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Analysis of the 30-m running speed test results in soccer players in third soccer leagues

Miłosz Drozd, Michał Krzysztofik, Monika Nawrocka, Magdalena Krawczyk, Krzysztof Kotuła, Alan Langer, Adam Maszczyk

Department of Sports Theory, the Jerzy Kukuczka Academy of Physical Education in Katowice, Poland.

Abstract. The basic goal of this study was to analysis of the results of the 30-m running speed test in soccer players in third soccer leagues. The study examined the group of randomly selected seventy athletes from two soccer teams from the Ekstraklasa league, two teams from the first league and two teams from the second leagues were randomized into the study group. All the measurements were performed in indoor arenas. The temperature in the arenas ranged from 22 to 24 C. Measurements were recorded in the morning (between 10:00 am and 12:00 am). The Running Speed Test was used in the study to diagnose speed potential in the athletes. The running speed was measured by means of a set of photocells located at 0m, 5m, 20m, 30m. The results obtained demonstrated that the elite-level matches are more dynamic since the players show higher values of speed parameters. Apart from starting speed, the results obtained for the distance of 5 m provide information for coaches concerning their work on special strength. The speed is indicated by the results obtained for 20 and 30 m distances, whereas flying measurements between 5/20m and 20/30m reflect inherited speed aptitudes.

Keywords. Motor potential, soccer, speed, speed tests.

Introduction

Running speed is a parameter that determines body potential to run over a specific distance in the shortest time possible, with three major components: reaction speed, simple movement time and movement frequency Ferro et al. (2014). Adequate level of these parameters has a direct effect on player's effectiveness during the game. Mohr (2016) argued that new concepts of the training process should emphasize the priority of speed and strength training over the endurance training. It can be observed that sprints are sometimes started when the player runs at an insignificant speed and performs frequent directional changes typical of this discipline, e.g. when the player starts an individual action, runs to his or her position or fights in the air for the ball. Therefore, it should be emphasized that acceleration over the first few steps is critical to effective playing.

Mean distances covered during a match using sprints range from 215 to 446m Di Salvo et al. (2007), 199 to 290m Della et al. (2011), 179 to 334m Lago et al. (2010), 193 to 260m in the Spanish league, 208-278m in the English league and 167-345m in the Europa league (Bajramović et al., 2013; Moir et al., 2007) found that the use of adequate training methodologies in sports periodization is likely to enhance speed performance reflected by acceleration, time to reach maximal speed and maintaining maximal speed, thus improving competitiveness of the player.

Speed is becoming more and more important in contemporary soccer. Player's speed is not merely related to the athlete's fitness. Its structure is much more complex. During a match, it is manifested by e.g. speed of actions (comprehensive psychophysical ability to perform a specific technical and tactical action during playing under the opponent's pressure and time pressure) (Lago et al., 2010; Andrzejewski et al., 2012)

As emphasized by Andrzejewski et al. (2013), the speed of action is build based on motor and cognitive components which are closely related with each other. With the motor components, speed is controlled neurophysiological (jump, directional changes, sprint, acceleration, changes in running direction, dynamic stopping, speed of a start). The major role in cognitive components is played by the processes of reception and processing of information in analytical and decision-making centres of the cerebral cortex e.g. (choosing actions, speed of making right decisions, reaction time, speed of perception and prediction). The process of information reception and processing in the cerebral cortex occurs invisibly, whereas the motion and its speed are observable. The speed of actions of a player during a match depends not only on the speed of the person but also on their psychophysical aptitudes. For example, delayed perception or wrong assessment of the situation on the pitch results in inaccurate decisions and choosing unsuccessful actions. Therefore, performing a fast but wrong movement during a match is considered an ineffective movement. Players do not run to the ball unless they analyse the situation and make right decisions. A very fast player cannot use this ability, especially with

Corresponding Author: M. Drozd, e-mail; milosz880509@gmail.com

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high density of players in the playing field, under the pressure of opponents and time, when he or she has to use e.g. an unconventional feint, perform a dynamic individual action ended with a rapid shot on the goal, accurate pass or cross to another team member. (Carling et al., 2012; Haas et al., 2004) Many speed-type athletes move too fast or too slow to the free area and cannot use the advantage of the number of players in 2:1, 3:1 or 3:2 situations. This is caused by wrong assessment of the situation or the situation which was noticed too late, which leads to wrong decision and wrong choice of action. During the dynamic actions with or without the ball, the player is incessantly engaged in observation and assessment of the direction of the ball's flight and the movement of players from their own or the opposing team. In such cases, cognitive processes are critical, but it does not mean that the speed of action is less important and can be neglected. On the contrary, this ability should be adequately and constantly improved since in contemporary soccer, speed is regarded to be a key motor skill to determine velocity of the player's movement Rodriguez et al. (2016).

