ORIGINAL ARTICLE

The impact of players' motor skills on match performance in top German Bundesliga teams

MAREK KONEFAŁ[1], PAWEŁ CHMURA[2], EDWARD KOWALCZUK[3], MARCIN ANDRZEJEWSKI[4], JAN CHMURA[2]

Abstract

Introduction. Soccer is a highly dynamic and acyclical game and a soccer player's performance during a match involves a high variability of actions since. **Aim of Study.** The aim of the present study was to determine the effects of endurance and speed skills of players from two top German Bundesliga teams on their teams' final standings in the league table. **Material and Methods.** The study covered all 34 matches of the 2013/2014 season, and it consisted of 480 observations of 41 players. It was carried out using the Impire AG motion analysis system on the basis of official Deutscher Fußball-Bund (DFB) match reports. The players' endurance skills were estimated on the basis of total distance covered during match play and distances in different intensity ranges. The players' speed skills were assessed on the basis of the total number of performed sprints, sprinting distance, and maximal and mean running speed. **Results.** The results showed that the team which was ranked lower in the final league table scored higher in all players' motor parameters than the team which was ranked higher. **Conclusions.** Pre-season motor preparation of top German Bundesliga teams is not the decisive determinant of the teams' final standings in the league, and even the highest level of players' skills does not guarantee reaching the championship position.

KEYWORDS: soccer, endurance skills, speed skills, Bundesliga, match performance, score.

Corresponding author: jan.chmura@awf.wroc.pl

[1] University School of Physical Education, Department of Athletes' Motor Skills, Wrocław, Poland
[2] University School of Physical Education, Department of Team Games, Wrocław, Poland
[3] Football Club, Hannover 96, Hannover, Germany
[4] University School of Physical Education, Department of Recreation, Poznań, Poland

What is already known on this topic?

Endurance and speed skills are the basic components of a soccer player's preparation. They are significant for achieving top results in soccer. Game dynamics in soccer depends on players' total covered distance, and number, frequency and length of performed sprint runs. A player who can outrun his opponent over a short distance is extremely useful to his team. In modern soccer hundredths of a second may decide about winning or losing a ball.

Introduction

The directions of development of modern soccer have been set for many years by renowned Western European clubs, including German Bundesliga teams. These teams represent high levels of players' motor preparation and performance skills, and they have scored successfully in top European competitions. Motion analysis of the match performance of elite soccer players makes it possible to determine the necessary motor potential for players and define standards in modern association football [1].

Soccer is a highly dynamic and acyclical game and a soccer player's performance during a match involves a high variability of actions. This specific aspect of the sport requires players to undertake numerous intensive and explosive exercises, often interrupted with rest breaks of different duration, depending a match situation. A player's standing time during a match is about 19.5% of total match play, walking – 41.8%, forward and backward jogging and low-speed running – 29.9%, medium speed running (15 km/h) – 4.5%, high speed running (18 km/h) – 2.8%, and sprinting (30 km/h and more) – 1.4% [2]. According to Stølen et al. [3] during a match each player performs from 1,000 to 1,400 actions. Sprints, which can last from 2 to 4 seconds, are repeated by soccer players every 1.5 minutes on the average.

Endurance skills constitute the basic components of a soccer player's motor preparation. The level of these skills can be assessed by the total distance covered by players in match play, 1st half and the 2nd half of the match, as well as by the distance covered by players in various intensity ranges [4]. The motion analysis of players taking part in the 2014 World Cup in Brazil shows that the longest mean distance in three consecutive matches of the group stage was covered by the Australian players (118.1 ± 2.3 km), while the world champions, i.e. the Germany national team, covered 113.8 ± 2.8 km. Similar distances covered by soccer players from different European national leagues were noted by other authors [5, 6].

Players' speed skills are crucial for top soccer performance. The game dynamics in soccer greatly depends on the number, frequency, duration and total distance of sprints performed by the players [7]. Another important indication of soccer game dynamics is players' maximal running speed [8]. A soccer player who can outrun an opponent over a distance of a few meters is an indispensable asset to his or her team, as in modern soccer a ball can be won of lost in a few hundredths of a second [9].

In professional association football optimal motor performance is a factor determining players' performance during a game [10]. Carling et al. [11] in their discussion of factors affecting players' performance in five consecutive league seasons noted that when a team was ranked higher in the league table, a slightly decreased players' motor activity was observed. Faude et al. [12] in their study of German Bundesliga players concluded that players' speed activities (power, maximal speed, sprinting) most often occur in goal situations. Soccer players must represent a high level of endurance skills to perform repeated explosive

actions in scoring situations [13]. Research into determinants of sport performance is regarded as key to the development of modern soccer [14-16]. Regular tracking of motor actions of soccer players from the world's top national leagues has become a necessity. The knowledge of performance fitness of elite players allows for implementation of new training loads and optimization of the training process. The aim of this study was to assess the effects of endurance and speed skills of players from the German Bundesliga teams on their team's final standings in the league table.

