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The evaluation of small-sided games as a talent identification tool in highly trained prepubertal soccer players

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ABSTRACT
The aim of this study was to evaluate physiological and technical attributes of prepubertal soccer players during multiple small-sided games (SSGs), and determine if SSGs can act as a talent identification tool. Sixteen highly trained U10 soccer players participated and separated into two groups of eight. Each group played six small-sided (4 vs. 4) matches of 5-min duration. Each player was awarded total points for the match result and goals scored. A game technical scoring chart was used to rate each player’s performance during each game. Time-motion characteristics were measured using micro-mechanical devices. Total points had a very large significant relationship with game technical scoring chart ($r = 0.758$, $P < 0.001$). High-speed running distance had a significantly large correlation with game technical scoring chart ($r = 0.547$, $P < 0.05$). Total distance covered had a significant and moderate correlation with game technical scoring chart ($r = 0.545$, $P < 0.05$) and total points ($r = 0.438$, $P < 0.05$). The results demonstrated a large agreement between the highest-rated players and success in multiple SSGs, possibly due to higher-rated players covering larger distances in total and at high speed. Consequently, multiple SSG could be used to identify the more talented prepubertal soccer players.

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KEYWORDS
Small-sided games; youth soccer; identifying talent

Introduction
The majority of professional soccer clubs run their own youth academy, in an attempt to identify and nurture talent from an early age, with an expectation that players will progress to the senior team (Reilly & Gilbourne, 2003). Identifying talent, therefore, is a priority within soccer clubs, as it would equate to a more effective financial investment by focusing resources on the development of a small but talented pool of players. The identification of talented players is historically based on a coach or scouts’ subjective view of a player (Unnithan, White, Georgiou, Iga, & Drust, 2012). This evaluation technique is often used in isolation and can result in repeated misjudgements (Meylan, Cronin, Oliver, & Hughes, 2010). This system unfortunately is associated with low predictive value and therefore its usefulness has been criticised (Vaeyens et al., 2008). In order to identify talent within soccer, an approach that allows simultaneous evaluation of a combination of technical skills and physical attributes (Vaeyens et al., 2008). These models predictive value are problematic in team sports, as excellence in sports such as soccer are not idiosyncratic to a standard set of skills; therefore superior ability can be achieved in individual and unique ways through different combinations of technical skills and physical attributes (Vaeyens et al., 2008). In order to identify talent within soccer, an approach that allows simultaneous evaluation of a combination of technical skills and physical attributes that contribute to successful soccer performance is essential (Unnithan et al., 2012), the use of small-sided games (SSGs) may play a crucial role in future talent identification models.

The majority of the research pertaining to SSGs has focused on their use as a training modality as it is suggested that SSG replicates movement demands, physiological intensity and technical demands of competitive match play (Hill-Haas, Dawson, Impellizzeri, & Coutts, 2011). An appropriate game design can alter the physiological and technical outcomes of an SSG (Hill-Haas et al., 2011), through manipulating factors such as player number (Hill-Haas, Dawson, Coutts, & Rowsell, 2008)...

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2009; Little & Williams, 2006, 2007), coach encouragement (Rampinini et al., 2007), continuous and intermittent training (Hill-Haas et al., 2009), and pitch size (Dellal et al., 2011; Kelly & Drust, 2009). Technical analysis of SSGs revealed that there was significantly more ball contacts per individual \((P < 0.05)\) when compared to larger-sided games (9 vs. 9) (Owen, Wong, McKenna, & Dellal, 2011). This increase in ball interaction as well as the close replication of the physical demands of competitive match play (Jones & Drust, 2007) demonstrates SSGs ecological validity as a surrogate for successful competitive soccer performance and, therefore, as a potentially effective platform to identify talented soccer players.

