Examination of Physical and Technical Variables of Soccer Players in terms of Their Positions

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Abstract

The aim of this study was to identify performance variables (linear sprint speed with and without the ball, Hacettepe University Football Research (HÜFA) defense pace and rapidity test with and without the ball, and reactive agility and technical test with and without the ball) for midfield and forward male soccer players aged between 11 and 16. Forty-one amateur soccer players voluntarily participated in the study. The following measurements were conducted in the study: body composition, 10- and 20-meter sprint tests (with and without the ball), HÜFA test (with and without the ball), reactive change of direction (without the ball), reactive dribbling (with the ball) tests, reactive agility (without the ball) tests, and reactive technique (with the ball) tests. The findings of the study revealed statistically significant differences in body height and weight between defense and midfield players according to the analysis of variance (ANOVA) test ($p<0.05$), and the body height and weight of defenders were found to be higher than those of midfield players. In addition, the dribbling test with the ball (HÜFA) of the midfield players and forward players showed significant differences ($p<0.05$) as well. Forward players displayed better performance. Derived from the data collected from the study, it was found that the duration of a 10-meter dribbling pass with the ball was statistically higher for forward players than midfielders. Even though the statistical differences did not occur for most of the variables, the players’ development could be examined periodically with the testing methods used in this study. In this way, technical skills differences between athletes could be identified, and technical application errors that may occur could be minimized with early precautions.

Keywords: Soccer, different positions, reactive tests, technique tests
INTRODUCTION

Sports scientists, trainers, and athletes have been looking for the most reasonable ways to increase athletic performance (Nevill et al., 2008). Today, with the help of developed technology, characteristics of sports can be analyzed during official games, and training sessions are designed in accordance with it. With the help of time-motion analyses, soccer matches can be studied in detail (Krstrup et al., 2005; Mohr et al., 2005; Morgans et al., 2015). In the light of the information gathered from these researchers, soccer can be defined as a game that includes activities such as: short sprints, sudden speed ups and slow downs, turning, jumping, kicking the ball, and sliding tackles (Lago-Peñas et al., 2011). Being both superior to the opponent and competing for two halves 45 minutes each, on a pitch of approximately 100 m by 60 m, requires highly developed conditional characteristics in a game full of these various activities (Cerrah et al., 2011) According to the results gathered from the time-motion analyses, approximately 1000 to 1500 similar and different movements could be performed, and these movements occur every 5 to 6 seconds with 3-second breaks every 2 minutes (Strudwick et al., 2002). In order to increase the success level in such a variable game, cardiovascular fitness, muscle power, endurance, elasticity, speed, agility, coordination, technical skills and tactical skills should be tested and developed (Reilly, 1996).

In addition, in recent years, among the criteria affecting success in soccer are the soccer player’s awareness of the right motivators during the game, the short-term rapidity with and without the ball, and the rapid performance of movements that require decision-making skills. Players should correctly perceive the exhorder coming from the ball, opponent, or teammate. Moreover, a player should make a sudden decision regarding where to send the ball effectively before, or in the first second in which the player touched the ball (Young and Rogers, 2014). For this reason, the identification of linear sprint skills, reactive change of direction speed, reactive agility, and dribbling skills with and without ball, might facilitate guidance for developing new training suggestions and matching soccer players to various positions in accordance with their talents.

There are some studies in the literature that have analyzed the differences between soccer players in terms of their positions on the basis of some parameters. These analyses include: 1) notational analysis values of the number of total shots during a match, the number of total shots on target, and the number of passes and ball losses; 2) physical and somatotype characteristics (Köklü et al., 2008; Sutton et al., 2009); 3) physiological parameters (Sezgin et
al., 2011); and 4) differences in visual and audial reaction characteristics in terms of positions (Göral et al., 2012). However, the number of studies analyzing the differences between dribbling and reactive agility performances specific to soccer in terms of positions is rather limited (Rebelo et al., 2013).

