ORIGINAL ARTICLE

Relationships between results of soccer-specific skill tests and game-related soccer skill assessment in young players aged 12 and 15 years

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Abstract
The aim of this study was to examine relationships between results of soccer-specific skill tests and game-related soccer skills in young players aged 12 and 15 years. The participants were 60 male soccer players aged 11.87-14.76 years divided into two groups: lower secondary school candidates (12y) aged 11.87 ± 0.23 years (n = 30), and upper secondary school candidates (15y) aged 14.76 ± 0.42 years (n = 30). Soccer-specific skills were assessed using two outdoor tests in competitive match conditions: Dribble Test and Turning Test. The assessment of the game-related skills was carried out by five expert judges during a 5 vs 5 small-sided game. The evaluation criteria had been set by a panel of experts. The reliability of game-related skills assessments procedures was calculated using intra class correlation (ICC), standard error of the mean (SEM), coefficient of variation (CV). Spearman's rank correlation coefficients were used to determine the relationships between results of assessments of game-related skill and soccer-specific skill tests. Relationships between soccer-specific skills and game-related skills in 15-year-old players (–0.325 to –0.452) are less pronounced than in 12-year-old players (–0.496 to –0.667). It seems to be unjustified to use soccer-specific skill tests for prediction of young soccer players' potential. The results of these tests can depend on numerous biological differences in the development of adolescent players. In conclusion, evaluation of players by judges should be part in talent identification models in youth soccer.

KEYWORDS: soccer-specific skills, game-related skills, talent identification.

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What is already known on this topic?
Soccer-specific skill tests are extremely popular in assessing the potential of young soccer players. The great majority of them, evaluates skill in isolated condition i.e.: without the presence of opponent. There were no reports about relationships between results of soccer-specific skill tests and game-related soccer skill.

Repeatable and reliable measurements of players' skills are problematic. This may be due to the fact that researchers define skills in different ways [1]. Cruuel and Jeukendrup [2] highlighted three important statistical parameters without which it is not possible to make a proper assessment of players' performance. It is important to develop tools to objectively measure the progress of sport skills in young players and determine the scientific criteria for evaluation of these skills [3, 4]. Unfortunately, results of soccer-specific skill tests and evaluation of players' behaviors during the game can directly depend on equalization of the differences in anthropometric profiles of players as they grow up [5, 6, 7].

Talent Identification (TI) studies demonstrated the importance of selection of research tools for diagnosed players and their long-term training process [8, 9, 10]. An alternative is offered by identification of athletes with multidisciplinary talents and aptitudes, who do not have to demonstrate soccer-specific technical skills. This method is termed „talent shift" [11]. Nevertheless, talent identification has been found to be difficult due to the lack of unequivocal predictors to reflect athletes' high potential [1, 5].

Soccer specific skills tests are an integral part of the process of selection and recruitment of youth soccer players. Assessment of players' skills by this form of tests seems to be reliable for determining players' technical potential. However, evaluation of closed technical skills diagnosed by soccer-specific tests does not have to necessarily reflect a player's effectiveness during a match [12]. Studies of young players carried out in recent years have demonstrated a relationship between test results of closed technical skills and the player's division [13]. Nevertheless, the effectiveness of players' actions performed during a match is determined by a total of interactions between sets of psychological, tactical, or technical factors [10].

Identification of factors that relate to the opportunities of predicting the player's talent is very difficult [12]. To date, recruitment of talented players has often been based on a talent predicated in the form of closed technical skills [14, 15]. However, a significant correlation of perceptive and cognitive abilities with successful careers of soccer players has also been demonstrated [16]. In match conditions, technical skills are not directly transformed into effective actions, while this correlation should be individually verified through observation [12, 16, 17].

Small-sided games (SSG) are reported to be useful in assessing the tactical potential of players [18]. In assessing the players' skills in a group context, evaluation sheets are used in 3 vs 3 to 6 vs 6 games. Furthermore, SGGs can be useful for researchers to estimate the dispersion of tactical behavior, e.g. man to man marking [19]. The context of a situation on the field when a specific decision is made is also essential [20, 21].

