Actions with the Ball that Determine the Effectiveness of Play in Women's Football

by
Andrzej Soroka[1], Józef Bergier[2]

Various actions with the ball performed by players during football matches encourage continuous research on game observation to be carried out. It is of special significance in providing information about players and their contribution to the effort of the whole team. Both quantitative and qualitative records enable transformation of the information obtained into data supporting training tasks. In the opinion of the authors, the determination of a winning team is affected to the greatest extent by qualitative factors in the form of coefficients of accuracy and efficiency of particular actions with the ball. A hypothesis was advanced in the study that in women's football there are ball actions whose quality of execution affects winning a match, and that there exists a specific ranking of their significance. Analyses were conducted for nearly 18,000 actions performed with the ball by 130 players, competitors in the European Women's Football Championship in 2005. Statistical tests applied in the study enabled differences between teams of winners and losers to be defined, whereas the analysis of a discriminant function indicated which qualitative factors were the most significant and had the greatest impact on winning a match. A specific hierarchy of the significance of those activities was also elaborated in the study. The most significant activities that affected the victory were: 1x1 play in defense, 1x1 play in offense, accuracy of passes and effective execution of dead-ball situations.

Key words: Women's Football, Championship, analyses

Introduction

Football is amongst the most popular sports disciplines recently chosen by women. A decisive moment in development for football was its adoption to the program of Olympics Games that took place in Atlanta in 1996. However, worth noticing is the fact that, taking Iran as an example, that women's football meet in many countries considerable difficulties. Its inclusion in the program of the Olympic Games in Atlanta in 1996 should be regarded as the turning point in the development of women's football, although it is worth mentioning that, as exemplified in Iran, it still faces great difficulties (Fozooni, 2008). The participation of women in football has encouraged researchers to investigate the behavior of their organisms as affected by playing the game. Studies were undertaken to explore such issues linked with the specificity of a woman's organism as: the menstruation cycle (Bonekat et al., 1987), body adiposity (Davis and Brewer, 1993), energy expenditure (Krustrup et al., 2008; Miles, 1993), maximum oxygen uptake (Davis and Brewer, 1992; Krustrup et al., 2005; Rhodes and Mosher, 1992), morphological components of the body (McKay and Shephard, 1988; Wells and Reilly, 2002), and recently also an extremely significant problem, namely injuries (Faude et al., 2005; Junge et al., 2006; Tscholl et al., 2007; Junge et al. 2007).

In order to study specific actions performed during the football game, the method of observation is very useful because defining the players' actions de-

[1] - *The Pope John Paul II University in Biala Podlaska, Poland*
[2] - *Academy of Physical Education, Warsaw External Faculty of Physical Education, Biala Podlaska, Poland*

livers information about the contribution of each of them to collective effort of team, as a whole (Barros et al., 2007, Di Salvo et al., 2007). Through the observation, the structure and functional characteristic of football players form the world elite is described (Reilly et al., 2000, Helgerud et al., 2001). Research has also been carried out on the specificity of women's play in terms of their actions with the ball (Bergier, 1997; Bergier and Buraczewski, 2005, Bergier, Soroka and Buraczewski, 2008; Konstadinidou and Tsigilis, 2005; Tumilty and Derby, 1992) and distance covered during a match (Hewitt et al., 2007; Mohr et al., 2007; Scott and Drust, 2007).

The range of issues linked with the specificity of women's football elucidated so far encourages further research into more accurate recognition of their contribution to the game. Special significance seems to be the issue of identifying those actions with the ball that determine winning a match to the greatest extent. Their identification may contribute to further rationalization of training aimed at achieving success in women's football.

Particularly interesting research issues refer to the most important premises for trainers, i.e. factors that determine victory in a match. Most authors analyzed shots at goal presenting sample data exemplified in the best national teams. The research on the symmetry of shots at goal in the 1978 World Championship (Starosta, 1988) showed that right leg was dominant among footballers – 69.8%. The opposite tendency, however, was characteristic of the world champions – Argentinean footballers who showed the preference for shots with their left leg – 56.2%. The issue of shots was continued by Wrzos (1991) who analyzed the 1990 World Championship and pointed out that the winner (German national team) had the highest index of accuracy of passes - 60.7%, and the index of effectiveness came to 12.8%. The research on the 1988 European Championship and 1990 Junior European Under- 16 Championship (Bergier, 1998) demonstrated that winning teams had statistically much higher indices in dribbling.