Sport performance plays the utmost important role in soccer. Compared to previous decades, today, soccer has become a speedier game with developed technical and tactical components based on speed, agility, and strength. In order to keep up with all these rapid developments in soccer, players must be speedier, be able to think immediately, and move rapidly (Nas, 2010) In this framework, the aims of this study are to determine the differences between parameters for: 1) linear sprint speed; 2) HÜFA speed and agility; 3) reactive change of direction (without the ball) and reactive dribbling (with the ball); and 4) reactive agility (without the ball) and reactive technique (with the ball), all in terms of soccer positions for players aged between 11 and 16.

**METHODS**

Research group

A study group sample comprised male soccer players aged between 11 and 16 (training age of defenders: 5.11 ± 1.94; midfielders: 5.16 ± 1.64; forwards: 4.55 ± 1.12) playing for Anadolu University youth groups during the 2014–2015 season. The soccer players who had been injured in the last six months were excluded from the study. Coaches of the players chose the best technical players from each age group. In order to eliminate the age effect, equal percentages (11–12: 40%; 13–14: 40%; 15–16: 20%) of players from each age group participated in the study. Measurements were conducted in three different stages. Anthropometric measurements (height and weight) and 10- to 20-meter speed tests (with and without the ball) were conducted on the first day. The dribbling test (with and without the ball) (HÜFA) was conducted on the second day, while the reactive change of direction (without the ball), reactive dribbling (with the ball), reactive agility (without the ball), and reactive technique (with the ball) tests were all conducted on the third day. Participants were informed about the tests and the study prior to these measurements. The players did their typical warm-up exercises before the measurements. The warm-up period included a general warm-up for 10 minutes (jog, gentle stretching, and so on) and dynamic movements (jumping
and, arm and leg swinging) for 10 minutes. Having completed the warm-up exercises, the athletes were free to relax for 3 to 5 minutes prior to the performance tests. In order to have them become accustomed to the measurement protocols, each test was applied after two trials. The Smart Speed Photoelectric Timing System (Fusion Sport, Austria) was used for the: 1) 10- and 20-meter linear sprint tests; 2) HÜFA speed test; 3) reactive change of direction (without the ball) and reactive dribbling (with the ball) tests; and 4) reactive agility (without the ball) and reactive technique (with the ball) tests. The reactive change of direction and reactive agility tests have started to be used recently in the literature and are included in the Smart Speed Timing System protocol list. Moreover, in order to measure the technical skills regarding reactive agility, these tests were also performed by players with the ball and were named “reactive dribbling” and “reactive technique.” All players and their parents have been informed about the protocol of the testing and the possible benefits and risks, and written informed consents have been signed by both the players and their parents. This study was approved by the local Ethics Committee of Anadolu University (29344) and carried out in accordance with the Declaration of Helsinki.

Data collection

Height measurement

Height measurements were acquired with a device produced by Seca, Vogel, & Halke & Co., Hamburg, Germany. Measurements were taken when the athletes were in their daily training sportswear with their shoes removed. In order to measure body weight, participants were told to stand in a balanced position with both legs apart and put their head in the “Frankfort horizontal plan” position with arms at their sides and palms turned toward their legs. They were in the orthostatic position with heels touching each other at an interior angle of approximately 60°. All height measurements were taken twice. Analyses were made on the basis of taking the average of both measurements (Akın et al., 2004).

Weight measurement

Weight measurements were taken with a digital bascule, produced by Seca, Vogel & Halke & Co. in Hamburg, Germany, which had a sensitivity of 0.01 kg. Measurements were taken when the athletes were in their daily training sportswear with their shoes removed. Soccer players were told to take a deep breath, and while they were holding their breath, their weight values were recorded.
The 10- and 20-meter sprint tests

The 10- and 20-meter sprint times (with and without the ball) were calculated by following the Svensson and Drust (2005) test protocol using a photocell and a Smart Speed Chronometer System with ±0.01 second sensitivity (Svensson and Drust, 2005). Electronic photocell gates were set on the start line, 10-meter line, and 20-meter line at 0.6 m above the ground. Each soccer player performed two maximal sprints (with and without the ball), and higher scores were taken into consideration (Pasquarelli et al., 2010).