Unlike endurance or muscle strength, speed largely depends on genetic factors. Therefore, positive changes in speed are mainly correlated with the genotype of a player. Consequently, even a long-term and intensive training plan with the duration of several years cannot change this ability. Speed is closely related with such genetic factors as substantial amount of fast-twitch (IIb, white) fibres, ability to selectively excite these fibres, efficiency of nervous processes, ability to quickly switch from excitation to inhibition and the other way round Djaoui et al. (2016). Obviously, speed and other abilities that determine the high skill level of an athlete are composed of several components.

Methods

Participants

Seventy athletes from two soccer teams from the Ekstraklasa league, two teams from the first league and two teams from the second leagues were randomized into the study group. All the measurements were performed in indoor arenas. The temperature in the arenas ranged from 22 to 24 C. Measurements were recorded in the morning (between 10:00 am and 12:00 am). Before each test, players followed a standardized warm-up protocol (15 min) consisting of running, stimulating and stretching exercises. Measurements were performed in July and August. The analysis was based on the best results. Cooperation with coaches who coordinated groups and offered help during tests was indispensable.

Tests and measurement methodologies

The Running Speed Test was used in the study to diagnose speed potential in the athletes. The running speed was measured by means of a set of photocells located at 0m, 5m, 20m, and 30m. The measurements did not take into consideration reaction time of the athlete as the photocells were activated automatically when the athlete started running. The split times were also measured at the distances between the measurement points.

Statistical analysis

The descriptive statistics, including mean standard deviation (± SD), standard error (SE), Min-Max range, coefficient of variation, Skewness and Kurtosis were calculated for the speed test over the distance of 5 m, 20 m and 30 m in each league studied. The variables were verified in terms of normal distribution using the Kolmogorov–Smirnov test. Quality of distribution was examined using the coefficient of variation. The profile of data distribution was evaluated using skewness and kurtosis. Differences between the dominant limb were analysed using the univariate analysis of variance (ANOVA). The homogeneity of variance was evaluated by means of the Levene's test. The correlations between the speed tests test results were analysed based on Pearson's correlation analysis. The level of significance was set at 0.05 for all the tests. Computations were made using the Statistica 12.5 statistical software package (StatSoft, USA).

Results

The following results for individual teams were obtained during the speed tests. Table 1 presents descriptive statistics of the results obtained in the speed tests for the distance of 5 m, 20 m and 30 m divided into the Ekstraklasa league, 1st league and 2nd league. The fastest players over the distance of 5 metres were from the Ekstraklasa league (1.07±0.05) and 1st league (1.10±0.10). Over the longer distances, the 2nd league players were the best in the 20 m test (3.07±0.15), whereas the Ekstraklasa league players obtained the best results in the 30 m test (4.21±0.18).

The mean time values show that the results of the 5 m distance are similar in each soccer league. With higher distances, ranges for the times were increasing. Division of the results obtained by players from the 2nd league showed a substantial asymmetry for each distance. The measurements pointed to the positive Skewness. Insignificant asymmetries were observed in the 1st league players for each distance and 1st league players excluding 30 m, where asymmetry was substantially negatively skewed, although with positive kurtosis. The measurements for the 1st league players showed negative Skewness for 5 m and 30 m and positive Skewness for 20 m yet with negative kurtosis.

Figure 1 illustrates the times obtained over the distance of 5 m during the speed test. Analysis of variance presented in Table 3 did not reveal significant differences between three soccer leagues ($F= 1.86$, $p = 0.426$). Figure 2 presents results of times for 20 m. Analysis of variance revealed substantial differences ($F =13.55$, $p = 0.034$, $p <0.001$), see Table 2. Figure 3 shows graphical representation of times for 30 m obtained for the three football

leagues. Analysis of variance presented in Table 2 showed significant differences (F = 13.19, p = 0.048).