The analysis of the 1994 World Championship (Loy, 1995) indicated that champion and vice champion teams had the best indices in 1x1 play in defense: the index of Brazilian team was 69.5%, and of Italian team – 67.7%. These results were confirmed by Bergier (1998) who stated that in the play of seniors the action with the ball that determines winning a match is the effectiveness of 1x1 play. Its indices in top teams come to 70%.

The aim of the study was to identify actions with the ball, and their qualitative dimensions in particular, which have the greatest impact on winning a match, and the resultant differences and dependences.

In terms of the research problem, the type of research was stipulated as empirical, which enables formulating conclusions that will be practically applied in women's football training in order to improve the effectiveness of play.

The identification of factors that may determine success does not seem easy. However, such attempts should be undertaken even in the case of the immeasurability of a sports discipline such as football. This will promote the intended improvement of the training process.

Research hypothesis:

1. In football game there are certain qualitative factors whose performance conditions the victory. There is also their specific rank.
2. The players of victorious teams undertake 1x1 play more often than the players of losing teams and they perform it more effectively.

Material and Methods

The material for the study comprised observations of all 130 women players who participated in the VI European Senior Women's Football Championship held in England in 2005.

Observations were made for 15 (all) matches, and the total observation time reached 1380 minutes, in which analyses were carried out for nearly 18,000 actions with the ball performed during the game.

The research was empirical in character, and in its scope the most useful element turned out to be the method of observation, understood as intended, planned and systematic perception as well as gathering and analysis of facts, events and phenomena.

From the applicatory perspective, the observation was indirect in character owing to the use of DVD records. The observation was conducted while playing back the football matches recorded previously on DVDs from the TV broadcast. Analyses were carried out for: the accuracy of passes, effectiveness of shots, effectiveness of one-on-one play in general but also in offensive and defensive actions, and for the effectiveness of offensive actions that were classified as fast attack, positional attack and attack after a dead-ball situation, with a division into teams of winners and losers in each match..

A statistical analysis of the study results was done using the *Statistica* software. Use was made of the Student t-test for independent variables, and of the Mann-Whitney U test for a lack of normal distribution of the variables. The tests were applied to determine differences in the qualitative factors occurring between teams of the groups analyzed. Actions with the ball with the greatest significance for winning were identified by means of the analysis of a discriminant function.

Results

An argument for the advisability of the study undertaken was the fact that the authors have focused on the basic actions performed with the ball in order to avoid the multiplicity of information that could hinder the proper conclusion. An additional advantage was that analyses were conducted as a whole (i.e. for all matches), for all players that participated in the Championship, and for all basic actions performed with the ball. The level of significance was adopted at p<0.05 for analyses of differences in the qualitative factors between teams of winners and losers.

All the analyzed actions were observed to be performed with a greater frequency by the winning teams, which may indicate a considerably higher game activity in that group of teams (Table 1).

A comparative analysis of the qualitative activities of technical elements allowed the selection of those whose effectiveness of performance, in statistical terms, significantly differentiated the teams of the winners and the losers. Such elements included: accuracy of passes, accuracy of shots, total effectiveness of 1x1 play, effectiveness of 1x1 play in attack, effectiveness of 1x1 play in defense, and effectiveness of the form of an offensive action (i.e. execution of dead-ball situations) (Table 2 and 3).

Based on the analysis of a discriminant function, a search was made amongst the earlier selected variables for those which contribute to group discrimination, namely factors that affect significantly the winning of a match.

Table 1

Quantitative and qualitative differences in technical and tactical elements performed by the winning and losing teams

Analyzed activity	Winning teams		Losing teams	
	Number	Coefficient of effectiveness*	Number	Coefficient of effectiveness
Accuracy of passes	5435	76.1	5091	67.4
Total effectiveness of	2351	56.9	2351	43.5
Effectiveness of 1x1 play in offense	1175	49.5	1175	35.7
Effectiveness of 1x1 play in defense	1175	62.7	1175	49.4
Effectiveness of shots	34	20.6	12	9.2
Effectiveness of fast attack	15	17.2	6	8.8
Effectiveness of positional attack	9	27.2	2	16.7
Effectiveness of executing dead-ball	14	27.7	4	6.8

determined by accurate and effective actions

Table 2

Differentiation of technical and tactical actions of the winning and losing teams analyzed by means of the Student's t-test

