prior to testing. The players then performed the following tests in order: countermovement jump (CMJ) without the use of their arms, 10 and 30m sprint.

## Countermovement jump protocol

Lower body power was determined with a CMJ without the use of the arms. All the jumps were recorded using a jump mat (JumpMat, Perform Better, Warwick, UK). Each player had 3 attempts with 2 minutes recovery in between each attempt. The highest score was recorded and used for analysis.

The players performed the CMJ without the use of arms by standing on the jump mat placing their hands on their hips. Following a countdown, the players then went down as fast and as deep as felt natural to them and jumped up as high as possible, aiming to land in the same spot on the jump mat, with a cushioned landing.

## Speed protocol

The players sprinting ability was measured using a maximal 30 m straight-line sprint with 10 m and 30 m split times. Infrared timing gates (Brower Timing System, Utah, USA) were placed (approximately) at hip height, at 0, 10, and 30 m. Players started in a standing position in a split stance, 1 m behind the first timing gate. Each player was instructed to run as fast as they could to a cone placed 5 m beyond the last timing gate. This was done to ensure the players were maximally sprinting when passing the last gate rather than decelerating. Each player performed 3 sprints with 2 minutes rest in-between each sprint. The fastest time was recorded and used for analysis.

## Statistical analyses

Prior to conducting any statistical analyses, assumptions of normality were checked using the Shapiro-Wilk test and the data was confirmed to be normally distributed, therefore, paired sample *t*-tests were used to assess for differences between total distance covered (TDC), high speed running distance (HSRD), PlayerLoad<sup>TM</sup> and PlayerLoad<sup>TM</sup> per metre between the winning and losing teams for each match. No significant differences ( $P > 0.05$ ) were found between the winning and losing teams for any of the time-motion variables in each game. Therefore, the individual players load per game was pooled to provide a total load for the entire SSG session (i.e. a load for all 6 games, per player). Pearson's moment correlations were employed to examine the relationship between the decision-making test and GTSC, TP of the possession-based SSG's, fitness test results, and the total load for all six games for each of the time-motion variables obtained from the possession-based SSG's. Magnitudes for thresholds were set at 0.1 for small, 0.3 for moderate, 0.5 for large, 0.7 for very large and 0.9 for extremely large correlation coefficients.<sup>15</sup> Statistical significance was set at  $P < 0.05$ . All statistical analysis was performed in SPSS version 21 (SPSS Inc., Chicago, IL).

## Results

Table 1 presents the (pooled) means and standard deviations of all variables with 95% confidence intervals.



**Table 1** Descriptive statistics for all variables obtained during the small-sided games and testing protocols.

Variable	Mean $\pm$ SD	95% Confidence Interval of the difference	
		Lower	Upper
TDC (m)	2143 $\pm$ 175	1996	2289
HSRD (m)	106 $\pm$ 47	66	146
PlayerLoad <sup>TM</sup> (Au)	339 $\pm$ 63	286	393
PlayerLoad <sup>TM</sup> per metre (Au)	0.95 $\pm$ 0.14	0.84	1.07
Coaches Game Technical Scoring Chart after 6 matches (GTSC) Possession SSG	131 $\pm$ 15	119	143
Total points after 6 matches (TP)	35 $\pm$ 9	27	42
CMJ (No Arms) (cm)	26.3 $\pm$ 3.5	23.3	29.2
10m Speed (secs)	1.95 $\pm$ 0.07	1.90	2.01
30m Speed (secs)	5.08 $\pm$ 0.16	4.95	5.22
Decision-Making Test Score	18 $\pm$ 6	13	23

Note: TDC, Total Distance covered; HSRD, High speed running distance; CMJ, Countermovement Jump.

### Technical evaluation

Fig. 1 illustrates the results from the technical evaluations (GTSC) along with each individual total points (TP) for the six SSGs. There was a significant and *very large* relationship between TP and GTSC ( $r = 0.784$ ,  $P < 0.01$ ,  $R^2 = 61\%$ ).

### Time-motion analysis

Table 2 present the score and time motion analysis data for each team, for each game, across the six games, while Table 3 displays the cumulative load of the time-motion variables for all 6 SSG's against the players GTSC and TP score.