SSGs have recently been used within a talent identification model using post-pubertal elite soccer players and a small relationship that was not significant \((r = 0.39, P > 0.05)\) was found between success in SSG and coaches subjective rating of a player (Unnithan et al., 2012). Unnithan et al. (2012) concluded that the elite status of the sample led to homogeneity of their technical skills and thus reduced the predictive power of SSGs. It may be postulated that if this model was applied to a sample of elite soccer players that had not been exposed to as many years of systematic training, multiple SSGs could be a useful tool within a talent identification model. Furthermore, recent literature in talent identification has assessed adolescent soccer players, whereas sport specialisation occurs early in soccer (Vaeyens et al., 2008). Consequently, talent identification models may need to be applied prior to the onset of puberty. Therefore, the aim of this study was to evaluate the physiological loading and technical attributes of highly trained prepubertal soccer players during multiple SSGs and to determine whether SSGs can act as a talent identification tool within youth soccer players.

**Methods**

**Participants**

Sixteen highly trained U10 soccer players (Mean ± SD; age, 10.6 ± 0.3 years; stature 1.45 ± 0.07 m; body mass 37.2 ± 4.1 kg) were recruited from a youth soccer academy in England. Participants were considered physically active based upon a physical activity questionnaire (7 ± 1.6 h a week), and had three sessions of technical and tactical training a week (8 ± 0.8 h a week) with one competitive match a week. Players had trained at the club for 2 ± 0.4 years and were training for 45 weeks a year. 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. Physical activity questionnaires, written informed consent provided by the players’ parents, written assent from the players, medical questionnaires and a training diary were all obtained prior to the study. Ethical approval was obtained from a local ethics university committee. The study was also approved by the academy manager at the club.

**SSG protocol**

The SSGs were played outdoors on natural turf which is the squad’s usual training venue at the squad’s allocated training time of 18:00. Two (2 m × 1 m) goals with no identified goalkeepers were used. Goals could only be scored in the attacking half. A standardised 15-min warm-up was prescribed prior to participating in the SSGs. 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 and the score was provided during the game.

Participants were separated into two groups of eight. Within their groups, two teams of four players were made. Each team played six, four versus four matches, which were 5 min in duration, with 3 min of passive recovery, on a pitch 18.3 m × 23 m in dimension. The players were reorganised into different combinations after each game within their group of eight players, so no player played with the same three teammates on two occasions. All players had been habituated to SSGs, as they were often used in their regular training sessions. This pitch size, game duration and player number was selected as it is the players’ normal SSG methodology for SSGs in training at their club. A pilot study demonstrated that the current pitch size and game duration in comparison to a larger pitch size and shorter game durations did not change the technical outcomes of the SSGs and provided a consistent physiological stimulus. Test–retest reliability measured over six SSGs was assessed and produced similar physiological responses in most of the time-motion characteristics (typical error <9%) with the exception of high-speed running distance in the last three games of the protocol, which demonstrated greater variability with a typical error ranging from 16% to 69%.

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

During each individual game of the SSG protocol, each player was awarded total 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 regardless of result. Two coaches with F.A. qualifications (level 1) technically evaluated the players throughout the games using a game technical scoring chart (GTSC) and both the 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. All players’ performance was evaluated on 10 football elements and were given a score between 0 and 5. 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 versus One, Shooting, Assist and Marking. Thus, during a game, if a player was perceived by the coach rating them to be a poor passer of the ball during that SSG, then they would be given a score of 1 in the passing element.

The inter-tester reliability of the GTSC has previously been established through a pilot study that found no significant differences \((P > 0.05)\) between two coaches (F.A. level 1) rating the same players across three games. Reliability of GTSC has been established in literature previously and yields similar
results to the present study, 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 working with coaching qualifications (F.A. level 1) (Unnithan et al., 2012). Construct validity of the GTSC was examined in a pilot study. An FA qualified (F.A. B licence) coach assessed players using the GTSC via video feedback, in comparison to a coach assessing the same players live in the field during three SSGs. The results demonstrated significant ($P < 0.05$) inter-observer differences in technical skills for only one out of the three games. Content validity was established via a panel of highly qualified and experienced coaches (F.A. A licence), detailing the important performance elements that needed to be scored during a soccer performance to accurately identify talented players.

