



Performance Indicators of Winning and Defeated Female Handball Teams in Matches of the 2012 Olympic Games Tournament

by

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The aim of the study was to determine performance indicators of winning and defeated women teams of the 2012 Olympic Games handball tournament. The sample of entities consisted of 27 games played during the preliminary round of the competition. The sample of variables consisted of the completed and unsuccessfully executed technical and tactical handball elements in attacking and defensive actions during handball matches (14 variables describing performance in attack and three variables related to defensive play). The differences between the winning and defeated teams in performance variables were determined using the Mann-Whitney U-test. The results showed statistically significant differences between the winning and defeated teams in the following variables: successful fast-break shots (5.11 ± 2.79 vs. 3.00 ± 1.88), unsuccessful wing shots (2.33 ± 1.24 vs. 3.67 ± 1.98), unsuccessful long-range shots (10.70 ± 3.98 vs. 13.37 ± 4.33), steals (5.48 ± 2.28 vs. 4.04 ± 2.07), and assists (13.81 ± 4.04 vs. 11.37 ± 3.59). The winning teams were better in the variables defining offensive performance effectiveness, especially with regard to successful performance of counter attacks; they also had higher efficiency of attacking actions with a strict selection of distance shots and wing shots, as well as a higher number of assists and steals.

Key words: *technical-tactical elements, team handball, the Olympic Games, women, performance, notational analysis.*

Introduction

Performance indicators that reflect situational efficiency of individual players in a team are collected by the methods of their registration in the course of a competition (real time), or during a subsequent viewing of match recordings, or by their combination (Hughes and Bartlett, 2008). Video recordings of matches are particularly valuable because they allow handball experts to assess and analyse technical-tactical and other situation-related elements of players' behaviour in games. Each match and players' behaviour in it is a specific manifestation of athletes' abilities, traits, skills, knowledge and other characteristics, but it is also a reflection of the work performed by coaches and other team supporting personnel. However, every confrontation of the same two opponents

produces only a similar, but never the same development or outcome of the game (Hughes and Franks, 2004), due to multifactorial nature of team sports games. Yet, coaches and researchers of handball can create probable profiles of play style of a particular team. Using the game inherent indicators, it is possible to assess performance of a team as the whole and of its individual players in game specific situations. Unfortunately, a defined and unified way of performance-relevant data registration, that could give a precise insight into on-court events, does not exist. Notational analysis of selected performance indicators is perhaps the best method created up to date. Application of its results to the design of the process of modern training and competition strategy in handball and

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other team sports is indispensable if high sports goals are a target. The game of handball is characterized by different typical and atypical situations in a match, therefore we need objective observation and registration of certain game situations and of performance variables (behaviour) of each player under competitive conditions. During a match, it is possible to record every successful and unsuccessful move each player has made; for example: shots on goal, number of goals scored from different playing positions, efficiency of shots on goal, turnovers, technical mistakes, suspensions, goalkeeper's saves and more. In this way, it is possible to register objective variables of competitive activity, as well as the number and efficiency of various technical-tactical activities performed by players and teams. Based on these data the coach and coaching staff can competently evaluate contribution of each player to play in attack and/or defence, and to the final team result in competition.

Previous studies of performance in handball have been focused more on the analysis of men World and European championships and Olympic tournaments than on their female counterparts (Prieto et al., 2015). Most of those studies relate to the frequency of several technical-tactical activities in the game and their application efficiency in some phases of the handball game (Kovacs, 2015; Smits et al., 2011; Taborski, 2013; Tuma et al., 2011; Varbanov, 2013) and, by nature, they are descriptive analyses of standard variables specific to an individual team performance at several international competitions. Several researchers have determined the influence of differently structured indicators of situational efficiency on the outcome of games (Gruić et al., 2005; Ohnjec et al., 2008). They established that successful back-court players' shots and those taken from the wing and 6 m-line positions had a statistically significant influence on the match outcome defined in terms of goal difference. The most interesting research problems included differences between winning and defeated female handball teams. Results of those research studies indicated that performance or success in a game was substantially defined by the successful outcome of counterattacks (Bajgorić et al., 2016; Ohnjec et al., 2013, 2015) and by the successful prevention of positional attacks and

counterattacks (Hianik, 2013); also, the overall efficiency in attack (shot efficiency) was significantly lower in the defeated than in the winning teams (Yamada et al., 2014). Winning teams are superior in the performance of shots on goal, the number and successful realization of counterattacks as well as in the number of goalkeeper's saves during a match (Vurgun et al., 2014).