Total distance covered was significantly and *very largely* correlated to GTSC ( $r = 0.771$ ,  $P < 0.01$ ,  $R^2 = 59\%$ ). In

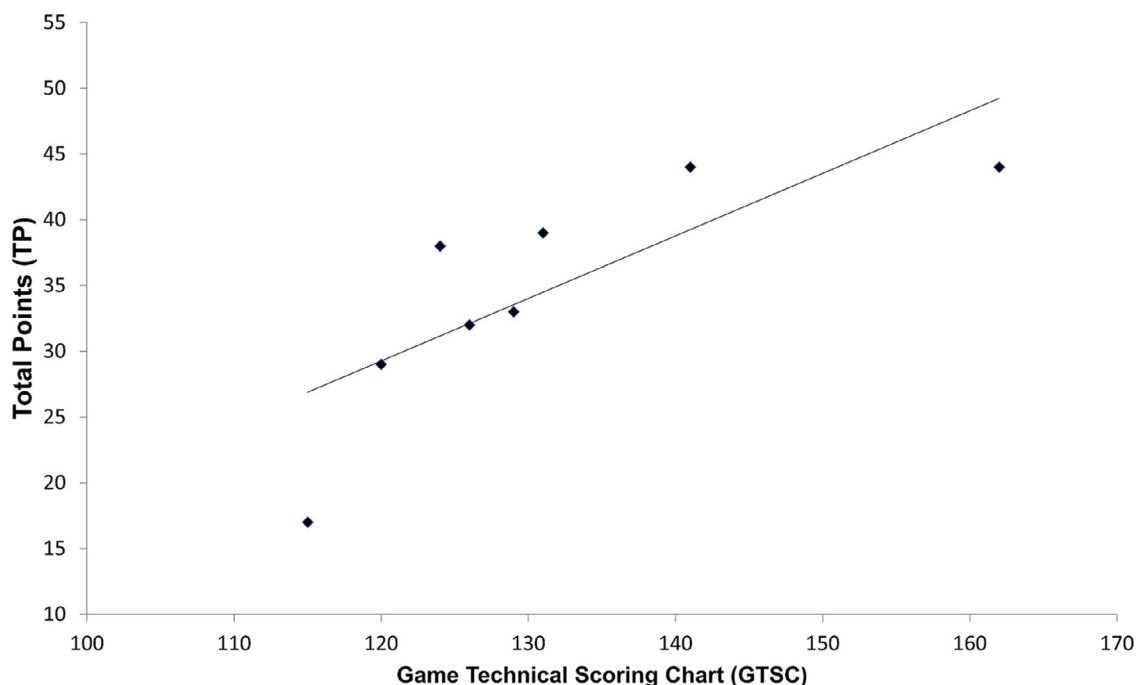
addition, PlayerLoad<sup>TM</sup> was significantly and *largely* correlated to GTSC ( $r = 0.669$ ,  $P < 0.05$ ,  $R^2 = 45\%$ ).

### Physical testing

Table 3 presents players' individual TP, GTSC, decision making scores and fitness testing scores. Countermovement jump was significantly and *largely* correlated with GTSC ( $r = 0.745$ ,  $P < 0.05$ ,  $R^2 = 56\%$ ) and with TP ( $r = 0.667$ ,  $P < 0.05$ ,  $R^2 = 44\%$ ).

### Decision-making testing

The decision-making testing scores are presented in Table 3 alongside the GTSC and TP scores of the possession SSG, for



**Fig. 1** Relationship between Game Technical Scoring Chart (GTSC) and Total Points (TP).

**Table 2** Time motion characteristics across all 6 small-sided games.

	Game 1		Game 2		Game 3		Game 4		Game 5		Game 6	
	A	B	A	B	A	B	A	B	A	B	A	B
Match Score	2	5	1	5	5	4	3	6	3	3	2	6
TDC (m)	362 ± 35	398 ± 39	350 ± 34	347 ± 54	394 ± 47	371 ± 15	339 ± 52	346 ± 32	346 ± 38	336 ± 33	335 ± 75	360 ± 17
HSRD (m)	23 ± 10	21 ± 5	13 ± 7	30 ± 19	30 ± 28	18 ± 7	17 ± 14	20 ± 4	13 ± 7	13 ± 12	9 ± 7	7 ± 8
PlayerLoad™ (Au)	53 ± 9	66 ± 13	48 ± 6	59 ± 13	64 ± 10	51 ± 9	54 ± 11	64 ± 13	58 ± 11	54 ± 9	54 ± 11	55 ± 8
PlayerLoad™ per metre (Au)	0.15 ± 0.03	0.17 ± 0.02	0.14 ± 0.03	0.17 ± 0.02	0.16 ± 0.02	0.14 ± 0.02	0.16 ± 0.04	0.18 ± 0.02	0.16 ± 0.03	0.16 ± 0.02	0.17 ± 0.04	0.15 ± 0.02

Note: TDC, Total Distance covered; HSRD, High speed running distance.