**Time-motion analysis**

The micromechanical device (MEMS; MinimavX S4, Catapult Innovations, Melbourne, Australia) contains a 10 Hz global positioning satellite (GPS) chip that was used to record time-motion data. Total distance covered (TDC, meters) and high-speed running distance covered (HSRD, meters) 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. (2010). These researchers concluded categorising player motion into speed zones should be normalised relative to the individual’s speed capabilities, specifically, in young 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. The number of satellites was 7 and HDOP was 1.02 which met these requirements.

The MinimavX S4 contains a triaxial 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 (au). PlayerLoad™ per meter 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).

**Physiological testing**

Physiological testing was conducted two weeks post SSG protocol as part of the clubs periodic testing battery. Testing was completed at the same time of day as the SSG to control for circadian variation in performance (Chitourou et al., 2012). The testing was conducted on a 3G artificial turf pitch, in an indoor facility to ensure weather conditions did not affect the testing battery. The players followed a standardised warm up lasting 15 min prior to testing. The players then performed the tests in the following order: countermovement jump (CMJ) without the use of their arms, 10 m sprint and 30 m sprint. Unfortunately, one player could not attend the testing session due to illness.

**Jumps**

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

**Countermovement jump protocol**

The players performed the CMJ without the use of arms by standing on the jump mat and placed 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, landing on the jump mat with a cushioned landing.

**Speed protocol**

The players sprinting ability was measured with a maximal 30-metre 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 above the ground, at 0, 10 and 30 m. Players started in a standing position, 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 slowing down. Each player performed three sprints with 2-min rest in-between each sprint. The fastest time was recorded and used for analysis.

**Statistical analysis**

The data is reported as mean and standard deviation (mean ± SD). Prior to conducting any statistical analyses, assumptions of normality were checked via Kolmogorov–Smirnov test and no violations of normality were found in any testing variables. Homoscedasticity was also checked through P-P plots, linearity was identified in the data. To assess if there were any differences between the winning and losing teams in the SSGs, Mann-Whitney tests were used, due to the small sample size (4 vs. 4), to test for differences between total distance covered, high-speed running distance, PlayerLoad™ and PlayerLoad™ per meter between the winning and losing teams for each match. No differences ($P > 0.05$) were found between the winning and losing teams in any of the time-motion variables in every game. Therefore, the individual player’s load per game was pooled to provide a total load for the entire SSG session. A Pearson correlation coefficient test was used to examine the relationship between GTSC and TP and between GTSC, TP, fitness tests results and the total load for all six games for each of the time-motion variables. 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 (Hopkins, Marshall, Batterham, & Hanin, 2009). Statistical significance was set at $P < 0.05$. All statistical analyses were performed using SPSS version 21 (SPSS Inc., Chicago, IL).
Results

Technical evaluation

Figure 1 illustrates the results from the technical evaluations (GTSC) along with each individual’s TP for the six SSGs. There was a significant and large relationship between TP and GTSC ($r = 0.758$, $P < 0.001$, $R^2 = 57\%$).

Time-motion analysis

Tables 1 and 2 present the mean and standard deviation between the winning and losing teams for each game for the external physiological variables. GTSC had a significant and large correlation with high-speed running distance ($r = 0.547$, $P < 0.05$, $R^2 = 30\%$) (Figure 2). Total distance covered had a significant and moderate correlation with GTSC ($r = 0.545$, $P < 0.05$, $R^2 = 21\%$) (Figure 3) and TP ($r = 0.438$, $P < 0.05$, $R^2 = 19\%$) (Figure 4).

Physiological testing

No physiological testing variable was correlated to either GTSC or TP.

Discussion

The aim of this study was to evaluate if multiple SSGs could act as a talent identification model in highly trained pubertal soccer players. The main finding of this study was that a very large relationship between GTSC and TP was identified ($r = 0.758$, $P < 0.001$). The evidence suggests that it is possible to identify the most talented player, according to coach’s subjective scoring system, simply by examining if they won the most number of games in a multiple SSG model. Successful performances in soccer are as a result of multiple factors interacting (Unnithan et al., 2012), the most talented
players in this study were those that scored the higher result in TP from six SSG. To differentiate between what made these players more successful than others we examined multiple factors; physiological fitness, time-motion characteristics and technical characteristics, to examine if there was a particular factor that contributed to their success.