The aim of this research was to establish probable differences between the winning and defeated female teams, participants of the Olympic handball tournament in London in 2012, in variables of performance indicators, i.e. situation-related efficiency of players. We aimed at determining which variables of game performance, i.e., which technical-tactical activities, performed by handball players, had the greatest influence on a positive game outcome - victory in a handball game.

Methods

Participants

The sample of entities consisted of 27 matches, that is of attacking and defensive actions of 54 opposing handball teams during the preliminary round of the competition at the 2012 Olympic Games in London. Twelve national teams participated in the tournament (nine from Europe and three teams represented South America, Africa and Asia) divided into two groups of six teams. In a group, every team played five matches of the preliminary round. A total of 30 games were played in the preliminary round, but in this study only the resolved matches were analysed (the matches that ended with a victory for one team and a defeat for the other). Thus, game performance was analysed in 27 matches, which means that play activities of 27 winning and 27 defeated teams were analysed. The number of 54 entities was regarded sufficient to test the proposed hypotheses with the determined number of degrees of freedom, that is, the criterion of statistical power of inference and generalization of the results was satisfied.

Measures

The method of notational analysis was used to collect data. The sample of variables consisted of frequencies of successfully and unsuccessfully executed technical-tactical elements of game, performed during 27 handball

matches in the phases of attack and defence. The 17 analysed variables were 14 indicators of game performance (situational efficiency) in the phase of attack and three indicators of game performance in the phase of defence (Table 1). Shots on goal, taken from different playing positions, are presented as successful or completed (COMP) and unsuccessful (MISSED) shots. All data were officially collected by the IHF notators. The IHF official game statistics is posted at the official website www.ihf.info/.

Statistical Analysis

Within descriptive statistics, the following central and dispersion parameters of the observed variables were determined: Mean: arithmetic mean, SD: standard deviation, Min: minimum value, and Max: maximum value. To determine differences between the winning and defeated teams in game performance variables, the Mann-Whitney U-test was used and the following indices were calculated: Σ_{rwin} : sum of range values of the winning teams, Σ_{rdef} : sum of range

values of the defeated teams, U: value obtained by testing the statistically significant differences, Z: value for the U approximation for big samples, p: statistical error allowing the acceptance of the hypothesis where the difference is statistically significant. The level of statistical significance was set at $p = .05$.

Results

The descriptive statistical data of variables for the winning and defeated female handball teams and the results of the Mann-Whitney U-test are presented in Table 2. The following differences between the winning and defeated teams in game performance variables were obtained in the variable successful fast-break shots (FBSCOMP) at the significance level of $p = .01$ and in four variables at the level of $p = .05$: unsuccessful long-range shots (9MSHMISSED), unsuccessful wing shots (WSHMISSED), steals (ST) and assists (ASS).

Table 1

<i>Sample of variables</i>	
Variable	Description
6MSHCOMP	successful line shots, taken from the 6-metre line – a goal scored
6MSHMISSED	unsuccessful line shots, taken from the 6-metre line – no scoring
WSHCOMP	successful wing shots, taken from either wing position – a goal scored
WSHMISSED	unsuccessful wing shots, taken from either wing position – no scoring
9MSHCOMP	successful long-range shots, taken outside the 9-metre line (back-court positions) – goals scored
9MSHMISSED	unsuccessful long-range shots, taken from the back-court positions – no scoring
7MSHCOMP	successful 7-metre throws (penalty) – goals scored
7MSHMISSEC	unsuccessful 7-metre throws (penalty) – no scoring
FBSHCOMP	successful fast-break shots – goals scored
FBSHMISSED	unsuccessful fast-break shots – no scoring
BTSHCOMP	successful break-through shots, taken after a break through the defence wall – goals scored
BTSHMISSED	unsuccessful shots taken after a break through the defence wall – no scoring
ASS	assists
TO	turnovers
ST	steals
BLSH	blocked balls/shots
2MIN	2-minute suspension

