Relationship between kicking and sprinting performance

Goran Sporiš, Vlatko Vučetić & Marjan Jerković

Abstract

Kicking is one of the most vital skills in soccer and strength and power share importance in the explosive movement of top level play. The full instep – kick is one of the kicks typically used to generate fastball speed. Twenty-seven Croatian national football team members (U-15) (mean (SD) age 15.8 (2.9) years, height 173.5 (5.5) cm, weight 62.1 (5.4) kg took part in the study, and performed sprint tests and kicking performance test (measured by radar gun, Stalker-Pro, Texas). The purpose of this study was to investigate the relationship between kicking performance and sprinting performance, using field performance tests. Kicking performance correlated with sprinting performance in all four sprinting variables (r = 0.49 to 0.54; p<0.05) and body mass (r =0.53, p<0.05). SRA revealed a simple solution with sprint distance of over 30m and body mass as significant predictors variables, which explained 52.6 % of kicking performance. Using a radar gun to measure the velocity of a soccer kick is a reliable test of kicking performance. Some motor abilities, also important to the basis of sprinting and kicking performance, are related. Players who perform well on sprinting test are also likely to be successful in kicking performance tests. A sprint of over 30m is one of the most important indicators of kicking performance efficiency.

Key words: soccer players, sprinting performance, kicking performance.

1. Introduction

Strength and power (explosive movement) share importance in top level soccer play. During a soccer game a player performs several dynamic-explosive movements (headers, cutting, tackling, sprints and kicks) which require good level of muscle strength and power (Cabri et al., 1988; Bangsbo, 1994a). The most frequently used soccer kick is the full-instep kick and the inside-of-foot-passing shot. The full-instep kick is normally used for generation of fastball speed. Soccer practice suggests that a soccer player needs to develop maximum level strength and power, which is utilized effectively within the game (Bührle, 1985). A soccer kick is a multi joint activity which depends on various factors: maximum strength and power of the muscle activated during the kick (De Proft et al., 1988; Isokawa & Lees, 1988; Weineck, 1992; Lees & Noland 1998), the timing and appropriate transfer of energy between the segments that participate in the kick (Plagenhoef, 1971), the speed and angle of approach of the player to the ball (Isokawa & Lees, 1988) and utilization of stretch-shortening cycle muscle characteristics of kicking leg (Weineck, 1992).
Many studies on soccer kick emphasized the importance of maximum power of lower limb muscle and coordination between agonist and (vastus lateralis and medialis, rectus femoris, tibialis anterior and m. iliopsoas) and antagonist muscle (gluteus maximus, biceps femoris and semitendinosus) during the kick (De proft et al., 1988; Isokawa & Lees, 1988; Lees & Noland 1998). Subsequent studies have calculated force and torques exerted at the joints of the kicking leg (Putman, 1980, 1991; Robertson and Morsher, 1985). Descriptive normative data for soccer players in terms of sprints and kicking performance are sparsely presented. Most studies have used isokinetic equipment (Wahrenberg et al. 1978; Zernicke & Roberts, 1978; De Proft et al., 1988; Mangine et al. 1990) with different speed and joint angles, making direct comparisons difficult. The relation between peak torques and maximal ball velocities has no solid physical ground, this seems true in ballistic and isokinetic conditions. Isokinetic torques are poor predictors of field performance. This observation may be attributed to differences in the neuromuscular control of muscle groups when contracting independently under isokinetic conditions, simulating an actual kick. (Mognoni et al., 1994). The purpose of this study was to investigate the relationship between kicking performance, and sprinting performance, using field performance tests. The second goal was to determine reliability of kicking performance test measured by radar gun.

2. Methods

2.1. Subjects
Twenty-seven Croatian national football team members (U-15) (mean (SD) age 15.8 (2.9) years, height 173.5 (5.5) cm, weight 62.1 (5.4) kg took part in the study, and performed all the tests described below. The playing positions occupied by these players were: seven fullbacks, ten midfielders, three strikers, four midfield/strikers and three central/defenders. Twenty-six of twenty-seven players were right footed. Each subject reviewed and signed consent forms approved by the human research review committee before participating in the study.

2.2. Procedure
All tests were measured on a soccer field from 2 to 4 pm, during the preparation period of Croatian national team members (U-15) in Porec – Croatia. Players had 25 min of warm-up before testing protocol began. All tests were performed three times and a mean value was used in data analysis. The first test for players was a kicking performance test (full-instep kick). Players had 3 minutes of the rest between each attempt. At the end of the test protocol players were tested for their sprinting abilities, sprints over 30 m were measured, times over 5, 10, 20 and 30 m were recorded. Players had 2 minutes of rest between each trail.

2.2.1. Kicking performance (KP)
Kicking performance (ball velocity) was measured using a radar gun (Stalker-Pro, Texas). Subjects were asked to kick a stationary soccer ball (placed in the penalty kick area) as fast as possible. Players then performed a full-instep kick after a five meter run up, with preferred foot into the unguarded soccer goal. The radar gun was placed one meter behind a soccer goal.