The current study focused on finding accurate and reproducible tools for identification of players' skills used during a soccer match. The Game Performance Evaluation Tool (GEPT) has been regarded as a reliable research tool for identification of game-related skills in the context of decisions made by a player during a match [22, 23]. Furthermore, Waldorn & Worsfold [17] proposed a set of eighteen performance indicators

which, based on video recordings, can be used to form a player's individual profile. The indicators refer to the effectiveness of an action and its value compared to the goals achieved during a game, e.g. a short key pass.

On the other hand, investigations of soccer-specific skill tests in an increasing number of cases demonstrate their reliability and validity. For example, researchers suggested the use of the Loughborough Soccer Passing Test (LSPT) or Reactive Motor Skill Test as validity tests for diagnosing young players [24, 25]. However, the frequent use of a test battery developed by the German Football Association (Deutscher Fussball Bund Tests) and the Portuguese Football Association has also been reported [6, 26, 27, 28]. These tests diagnose the fundamental technical skills without referencing to conditions of a football match, and their reliability has not been clearly demonstrated.

In a classic approach, typical representatives of a group of soccer-specific skill tests can be a test set included in the FA Soccer Challenge [29]. All the trials can diagnose only one isolated technical skill, generalizing it to quantifiable units such as time or number of repetitions. Despite attempts to withdraw it, the FA Soccer Star Challenge has been used in other countries to this day as an effective means of diagnosing the technical skills of young football players [30]. A question often raised is the possibility to use the results of such tests for selection and recruitment of young football players.

The purpose of this study was to examine relationships between results of soccer-specific tests diagnosing isolated technical skills, and assessments of game related soccer skills by expert judges. Therefore, the study attempted to evaluate the usefulness of the results of these tests for recruitment 12- and 15-year-old football players to sports school classes.

Method

Participants

Sixty young soccer players (candidates for the Sport School in Wrocław, Poland) were divided into two study groups: lower secondary school candidates (aged 11.87 ± 0.23 years; body height: 155.41 ± 7.6 cm; body mass: 45.32 ± 8.4 kg) and upper secondary school candidates (aged 14.76 ± 0.42 years; body height: 164.3 ± 5.7 cm; body mass: 53.5 ± 4.9 kg). The participants were players from several youth clubs from Wroclaw and its surrounding area. Before the recruitment tests, all the participants presented a written consent signed by their parents or legal guardians confirming the boys had no medical contraindications to their participation

in the study and did not suffer from any health problems or injuries. All the participants had valid medical certificates that allowed them to participate in the research. The parents or legal guardians of participants were present during the experiment. All procedures had the prior approval of the University's Ethical Advisory Committee.

Study design

The study was carried out on March 4 and 5, 2014, on the artificial turf of the Sport School „Junior" in Wrocław, Poland. A one-day research session (separate for each group) began with a 20-minute standardized warm-up instructed by qualified football coaches (with UEFA A diplomas). The warm-up protocol consisted of three parts: a 5-minute continuous run, 15-minute tasks with the ball, 5 minutes of dynamic stretching of the lower limbs (hamstrings, quadriceps, gastrocnemius). Next, the participants performed two repeats of the Dribble Test in the alphabetical order. Between repetitions of the test, the players had 2 minutes of active recovery (low-intensity run). After completion of the test, the players were asked to rehydrate using mineral water. Next, they performed 2 repeats of the Turning Test. After completion of this test, the players were asked to rehydrate using mineral water again. Between repetitions of the second test, the participants had 2 minutes of active recovery (low-intensity run). The players were then randomly selected for a 5vs5 small sided game, with a goalkeeper assigned additionally to both teams. In order to minimize the synergy effect, the random selection was repeated if more than 2 athletes from the same club were assigned to the same group. The time of the game was 15 minutes. The players' game-related skills were evaluated by five qualified, UEFA certified, expert judges who recorded the observation on an observation sheet prepared by the authors of this study (Figure 1). Each game was recorded using a video camera. After watching the video recordings, the referees made the final evaluation of behaviors of players during the game.