As demonstrated above in the Table 3, significant differences in times between the leagues were observed for the distances of 20 m and 30 metres. Based on the results of the post-hoc Tukey's test contained in Table 3, times showed intragroup statistically insignificant differences. Graphical differences were observed only for the distance of 30 m between the 1st league and 2nd league but were statistically insignificant (p = 0.07).

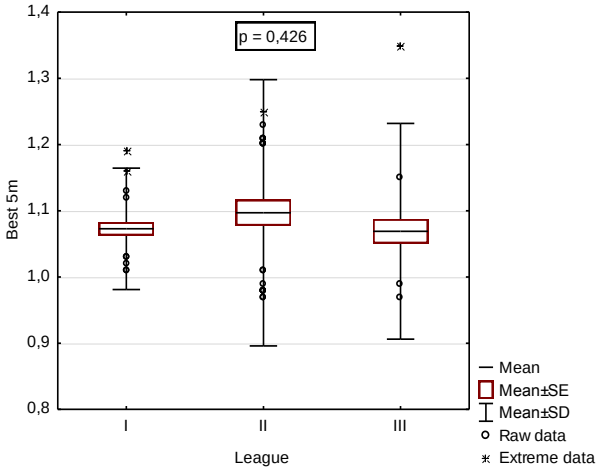

Figure 1. Results recorded for the speed test and the distance of 5 meters for the 1st, 2nd and 3rd leagues.

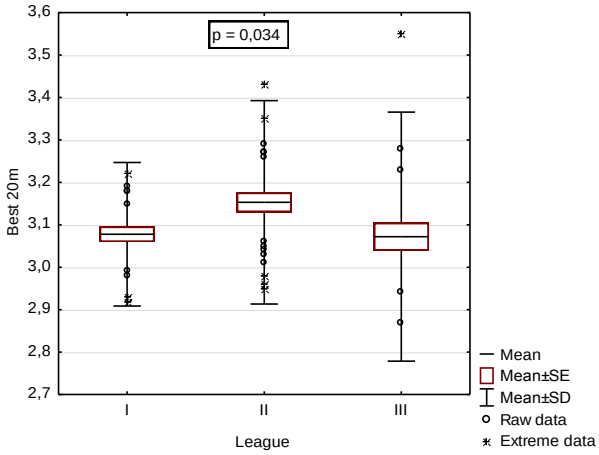

Figure 2. Results recorded for the speed test and the distance of 20 meters for the 1st, 2nd and 3rd leagues.

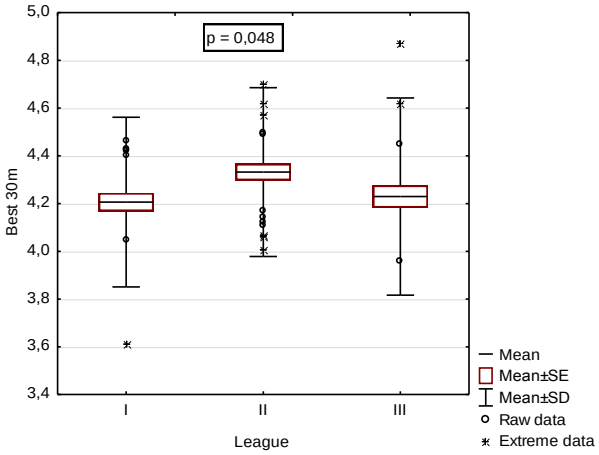

Figure 3. Results recorded for the speed test and the distance of 30 meters for the 1st, 2nd and 3rd leagues

Table 1

Descriptive statistics of speed test for the distance of 5, 20 and 30 meters for Ekstraklasa, 1st and 2nd league.

Speed Test	Mean ± SD	Min/Max	VC	Skewness	Kurtosis
5 m					
Ekstraklasa	1.07 ± 0.05	0.98/1.19	4.28	0.94	0.95
1st league	1.10 ± 0.10	0.97/1.25	9.16	-0.01	-1.69
2nd league	1.07 ± 0.97	0.97/1.35	4.88	1.98	2.65
20 m					
Ekstraklasa	3.08 ± 0.08	2.92/3.22	2.75	-0.20	-0.82
1st league	3.15 ± 0.12	2.95/3.43	3.80	0.20	-0.24
2nd league	3.07 ± 0.15	2.87/3.55	4.78	1.98	2.98
30 m					
Ekstraklasa	4.21 ± 0.18	3.61/4.46	4.22	-1.60	1.30
1st league	4.33 ± 0.18	4.01/4.70	4.08	-0.02	-0.50
2nd league	4.23 ± 0.21	3.96/4.87	4.88	1.98	2.89

Table 2
The results of the analysis of variance for the speed test for the distance 5m, 20 m and 30 m between leagues.