Table 2
Descriptive statistics of the performance variables registered for either the winning or defeated female handball teams and results of the Mann-Whitney U-test of the difference between the successful (winning) and unsuccessful (defeated) female handball teams

Variable	Winning teams	Defeated teams	Different from the		
	Mean \pm SD (Min-Max)		winning team	z	p
6MSHCOMP	5.26 \pm 2.88 (1-13)	4.37 \pm 2.53 (0-9)	+0.94	0.95	0.34
6MSHMISSED	1.78 \pm 1.78 (0-6)	1.81 \pm 1.66 (0-7)	-0.03	-0.32	0.75
WSHCOMP	3.96 \pm 2.07 (1-10)	3.81 \pm 1.73 (1-8)	+0.15	-0.10	0.92
WSHMISSED	2.33 \pm 1.24 (0-5)	3.67 \pm 1.98 (1-8)	-1.34	-2.40	0.02
9MSHCOMP	7.22 \pm 2.85 (2-13)	6.19 \pm 3.29 (0-13)	+1.03	1.16	0.25
9MSHMISSED	10.70 \pm 3.98 (5-20)	13.37 \pm 4.33 (7-21)	-2.67	-2.32	0.02
7MSHCOMP	2.85 \pm 1.92 (0-7)	2.70 \pm 2.09 (0-8)	+0.15	0.36	0.72
7MSHMISSEC	0.81 \pm 1.00 (0-4)	1.11 \pm 1.09 (0-3)	-0.3	-0.99	0.32
FBSHCOMP	5.11 \pm 2.79 (1-10)	3.00 \pm 1.88 (1-6)	+2.11	2.79	0.01
FBSHMISSED	1.37 \pm 1.33 (0-5)	1.26 \pm 1.51 (0-5)	+0.11	0.62	0.53
BTSHCOMP	3.67 \pm 2.48 (0-11)	2.59 \pm 1.58 (0-6)	+1.08	1.60	0.11
BTSHMISSED	1.63 \pm 1.31(0-5)	1.15 \pm 1.41 (0-5)	-0.48	1.63	0.10
ASS	13.81 \pm 4.04 (7-22)	11.37 \pm 3.59 (5-19)	+2.44	2.13	0.03
TO	15.22 \pm 4.66 (7-25)	17.07 \pm 5.29 (8-29)	-1.85	-1.18	0.24
ST	5.48 \pm 2.28 (2-10)	4.04 \pm 2.07 (1-8)	+1.44	2.24	0.03
BLSH	2.67 \pm 1.66 (0-6)	2.26 \pm 1.81 (0-6)	+0.41	0.90	0.37
2MIN	3.26 \pm 1.75 (0-7)	2.63 \pm 1.62 (0-7)	+0.63	1.27	0.20

Discussion

The aim of the present study was to establish differences between the winning and defeated women teams participating in the London 2012 Olympic handball tournament in the variables of game performance. The first main finding of the study is that the winning teams had higher shot efficiency in almost all shooting variables. Comparing performance indicators of the winning teams obtained in this study with the ones reported by Foretić et al. (2011), Hianik (2013), Ohnjec et al. (2008), Vurgun et al. (2014) and Yamada et al. (2014), it can be concluded that the obtained indicators are quite similar in respect of frequencies and execution efficiency. The defeated teams showed a trend of improving their play standard in the average number of successful line shots and successful fast-break shots. The teams from this study reached higher values in the same variables that had been established by Ohnjec et al. (2008) and Vurgun et al. (2014). The greatest relative differences in shooting efficiency

were found in the variables of shooting from wing and back-court positions, followed by shooting from fast breaks and in penalty throws. The smallest difference was found in line shooting. Both the winning and defeated teams were equally efficient in shooting after breakthroughs.

