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RELATIONS BETWEEN PRECISION, SPEED AND PERFORMANCE QUALITY OF HEAD AND FOOT INSTEP KICK AMONG FOOTBALL PLAYERS

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Abstract

The aim of this study was to determine the correlation between the precision, speed and performance quality of head and foot instep kick as the basic technical elements of soccer game. Sample was consisted of 27 players (15 ± 0.6 yr.) and they were measured in the variables: precision of foot instep kick, precision of head kick, foot instep kick technique, head kick technique, speed of the penalty kick, precision while measuring foot instep kick technique, speed of the ball while measuring foot instep kick technique, precision while measuring head kick technique, speed of the ball while measuring head kick technique, speed of the ball while measuring precision of the foot instep kick, speed of head kick while measuring precision. Canonical correlation analysis was applied. The correlation between sets of variables was identified ($\text{CanR}=0.87$, $p=0.00$). The results indicate a complex relationship and reciprocal conditionality of precision and speed with performance quality of basic football games technical elements.

Key words: motor control, motor learning, young football players, canonical correlation analysis, reliable estimation of football-specific motor knowledge

Introduction

Given the complexity and polistructurality of football game, surely there is no motor ability for which it can be sad that it is unnecessary in terms of success in football (Araujo et al., 2004; Ward & Williams, 2013). On the other hand, regardless of team sport game, not knowing the optimal biomechanical complex of movements that should be realized as part of the motor program usually results in non-optimal performance which as consequence generates a very high physiological response on load (Hart, 1999; Schmidt & Wrisberg, 2000). Also, improving of motor skills is directly reflected through increased accuracy of movement performance, reduction of energy consumption and sometimes minimization of the time required to perform a needed movement (Brady, 1998; Côté et al., 2003). In addition, it is important to emphasize that all anthropological potentials of players can be used optimally only when the motor knowledge comes into automation phase (Araújo et al. 2004; Mandić Jelaska, 2014). Researches suggest a positive correlation between variables of outstanding importance in football: the level of motor skill of head kick, level of motor skill of foot instep kick and accuracy (Mandić Jelaska et al., 2012). Furthermore, it is clear that quality players have the appropriate high level of football-specific motor knowledge which is manifested through performing skill of characteristic technical elements in football (Reilly et al. 2000). It should be noted that motor knowledge beyond the direct impact on the quality of the performance of specific motor tasks indirectly affects the dimensions of anthropological status (McCullagh & Weiss, 2001).

In a football game, head kick and foot instep kick are the basic technical elements. Certainly the quality of the realization of previously anticipated game tactics can be better if those main technical elements are realized optimally. It is important to say that kick (either foot or head) have to be achieved in a timely manner, accurately and powerfully, and perform relatively quickly (Davids et al., 2000; Mandić Jelaska, 2014). Foot kick is classified given which part of foot is used for its realization. Accordingly, we distinguish several types of foot kicks: kick with the ridge of the foot (middle, outer or inner part), kick with inner or outer side of the foot, kick with the top of the foot, kick with bottom of the foot and kick with the heel. The most commonly used in football is foot instep kick. In accordance with the foregoing, the aim of this research was to investigate the relations between various manifestations of ball speed, accuracy and performance quality of foot and head ball kick.

Methods

Sample in this research consisted of 27 football players (15 ± 0.6 yr.). Tested are only players who have been training for at least two years. Subjects were measured in variables: precision of foot instep kick (PFIK), precision of head kick (PHK), foot instep kick technique (FIKT), head kick technique (HKT) and speed of penalty shot (SPS). Also variables: achieved accuracy while measuring foot instep kick technique (AFIKT), speed of the ball while measuring foot instep kick technique (SFIKT), achieved accuracy while measuring head kick technique (AHKT), speed of the ball while measuring

head kick technique (SHKT), the speed of the ball while measuring accuracy (SA), speed of the ball while measuring precision of head kick (SPHK). All measurements were performed 3 times. Reliability and validity of used tests for the assessment of foot instep and head kick performance quality and precision have been previously tested on the same sample and tests were explained in details (Mandić Jelaska, Miletić & Jelaska, 2011). Two expert coaches and one first league player were judges who evaluated technique of motor skills according to defined criteria. Respondents during the measurement of foot instep and head kick performance technique did not know that precision is also measured. For all the variables parameters of descriptive statistics were calculated. Kolmogorov-Smirnov test was applied for testing of normality. Canonical correlation analysis between variables of foot and head kicking accuracy, precision ball head, foot instep kick technique, head kick technique and speed of the penalty kick with one hand, and all other variables on the other side was applied. Canonical correlation coefficient and coefficient of canonical determination, the value of Bartlett χ^2 test, the number of degrees of freedom and the associated significance level was calculated. Also given are the correlation coefficients of all the observed manifest variables with significant factors of only significant extracted canonical pair.

Results

In table 1 results of descriptive statistics and Kolmogorov-Smirnov test for all measured variables are presented.