Soccer-specific tests

The study used two tests from a test battery of the Soccer-Star Challenge, developed by the English Football Association. The tests, designed to evaluate young soccer players aged 6 to 16 years, are characterized by their high validity and reliability [29]. The tests chosen for the study showed a significant component of player's locomotion speed and ability to control the ball in closed conditions. Time measurements in the Dribble Test and the Turning Test were carried out using a photocell system (Sectro Timming System, TS-F7, Poland). Each participant performed two repeats of each test. All the tests began from the starting position (feet parallel and flat on the ground, placed on the line of vertical projection of shoulders), 30 centimeters from

GAME NO.: TIME:	BEHAVIOR OF A PLAYER DURING THE GAME: (1 TO 10 POINTS)		
TIME: PLACE:			
EXPERT JUDGE:			
Number on the jersey RED TEAM	IND-DEF	IND-OFF	COPR
1			
2			
3			
4			
5			
Number on the jersey BLUE TEAM	IND-DEF	IND-OFF	COPR
1			
2			
3			
4			
5			

Figure 1. Observation sheet
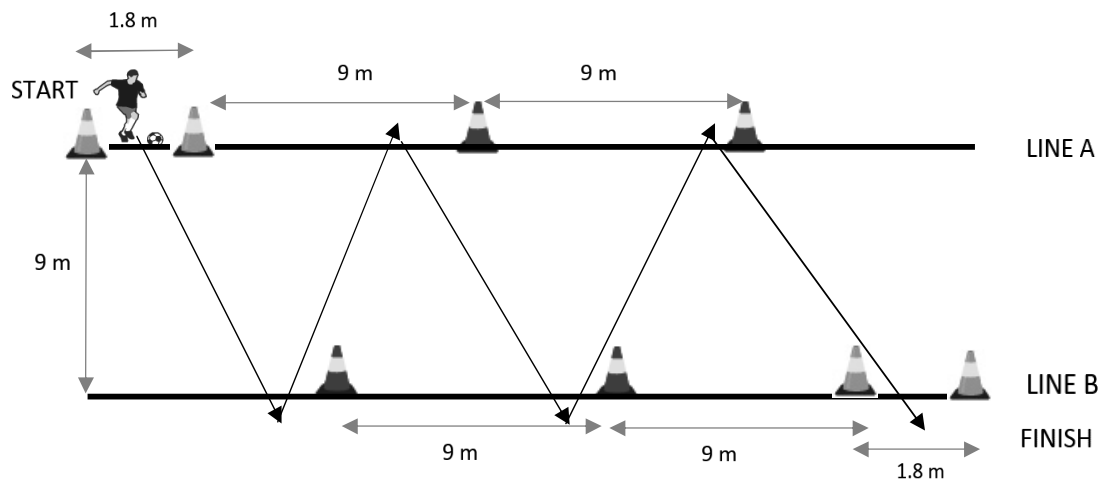
Figure 2. Dribble Test procedure

the starting line. Time measurement was started at the moment of crossing the starting line.

Dribble Test

The participants were asked to perform a test with a ball along a marked route, in the shortest possible time (Figure 2). After starting the test, the participants ran between lines A and B for five times, performing four turns with the ball. Each turn with the ball had to be made after crossing the line that marked the turning zone. In the case of an incorrect turn (with the ball in front of the line at the moment of the turn) the test was considered invalid. The quality of the test was evaluated by two coaches who were standing at the level of lines A and B. No suggestions were made for the participants as to how to cover the route and how to perform the turn with the ball. Time measurement was started at the moment of crossing the starting line and stopped at the moment of crossing the finishing line.
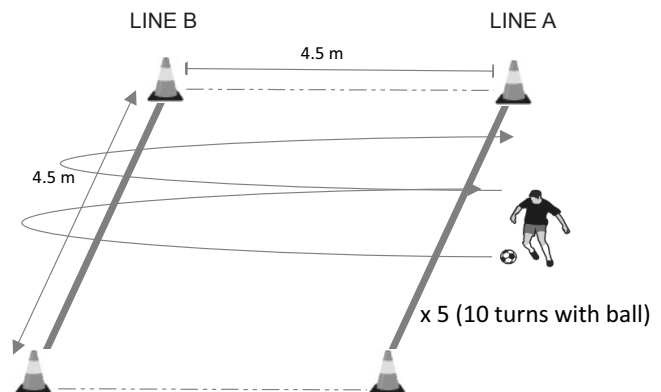
Turning Test