<table>
<thead>
<tr>
<th>Match Score</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
<th>Game 4</th>
<th>Game 5</th>
<th>Game 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDC (m)</td>
<td>310±48</td>
<td>393±40</td>
<td>345±29</td>
<td>345±29</td>
<td>319±37</td>
<td>374±88</td>
</tr>
<tr>
<td>HSRD (m)</td>
<td>26±7</td>
<td>23±9</td>
<td>25±8</td>
<td>27±10</td>
<td>31±13</td>
<td>52±13</td>
</tr>
<tr>
<td>PlayerLoad™ (Au)</td>
<td>51±4</td>
<td>59±11</td>
<td>53±3</td>
<td>51±5</td>
<td>51±6</td>
<td>52±5</td>
</tr>
<tr>
<td>PlayerLoad™ per metre (Au)</td>
<td>0.17±0.02</td>
<td>0.16±0.01</td>
<td>0.15±0.01</td>
<td>0.15±0.01</td>
<td>0.15±0.01</td>
<td>0.15±0.01</td>
</tr>
</tbody>
</table>

$\text{r} = 0.547, P < 0.05, R^2 = 30\%$

**Figure 2.** Relationship between game technical scoring chart and high-speed running distance.

<table>
<thead>
<tr>
<th>Total Distance Covered (TDC) (m)</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
<th>Game 4</th>
<th>Game 5</th>
<th>Game 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game Technical Scoring Chart (GTSC) (Au)</td>
<td>51±4</td>
<td>59±11</td>
<td>53±3</td>
<td>51±5</td>
<td>51±6</td>
<td>52±5</td>
</tr>
</tbody>
</table>
| $\text{r} = 0.545, P < 0.05, R^2 = 21\%$

**Figure 3.** Relationship between game technical scoring chart and total distance covered.
A player’s technical ability is the predominant component of successful soccer players, as it can consistently determine the difference between non-elite, sub-elite and elite players (Meylan et al., 2010). Therefore, the use of a competitive SSG format, which would induce a high amount of technical actions, should discriminate between talented and less talented players. The present study evaluated technical ability through the use of GTSC which demonstrated a significant and very large relationship with success in multiple SSGs via the accumulation of TP \( r = 0.758, P < 0.001 \). This data demonstrates that the more talented players, as identified by the GTSC, emerge within multiple SSGs simply by winning games and 57% of the variability in TP is explained by the technical skill level of the players as measured by the GTSC. This ability to win regardless of team combination indicates that these players have superior technical ability and are able to work effectively within a team to ensure a victory. These findings are in agreement with previous research (Unnithan et al., 2012) that technical skill level is a strong characteristic that distinguishes between the more talented soccer players. Unnithan et al. (2012) demonstrated a moderate relationship between GTSC and TP in a group of highly trained adolescent soccer players, however, it was not significant \( r = 0.39, P > 0.05 \). These researchers theorised that due to the number of years that this cohort had been involved in systematic training, a relative homogeneity of their technical ability had occurred; thereby, reducing the predictive power of the SSGs. The present study used a cohort of players that had been exposed to minimal systematic training whilst still being considered highly trained; this, therefore, has resulted in a larger relationship between TP and GTSC and, therefore, increasing the predictive power of SSG and has established that SSGs potentially, could act as a talent identification model.

The present study pooled the data across the six games, as there was no significant difference \( (P > 0.05) \) between the winning and losing teams, and analysed it as a total load for all six games. High-speed running distance was found to be a determining factor in the coaches’ scoring a player with a higher GTSC score, as high-speed running distance had a large correlation which was significant with GTSC \( (r = 0.547, P < 0.05) \). This demonstrates that players that had exhibited greater high-speed movements also displayed better technical skills. The \( R^2 \) value demonstrates that high-speed running distance explains 30% of the variability technical level of the player, as measured by the GTSC. A recent study, however, reported no difference between a retained and released group for high-intensity running during a 11-a-side match play for U11’s (pitch dimension 78.7 x 54.1 m) (Goto, Morris, & Nevill, 2015). These researchers found that the retained group spent a lower proportion of the match in the speed zone of 0.0–1.5 m s\(^{-1}\) and during standing and walking compared to the released group. These two findings suggest that the retained group could cover the required amount of high-intensity running for match play with less recovery time than the released group. Consequently, it would appear that talented players have the ability to recover quickly from bouts of high-speed running (Goto et al., 2015); this ability has been demonstrated in the present study, with the more talented players able to cover more distances at greater speeds than their less talented peers with the same recovery period between games.

