**INDICATORS OF SITUATIONAL EFFICIENCY OF *PPD ZAGREB* AND *MVM VESZPREM* HANDBALL PLAYERS IN REGULAR**

**2015. / 2016. *SEHA* LEAGUE SEASON**

**Abstract**

The players’ situational efficiency parameters are important for experts, trainers and the club’s coaching staff because the obtained results show the real situation and can be compared with the modal values. This paper is an analysis of some situational efficiency indicators of shots on goal variables from *Zagreb* and *Veszprem* handball players, who performed in the regular 2015. / 2016. *SEHA* league season. Each team played 18 games in as many rounds. Situational efficiency of shots on goal was analyzed with 10 variables. A multivariate analysis of variance showed no statistically significant differences between clubs, as was to be expected given that *Veszprem*, at the end of the regular season, ranked at 1. position, and *Zagreb* at 3. position. This analysis included only some parameters of situational efficiency. Presumably a further analysis, which would have more variables from the phase of attack, and take into account other aspects of game, would show the differences between the two clubs.

**Key words:** team handball, seniors, regional league, technical elements, performance, analysis

**Introduction**

 Handball game (HG) is marked by various typical and atypical situations, therefore, there is a need for an objective registration of certain situations in the game, respectively parameters of situational efficiency of each player in the competition and situational conditions. By conducting appropriate statistics, we can reach indicators of situation efficiency during the HG, as well as the parameters that belong to the tactical responsibility, involvement, behavior and other (Vuleta et al, 2003). Each HG offers many options for registering large amounts of data suitable for interpretation regarding types and action quality of individual players and the team. Statistical analysis application in the process of modern training and competition in handball and other sports is important in multiple ways and indispensable for achieving top results. In order to analyze the HG, it is necessary to monitor and define a repertoire of technical and tactical activities during the game and register events based on certain situations in which a player is usually located. During the HG it is possible to note every successful and unsuccessful move of the individual, such as the number of shots on goal, number of goals, shot on goal percentage of realization, turnovers, technical mistakes, penalties, successful and unsuccessful goalkeeper’s defense from all positions, from fastbreak, from penalties and more. In that way, we can get objective indications of status, respectively the players’ and team’s effectiveness. Based on such indicators the coach may well assess the contribution of individual players, groups of players, and the entire team (Gruić, 2006; Ohnjec, 2006).

 The top athlete’s pursuit is only victory. These requirements are precisely what inspired numerous studies. We can apply above facts to HG as well, where a lot of research was made on factors that have an impact on performance, and therefore the ultimate sports achievement as well (De Rose, Jr., 2004; Taborsky, 2008). Previous HG efficiency analyses can be divided into 3 directions of research. The 1. group represents research where a descriptive approach was used to analyze the frequency of various events during the HG, and the performance of different technical and tactical elements was recorded and analyzed (Vuleta & Šimenc, 1989; Czerwinski, 2000). Determining the difference between handball teams according to different criteria (victory or defeat, better or worse placement in competition or any other criterion) is the main approach in the 2. direction of research (Rogulj, 2000). The 3. group of research focused on impact determination of various standard performance indicators according to different criteria (Vuleta, 1997; Vuleta et al, 2005).

 The aim of this study was to determine the situational efficiency of Zagreb and Veszprem handball players during the regular part of SEHA League in season 2015. / 2016. As an extra aim, a results comparison between handball players of both teams was made.

**Methods**

Sample of respondents

 The sample consisted of two handball team players who played in the regular *SEHA* league season 2015. / 2016. During this season *SEHA* (*South East - European Handball Association*) league consisted of 7 handball federations (Belarussian, Bosnian and Herzegovinian, Croatian, Hungarian, Macedonian, Serbian and Slovakian). 10 clubs competed in that league (*MVM Veszprem, Vardar, PPD Zagreb, Meshkov Brest, Tatran Presov, Nexe, Vojvodina, Borac m: tel, Spartak Vojput, Max Strumica*).