The participants were asked to perform a test with a ball along a marked route, in the shortest possible time (Figure 3). The participants covered the distance between the lines A and B for ten times, thus performing ten 180° turns with the ball. Each turn with the ball had to be made after crossing the line that marked the turning zone. In the case of an incorrect turn (with the ball in front of the line at the moment of the turn), the test was considered invalid. The quality of the test was evaluated by two coaches who were standing at the level of lines A and B. No suggestions were made for the participants as to how to cover the route and how to perform the turn with the ball. Time measurement was started at the moment

of crossing the starting line and stopped at the moment of crossing the finishing line after last turn with the ball.

Assessment of game-related skills in a 5 vs. 5 small sided game

The participants attempted to achieve the best possible goal score for their team during a 15-minute 5 vs. 5 game. Goalkeepers were also randomly selected from the candidates for football classes in the Sport School in Wroclaw, Poland and joined the teams. The field size was 30 × 20 m to increase the frequency of players' contacts with the ball [31]. The dimensions of the two goals located opposite each other were 5 × × 2 meters. The games were supervised by one soccer referee. The participants were evaluated by five expert judges on observation sheets developed earlier using the Delphi method [32]. The expert judges stood along the sidelines on one of the sides and evaluated players' game-related skills in three categories: quality of individual skills in attack (IND-ATK), quality of

Figure 3. Turning Test procedure

Evaluation area	Assessment criteria (in accordance with aims of the game)
Quality of Individual Skills in Offence (IND – OFF)	– goal scoring – creating goal scoring opportunity through individual action – conquering free space through individual action – ball possession through individual action
Quality of Individual Skills in Defense (IND – DEF)	– ball recovery through individual action – counteracting the conquering of free space by an opponent – counteracting creating goal scoring opportunity by an opponent – counteracting goal scoring by an opponent
Quality of Cooperation Skills with Teammates in Offence and Defense (COPR)	support teammates in achieving the aims of the game through: – verbal and non-verbal communication with teammates in attack – verbal and non-verbal communication with teammates in defense – behaviour of players without the ball in attack – behaviour of players without ball in defence

Figure 4. Assessment criteria of game related-skills by expert judges

individual skills in defense (IND-DEF), and quality of cooperation skills in attack and defense (COPR). Evaluation criteria were presented in Figure 4. One to ten points could be attained by a participant in each assessment area. During the game, the players were wearing soccer jerseys with numbers for identification by the expert judges. The games were recorded with a video camera (Sony, Handycam HDR-CX505, USA) to enable replaying the match with all the referees watching again after the match. Directly after the analysis of the replay, the expert judges assigned the final ratings, entering them on the observation sheets.

Statistical analysis
The results were presented as mean (M) ± standard deviation (SD). The Shapiro-Wilk test was used to check the distribution of variables. The reliability of the game-related skills assessment procedures was calculated using intra class correlation (ICC), standard error of the mean (SEM), coefficient of variation (CV), Pearson's correlation coefficients (r), and tau-Kendall rank correlation coefficient (W) [2, 33, 34]. W was calculated for assessment variables to determine the stability of evaluation by expert judges. The expert judge with the lowest reliability was excluded from further analysis. Only the maximum score of each soccer-specific skill tests was included for data analysis. Spearman's rank correlation coefficients were used to determine the relationships between assessment results of game-related skills and soccer-specific skill tests. The results were interpreted using threshold values for Spearman's rank correlation coefficient: low ($r_s < 0.4$), moderate (r_s 0.41 > 0.7), and high ($r_s > 0.7$). Data analysis was performed using the SPSS software (Version 22.0; SPSS Inc, USA).