Technical actions	Winning teams		Losing teams		Student s t-test	
	Mean value of effectiveness coefficients	Standard Deviation	Mean value of effectiveness coefficients	Standard Deviation	Value of Student's t-test	Level of significance *p*
Effectiveness of 1x1 play in defense	64.8	6.9	51.1	5.7	5.258	0.001*
Effectiveness of 1x1 play in offense	48.8	5.7	35.2	6.9	5.258	0.001*
Effectiveness of shots	20.6	6.8	9.2	10.1	3.234	0.003*

determined by accurate and effective actions

In this way, variables were selected that formed a "model" to be used in further analyses: effectiveness of 1x1 play in defense, effectiveness of 1x1 play in attack, accuracy of passes and effectiveness of the execution of dead-ball situations. The value of the general statistics of the "model" in the Wilks lambda test reached – 0.091, at F – 35.748. The lowest value of partial Wilks lambda was determined for the variable describing the effectiveness of 1x1 play in defense and the variable describing the effectiveness of 1x1 play in offense. Both variables had high F values of elimination. The variable describing the accuracy of passes also appeared to show significant statistical differentiation. Despite a lack of significant differences in the variable describing the effectiveness of executing dead-ball situations, it was also included in the formed "model" of a discriminant function. The significance of those variables is additionally indicated by the values of explained variables presented as 1 minus R square ($1-R^2$) a given variable at the inclusion of all other variables to the current "model" (Table 4).

Another step of the study involved carrying out a canonical analysis that formulated a discriminant function. Owing to two groups of variables (i.e.: teams of winners and teams of losers), one discriminant function was established following a rule that the number of discriminant functions cannot exceed the number of groups minus one. A low value of the Wilks lambda coefficient indicates a high discriminating power of that root. Nearly total canonical correlation that occurred between the groups analyzed and the discriminant function, as well as a high value of the hi-square test, confirmed the significance and the power of the discriminant function formulated (Table 5).

The formulated function explained 100% of the total discriminant power. Crude results of coefficients after standardization explained and determined the contribution of the variables in the canonical function. The study showed that the greatest contribution to the formulated function was made by discriminant variables describing the effectiveness of 1x1 play in both defense and offense. In turn, the

Table 3

Differences between the winning and losing teams analyzed by means of the Mann-Whitney U test

Technical activities	Sum of ranks of the winners	Sum of ranks of the losers	Value of U Mann-Whitney test	Accurate *p*
Accuracy of passes	208.0	92.0	14.0	0.001*
Total effectiveness of 1x1 play	222.0	78.0	22.0	0.001*
Effectiveness of fast attack	181.0	119.0	41.0	0.078
Effectiveness of positional attack	120.0	70.0	34.0	0.442
Effectiveness of executing dead-ball	187.5	112.5	34.5	0.028*

*determined by accurate and effective actions

Table 4

Results of the selection of discriminant variables constituting the "model" of variables to be used for further analyses

"Model" variables	Wilks lambda	Partial Wilks lambda	F of elimination (2.30)	Level of significance *p*	Tolerance value	1-Tolerance (R-square)
Effectiveness of 1x1 play in defense	0.264	0.346	33.98	0.001	0.542	0.457
Effectiveness of 1x1 in offence	0.198	0.461	21.03	0.001	0.595	0.404
Accuracy of passes	0.123	0.739	6.350	0.021	0.794	0.205
Effectiveness of executing dead-ball	0.108	0.841	3.398	0.081	0.892	0.107

Table 5

Chi – square test of subsequent roots (discrimination functions)

Eliminated root	Own value	Canonical R	Wilks lambda	Chi-square	*p* level
0	9.930	0.953	0.091	46.634	0.001

discriminant variables describing the accuracy of passes and execution of dead-ball situations had a considerably smaller contribution to the function (Table 6).

The significance of the effectiveness of 1x1 play in defense, the effectiveness of 1x1 play in offense, the accuracy of passes and the effectiveness of executing dead-ball situations was also indicated by the values of intra-group correlations between the primary variables and the discriminant function (Table 7).

Results of standardized discrimination coefficients and those of structural coefficients enabled the establishment of a rank of significance of those actions with the ball, during a game, which most greatly influenced the effectiveness of play during the European Women's Football Championship in 2005. The most significant actions resulted from effective 1x1 play in defense and offense, accurate passes and effective execution of dead-ball situations.