Materials and Methods

Participants
The study covered all 34 Bundesliga matches of the 2013/2014 season and involved 480 observations of 41 soccer players (including 13 members of the Germany national team and a number of members of other national teams) from two top German Bundesliga teams. Only those players were selected who played the entire duration of a match. In the first team, which was ranked higher in the final league table, 242 observations of 20 players (7 defenders, 10 midfielders, 3 forwards) were made. While in the second team, which was ranked lower, 238 observations of 21 players (9 defenders, 8 midfielders, and 4 forwards) were taken into account. The mean body height of the first team players was 180.95 ± 8.04 cm, body mass – 76.85 ± 8.56 kg, and mean age – 27.80 ± 4.87 years. In the second team, the players' mean body height was 183.86 ± 4.67 cm, body mass – 78.67 ± 5.63 kg, and mean age – 27.00 ± ± 4.10 years. The study was approved by a local ethics committee.

Data collection
The study was conducted using an Impire AG motion analysis system [17], which tracked each movement of each soccer player in all the 34 matches and transformed the analyzed motions into quantitative data. The analysis was carried out on the basis of official match reports from the Deutscher Fußball-Bund (DFB).

The players' endurance skills were assessed in terms of total covered distance during match play, 1st half and 2nd half, as well as distances covered in the following intensity ranges: ≤ 11 km/h, $>11 \leq 14$ km/h, $>14 \leq 17$ km/h, $>17 \leq 21$ km/h, $>21 \leq 24$ km/h, and >24 km/h. The players' speed skills were assessed on the basis of total number of performed sprints, covered sprinting distance, maximal and mean running speed in match play, the 1st half and the 2nd half. A sprint was defined as

a running exercise lasting at least 1 second, at the speed of at least 22.68 km/h (6.3 m/s).

Data analysis
Statistical analyses were carried out using Statistica ver. 10.0. All examined variables were checked against normal distribution with the Shapiro-Wilk test ($p \leq 0.05$), and arithmetic means and standard deviations were calculated. To compare mean values of examined variables a single-factor ANOVA was applied. Differences between pairs of means were verified with Fisher's least significant difference test. In all statistical analyses the level of statistical significance was set at $p \leq 0.05$, $p \leq 0.01$, and $p \leq 0.001$.

Results
The analysis of endurance skills of players from top 2013/2014 teams of the German Bundesliga revealed that the mean total distance covered in match play by players from the first team amounted to 10.91 ± 0.71 km, and by players from the second team to 11.27 ± 0.89 km. The difference was statistically significant at $p \leq 0.001$ (Figure 1).
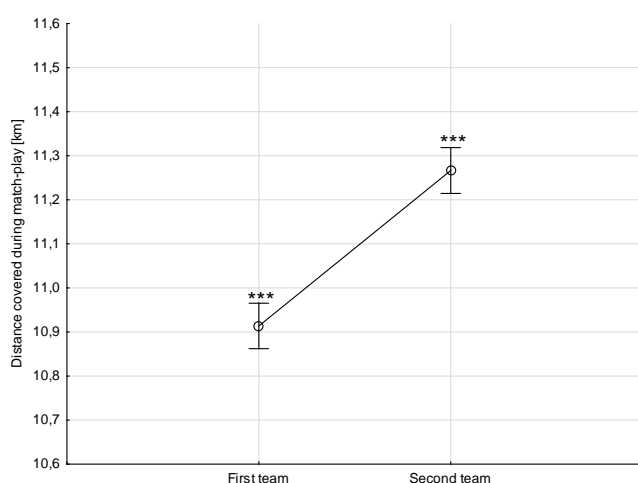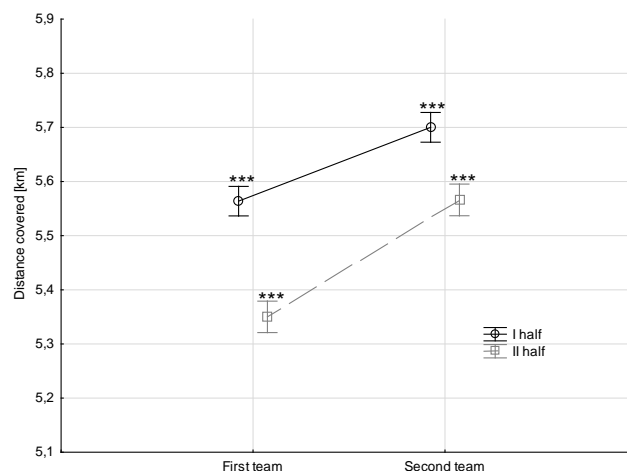

Statistically significant: * ($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

Figure 1. Total distance covered during match play by players of two Bundesliga teams

As far as the distance covered by the players in the first and the second halves of matches is concerned, significant differences ($p \leq 0.001$) were found between the teams. The first team players covered the mean distance of 5.56 ± 0.38 km in the 1st half, and 5.35 ± 0.40 km in the 2nd half; whereas the second team

players covered the distances of 5.70 ± 0.46 km and 5.57 ± 0.50 km, respectively (Figure 2).