Results
The mean values of soccer-specific tests for both groups are presented in Table 1. The coefficients of variation (CV) for Dribble Test (DT) and Turning Test (TWB) ranged from 5.14 to 9.12%. It can be observed from Table 1 that CV were lower in the group of 15-year-old players (15 y) (5.14% – 5.24%) as compared with the group of 12-year-old players (12 y) (7.51% – 9.12%).
The results of game-related assessments by expert judges are presented in Table 2 and Table 3. The exclusion of Expert Judge 4 from analysis increased in range the intra class correlation coefficient (ICC) from 0.786 – 0.885 to 0.895 – 0.907 in the 12-year-old players, and from 0.759 – 0.796 to 0.812 – 0.842 in the 15-year-old players. Similarly, the range of CV and tau-Kendall correlation coefficient (W) increased as well. The reliability of game-related skills assessments at this level can be considered moderate in the case of evaluation of all judges (ICC > 0.7), and high after exclusion of Expert Judge 4 (ICC > 0.88). However, the low value of tau-Kendall correlation coefficient

Table 1. Results of soccer-specific test in 12- and 15-year-old players

Soccer-specific test	Group	Mean [s] (± SD)	CV
Turning Test	12 y	22.90 (± 1.72)	7.51%
	15 y	20.39 (± 1.05)	5.14%
Dribble Test	12 y	17.31 (± 1.58)	9.12%
	15 y	15.07 (± 0.79)	5.24%

SD – standard deviation; CV – coefficient of variation; 12 y – group of 12-year-old players – sports school candidates, 15 y – group of 15-year-old players – sports school candidates

Table 2. Results of assessment of game-related skills in a 5 v. 5 small-sided game

Game--related skill	Group	Expert Judge 1	Expert Judge 2	Expert Judge 3	Expert Judge 4	Expert Judge 5	Means (± SD)	ICC	SEM	CV	r	W
Quality of IND-OFF	12 y	5.84 (± 2.28)	5.5 (± 1.58)	4.75 (± 1.87)	6.81 (± 1.4)	4.69 (± 1.83)	5.53 (± 2.09)	0.885	0.708	37.86%	0.630	0.351
	15 y	5.76 (±1.76)	6.09 (± 1.42)	5.18 (± 1.60)	6.03 (± 2.39)	4.24 (± 1.61)	5.46 (± 1.91)	0.796	0.862	35.12%	0.450	0.224
Quality of IND-DEF	12 y	5.75 (± 2.12)	5.25 (± 1.58)	4.47 (± 1.52)	6.72 (± 1.15)	4.49 (± 1.53)	5.33 (± 1.81)	0.786	0.837	34.12%	0.438	0.431
	15 y	5.70 (± 1.82)	5.91 (± 1.46)	4.97 (± 1.52)	6.15 (± 2.28)	4.06 (± 1.52)	5.35 (± 1.87)	0.791	0.854	34.92%	0.444	0.308
Quality of COOPR	12 y	5.59 (± 2.28)	5.5 (± 2.19)	4.88 (± 1.65)	7.25 (± 1.15)	4.48 (± 1.65)	5.61 (± 1.91)	0.812	0.828	35.03%	0.512	0.385
	15 y	5.67 (± 1.82)	6.03 (± 1.53)	5.18 (± 1.29)	6.15 (± 2.24)	3.97 (± 1.34)	5.4 (± 1.85)	0.759	0.908	34.40%	0.394	0.290

SD – standard deviation, SEM – standard error of the mean; ICC – intra class correlation; CV – coefficient of variation; r – Pearson's correlation coefficient; W – tau-Kendall correlation; IND-OFF – Individual Skill in Offence; IND-DEF – Individual Skill in Defence; COOPR – Cooperation Skill in Offence and Defence; 12 y – group of 12-year-old players – sports school candidates, 15 y – group of 15-year-old players – sports school candidates