 Total number of respondents was 47. The physical characteristics of the *Zagreb* players (n = 24) were 25,7 ± 4,85 years (group means ± standard deviations); 193,29 ± 7,7 cm and 89,75 ± 10,11 kg, compared to *Veszprem* players (n = 23) who were 27,3 ± 6,48 years; 191,65 ± 8,16 cm and 90,82 ± 12,49 kg.

 Data were collected by experts who observed this two clubs in 36 games. Eeach team played 18 games in as many rounds.

Sample of variables

 Sample of 10 variables in this study consisted of situational efficiency shots on goal variables: *FSS* - field shots sucessfull (from the backcourt positions); *FSU* - field shots unsucessfull (from the backcourt positions); *LSS* - line shots successful (from the pivot position); *LSU* - line shots uncucessfull (from the pivot position); *SSS* - side shots sucessfull (from the wings’ position); *SSU* - side shots unsucessfull (from the wings’ position); *FBS* - fastbreak sucessful; *FBU* - fastbreak unsucessful; *7MS* - 7 meters sucessfull; *7MU* - 7 meters unsucessfull.

Data processing methods

 Descriptive statistics (M, SD, Ʃ, %) were calculated (Table 1). Normality of variables was determined with the Kolmogorov-Smirnov test. A multivariate analysis of variance (MANOVA) was conducted for determining statistical significance of differences between clubs in 10 variables. A univariate analysis of variance (ANOVA) was made for insight into the contribution of individual variables difference. The level of significance was set at p < 0.05. All results and processed data are available on the official *SEHA* league website ([www.seha-liga.com](http://www.seha-liga.com)). The statistical analysis was performed with the software package *Statistic for Windows 12.0.* (*StatSoft, Inc*., Tulsa, OK, USA).

**Results**

 Table 1. Descriptive parameters (M, SD, Ʃ , %) and results of the Kolmogorov-Smirnov test of normality of distribution (Max D, K –S p) for shots on goal variables

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***ZAGREB*** | ***VESZPREM*** | **Max D** | **K – S p** | ***ZAGREB*** | ***VESZPREM*** |  |
|  | **M ± SD** | **M ± SD** | **Ʃ** | **%** | **Ʃ** | **%** |  |
| **FSS** | 6,96 ± 8,49 | 8,09 ± 12,76 | 0,18 | p > .10 | 177/368 | 48 | 186/331 | 56 | **FS** |
| **FSU** | 7,96 ± 9,69 | 6,61 ± 10,03 | 0,27 | p > .10 | 169/217 | 78 | 193/256 | 75 | **LS** |
| **LSS** | 7,04 ± 8,86 | 8,57 ± 12,93 | 0,12 | p > .10 | 57/90 | 63 | 93/142 | 65 | **SS** |
| **LSU** | 2,00 ± 3,02 | 2,91 ± 3,98 | 0,04 | p > .10 | 94/107 | 88 | 99/117 | 85 | **FB** |
| **SSS** | 2,42 ± 4,17 | 4,04 ± 8,43 | 0,08 | p > .10 | 52/65 | 80 | 60/66 | 91 | **7M** |
| **SSU** | 1,63 ± 2,73 | 2,09 ± 4,45 | 0,16 | p > .10 | **549/847** | **65** | **631/912** | **69** |  |
| **FBS** | 3,88 ± 4,98 | 4,30 ± 5,93 | 0,07 | p > .10 |
| **FBU** | 0,54 ± 1,06 | 0,78 ± 1,31 | 0,00 | p > .10 |
| **7MS** | 2,17 ± 5,00 | 2,57 ± 7,49 | 0,20 | p > .10 |
| **7MU** | 0,54 ± 0,98 | 0,26 ± 0,75 | 0,20 | p > .10 |