**Table 3** Individual scores for total points and game technical scoring chart against fitness testing, decision-making and time-motion data.

Player (Position)	Total points after 6 matches (TP)	Coaches Game Technical Scoring Chart after 6 matches	Decision- Making Test Score	CMJ (no Arms) (cm)	10m Sprint time (secs)	30m sprint time (secs)	TDC (m)	HSRD (m)	PlayerLoad ™ (Au)	PlayerLoad™ per metre (Au)
1	29	120	15	26.2	2.03	5.37	1923	110	359	1.13
2	17	115	24	23.9	1.92	5.05	2117	71	260	0.74
3	33	129	15	25.1	1.96	5.11	1954	35	270	0.84
4	38	124	21	24.7	1.90	4.83	2122	145	367	1.05
5	39	131	20	25.8	1.95	5.13	2178	80	304	0.84
6	44	141	6	32.4	1.84	4.92	2143	81	330	0.93
7	44	162	19	30.6	2.00	5.08	2495	175	456	1.10
8	32	126	22	21.7	2.05	5.18	2213	153	370	1.00

Note: TP = 4 points for a win, 2 points for a draw and 0 points for a defeat. Additionally each player gets one point per goal scored by the team regardless of result. TDC, Total Distance covered; HSRD, High speed running distance; CMJ, Countermovement Jump.

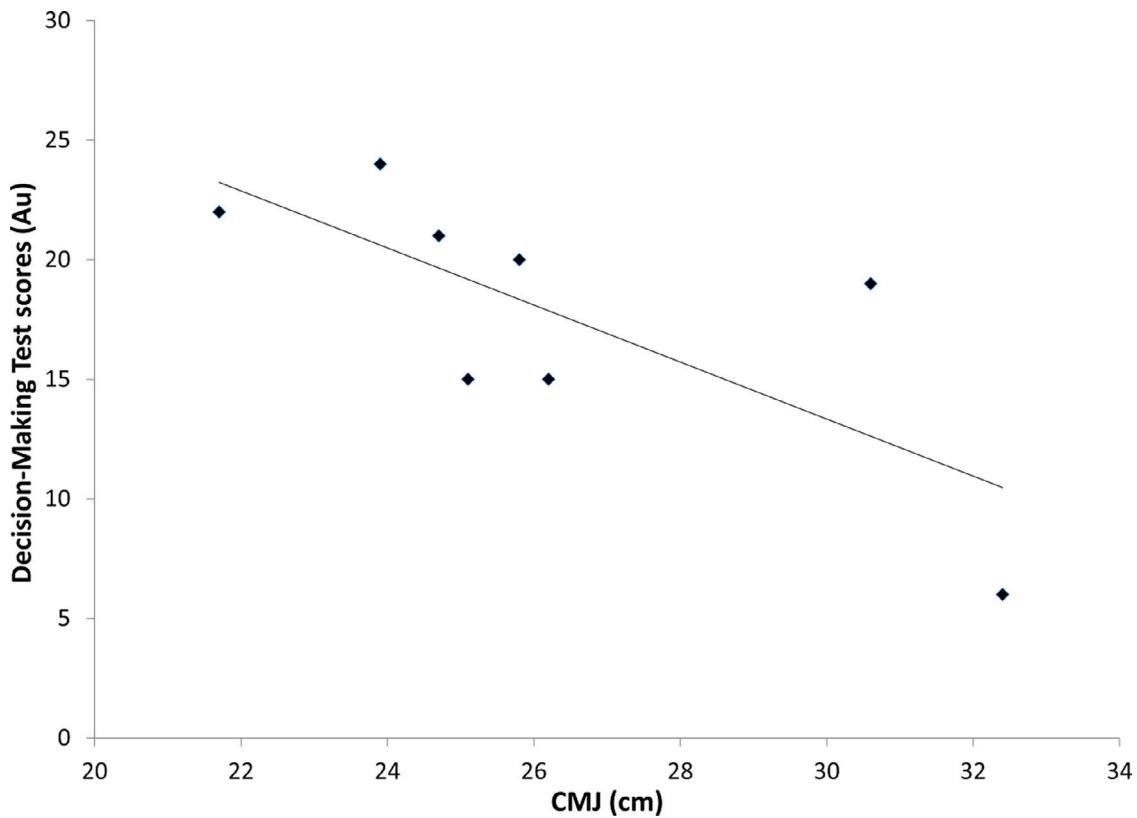


Fig. 2 Relationship between decision-making test and Counter Movement Jump (CMJ).