Discussion and Conclusions

In research carried out on the effectiveness of men's play in top football competitions an attempt was made to characterize the effectiveness of play actions with the ball performed by winning teams. The research concerned shots mainly (Starosta and Bergier 1992; Luthanen, Korhonen and Ilkki 1997). Based on this research, sample characteristics of shot effectiveness were presented on the example of the best teams. Over the years, greater attention has

been paid to the search of actions with the ball that differentiate winning and losing teams by analyzing various game elements. Other studies indicated that in order to win, the effectiveness of 1x1 play is indispensable and particularly 1x1 play in defense (Loy 1995; Luhtanen, Hayrinen and Vantinen 1999).

The role of defense actions seems to have been noticed first by Brazilian coaches whose team despite of playing impressively, stopped achieving successes in World Championships in 1980. As practitioners and theoreticians stated then, one of the main reasons for the weaker play of Brazilian team was their worse preparation to play in defense. The improvement of players' defense skills let the team in 1999 become the world's best footballers again. High effectiveness of Brazilian team in 1x1 play in defense in the1994 World Championship was indicated by Loy (1994) in his research. The significance of 1x1 play in defense was confirmed by the analyses of the1998 World Championship carried out by Luhtanen, Hayrinen and Vantinen (1999).

The significance of the ability of 1x1 play results from the fact that it constitutes the complex of consecutive actions. In 1x1 play in offence these actions are as follows: the ability to dribble the ball, feints with the ball, body play; in 1x1 play in defense these actions are: overtaking an opponent, reaction or the lack of reaction to the feint movements, body play, the ability to perform sliding tackle. Moreover, it should be remembered that 1x1 duels are performed at high speed and quite often in direct closeness to

Table 6

Coefficients of discrimination function

Discrimination variable	Function 1	
	Crude	Standardized
Constant	27.708	
Effectiveness of 1x1 play in defense	0.181	1.151
Effectiveness of 1x1 play in offense	0.159	0.998
Accuracy of passes	0.123	0.601
Effectiveness of executing dead-ball	0.020	0.442
Own value	9.930	
Per cent of variation	100%	

Table 7

Structural coefficients

Discrimination variable	Root
Effectiveness of 1x1 play in defense	0.300
Effectiveness of 1x1 play in offense	0.360
Accuracy of passes	0.292
Effectiveness of executing dead-ball situations	0.173

the goal, thus good psychological preparation of the player is indispensable to carry out such action.

So far, the search for the effectiveness of play has concerned the research on male teams. The research carried out by the authors of the paper concerned the play of women in the 2005 European Championship and confirmed the importance of the effectiveness of 1x1 play, especially in defense, as a factor that determines the victory. The average number of 1x1 duels played by women in the tournament analyzed by the authors was comparable with the research on the footballers of the Champion League carried out by Gerisch and Reichelt (1993) as well as by Bauer (1996) who made observations of the 1996 European Men's Championship. Diversity in frequency and effectiveness of 1x1 duels depending on the position on the field was found among women as well as men (Loy 1998).

The importance of the effective passes which was demonstrated in the research on the women's play confirmed previous analyses of male teams (Dufour 1993, Grand et al. 1998). There exists suggested by Yamanaka, Hughes and Lott (1993) as well as by Milijkovic, Jerovic and Simenc (2002) diversity in the number of passes which are conditioned by the competence of individual teams as well as by their level of tactical-technical advancement. In addition, the study enabled the identification of ball actions whose quality of performance determined victory in matches and the determining of a specific ranking of

their significance. The most significant actions that influenced victory were: effective 1x1 play in defense and offense, a higher index of the accuracy of passes and effective execution of dead-ball situations.

The data obtained in the study have important implications for the training process of women football players. They indicate that effective 1x1 play in both defensive and offensive actions. Worth remembering, however, is the fact that such skills are among the most difficult to master, for they test a player's capabilities in direct contact with an opponent without the possibility of any support from a team partner. Therefore, practical activities undertaken in the training process should include the development of that capability.

Significant importance in this respect is also ascribed to the quality (accuracy) of passes – the basic action of play during the game, and to the effectiveness of executing dead-ball situations. Mastering both those skills by women football players determines their achievement of success to the greatest extent.

The lack of similar studies on the factors that determine success in women's football does not allow to deepen the comparative analysis in terms of conducted research. Such situation encourages researchers to continue study which will enable to determine in a more precise way tactical-technical actions that condition the effectiveness in women's play.

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Corresponding author

Soroka Andrzej
The Pope John Paul II University in Biala Podlaska, Poland
95/97, Sidorska str. 21-500 Biała Podlaska, Poland
Mobile phone: +48 501 232 151
Fax: +48 83 342 65 31
E-mail: wachmistrz_soroka@o2.pl

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