HÜFA speed and agility test

In order to determine the agility skills of athletes, with and without the ball, the HÜFA test was used (Özkara, 2002) (Figure 1). The HÜFA test is a speed test specific to soccer. It consists of six different deflection points between the start and finish lines and is 30 meters long. In order to become used to the test platform, the players performed the test twice with low intensity before the actual test trials. The total test time was detected via two photocells, which were placed at the start and finish lines (Cerrah et al. 2011).

Figure 1. HÜFA speed and agility test.

Reactive change of direction (without the ball) and reactive dribbling (with the ball) tests

In both tests, the players stood one meter behind the start photocell gate, and the duration started with the green light on the photocell. As soon as the player saw the green light, he reacted and passed through the photocell. As soon as he passed the first gate, another green light flashed randomly on one of the gates on both the right and left sides at 2.5 meters from the start gate. Reacting to the lights, the athlete passed through the gate when the light flashed. Then, he passed
through the last gate, which was in alignment with the first one, and completed the test (Figure 2). The duration between the flash of light from the first gate and passage through the last gate was calculated as the total time, and statistical analyses were conducted using these data.

![Diagram of gates](image1)

**Figure 2.** Reactive change of direction (without the ball) and reactive dribbling (with the ball) tests; reactive agility (without the ball) and reactive technique test (with the ball).

![Diagram of gates](image2)

**Figure 3.** Reactive agility (without the ball) and reactive technique (with the ball) tests.

Both tests were conducted in an area among four photocell gates, each 3 meters away from the center. Soccer players stood at the center of the tests. During the test without the ball, while the athlete was waiting in the center square, at each side, which was 40 cm long, the light flashed at one of the four gates randomly and the test duration started after the soccer player passed through the first gate. Traffic signs were placed 40 cm behind each photocell gate, and the soccer player was obliged to touch the top of each gate during the tests without the ball. It was compulsory to push the central point after passing through each gate. The test was completed after passing through ten photocell gate lights, which flashed randomly. As for the test with the ball, markers were placed every 30 cm instead of traffic signs, and athletes were asked to dribble to the marker 40 cm behind the photocell gate. Then, they returned back and dribbled to the center. After
passing through the five photocell gate lights, which flashed randomly, the test was completed (Figure 3).

Data analysis

Descriptive statistics were applied to identify the characteristics of the participants and groups. Mean scores were calculated for each parameter from all playing positions and averaged across each group. All data were normally distributed (Shapiro Wilk) and expressed as a mean ± SD. The ANOVA was used to analyze whether the performance values of the athletes differed in terms of positions (using SPSS 22 for Windows). The Tukey test was used to determine which groups demonstrated any statistical significance. The statistical significance level was accepted as 0.05.

RESULTS

Table 1. Demographic characteristics of soccer players.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Height (cm)</th>
<th>Age</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean ± SD</td>
<td>Min-Max</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>D</td>
<td>18</td>
<td>160.22±10.81*£</td>
<td>146-179</td>
<td>13.22±1.76</td>
</tr>
<tr>
<td>MF</td>
<td>11</td>
<td>150.64±9.61</td>
<td>140-172</td>
<td>12.81±1.16</td>
</tr>
<tr>
<td>F</td>
<td>12</td>
<td>158.75±9.95</td>
<td>143-172</td>
<td>13.25±1.60</td>
</tr>
</tbody>
</table>

*£: Defenders with significant difference from midfielders.

As shown in Table 1, there was a statistically significant difference between defenders and midfielders (p<0.05), and the height and weight averages of defenders were found to be higher than those of the midfielders.
Table 2. Performance differences of soccer players in terms of their positions.