Statistically significant: * ($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

Figure 2. Distances covered by players in the 1st half and the 2nd half of the matches

The analysis of covered distances in various intensity ranges showed that the longest distance was covered at below 11 km/h by players of both teams. However, the players from the second team covered a significantly longer distance at this intensity than the first team players ($p \leq 0.001$). The second team players also covered longer distances than the second team players in higher intensity ranges, however, at various levels of statistical significance: $p \leq 0.05$ at 14-17 km/h, $p \leq 0.001$ at 17-21 km/h, $p \leq 0.01$ at 21-24 km/h, and $p \leq 0.05$ above 24 km/h (Table 1).

Table 1. Distances in different intensity ranges covered by the players

Team	First	Second	
Intensity range	$\bar{x} \pm SD$		p
< 11 km/h [km]	6.35 ± 0.37	6.52 ± 0.33	0.001***
11-14 km/h [km]	1.90 ± 0.34	1.91 ± 0.34	0.788
14-17 km/h [km]	1.19 ± 0.22	1.24 ± 0.31	0.039*
17-21 km/h [km]	0.86 ± 0.16	0.93 ± 0.25	0.001***
21-24 km/h [km]	0.33 ± 0.10	0.36 ± 0.13	0.006**
>24 km/h [km]	0.27 ± 0.14	0.31 ± 0.19	0.034*

Statistically significant: *($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

One of measures of soccer players' speed skills is the number of sprints performed during match play. The analysis of the number of sprints performed by the players from the two Bundesliga teams showed that, on the average, the second team players performed sprints more often, i.e. one sprint more than the first team players, however, the difference was statistically non-significant. As for the number of sprints performed in the 1st half and the 2nd half, the second team players performed more sprints only in the first half of the match ($p \leq 0.05$) (Table 2).

Table 2. The number of sprints performed by the players from the first and the second team

Team	First	Second	
Sprints [number]	$\overline{x} \pm SD$		p
match play	20.65 ± 8.32	22.05 ± 10.37	0.105
1st half	10.34 ± 4.55	11.28 ± 5.64	0.045*
2nd half	10.31 ± 4.66	10.76 ± 5.56	0.332

Statistically significant: *($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

During match play the second team players covered the mean total sprinting distance of 432.76 ± 239.70 m, and the first team players 391.40 ± 179.29 m. Similarly, the second team players covered a longer sprinting distance in the 1st and the 2nd half than the first team players. However, significant differences between the players of both teams were found for the sprinting distance in match play (41.36 m) and the 1st half (25.21 m) – $p \leq 0.05$ (Table 3).

Table 3. Mean sprinting distance covered by players of the studied Bundesliga teams

Team	First	Second	
Sprinting distance [m]	$\overline{x} \pm SD$		p
match play	391.40 ± 179.29	432.76 ± 239.70	0.033*
1st half	194.32 ± 98.82	219.53 ± 129.66	0.017*
2nd half	197.12 ± 104.42	213.17 ± 129.69	0.136

Statistically significant: *($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

The analysis of the players' mean and maximal running speed revealed that only the former featured a significant difference between the teams (Table 4). The second team players' mean speed during match play amounted to 7.24 km/h, i.e. 0.17 km/h higher from the

mean speed of the first team players ($p \leq 0.001$). Both teams attained lower running speed in the 2nd half than in the 1st half: first team for 0.47 km/h, and second team for 0.41 km/h. The levels of significance of differences in the running speed between the teams were $p \leq 0.001$ during match play, $p \leq 0.01$ in the first half, and $p \leq 0.001$ in the second half (Table 4).

