

FOOTBALL (SOCCER) PLAYERS KINEMATICS AT DIFFERENT DEVELOPMENT LEVELS. PART TWO – RESULTS AND CONCLUSIONS

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The paper presents description of a match play of soccer players at different development levels – Junior, Olympic and Senior Teams. Also different formations were taken into account. Video analysis of the whole match using a picture of the entire pitch was utilised. Kinematics of play differed. Juniors played similar to Olympic players but less intense comparing to senior players. They covered shorter distance, at lower mean velocity. Defenders covered shorter distance with the lowest mean velocity.

KEY WORDS: football (soccer), kinematics, development level, formations

INTRODUCTION:

Tactics is a manner of action according to acquired plan and conditions of action. There is individual tactics, group tactics and entire team tactics. Total body kinematics of individual players' tactics and kinematics of groups and teams' tactics takes into account position occupied by a player, position of the group and team in the pitch according to pitch's lines as a reference system, and also displacement, distribution of velocity within a part or within the whole match, and acceleration of movement.

There is some problem of differences between manner of play during training and during a match. It is not easy to obtain within players such level of engagement during a training as it is needed during a match (Czerwinski 1995, Konarski 2003).

Kinematics of play is based on both team engagement into the game, and also on rules of the discipline. The intensity of play is often diminished. There are many brakes of a play: ball outside a pitch, fouls and execution of free kicks, penalty kicks, exchange of players, contusions of players, etc. Other feature that influence intensity of play are: level of a game, i.e. whether it is a friendly match, qualifying match or final match of the tournament. Still other feature is an instant of a match, i.e. different intensity exists e.g. at the beginning of a match and during an extra time.

A play of young soccer players differs comparing with a play of adult players. Our hypotheses acquired an assumption there is significant difference in kinematics data of young and adult players. The overall aim of this research work was investigation of differences of kinematics data of a play of football players at different level of development. Within the first part of a paper detailed acquisition and processing of data were presented (Erdmann and Dargiewicz, 2006). The aim of this particular paper was presentation of results and discussion taking into account a play of teams at different developmental level and of different formations.

METHOD:

Material: The paper presents investigations on three groups of players belonging to different levels of development. The groups were as follow: 1) Senior ('A') level, 2) Olympic, 3) Junior. Altogether 101 players were analyzed. They played within following teams: 49 in 'A', 26 in Olympic, 26 in Junior teams. Players were divided onto following formations: defenders, midfielders, attackers. No detailed data on goalkeepers were presented in this paper.

Method: Erdmann (1987) proposed recording of a match using stationary video camera equipped with a wide-angle (130°) lens. Camera was situated at an elevated level and at far distance from the pitch. In a viewfinder of a camera the whole pitch was seen. In this way it was possible to obtain data on a position of every player, at every place of a pitch, and at every second of a match – Figure 1.

Protocol: In this paper the following matches were analyzed: 1) Poland – England ('A' level), 2) Poland – Italy ('A' level), 3) Poland – Norway (Olympic level), 4) Poland – Germany (U-16 level). 'A' matches were played in the evening with artificial light. Temperature was below +10 °C. Olympic teams match was played afternoon with natural light. Temperature was below +5 °C. Junior teams played match afternoon with natural light. Temperature was over +10 °C. The wind was significant factor influencing a play.