**Legend**: M - mean; SD - standard deviation; Max D - maximum difference between the cumulative

frequency variable and cumulative frequency expected for a normal distribution; K - S p - the smallest error with which the deviation of the distribution variables of normal distribution can be declared statistically significant according to the Kolmogorov - Smirnov test; Ʃ – ratio of goals (score / attempt); % - percentage of Ʃ; FSS - field shots sucessfull; FSU - field shots unsucessfull; LSS - line shots successful; LSU - line shots uncucessfull; SSS - side shots sucessfull; SSU - side shots unsucessfull; FBS - fastbreak sucessful; FBU - fastbreak unsucessful; 7MS - 7 meters sucessfull; 7MU - 7 meters unsucessfull; FS – field shots; LS – line shots; SS – side shots; FB – fastbreak shots; 7M – 7 meters shoots.

 By examination of Table 1. and through analysis of basic parameters (M, SD), as well as by indicators of normality distribution according to the Kolmogorov-Smirnov test (Max D, K – S p), it can be determined that there are no variables that deviate from the normal distribution, respectively all 10 variables are normally distributed.

Table 2. Playing position efficiency of analyzed handball teams

|  |  |
| --- | --- |
| **SHOOTS** | **PLAYING POSITION** |
| **WINGS** | **PIVOTS** | **BACKCOURT ATTACKERS** |
| **ZG.** | **VE.** | **ZG.** | **VE.** | **ZG.** | **VE.** |
| **FS** | 16/34 | 9/23 | 4/7 | 2/6 | 157/327 | 175/302 |
| **LS** | 28/31 | 24/29 | 60/86 | 103/133 | 81/100 | 66/94 |
| **SS** | 55/86 | 85/128 | 1/1 | 1/3 | 1/3 | 7/11 |
| **FB** | 61/72 | 56/66 | 14/15 | 22/25 | 19/20 | 21/26 |
| **7M** | 41/51 | 38/40 | 0/0 | 2/3 | 11/14 | 20/23 |
| **Ʃ** | **201/274** | **212/286** | **79/109** | **130/170** | **269/464** | **289/456** |
| **%** | **73%** | **74%** | **72%** | **76%** | **58%** | **63%** |

**Legend**: ; FS – field shots; LS – line shots; SS – side shots; FB – fastbreak shots; 7M – 7 meters shoots; Ʃ – ratio of goals (scored / attempt); % - percentage of Ʃ; ZG. – *Zagreb*; VE. – *Veszprem.*

 Table 2. presents the results of shooting on goal (score / attempt) in various situations with the percentage of efficiency, systematic under certain playing positions.

 Table 3. MANOVA - multivariate differences between two handball teams for shots on goal variables

|  |  |
| --- | --- |
| **Effect** | **Multivariate Tests of Significante** |
| **Test** | **Value** | **F** | **p** |
| **Intercept** | Wilks | 0,34 | 7,07 | 0,00 |
| **Klasif** | Wilks | 0,69 | 1,58 | 0,15 |

 **Legend**: Intercept – the value of free coefficient; F – F value statistics, p – significance level

 Results from Table 3. indicate that there is no statistically significant difference between *Zagreb* and *Veszprem* handball players (Wilks = 0.69; F = 1.58; p 0.15).

 Table 4. ANOVA - univariate differences between the two handball teams in the shots on goal variables

|  |  |
| --- | --- |
| **Dependent Variable** | **Test of SS Whole Model vs. SS Residual** |
| **Multi R** | **Multi R2** | **F** | **p** |
| **FSS** | 0,53 | 0,03 | 0,13 | 0,72 |
| **FSU** | 0,70 | 0,05 | 0,22 | 0,64 |
| **LSS** | 0,07 | 0,05 | 0,22 | 0,64 |
| **LSU** | 0,13 | 0,17 | 0,79 | 0,38 |
| **SSS** | 0,12 | 0,15 | 0,71 | 0,40 |
| **SSU** | 0,64 | 0,04 | 0,19 | 0,67 |
| **FBS** | 0,04 | 0,02 | 0,07 | 0,79 |
| **FBU** | 0,10 | 0,01 | 0,48 | 0,49 |
| **7MS** | 0,03 | 0,00 | 0,05 | 0,83 |
| 7MU | 0,16 | 0,26 | 1,21 | 0,28 |