The present study also demonstrated that the more talented players covered greater distance than their less talented peers as total distance covered was significant and moderately correlated to both GTSC \( (r = 0.545, P < 0.05) \) and TP \( (r = 0.438, P < 0.05) \) with 21% and 19% of the variability shared with total distance covered, respectively. A recent study demonstrated similar findings as, a retained group of players covered significantly \( (P < 0.05) \) greater total distance during a match than a released group of players in U11 competitive matches (Goto et al., 2015). Goto et al. (2015) suggest that total distance covered may help to identify players that could progress through an academy, as with total distance covered is one factor that potentially coaches may knowingly or unknowingly consider when retaining or releasing players. Similar findings to the present paper are found throughout literature up to senior level that indicates total distance covered during match play is shown to distinguish between standards of soccer players (Mohr, Krustrup, & Bangsbo, 2003). The present study findings suggest that total distance covered is a possible factor in identifying talented players.

Physiological characteristics have been seen as important discriminating factors between elite and sub-elite players, particular running speed in younger players (U13 and U14), and aerobic endurance, power, and flexibility in older players (U15 and U16) (Gonaus & Müller, 2012). The present study demonstrated that there were no significant correlations between any of the physiological variables and either the GTSC or TP. This suggests that power and speed attributes may not have an effect at the prepubertal age group in identifying talented players. As players start to enter puberty, this finding changes as previous literature found that future drafted players were...
significantly more powerful in a CMJ than future non-drafted players at 14-years old age ($P < 0.05$) (Gonaus & Müller, 2012). This suggests that chronologically older and more mature players may gain advantage in selection process during maturity and, therefore, get more opportunities to become an elite soccer player; however, it is evident from the present study’s findings that in prepubertal soccer players technical skill level and not any physical attributes may be the determining factor in becoming identified as talented.

Some limitations of the present study exist firstly; sample size, an increase in the participant population may have increased the strength of the associations. This, however, was not possible due to the squad size available. Secondly, the results of this study are commensurate with the design of the SSG if there are changes to this design this could in turn not yield the same results as a small change in SSG design could have an effect on SSG intensity and, therefore, the player’s ability to demonstrate superior skill. Thirdly, while the SSG model in the present study demonstrates the potential to accurately identify talented players simply by measuring the number of games won, longitudinal studies are required to establish if the successful players at this age continue to be successful in their future playing career.

**Conclusion**

This is the first study to evaluate prepubertal players’ talent potential in multiple SSG, based simply on the win to loss ratio. Our results demonstrate that the more talented players are more successful during SSG regardless of their team combinations. These more talented players were also the same players rated highly by coaches and played the SSGs at a higher speed and covered greater distances than the less talented peers. SSGs, therefore, could be used within a talent identification model as they provide an environment in which talented players can showcase their superior ability simply by winning games.

**Practical applications**

This study demonstrates the potential usefulness of SSGs within a talent identification model, coaches, scouts and clubs could utilise the model described in this paper to help identify talented players. This model has the potential to be used on a large-scale talented identification day. Whereby, there are large number of players, which would normally be too difficult for a coach or scout to sufficiently observe a player for long enough to identify if they are talented or not. This model allows the scout or coach to specifically look at the players with the highest TP and, therefore, narrow their search and make an efficient use of their time. Furthermore, this model could also be utilised within a club as a marker of technical and tactical proficiency in the same vein clubs periodically assess players fitness they could periodically assess players talent to establish if the same player throughout the year and subsequent years is continually the best player in their group and, therefore, provide that player with the resources to become successful. Further research needs to assess the longitudinal variability in players’ technical performance as well as time-motion characteristics to provide evidence as to the stability of the data being collected.

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**Disclosure statement**

No potential conflict of interest was reported by the authors.

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