<table>
<thead>
<tr>
<th>Tests</th>
<th>Defenders</th>
<th>Midfielders</th>
<th>Forwards</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n.18</td>
<td>n.11</td>
<td>n.12</td>
</tr>
<tr>
<td></td>
<td>Min-Max</td>
<td>Mean ± SD</td>
<td>Min-Max</td>
</tr>
<tr>
<td>10m_DB</td>
<td>1.71-2.25</td>
<td>2.03±0.18</td>
<td>1.91-2.21</td>
</tr>
<tr>
<td>10m_S</td>
<td>1.63-2.12</td>
<td>1.88±0.17</td>
<td>1.77-2.11</td>
</tr>
<tr>
<td>10m_DB</td>
<td>3.16-4.36</td>
<td>3.74±0.36</td>
<td>3.53-4.35</td>
</tr>
<tr>
<td>10m_S</td>
<td>1.89-2.91</td>
<td>2.31±0.33</td>
<td>1.79-2.80</td>
</tr>
<tr>
<td>HÜFA_WB</td>
<td>9.14-11.92</td>
<td>10.24±0.82</td>
<td>9.76-11.53</td>
</tr>
<tr>
<td>RCOD_WB</td>
<td>2.53-3.91</td>
<td>3.04±0.40</td>
<td>2.44-3.36</td>
</tr>
<tr>
<td>RCOD_B</td>
<td>3.10-4.51</td>
<td>3.57±0.41</td>
<td>2.68-4.45</td>
</tr>
<tr>
<td>RA_WB</td>
<td>24.86-33.82</td>
<td>29.78±2.38</td>
<td>26.84-38.29</td>
</tr>
</tbody>
</table>

*p<0.05; 10_DB: 10 m dribbling with the ball; 10_S: 10-m sprint without the ball; 20_DB: 20 m dribbling with the ball; 20_S: 20-m sprint without the ball; HÜFA_WB: HÜFA test without the ball; HÜFA_B: HÜFA test with the ball; RCOD_WB: Reactive change of direction (without the ball); RCOD_B: Reactive change of direction (with the ball); RA_WB: Reactive agility (without the ball); RA_B: Reactive agility (with the ball). ¥: midfielders with a statistically significant difference from forward players.

Table 2 reveals that there was a statistically significant difference between midfielders and forward players in terms of the dribbling test values with the ball (p<0.05; f: 3.167), and forward players were found to have better performance according to the ANOVA test (p<0.05). As for the other test scores, no statistically significant difference was found (p>0.05).

**DISCUSSION**

The aims of the study were to establish the differences between parameters for: 1) linear sprint speed; 2) HUFA speed and agility; 3) reactive change of direction (without the ball), reactive dribbling (with the ball); and 4) reactive agility (without the ball) and reactive technique (with the ball) in terms of the positions of the soccer players aged between 11 and 16. The main findings of the current study are that: 1) the height and weight averages of defenders were found to be statistically significantly (p<0.05) higher than those of the midfielders; 2) HUFA test values (with the ball) for the forward players were statistically significantly (p<0.05) better than those of the midfielders; and 3) no statistically significant difference (p>0.05) was found for the other test scores among the player positions.

It is already established that physical and physiological characteristics of youth soccer players...
differ from adult players. Several factors, such as training experience years, maturity level, and morphologic and anthropometric characteristics directly affect the differences among players. The result of the current study is supported by previous findings (Lago-Peñas et al., 2011) in which the midfield players tend to be the shortest and leanest players and the defenders were the tallest and heaviest players. Hence, the playing position also plays an important role in the case of anthropometry. Rebelo et al. (2013) performed a study to compare anthropometric characteristics, physical fitness, and technical performance of U19 soccer players by level of competition and playing position. They concluded in their results that anthropometric characteristics, soccer-specific fitness, and technical skills differed among U19 players by competitive level and field position.

Bloomfield et al. (2007) performed time-motion analyses and investigated positional differences regarding physical demands in FA Premier League soccer players. They concluded that the defender players performed the highest amount of jogging, skipping, and shuffling movements and spent a significantly less amount of time sprinting and running than the other positions. Moreover, the midfield players performed with significantly less time standing still and shuffling and spent the most time running and sprinting.