Table 3. Results of assessment of game-related skills in a 5 v. 5 small sided game (after excluding Expert Judge 4)

Game--related skill	Group	Expert Judge 1	Expert Judge 2	Expert Judge 3	Expert Judge 5	Means (± SD)	ICC	SEM	CV	r	W
Quality of IND-OFF	12 y	5.84 (± 2.28)	5.5 (± 1.58)	4.75 (± 1.87)	4.69 (± 1.83)	5.53 (± 2.09)	0.907	0.637	40.61%	0.718	0.358
	15 y	5.76 (±1.76)	6.09 (± 1.42)	5.18 (± 1.60)	4.24 (± 1.61)	5.46 (± 1.91)	0.842	0.759	36.45%	0.585	0.260
Quality of IND-DEF	12 y	5.75 (± 2.12)	5.25 (± 1.58)	4.47 (± 1.52)	4.49 (± 1.53)	5.33 (± 1.81)	0.891	0.597	35.91%	0.698	0.468
	15 y	5.70 (± 1.82)	5.91 (± 1.46)	4.97 (± 1.52)	4.06 (± 1.52)	5.35 (± 1.87)	0.835	0.759	35.91%	0.591	0.378
Quality of COOPR	12 y	5.59 (± 2.28)	5.5 (± 2.19)	4.88 (± 1.65)	4.48 (± 1.65)	5.61 (± 1.91)	0.895	0.638	36.82%	0.700	0.461
	15 y	5.67 (± 1.82)	6.03 (± 1.53)	5.18 (± 1.29)	3.97 (± 1.34)	5.4 (± 1.85)	0.812	0.802	36.09%	0.527	0.389

SD – standard deviation, SEM – standard error of the mean; ICC – intra class correlation; CV – coefficient of variation; r – Pearson's correlation coefficient; W – tau-Kendall correlation; IND-OFF – Individual Skill in Offence; IND-DEF – Individual Skill in Defence; COOPR – Cooperation Skill in Offence and Defence; 12 y – group of 12-year-old players – sports school candidates, 15 y – group of 15-year-old players – sports school candidates

(W > 0.3) and the high value of coefficient of variation (CV > 30%) may be due to the type of rating scale used in this study.

Table 4 presents the values of Spearman's rank correlation coefficients between soccer-specific tests and assessments of game-related skills by expert judges. Moderate correlations were found between soccer-specific tests and assessments of game-related skills by expert judges in the 12-year-old players (–0.496 to –0.667) (Figure 5).

Discussion

This study assessed the results of soccer-specific test diagnosing isolated technical skills in the context of their relationships with assessments of game-related skills by expert judges. In this study we identified a correlation between the classic Dribble Test and the Turning Test in groups of 12- and 15-year-old soccer

players. Contrary to previous studies, we also examined game-related skills of young soccer players using a simple method based on experience of five expert judges. Although other researchers have attempted to assess players' skills in match conditions [17, 22], the methods proposed in these studies may be difficult to use in practice by coaches.

The main finding of this study was the determination of differences in the strength of relationships in groups of 12- and 15-year-old soccer players. Furthermore, with low to moderate correlations between results of soccer-specific tests and assessments of game-related skills, it is difficult to clearly define what factors influence the transfer of isolated technical skills to game-related skills. This finding may be related to the maturity process of young football players [7, 35]. Also, in the absence of opponents during soccer-specific tests, players seem to feel mental comfort, while the only motivation for their

Table 4. Spearman's rank correlation coefficients between results of soccer specific tests and assessments of game-related skills