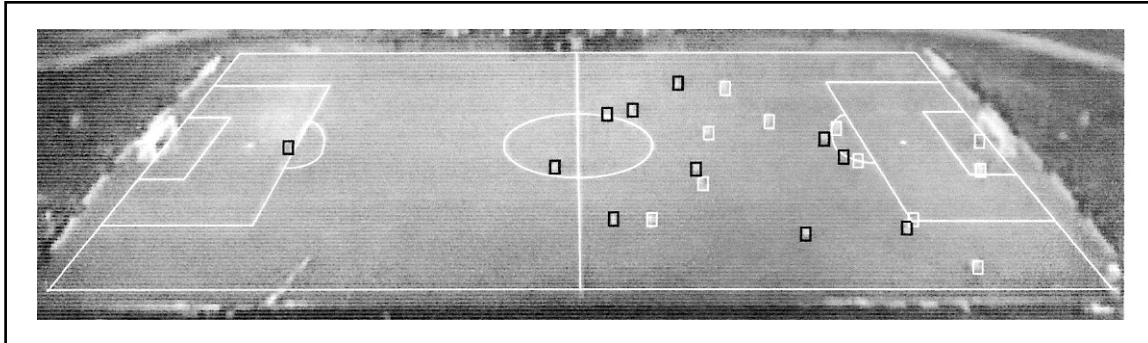


Figure 1: Fragment of a picture seen in the viewfinder of video camera equipped with wide-angle lens.

For every player the following data were gathered: time of play, position in the pitch (Figure 2), distance covered, velocity (Figure 3), acceleration. Based on physiological approach (Eckblom B., 1986; Bangsbo and Lindquist, 1992; Chmura, 1997; Jastrzebski, 2004) and at physiologists' request anaerobic threshold was introduced and acquired at 4.0 m/s level for adults (seniors and Olympic teams) and 3.7 m/s for junior teams. For sprint movement data over 7.0 m/s for adults and 6.0 m/s for juniors were acquired. For acceleration movement data over 2 m/s² were acquired (time and distance covered).



Figure 2: Position in the pitch in 45 min. (from the left): goalkeeper, defender, midfielder, attacker.

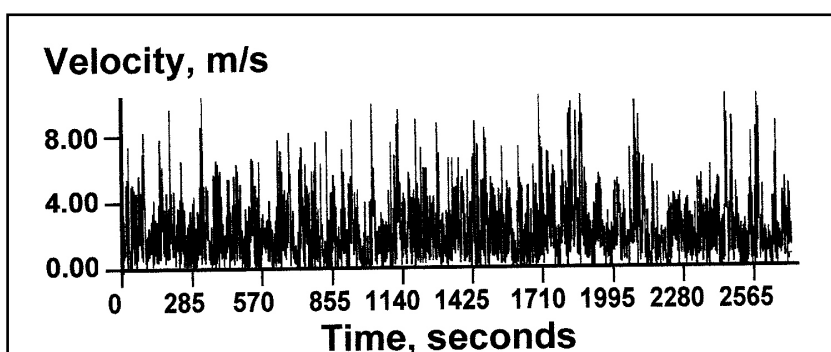


Figure 3: Distribution of velocity of a player in 45 min. of soccer play during a match.

During computerization of a method (program 'Banal' – Kuzora, 1995) every position of all players in the pitch through the entire match at intervals of 1/10th of a second were analyzed. Special indexes /1/ and /2/ were calculated. The higher values of indexes the better.

$$IKP = (TD \times |aD|) / (Tt \times St) \quad /1/$$

where: IKP – Index of kinematics of play, TD – total distance covered, aD – distance covered with acceleration over $2.0 \text{ m}\times\text{s}^2$, Tt – total time of play, St – standing time.

$$IAM = (D+ / TD) \times 100 \quad /2/$$

where: IAM – Index of anaerobic metabolism, D+ - distance covered with velocity above anaerobic threshold, TD – total distance covered.

For comparison of mean data T-test was used. Significant level of difference of mean values was acquired as $\alpha = 0.05$.

Data for Juniors were calculated from 80 min. of regular play to 90 min. in order to obtain a possibility for comparison with Olympic and senior teams which played 90 min.

RESULTS AND DISCUSSION:

Players stood during a match for 400 – 550 s. The longest standing was at Junior teams, then at Seniors. For all teams there were statistically significant differences. Players of teams covered in mean data from 9.4 to 11.9 km, where seniors covered significantly longer distance. Players of different teams walked in mean values about 1.3 to 1.4 km. Seniors moved significantly longer distance with velocity below 4.0 m/s and over 4.0 m/s than other teams. During sprinting seniors and juniors ran significantly longer distance than Olympic players. Taking into account mean velocity seniors obtained significantly bigger value (2.01 m/s) than two other teams (1.74 m/s for juniors and 1.76 m/s for Olympic players). Seniors also covered bigger distance with acceleration over 2 m/s^2 . Detailed data are presented in Table 1.