**Legend**: Multi R-correlation coefficient (beta); Multi-R2 coefficient of determination; F-F value statistics; p-level of significance; FSS - field shots sucessfull (from the backcourt positions); FSU - field shots unsucessfull (from the backcourt positions); LSS - line shots successful (from the pivot position); LSU - line shots uncucessfull (from the pivot position); SSS - side shots sucessfull (from the wings’ position); SSU - side shots unsucessfull (from the wings’ position); FBS - fastbreak sucessful; FBU - fastbreak unsucessful; 7MS - 7 meters sucessfull; 7MU - 7 meters unsucessfull.

 A univariate analysis of variance was made to display the content of each variable to a statistically significant difference. The difference was not found in any of the analyzed shots on goal variables (Table 4.) It is evident that these variables do not present statistically significant differences between two analyzed handball teams.

**Discussion**

 As expected, Table 1. shows that most shots on goal were from the field positions - FS (363 goals from 699 attempts). It is understood that field players are good shooters from the ground and from jump; they have a very good running start to the ball and they are equally dangerous from all three field playing positions (Malić and Dvoršek, 2011). Consequently, it is logical and expected that they make most shots due to their positioning on the field, they have the longest control time, the longest contact with the ball and then they can operate at optimal spatial positions (the central part of the handball court). That opens for them the best overview and the greatest shooting angle in relation to the opponent’s goal. It can be concluded that the effectiveness from external positions was at a good level (48 % *Zagreb*, 56 % *Veszprem*). The good and quality of a team’s game largely depends on the greater distance shooting efficiency from field position (Štimac, et al, 2015).

 From line position - LS, players (pivots) sent a total of 473 shots and achieved 362 goals. It is obvious (Table 2.) that field players and pivots cooperated very well together (725 goals out of 1180 goals). We can conclude that both teams designed their finish from field positions, but also from the line positions, as evidenced by a large number of shots from this very position (473 shots out of 1759 shots).

 Wing players – SS, from side positions reached a total of 150 goals. The percentage of realization from *Zagreb* players was 63%, and for *Veszprem* players 65%, suggesting that the wing attackers were on a high level of realization. We can note the number of attempts by *Zagreb* players (90 shoots, compared with 142 shoots from *Veszprem* players) was too small, which is certainly not a characteristic of modern, fast handball. The big difference in the number of shots and scored goals from wing positions in favor of *Veszprem* players, suggests that the game was conceived on the fast passing of the ball, fast field players crossing and on creating extra attackers on side positions. A prerequisite for such a game style are top wing players whose quality and constant is often crucial for the final outcome of match.

 From fastbreak - FB, players had 224 shots. *Zagreb* players had 10 attempts less and 5 goals less then *Veszprem* players. Observing the situations where fastbreak developed, whether in individual, group or collective form, which includes the players’ spatial temporal advantage, we can conclude that the efficiency of 85% from *Veszprem* players, and 88% from *Zagreb* players, was on a very high level.

 Gruić et al (2006) analyzed handball teams at the World Cup for men and displayed the same hierarchy of shots on goal variables (1. fastbreak shooting; 2. line shooting; 3. side shooting; 4. field shooting). A similar analysis was performed by Ohnjec et al (2008), when they observed 60 matches at the World Handball Championship for women, and obtained similar results (1. fastbreak shooting; 2. line shooting; 3. side shooting; 4. field shooting).

 Penalty shots realization – 7M, was also a segment with a very high level of success by both clubs. *Zagreb* players were observed to have more unrealized penalty shots (*Zagreb* 52/65 = 80%; *Veszprem* 60/66 = 91%), which certainly contributes to the outcome of an individual match, and the final ranking on the competition table.