Soccer-specific test	Group	Assessment configuration	Quality of IND-OFF	Quality of IND-DEF	Quality of COPR	Total Rating Points
Turning with the Ball Test	12 y	5 Expert Judges	−0.703*†	−0.649*†	−0.638*†	−0.681*†
		4 Expert Judges (one excluded)	−0.667*†	−0.591*†	−0.544*	−0.575*†
	15 y	5 Expert Judges	−0.386*	−0.313	−0.319	−0.244
		4 Expert Judges (one excluded)	−0.414*	−0.325	−0.353*	−0.329
Dribbling Test	12 y	5 Expert Judges	−0.537*	−0.663*†	−0.584*†	−0.679*†
		4 Expert Judges (one excluded)	−0.517*	−0.546*	−0.496*	−0.577 *†
	15 y	5 Expert Judges	−0.409	−0. 392*	−0. 370*	−0.306
		4 Expert Judges (one excluded)	−0.452*	−0.424*	−0.421*	−0.385*

IND-OFF – Individual Skill in Offence; IND-DEF – Individual Skill in Defence; COOPR – Cooperation Skill in Offence and Defence; 12 y – group of 12-year-old players – sports school candidates; 15 y – group of 15-year-old players – sports school candidates; * statistically significant at $p < 0.05$; † statistically significant at $p < 0.001$
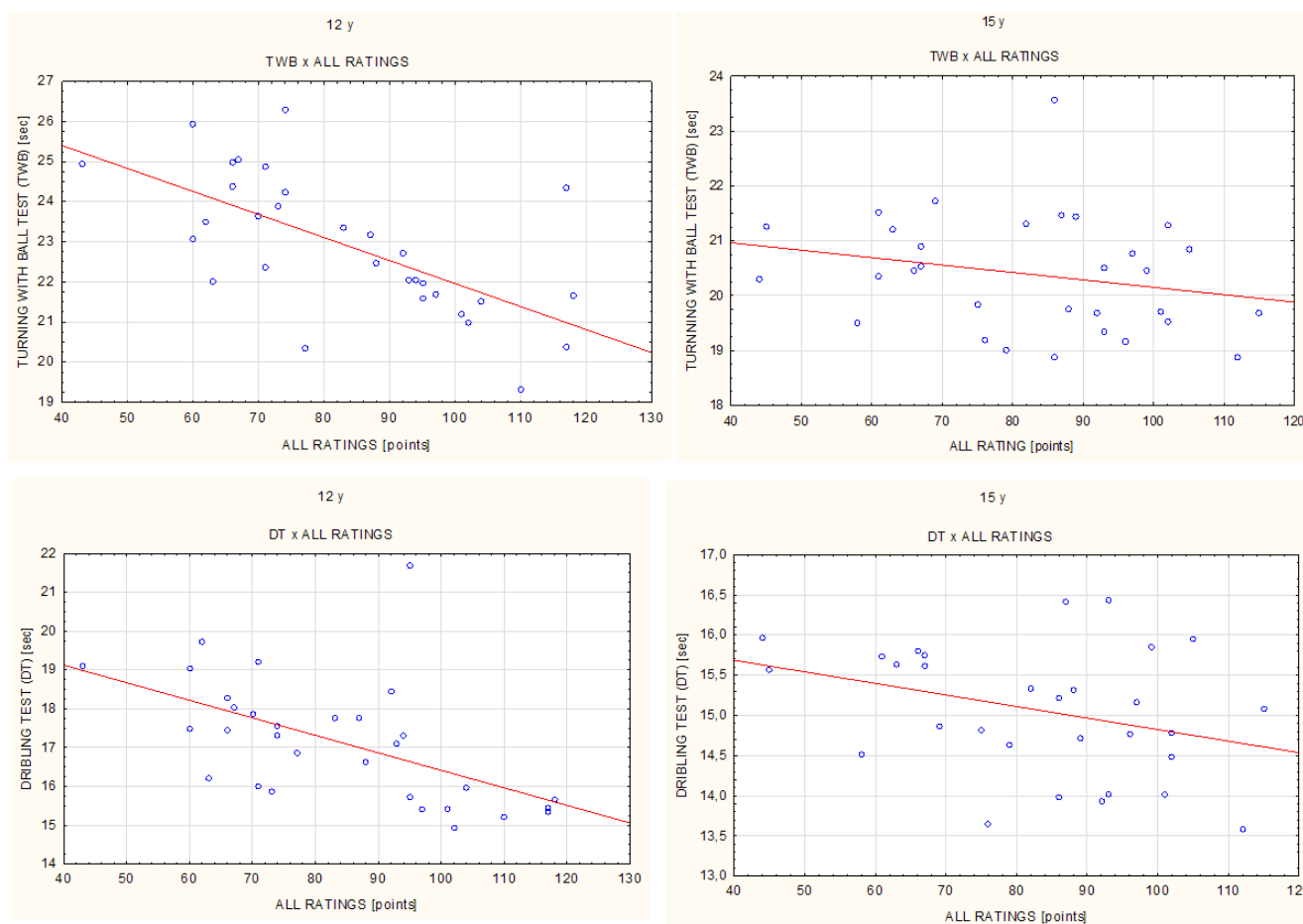
Figure 5. Relationships between results of soccer-specific skill tests and game-related soccer skills in young players aged 12 and 15 years