Upon examination of sprinting ability, Di Salvo et al. (2010) investigated sprints of elite soccer players during the European Champions League and UEFA Cup. They revealed that wide midfielders, followed by attackers and wide defenders, performed the highest number of short sprints (10 m), whereas central defenders performed the fewest sprints. Köklü et al. (2008) investigated the 10- and 30-meter sprint times of U16 soccer players and found no differences between playing positions. In the current study, the 10- and 20-meter sprint performances were evaluated with and without the ball. The 10-meter results with the ball indicated that forward players demonstrated the fastest performance, followed by defenders and midfielders. On the other hand, the performances with the ball were best for defenders, followed by forwards, and then midfielders. The 20-meter results with the ball indicated that defenders showed the fastest performance followed by forwards and midfielders, whereas performances without the ball were best for forwards, followed by midfielders, and then defenders. Even though there were no statistical differences between positions according to the 10- and 20-meter sprints with and without the ball, the results indicate that the sprint time differs according to playing positions and type of sprint (with or without the ball). Midfield players demonstrated the lowest performance compared to the others. In the current study, a 30-meter sprint performance was not evaluated. However, there are conflicting findings in the
literature. For example, Lago-Peñas et al. (2011) found no positional difference in 30-meter sprint times, and central defenders were the fastest of the positions. However, Malina et al. (2005) showed that forwards had the shortest 30-meter sprint time, followed by defenders and midfielders, although no significant differences were found. The differences might be due to different categorization methods and sprint test protocols utilized among the studies.

In another time-motion study, it was found that defenders dribble a shorter distance than the other players, whereas forward players perform a significantly higher number of sprints than defenders and midfielders (Di Salvo et al., 2009). Therefore, dribbling is also an important determinant for positions in soccer. In recent years, studies that have investigated reactive skills, such as agility, have become popular (Di Mascio et al., 2015; Matlak et al., 2015). In the current study, to analyze dribbling ability, the HÜFA test measured performance with and without the ball. The only statistically significant differences were observed between midfielder and defenders in the HÜFA test (with the ball) among the playing positions. Interestingly, midfield players displayed worse performance than defense and forward players. Cerrah et al. (2011) compared the HÜFA test scores of 89 amateur male soccer players from different playing positions (goal keeper, defender, midfielder, and forward) and found that midfielders and defenders were statistically faster than goalkeepers. In another study, Aslan (2015) determined differences in soccer skill characteristics of a group of Turkish amateur soccer players according to their playing positions. For technical skill scores, the test battery by Malina et al. (2007) was used. This test battery included ball control with the body, ball control with the head, slalom dribbling with passing (focusing on speed and accuracy), slalom dribbling (focusing on speed), passing accuracy, and shooting accuracy. The Z scores of each test were calculated and summated to define the soccer skill score for each player. However, no statistically significant differences were found for the soccer skill scores between positions.

The other important performance criterion in soccer is reactive agility performance (Jordan et al., 2014). However, to the authors’ knowledge, there is no study regarding reactive agility and technique performances of youth soccer players according to their playing positions. In the current study, the two different reactive tests (with and without the ball) have been performed by soccer players (Figures 1 and 2). Even though forward players have shown better performances in most of the reactive tests, no statistically significant differences occurred between playing positions.
The absence of association in the current and previous studies between playing positions might have been due to: 1) the selection criteria (self-selection, selection by coaches, or some combination of both); 2) categorization of positions (goalkeeper, defender, central defender, wings, midfielder, and forward); 3) lack of individual specific training; and 4) lack of position-specific training of players at younger ages.

This study was one of the preliminary research studies investigating reactive ability differences, with and without the ball, between playing positions. Previous time-motion analyses have provided information that playing positions require different conditioning features. Therefore, training players according to their playing position requires specific tactical trainings, which are integrated with physical and physiological conditioning trainings.

To develop technical skills in soccer, the most important age range is between 11 and 16. Therefore, training applications should be appropriate for the physical development of athletes, and their development should be examined periodically with the testing methods in this study. In this way, the technical differences between athletes can be identified and technical application errors that may occur can be minimized with early detection.

References