comparisons. Pearson's correlation coefficient demonstrated there were no significant correlations between the decision-making test and GTSC and TP in the possession based SSG. Furthermore, there were no significant correlations between any of the time-motion variables in possession SSG's and the decision-making score. There was, however, a significant and a *very large* inverse correlation between decision-making and countermovement jump performance ( $r = -0.737$ ,  $P < 0.05$ ,  $R^2 = 54\%$ ) (Fig. 2).

## Discussion

The main aim of this study was to assess if multiple, possession-based, small-sided games (SSGs) could act as a talent identification model. The main finding of this study was a significant (and *large*) relationship between GTSC and TP ( $r = 0.784$ ,  $P < 0.01$ ,  $R^2 = 61\%$ ) (Fig. 1). As a result, current results suggest that possession based, SSGs could be used as a ecologically valid means to identify the talented players in cohorts of pre-pubertal youth soccer players. Furthermore, this study found that TDC was significantly and largely correlated to GTSC ( $r = 0.771$ ,  $P < 0.01$ ,  $R^2 = 59\%$ ), and therefore demonstrates that the more talented players covered more distance than the less talented players during possession based SSGs. The second aim of this study was to discover if decision-making influenced success in multiple SSG's, however, results suggest that decision-making ability did not seem to affect success in a possession-based SSGs, nor did it have any correlation with coaches' player ratings, using the

GTSC, during the possession-based SSG's. Decision-making, however, was found to be inversely correlated to countermovement jumping ( $r = -0.737$ ,  $P < 0.05$ ,  $R^2 = 54\%$ ) (Fig. 2).

Results revealed that the more talented players, as identified by qualified coaches, also appear to be more successful during possession-based SSGs, as coaches' player ratings (GTSC) were found to be significantly correlated with TP ( $r = 0.784$ ,  $P < 0.01$ ,  $R^2 = 61\%$ ). This finding is in line with previous literature that has employed the GTSC to rate youth players' performance during SSGs.<sup>5</sup> Specifically, Fenner et al.<sup>5</sup> found more talented players, as identified by qualified coaches using the GTSC, were also shown to be more successful than their counterparts during multiple goal scoring orientated SSG's ( $r = 0.758$ ,  $P < 0.001$ ). The present data suggests that the talented players, as identified by the GTSC, retained possession more frequently and for longer durations, as those players gained more TP, therefore, indicating that they were part of a team that consistently passed and maintained possession of the ball, in comparison to their less talented peers. In soccer, the ability to retain possession of the ball enables teams to control the structure and tempo of the game.<sup>16</sup> This retention of the ball, therefore, indicates the more successful players (and therefore teams) can retain possession more frequently and for longer periods of time during match play. This finding is commensurate with senior elite level soccer match-play, as successful English Premier League teams typically display longer periods of possession when compared to unsuccessful teams.<sup>6</sup> Moreover, the use of SSGs, with small team numbers is likely to result in an increase in possession and ball contacts, thus



exacerbating these key characteristics of successful (or talented) performance and allowing the more talented players to be easily identifiable.<sup>3</sup>