Table 4. Mean and maximal running speed of players from the examined teams

Team	First	Second	
Speed	$\overline{x} \pm SD$		p
mean speed – match play [km/h]	7.07 ± 0.46	7.24 ± 0.55	0.001***
mean speed – 1st half [km/h]	7.31 ± 0.51	7.45 ± 0.61	0.004**
mean speed – 2nd half [km/h]	6.84 ± 0.51	7.04 ± 0.58	0.001***
maximal speed – match play [km/h]	31.12 ± 1.56	31.42 ± 1.90	0.066
maximal speed – 1st half [km/h]	30.31 ± 1.85	30.53 ± 2.19	0.231
maximal speed – 2nd half [km/h]	30.22 ± 1.85	30.51 ± 2.20	0.124

Statistically significant: *($p \leq 0.05$), **($p \leq 0.01$), ***($p \leq 0.001$)

Discussion

The results of the present study show that the players from the second German Bundesliga team – despite being ranked lower in the 2013/2014 league table than the first team – attained better scores in all types of tested motor skills than the players from the first team. In terms of endurance skills the second team players covered a significantly longer total distance in match play, the 1st half and the 2nd half of the match. The distance covered by the second team players in all examined intensity ranges was longer than the distance covered by the first team players. The analysis of players' speed skills showed that the second team players also performed a significantly greater number of sprints in the 1st half, and covered a longer sprinting distance during match play and in the 2nd half than the first team players. The second team players also attained a significantly higher mean running speed in match play, the 1st half and the 2nd half. The question remains why players of a team ranked lower in the Bundesliga table attained significantly higher indices of their motor fitness than players of a team ranked higher in the table. According to Haas et al. [18] a team's league standing is not always commensurate with

its playing effectiveness. It can be explained by a great number of factors affecting soccer players' performance. Studies have shown that apart from the primary contribution of players' motor skills their match performance is also greatly affected by technical-tactical skills, game strategy, efficiency of decision-making processes, personality traits, and body build and agility [19-22].

According to Kern and Sussmuth [23] soccer players' individual skills do affect their attainment of top sports results. These skills can be illustrated by the number of members of the Germany national soccer team among the examined players from the two German Bundesliga teams, who after finishing the league season became the world champions in 2014 in Brazil. In the 2013/2014 Bundesliga season the first of the studied teams included eight, and the second team five national team members. Yue et al. [9], who confirmed the significant role of players' motor skills in soccer, claimed that match outcome is decided not by the number of performed goal shots but by their accuracy. Tiendemann et al. [17] in their study of performance of Bundesliga teams from the 2002/2003 to the 2008/2009 season found a correlation between the mean assessment of players' performance and their team's final standings. Frik and Simmons [24] also claim that a team with more skilled players is placed higher in the German Bundesliga table. Also game strategy affects the players' profile activity during a match. A coach of soccer players of the highest skill levels can use a tactic based on playing more passes, and thus shorter distances covered by players during match play [25]. On the other hand, a team which uses many counterattacks and moves the ball quickly towards the opponent's goal, possesses the ball for a shorter time and performs fewer passes. Such a strategy results in a greater amount of work performed in defense play and thus in players covering a longer total distance during match play and performing a greater number of accelerations, sprints, and explosive movements [7]. This is why such an activity profile was noted among the players of the second team.

The results of the present study showed that players from two top German Bundesliga teams covered the mean total distance in match play from 10.9 to 11.3 km. The total covered distance and distances covered in different intensity ranges corresponded to the results by other authors [26-28]. The number of performed sprints, length of covered sprinting distance, and high mean running speed attained by the players are indicative of very good pre-season speed preparation of the examined teams [1, 29]. The similar values of the maximal running speed attained by the players of both examined teams may result from the high speed potential of the properly selected players and implementation of optimal speed training loads [7].

Conclusion

The present study indicates that the motor preparation of top Bundesliga teams is not the decisive factor influencing the final standings of a team. The team's sport result depends more on effective use of players' skills than their potential [30]. On the basis of their biological potential soccer players, thanks to an individualized choice of training loads, attain a certain level of motor skills; however, even the highest level of these skills does not guarantee the achievement of the top results. Despite the fact that the second team players represented a higher level of motor skills than the first team players, they failed to secure the top of the league standing. It can be assumed that their high level of motor capabilities was not fully implemented due to lower skill levels and less efficient analytic and decision-making processes of soccer players, which determine effective match performance.

The team which was ranked higher in the German Bundesliga table attained lower values of all examined motor parameters. This does not mean that they do not exert a significant influence on a team's match outcome and on the final league table standings. In the light of results of the present study it will be necessary to carry out further research concerning relationships between the motor and technical-tactical skills of soccer players.

What this study adds?

The study shows that pre-season motor preparation of soccer players is not the decisive factor affecting a team's standings in the league table. Even the highest level of players' endurance and speed skills does not guarantee sport success. Although the studied players from the second team represented a higher level of motor skills than the players from the first team, their position in the league table was lower. It may be assumed that the players' high level of motor skills was not utilized completely due to their lower skills and lower levels of decision-making and analytical processes, which are the main determinants of success in soccer.

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