The second major finding is a set of game performance variables that differentiated between the winning and defeated teams: successful fast-break shots, unsuccessful long-range shots, unsuccessful wing shots, steals and assists. The difference between the winning and defeated teams in the variable successful fast-break shots is in compliance with the results established by Hianik (2013), Ohnjec et al. (2013, 2015), Vurgun et al. (2014) and Yamada et al. (2014). The winners base their play tactics on the execution of quick attacks (fast breaks and quick throw-offs) against an unorganized opponent's defence, whereas the defeated teams are forced to play longer positional attacks as a way of longer possession of the ball. The winning teams performed fewer unsuccessful shots from the wing positions than

the defeated teams, which was also established by Grujić et al. (2005) and Ohnjec et al. (2008) who used goal difference as the efficiency criterion variable. The finding corresponds with the shooting efficiency model for wings, established by Czerwinski (2000), whereas the backcourt players' values were slightly lower than those in the model. It is evident that the winning teams averaged fewer unsuccessful long-range shots than the defeated teams. In accordance with the classical theory of handball, diversity of technical-tactical activities in the repertoire of winning teams creates more selectable viable solutions for the finalization of their attacks. The winning and defeated teams differed significantly in the variable steals. Ohnjec et al. (2015) established that steals of the winning teams enabled the application of a greater number of fast breaks, which had high scoring efficiency. Quality play of a handball team in the phase of attack is manifested in the number of assists, i.e., of the last passes executed prior to successful shots. The explanation lies in a higher quality of winners' play organization in the closing phase of attack, based primarily on group and/or team cooperation (Hergeirsson, 2008).

Based on the findings of the current study, a profile of optimal performance of elite female handball teams in the phases of defence and attack can be outlined. Winners construct their play on quick attacks (they perform a lot of counterattacks and quick throw-offs) against the unorganized opponent's defence. Success of such a strategy depends on their quality play in defence, on the efficiency of their goalkeepers, as well as on a high level of technical-tactical skills and physical fitness. Fewer unsuccessful shots from the wing positions in play of winners may be explained by their strategy to create realization opportunities for their wings by well-trained play combinations founded on a quick ball circulation and cooperation between the backcourt and wing players. The already mentioned diversity of technical-tactical activities of the winning teams creates more opportunities to finish their attacks by distance shots from backcourt positions. They successfully prepare shots from a greater distance by optimal tactical actions, but they also apply other types of attack finishing, like individual feinting back court players or passing to a pivot player. The winning teams win more ball

possessions (steals) by playing an organized, active and strictly controlled defence, which in turn allows them to execute a higher number of counterattacks with successful realization. Many assists in play of successful teams, winners, in terms of tactics mean that their play in the phase of attack is highly organized and that they make the simplest tactical decisions usually resulting in attack closer to the 6 m-line. Relatively low efficiency of long-range shots in female handball directs the game in attack towards searching for gaps or less dense areas in the defensive wall (Foretić et al., 2011) by a rapid ball circulation, feinting, or jumping over the goalkeeper's space and by different quality passes to the pivot.

Future studies should follow trends of change in certain match performance or situation-related efficiency variables of female handball teams across as many matches as possible that are played at several World and European Championships over several Olympic cycles. Also, physical indicators of match play, i.e., total distance covered, distances covered at various velocities, or acceleration moves (Michalsik et al., 2014), as well as information on intellectual and emotional characteristics of players (Manchado et al., 2013) must be included in further studies to allow better understanding of multifactorial handball playing performance.

In conclusion, the analysed game performance indicators in elite female handball show that the winning teams are superior in the variables that belong to the tactics of play in attack, meaning that the winners' attack play profile includes a successful implementation of fast breaks (counterattacks) and successful finalization of attacks with a strict selection of shots taken from the back-court and wing positions, then a higher number of assists and as many steals as possible. All the listed and investigated indicators of match performance are deeply rooted in different types of technical-tactical actions players execute in the phases of attack and defence and are, therefore, indispensable training contents of annual and perennial sports preparation cycles of female handball players of all age categories, but they are also critical components of tactical plans for the oncoming match.

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