ANOVA	5 m	20 m	30 m
	F(2;66): 1.86; p=0.426	F(2;66): 13.55; p=0.034	F(2;66): 13.19; p=0.048
Variance (total)	0.007	0.015	0.043
Ekstraklasa	0.002	0.007	0.032
1st league	0.010	0.014	0.031
2nd league	0.006	0.022	0.043

Table 3
The results of the Tukey's test (the uneven numbers) for speed test and the distance of 5m, 20 m and 30 m between leagues.

HSD (the uneven numbers)											
5m				20 m				30 m			
League	1st	2nd	3rd	League	1st	2nd	3rd	League	1st	2nd	3rd
1st		0.58	0.99	1st		0.10	0.99	1st		0.07	0.92
2nd			0.52	2nd			0.09	2nd			0.20
3rd				3rd				3rd			

Discussion

The results obtained demonstrated that the elite-level matches are more dynamic since the players show higher values of speed parameters (Castillo et al., 2016). It is known that the basis for the actions taken by players during sports competition is soccer skills. However, motor abilities are a factor that determines higher sport skill level (Konefał et al., 2014). Furthermore, roughly 90% of the energy in soccer is supplied from aerobic energy pathways, which means that soccer can be numbered as a strength and speed sport. However, it is explosive (anaerobic) exercise that determines the result obtained by the team. This type of exercise determines the effective performance of e.g. shots on goal, head shots, dribbling, feints or effective covering of opponents (Andrzejewski, 2009; Sampaio, 2009; Liu H et al., 2015). Apart from starting speed, the results obtained for the distance of 5 m provide information for coaches concerning their work on special strength. The speed is indicated by the results obtained for 20 and 30 m distances, whereas flying measurements between 5/20m and 20/30m reflect inherited speed aptitudes. Our study demonstrated that the best results for 30m were obtained for Ekstraklasa players (4.21 ±0.18), which is consistent with the description presented by Nyberg (2016), who found that this value for 30m ranges from 3.75s to 4.5s in trained soccer players. Vaeyens et al. (2006) examined a group of 138 soccer players in three categories (professional players, semi-professionals and amateur players). The results documented by these researchers for the distance of 30m were: professional athletes (n=37): 4.1±0.2s; semi-professionals: (n=25), 4.2±0.2s, amateurs (n=33): 4.4±0.3. The results obtained by Extraclass and 2nd league players (4.23±0.21) were similar to those recorded for semi-professionals, whereas 1st league players (4.33±0.18) were similar to amateurs. Furthermore, Mujika et al. (2009) suggests that soccer players have to meet very high requirements concerning motor preparation. A good soccer player should be prepared for running over both short (5-20m) and long (30-50m) distances at the highest speed possible (instantaneous accelerations from 9m/s to 10m/s) (Mujika et al., 2009; Khorasani et al., 2016). The results also show that the athletes from the Ekstraklasa league have values more similar to each other than players from lower leagues, apart from 30 m run. This suggests that players in the top league are the most selected in terms of the running speed parameter. Running speed test helps adjust individual physical load used during training sessions. Chlif et al. (2010) argues that it is unacceptable in modern training to use the same load for all players since each person has their individual motor aptitudes. This leads to the division of players into speed and endurance athletes. Unfortunately, coaches use wrong approach to training by copying training programs for the best players or organize their own programs without taking into consideration the experience of the athlete, his or her abilities and physiological aptitudes (Stoica, 2014). Śliwowski et al. (2013) used an example of two speed-type athletes who obtained the same times in 30 m sprints (3.90s). First of them was able to generate a very high power and explosive force at the distance of 4 to 7 metres and then accelerated gradually, whereas the other player generated insignificant power and explosive force in the first 7 to 10 metres but then he developed substantial acceleration. Although both players showed a high level of speed and obtained the same results, they can develop speed only if the differ-

ences and individual aptitudes are taken into consideration. The test results show an increase or decrease in specific motor abilities. A repeated series of several such tests can demonstrate how many centimetres or split seconds the athlete is better compared to the previous test or his or her personal best.

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