In contrast to the GTSC data, the time-motion characteristics demonstrated that there were no physical differences between the winning and losing teams. A possible explanation for this is that the small field dimensions did not allow for greater differences between the two teams' movement patterns. The results, however, did reveal that the more talented players covered larger distances than the less talented, as TDC was largely and significantly correlated to GTSC ( $r = 0.771$   $P < 0.01$ ,  $R^2 = 59\%$ ). This could be due to the talented players working hard when out of possession to regain possession or possibly the talented players creating space more often and consistently when in possession to receive a pass. A further time-motion characteristic that influenced coaches' ratings of players, was PlayerLoad™, as it was found to be largely and significantly correlated to GTSC ( $r = 0.669$   $P < 0.05$ ,  $R^2 = 45\%$ ). This finding is unlike previous research,<sup>5</sup> in which PlayerLoad™ did not correlate to either GTSC or TP in a goal based SSG design. This may be in part due to the difference in the design and purpose of the SSGs between the two studies (i.e. traditional goal-based SSG vs. possession-based SSG). Nevertheless, the present study may indicate that the more talented players performed more frequent changes of direction, as their PlayerLoad™ was shown to be higher than the less talented players. Playing against quality opposition is often associated with lower ball possession,<sup>17</sup> therefore, it was hypothesised that the less talented players would cover greater total and high intensity running distances in order to regain possession. The results from the present study demonstrated that this was not the case, as talented players covered more distance. Bradley et al.,<sup>8</sup> however, found that teams with a higher percentage of ball possession covered the same distance as low percentage ball possession teams in both total and high-speed distances in the English Premier League with senior men players. Bradley et al.<sup>8</sup> concluded that the percentage of ball possession does not affect overall activity profiles of a team at elite adult level. While discrepancies exist when comparing adult data with pre-pubertal data, in light of the lack of youth data, current results suggest that possession can affect the activity profile of highly-trained pre-pubertal players, with the more talented individuals covering greater distances and changing direction more frequently. As such, time-motion characteristics which may not be deemed to be distinguishable metrics of elite level senior players, may be valuable metrics in the identification of talented pre-pubertal youth soccer players, particularly during competitive possession-based SSGs.

A variety of physical and physiological characteristics are deemed essential for success in soccer, including; aerobic and anaerobic endurance, speed, agility and power.<sup>4</sup> Current results revealed a significant relationship between CMJ and GTSC ( $r = 0.745$ ,  $P < 0.05$ ,  $R^2 = 56\%$ ), and CMJ and TP ( $r = 0.669$   $P < 0.05$ ,  $R^2 = 45\%$ ). These findings suggest that lower-limb power capabilities (CMJ) are advantageous to soccer-specific activities during possession-based SSGs. This is in line with previous literature, that found that (future) drafted players were significantly outperformed (future) non-drafted players during CMJ assessments undertaken at 14 years old (drafted:  $35.8 \pm 5.5$  vs. non-drafted:  $34.1 \pm$

$5.5$  cm,  $P < 0.05$ ).<sup>18</sup> Countermovement jumping ability is a fundamental skill and its mastery underpins key performance elements associated with soccer match-play, with increases in jump height being related to changes in anthropometry, muscle strength and in the movement pattern of the jump itself.<sup>19</sup> The players within the current cohort were in the same pubertal stage, therefore the potentially confounding effect of biological maturity on strength and power, and ultimately performance during match-play is largely minimised. Consequently, it is possible that the difference in CMJ jump height was due to a greater proficiency in the jumping movement pattern. Williams et al.<sup>20</sup> argues that whilst jumping tests are considered the outcome measure, a criticism of these tests is that they do not assess the motor competence, and therefore, there is no way of identifying if there has been any task compensation occurring, resulting in a lower CMJ jump height. Vandorpe et al.<sup>21</sup> found that a generalised motor control test (Körperkoordinations test für Kinder) was able to distinguish between elite and sub-elite gymnasts, and predicted results of the top gymnasts in competition two years later. The role of motor control in talent identification may increase as the Körperkoordinations test für Kinder test measured general traits underlying a wide variety of skills, which was sensitive enough to give an indication about the potential to develop and future performance, rather than current performance.<sup>21</sup> Therefore, the more talented players in the current study could jump higher, however not because they were biologically more mature or physically more powerful, but possibly due to being more skilled at motor control movement patterns. This advantage may extend to both their movement efficiency (i.e. change of direction) and the technical skills they demonstrated during the possession based SSGs which allowed them to be identified as the talented players. Consequently, future research should seek to examine and explore methods in which pre-pubertal soccer players' motor control can be examined, in conjunction with CMJ performance.