action is „impersonal time pressure". This does not seem to reflect the actual actions taken by players on the field. The difference between correlations in groups of 12- and 15-year-old players can be explained by the design of tests used in this study. Measurement of soccer-specific skills in the Dribble Test and the Turning Test is based on speed and ball control skills. The individual differences in acceleration and maximum running speed are more varied in younger groups of player [36]. This may limit the impact of a skill on the final test results, in favor of a speed variable. For example, the results of the Dribble Test and the Turning Test were more comparable than the results obtained in previous studies [30].

Game-related skills are not only determined by players' motor abilities but also by perceptive and cognitive skills. In isolated conditions, outside the game, the role of ability based on the visual cortex function is marginalized [37, 38]. In addition, recent studies have shown the importance of perceptual and cognitive ability as a predictor of success in soccer [16, 39, 40]. In line with these observations, assessment of players' performance on the sole basis of soccer-specific tests can contribute to the exclusion of talented players from the sport, who will have no opportunity to demonstrate their skills during the game. Nevertheless, it seems that the only scientific criterion which might directly reflect a player's skills is the number and effectiveness of actions. However, a statistical analysis of actions taken during the game, without the context of the team's goals might be misleading [20, 21].

In the current study, a simple observation sheet was used to measure game-related skills by five expert judges. This approach is compatible with the hypothesis that only by observing a player during an actual soccer match we are able to observe his true skills. In contrast to earlier studies that used observation sheets to assess the tactical awareness and decision-making skills, we focused on developing a research tool that can be used by coaches in practice [17, 41]. However, a correct qualitative assessment using an interval scale is strongly determined by the number and experience of expert judges. Therefore, regardless of their confidence, the use of the Delphi method for setting criteria can help adapt similar tools to different environments. The fact is that many football teams represent different styles of play, thus in many cases, coaches are looking for players displaying different characteristics and abilities [42].

The practical application of current study evaluation of players by judges should be part of talent identification models in youth soccer. The results of the present study may undermine justification of application of soccer-specific skills in the Talent Identification process. Isolated soccer skills, e.g. juggling, cannot serve as a good predictor of the potential of young soccer players. Nevertheless, determinants of development are not clearly defined, and further studies in this field are recommended.

Conclusion

Relationships between soccer-specific skills and game-related skills are less pronounced in 15-year-old players than in 12-year-old players. This comes as no surprise. The variance of physical structure of younger players' bodies can substantially affect the results of assessment by expert judges. Along with the physical maturation of players, these differences become less marked. Soccer tests in which the high-speed component is important may have a misleading impact on identifying the potential of young soccer players.

What this papers adds?
This study shows relationships between results of soccer-specific skill tests and game-related soccer skill assessment by expert judges. This paper questionable the merits of use soccer-specific skills in the Talent |Identification process. In addition, to our knowledge, this is first study where five expert judges evaluated the player during the small sided game using the Delphi method. Nevertheless, further studies in this field are recommended.

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