Tablica 1: Descriptive statistics parameters of measured variables. Mean (AS), standard deviation (SD), coefficient of variation (CV%), minimal result (Min), maximal result (Max), skewness (Skew), kurtosis (Kurt), significance obtained by using Kolmogorov-Smirnov test (KS)

	AS	SD	CV%	Min	Max	Skew	Kurt	KS
HKT	8.11	2.81	34.59	3.00	14.00	-0.10	-0.28	>0.20
FIKT	9.30	2.23	24.02	4.00	13.00	-0.16	-0.05	<0.20
PHK	8.41	3.60	42.79	0.00	15.00	-0.11	0.02	>0.20
PFIK	10.04	3.80	37.84	2.00	15.00	-0.34	-1.04	<0.15
SPS	93.30	7.96	8.53	78.00	110.00	0.11	-0.38	<0.20
AFIKT	7.44	3.48	46.77	0.00	13.00	0.23	-0.86	<0.10
SFIKT	80.85	9.02	11.16	60.00	96.00	-0.28	-0.24	>0.20
AHKT	6.00	3.29	54.83	0.00	14.00	0.46	0.87	<0.05
SHKT	23.07	5.45	23.61	14.00	35.00	0.49	-0.35	>0.20
SA	84.22	10.28	12.20	65.00	103.00	-0.35	-0.73	>0.20
SPHK	24.07	5.53	22.39	14.00	35.00	-0.22	-0.54	>0.20

As expected, all variables of precision have a large relative variability and it can be seen through coefficient of variation. Looking at speed of the ball variables, it can be seen that the maximum speed is achieved when measuring variable SPS. Skewness and kurtosis coefficients are consistently relatively low.

As previously stated, in order to analyze the structure of relations of measured variables, canonical correlation analysis was applied between variables and foot instep and head kicking accuracy, precision of foot instep and head kick, foot instep and head kick technique and speed of the penalty kick with one hand, and all other variables on the other side. In Table 2 are the canonical correlation coefficient, coefficient of canonical determination, the value of Bartlett χ^2 test, the number of degrees of freedom and the associated significance of extracted canonical pair and correlation coefficients of all the observed manifest variables with factors of extracted canonical pair.

Table 2: Results of canonical correlation analysis: factor structure matrix (Root1), coefficient of canonical correlation (CanR), coefficient of canonical determination (CanR²), value of Bartlett χ^2 test, degrees of freedom (df) and significance level (p)

	Root 1		Root 1
HKT	0.86	AFIKT	0.37
FIKT	0.92	SFIKT	0.70
PHK	0.29	SPHK	0.86
PFIK	0.39	SHKT	0.48
SPS	0.44	SA	0.47
		BRZPG	0.59
CanR= 0.87; CanR ² =0.75; p=0.00; χ^2 =55.09; df=30			

Results of canonical correlation analysis indicate the existence of only one significant canonical pair and that the observed correlation is relatively high (CanR = 0.87). Also in the table it can be seen that all the coefficients of correlation are positive and none is quite close to zero or completely negligible.

Discussion

From Table 1 it can be seen that all variables, except AHKT have distribution for which it can be concluded that does not deviate significantly from normal. In accordance with the foregoing, it is clear that all the variables are suitable for further parametric statistical analysis. Furthermore, after examining the minimum and maximum values of all speed of the ball variables, it can be seen that used sample is relatively homogeneous. On the other hand, while analyzing all variables of foot instep and head kick precision and techniques it can be seen that there is still possibility for improvement in these dimensions in the observed sample. It was expected that the variable precision, while primary foot or head kick techniques were measured have a larger variability and consequently non-normal distribution but due to relatively small sample only variable AHKT have distribution which significantly deviates from normal distribution.

Results clearly indicate a large and statistically significant canonical correlation between observed sets of variables (Table 2). Probably, existence of reciprocal and nonlinear interdependencies between all observed variables generates high canonical correlation. The first factor of significant canonical pair can be interpreted as a factor of technical performance quality. Measured variables of precision in second canonical factor were certainly of less important for respondents since main objective was to gain the performance quality and respondents did not know that accuracy is also measured. Therefore it is likely that those variables are closer to realization in football game than speed and accuracy when they are measured independently. Therefore, the second factor may be defined as a situational ball speed and situational accuracy. Accordingly, it can be said that a significant correlation between quality of performance and situational speed and precision of foot and head ball kick was identified. From the practical point of view, obtained results clearly indicate the necessity of intensification of technical segments during training of football players.

Foot and head kicks are the basic technical elements and creation of appropriate motor program has impact not only on situational variables of ball speed but also on other prominent technical elements of football games (for example, passing ball to a small/large distance by foot or head). Fully automated and properly learned motor programs certainly allow athletes to optimally structure other complex motions as well as minimizing energy consumption and optimum load of the musculoskeletal and nervous systems. Certainly there are reciprocal relations between the observed variables. For example, higher level of motor knowledge of each technical element will likely generate greater precision during situational performance while probably greater precision when performing a particular technique will likely generate more technique when performing the same. The results are consistent with previous research (Davids et al., 2000) which stated clearly state that although research on coordination and control of soccer skills is currently sparse, there are indications that the relationship between motor control and biomechanics could form a significant component of scientific programs in talent identification and skill development. Same authors state that further interdisciplinary work is needed to enhance understanding of coordination and control of soccer skills. In future studies of this type would be of outstanding importance to extend battery of tests of motor skills, but also to identify and to explain the relations between the variables for different age categories.

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