No significant correlations were reported between decision-making ability and success during possession based SSGs, demonstrating that talented players that have been identified via successful performances in SSG's achieved this status without superior decision-making ability. These findings agree with previous literature,<sup>12</sup> which found no difference between the results of international and national youth players in a decision-making test. These tests or measures, however, may not be sensitive enough to discriminate between players who are relatively close together on the skill continuum.<sup>12</sup> A possible explanation for not finding a correlation between TP and the decision making test is that a player may not be an exceptional decision-maker, but may be able to compensate by being quick or agile or by developing excellent movement and/or technical skills.<sup>22</sup> Although, a significant and large inverse correlation between decision-making ability and countermovement jump ( $r = -0.737$ ,  $P < 0.05$ ,  $R^2 = 54\%$ ) was reported in the current study (Fig. 2). This finding may suggest that the less powerful players were better at decision making, therefore, those players may have compensated for a reduced level of lower-body physicality (and motor control) by developing better decision-making skills, in comparison to their teammates. While decision-making ability is an important component of expert

performance,<sup>10</sup> it would be incorrect to assume that all talented players are good decision-makers.<sup>23</sup> A characteristic of team sports is that deficiencies in some components of performances may be addressed by strengths in other components,<sup>23</sup> therefore, in the present study it is possible to speculate that the pre-pubertal players compensated poor power output with improved decision-making ability.

It is acknowledged that this study was a preliminary investigation into possession based SSGs as a tool for talent identification, resulting in a small sample size (Power (β) = 54.4%). Therefore, further investigation, with a larger sample size is required to examine the potential of possession based SSG's as a talent identification model. Furthermore, the current study did not assess player's decision-making ability during any state of fatigue, in which the players would experience when competing and making decision in the SSG's. McMorris et al.<sup>24</sup> investigated the decision-making performance of experienced soccer players at three intensities, rest, 70% maximal power output and 100% maximal power output. The investigation showed that experienced players decision making accuracy was unaffected by exercise intensity, and speed of accuracy improved between rest and 70% of maximal power output, indicating that experienced players are consistent decision makers regardless of their fatigue levels. This could have been an environment in which the more talented players may have shown their superior decision-making ability, as they may have been able to consistently select the right decision, during soccer-specific activities and while fatigued. As a result, research examining decision-making within a talent identification model may need to consider decision-making ability in relation to fatigue, to fully assess a player's competitive match potential. Finally, the decision-making test only measures one mechanism, and does not take into consideration players' perception, action or speed of response. All of these mechanisms may aid in the discrimination of high and low performers, particularly speed of response as this has been found to discriminate between expert and novice soccer players<sup>12</sup> and should therefore be considered in the development of any talent identification models.

## Conclusion

This study aimed to firstly, evaluate if possession style SSG could act as a talent identification model with pre-pubertal players. Secondly, to determine if decision making skills, physical attributes, and time-motion characteristics correlated to success in a possession SSG. Our results demonstrate that the more talented players, as identified by qualified coaches, were also the most successful players in the possession SSG, irrespective of their team combination. The talented players covered a greater total distance during the possession SSG and also attained the highest height in a jump test, possibly due to the higher level of proficiency in motor control movement patterns. The present preliminary investigation did not find any correlation between success in possession SSG and decision-making ability. This study did find that players potentially compensate for a lack of power, with improved decision-making ability, to enable them to succeed in SSG performance, as CMJ was inversely and significantly correlated to decision-making. Possession SSG's

have the potential to be used within a real-world task, talent identification model as they are an environment in which talented players are easily identified, simply by their success in the SSG format.