2.2.2. Sprint performance (SP)
Players performed 30-meter sprints, times over 5 meters (Sp5), 10 m (Sp10), 20 m (Sp20) and 30 m were recorded by photocells (RS Sport, Zagreb). Time was measured in 100 th of seconds. All sprints started out from a standing position. The subjects started on signal, time recording started after players moved their rear foot from the detecting platform, connected to the software.
2.3. Statistical analysis

The statistical Package for Social Sciences SPSS (ver. 11.5, SPSS Inc., Chicago, IL) was used for the statistical analysis. Data are presented as mean and standard deviation (SD), normality of distribution was tested using Kolmogorov-Smirnov test. The Pearson product-moment correlation was used to determine the relation between selected variables. Stepwise regression analysis (backward model; SRA) was used to calculate the relationship between sprinting variables and the kicking performance test. Reliability of kicking performance test was determinant by reliability analysis (Alpha). P<0.05 was considered significant.

3. Results

Mean ball velocity measured by radar was 94.4 (4.38) km/h. All tests had normally distributed data. Performance in sp5m, sp10m, sp20m, sp30m and body mass (BM) correlated significantly to kicking performance (kp) ($r = 0.49$ to $0.54$; $p<0.05$).

SRA revealed a simple solution with sp30m and bm as significant predictors variables, which explained 52.6% of kicking performance. For comparison, full regression model (i.e. all five variables included) explained only 0.5% more variance in kp. The reliability coefficient alpha was 0.96.

Table 1. Descriptive statistics

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Figure 1. Relation between kicking performance, sprinting performance (sp5m, sp10m, sp20m, sp30m) and body mass
4. Discussion

The results of this study confirm that a correlation exists between kicking and sprinting performance. Significant correlation was found between kicking performance tests and all measured times over 30 m sprint tests. It is known that sprinting constitutes 1-11% of the total distance covered in a match, corresponding to 0, 5-3,0% of effective playing time, that being, the time when the ball is in play. (Wisloff, 2004). Sprinting performance and sprint efficiency distinguishes elite soccer players (first division players) from second division players (Bangsbo, 1994b; Verheijen, 1997). Because of the strong correlation between sprinting and kicking performance measured by the field test, we could conclude that some motor abilities, which are the basis of sprinting and kicking performance, are in relation. According to results of this study players who perform well on sprinting tests (sp30m) are likely to be successful in kicking performance tests. One of the purposes of this study was to determine reliability of kicking performance test measured by a radar gun. Authors found only a small number of scientific articles in which a radar gun was used and none of them dealing with soccer situations (Pugh et al., 2001, 2003; Peterson et al., 2004; di Pramero et al., 2005; Frothomme et al., 2005; Gander et al., 1994; Jegede et al., 2005; Bower & Cross, 2005; Signorile et al., 2005). Reliability analysis (Alpha) performed on three items of the kicking performance test was 0.96. We can conclude that a kicking performance test measured by radar gun is reliable test, and can be used in future scientific research.

Correlation between kicking performance and body mass was found by Bosco, (1990) and confirms results from our study. Sprinting and kicking performance are characterised by explosive movements. The 100m sprints is usually divided into three phases, acceleration phase a maximum velocity phase and deceleration phase. Each phase seems to correspond to specific abilities (More, Komi & Gregor, 1992). For the purpose of this study we analysed only first phase-acceleration. Kicking motion also can be divided in three phases (Luhtanen, 1988). Kicking and sprinting performance have a lot of similarities, as we look at the phases of the movements. Plagenhoef’s (1971) conclusion was that the speed of the ball is determined primarily by the quality of the contact between the foot and the ball. Study of Levanon and Noland (1998) found out that the speed of the foot before impact was the main determinant of the speed of the ball after impact. Speed of the movement during kicking and sprinting performance is important both for good ball velocity and fast sprints. The speed of the ball depends on the speed of the foot (Levanon and Noland, 1998), but no relationship was found between strength and kick velocity. Narici et al. (1988) found the highest average ball velocity over a path of 10m after maximal kick performance, this was one of the reasons why authors decided to use penalty kicks, to measure maximal ball velocity. Also authors found the highest correlation between kicking performance and sprinting performance over thirty meter sprint (Figure 1.). According to results of this study sprint over a 30m are one of the most important indicators of kicking performance efficiency.

5. Conclusion

Author found no studies dealing with the correlation between kicking and sprinting performance measured with field tests, so direct comparison of these findings is difficult. Sprinting performance affects kicking performance. Sprints over 30m are one of the most important indicators of kicking performance efficiency. Some motor abilities, which are the basis of sprinting and kicking performance are related. Players who perform well on sprinting test (sp30m) are likely to also be successful in kicking performance tests.

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Nevertheless technical skill is still a predominant factors in kicking performance. However, the relationship between these parameters and kicking performance has not been fully investigated. Further study is required to determine how these parameters influence kicking performance.

6. References

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