Table 1 Kinematic data of groups according to age: Junior Teams – Germany and Poland, Olympic Teams – Norway and Poland, Senior Teams – England, Italy and Poland

No.	Quantity	Unit	Junior		Olympic	Senior
			80	90	90	90
	Time	min.				
1	Standing ($v < 0.1 \text{ m}\times\text{s}^{-1}$)	s	489	550	403	452
2	Whole distance covered	m	8377	9425	9639	10866
3	Walking ($v < 1.1 \text{ m}\times\text{s}^{-1}$)	m	1257	1414	1332	1374
4	Running ($v < 4.0 \text{ m}\times\text{s}^{-1}$)	m	7090	7977	8203	9234
5	Running ($v \geq 4.0 \text{ m}\times\text{s}^{-1}$)	m	1287	1448	1436	1632
6	Sprinting ($v \geq 7.0 \text{ m}\times\text{s}^{-1}$)	m	213	240	206	267
7	Number of sprints		25	28	28	32
8	Mean velocity	$\text{m}\times\text{s}^{-1}$	1.74	1.74	1.76	2.01
9	Maximal velocity	$\text{m}\times\text{s}^{-1}$	8.1	8.1	8.6	8.7
	Acceleration ($a > 2.0 \text{ m}\times\text{s}^{-2}$)					
10	Time	s	105	118	138	153
11	Distance	m	549	618	695	762

Adapted from: Dargiewicz (2005)

Note: Senior and Olympic Teams play entire match 90 min. while Junior Teams play 80 min. Data of 90 min. match for Junior Teams were calculated.

Comparing kinematics data of formations (defenders, midfielders, attackers) in compound values, i.e. common for junior, Olympic and senior teams the longest time of standing was obtained for attackers, the longest distance covered and mean velocity was obtained by midfielders. Detailed data are presented in Table 2.

Index of kinematics of play (IKP) was the highest among senior players: 3.4, medium among Olympic players: 3.1, the lowest among junior players: 2.0. Defenders gained 2.5, midfielders 3.1 and attackers 2.9.

Distance covered of running with velocity over anaerobic threshold comparing to total distance covered (IAM index) was similar to all three teams of different development, i.e. 15 - 16 %. Taking into account formations this index was also similar: 15.3 – 15.8 %.

Hypotheses was proved. Younger players had different kinematics of play. They moved shorter distance with lower velocity. Their index of a play was worse comparing to adults.

Table 2 Kinematics data of different formations: defenders, midfielders, and attackers of compound data for Junior, Olympic and Senior Teams.

No.	Quantity	Unit	Defenders	Midfielders	Attackers
1	Standing ($v < 0.1 \text{ m}\times\text{s}^{-1}$)	s	474	458	484
2	Whole distance covered	m	9269	10541	10199
3	Walking	m	1376	1350	1418
4	Movement ($v < 4.0 \text{ m}\times\text{s}^{-1}$)	m	7854	8976	8650
5	Movement ($v \geq 4.0 \text{ m}\times\text{s}^{-1}$)	m	1414	1564	1549
6	Sprinting ($v \geq 7.0 \text{ m}\times\text{s}^{-1}$)	m	210	246	255
7	Number of sprints		26	32	31
8	Mean velocity	$\text{m}\times\text{s}^{-1}$	1.71	1.95	1.89
9	Maximal velocity	$\text{m}\times\text{s}^{-1}$	8.33	8.54	8.58
	Acceleration ($a > 2.0 \text{ m}\times\text{s}^{-2}$)				
10	Time	s	128	143	143
11	Distance	m	648	724	716

Adapted from: Dargiewicz (2005)

Note: Data for Junior Teams were calculated from 80 min. to 90 min. of play.

CONCLUSIONS:

Taking into account juniors their kinematics of play in some quantities should be improved. They had much lower data than Senior Team, while their distance covered and mean velocity of running was similar to that of Olympic Team. Attention should be paid taking into account defending formation. Its mean velocity should be better. This can be achieved by more active play during attacking an opponent, i.e. by running along the side lines to help midfielders and attackers from the side of a pitch.

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