## Conflicts of interest

The Authors declare that they don't have any conflict of interests

## References

1. Vaeyens R, Lenoir M, Williams MA, Philippaerts RM. Talent identification and development programmes in sport: current models and future directions. *Sports Med.* 2008;38(9):703–14.
2. Reilly T, Williams AM, Nevill A, Franks A. A multidisciplinary approach to talent identification in soccer. *J Sports Sci.* 2000;18:695–702.
3. Hill-Haas S, Dawson B, Impellizzeri F, Coutts A. Physiology of small-sided games training in football: a systematic review. *Sports Med.* 2011;41(3):199–220, <https://doi.org/10.2165/11539740-000000000-00000>.
4. Unnithan V, White J, Georgiou A, Iga J, Drust B. Talent identification in youth soccer. *J Sport Sci.* 2012;30(15):1719–26, <https://doi.org/10.1080/02640414.2012.731515>.
5. Fenner J, Iga J, Unnithan V. The evaluation of small-sided games as a talent identification tool in highly trained prepubertal soccer players. *J Sports Sci.* 2016;34(20):1983–90, <https://doi.org/10.1080/02640414.2016.1149602>.
6. James N, Jones P, Mellalieu SD. Possession as a performance indicator in soccer as a function of successful and unsuccessful teams. *J Sports Sci.* 2004;22:507–8.
7. Hughes M, Franks I. Analysis of passing sequences, shots and goals in soccer. *J Sports Sci.* 2005;23(5):509–14.
8. Bradley PS, Lago-Peñas C, Rey E, Gomez A. The effect of high and low percentage ball possession on physical and technical profiles in English FA Premier League soccer matches. *J Sport Sci.* 2013;31(12):1261–70.
9. Williams AM. Perceptual skill in soccer: implications for talent identification and development. *J Sports Sci.* 2000;18:737–50.
10. Del Campo DG, Villora SG, Lopez LM. Differences in decision-making development between expert and novice invasion game players. *Percept Mot Skills.* 2011;112(3):871–88, <https://doi.org/10.1080/17461391.2010.521584>.
11. Roca A, Ford PR, McRobert AP, Williams MA. Identifying the process underpinning anticipation and decision-making in a dynamic time-constrained task. *Cogn Process.* 2011;12:301–10, <https://doi.org/10.1007/s10339-011-0392-1>.
12. Vaeyens R, Lenoir M, Williams MA, Mazyn L, Philippaerts RM. The effects of task constraints on visual search behaviours and decision-making skill in youth soccer players. *J Sport Exer Psych.* 2007a;29:147–69.
13. Harley JA, Barnes CA, Portas M, Lovell R, Barrett S, Paul D, Weston M. Motion analysis of match-play in elite U12 to U16 age-group soccer players. *J Sports Sci.* 2010;28:1391–7, <https://doi.org/10.1080/02640414.2010.510142>.
14. Chtourou H, Hammouda O, Souissi H, Chamari K, Chaouachi A, Souissi N. Diurnal variations in physical performance related to football in young soccer players. *Asian J Sports Med.* 2012;3(3):139–44.
15. Hopkins WG, Marshall SW, Batterham AM, Hanin J. Progressive statistics for studies in sports medicine and exercise science. *Med Sci Sports Exerc.* 2009;41(1):3–12, <https://doi.org/10.1080/02640410802206857>.

16. Shafizadeh M, Lago-Penas C, Gridley A, Platt G. Temporal analysis of losing possession of the ball leading to conceding a goal: a study of the incidence of perturbation in soccer. *Int J Sports Sci Coaching*. 2014;9(4):627–36, <https://doi.org/10.1260/1747-9541.9.4.627>.
17. Lago C, Martín R. Determinants of possession of the ball in soccer. *J Sports Sci*. 2007;25(9):969–74.
18. Gonaus C, Muller E. Using physiological data to predict future career progression in 14- to 17-year-old Austrian soccer academy players. *J Sports Sci*. 2012;30(15):1673–82, <https://doi.org/10.1080/02640414.2012.713980>.
19. Floria P, Gomez-Landero LA, Harrison AJ. Variability in the application of force during the vertical jump in children and adults. *J Applied Biomech*. 2014;30(6):679–84, <https://doi.org/10.1123/jab.2014-0043>.
20. Williams AM. *Science and Soccer: Developing Elite Performers*. London: Routledge; 2013.
21. Vandorpe B, Vandendriessche J, Vaeyens R, Pion J, Lefevre J, Philippaerts RM, Lenoir M. The value of a non-sport-specific motor test battery in predicting performance in young female gymnasts. *J Sports Sci*. 2012;30(5):497–505, <https://doi.org/10.1080/02640414.2012.654399>.
22. Vaeyens R, Lenoir M, MA Williams, Philippaerts RM. Mechanisms underpinning successful decision making in skilled youth soccer players: an analysis of visual search behaviours. *J Motor Behaviour*. 2007b;39(5):395–408.
23. Williams AM, Ericsson KA. Perceptual-cognitive expertise in sport: some considerations when applying the expert performance approach. *Human Movement Sci*. 2005;24(3):283–307, <https://doi.org/10.1016/j.humov.2005.06.002>.
24. McMorris T, Myers S, MacGillivray W, SexSmith J, Fallowfield J, Graydon J, Forster D. Exercise, plasma catecholamine concentrations and decision-making performance of soccer players on a soccer-specific test. *J Sports Sci*. 1999;17:667–76.