 There was no statistically significant difference between two clubs in the observed variables. Results indicate that both teams achieve the expected result and qualified for the final stage of competition. *Zagreb* took 3. place in the rankings with a total of 42 points won. *Veszprem* at the end of the regular season, took 1. place in the rankings with a total score of 50 points. Top players perform for both teams, most of whom are internationals. On most playing positions for both clubs, there was an adequate substitute, which certainly should be considered, because the clubs also participated in other competitions (National Championship, National Cup, Champions League).

**Conclusion**

 This paper is an analysis of some situational efficiency indicators of shots on goal variables from *Zagreb* and *Veszprem* handball players, who performed in the regular 2015. / 2016. *SEHA* league season. Each team played 18 HG in as many rounds. Situational efficiency of shots on g

oal was analyzed with 10 variables. A multivariate analysis of variance showed no statistically significant differences between clubs, as was to be expected given that *Veszprem*, at the end of the regular season, ranked at 1. position, and *Zagreb* at 3. position. This analysis included only some parameters of situational efficiency. Presumably a further analysis, which would have more variables from the phase of attack, and take into account other aspects of game, would show the differences between the two clubs. The players’ situational efficiency parameters are important for experts, trainers and the club’s coaching staff because the obtained results show the real situation and can be compared with the modal values. In each team’s result interpretations, it is necessary to respect the fact that interpretations are determined by various factors, while the model of situational effectiveness varies from team to team in each game at different levels of competition (Gruić, 2006).

**References**

Czerwinski, J. (2000). Statistical analysis and remarks on the game character based on the European Championship in Croatia. *EHF Periodical*, 2, 10-18.

De Rose Jr., D. (2004). Statistical analysis of basketball performance indicators according to home/away games and winning and losing teams. *Journal of Human Movement Studies*, 39 (2), 85-104.

Gruić, I. (2006). Situacijska efikasnost muških rukometnih ekipa na Svjetskom prvenstvu u Portugalu 2003 (magistarski rad). Zagreb: Kineziološki fakultet.

Gruić, I., Vuleta, D.,Milanović, (2006). D. [Performance indicators of teams at the 2003 Men's World Handball Championship in Portugal](http://bib.irb.hr/prikazi-rad?&rad=368750). // *Kinesiology* : international journal of fundamental and applied kinesiology. 38; 164-175.

Malić, Z., Dvoršek, B. (2011). Rukomet-pogled s klupe. 2 izdanje. Zagreb: Hrvatska olimpijska akademija.

Ohnjec, K. (2006). Situacijska efikasnost ženskih rukometnih ekipa na Svjetskom prvenstvu u Hrvatskoj 2003. (Magistarski rad). Zagreb: Kineziološki fakultet.

Ohnjec, K., Vuleta, D., Milanović, D., Gruić, I. (2008). Performance indicators of teams at the 2003 World Handball Championship for Women in Croatia. // *Kinesiology* : international journal of fundamental and applied kinesiology. 40, 1; 69**-**79.

Rogulj, N. (2000). Differences in situation-related indicators of the handball game in relation to the achieved competitive results of teams at 1999 World Championship in Egypt. *Kinesiology*, 32(2), 63-74.

Štimac, I.,Vuleta ,V., Milanović, M. (2015). Analiza pokazatelja situacijske efikasnosti mladih hrvatskih rukometaša na Europskom prvenstvu u Turskoj 2012. godine. U Igor Jukić i sur. (ur.), Kondicijska priprema sportaša. Zbornik radova, Zageb, 27. - 28. veljače 2015. godine (str.319-393). Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu

Taborsky, F. (2008). Cumulative indicators of team playing performance in handball (Olympic Games Tournaments 2008). *EHF Periodical*

Vuleta, D. (1997). Kineziološka analiza tehničkotaktičkih sadržaja rukometne igre. (Doktorski rad), Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.

Vuleta, D., & Šimenc, Z. (1989). Analiza nekaterih kazalcev učinkovitosti igre mladinske rokometne reprezentance na VII. svetovnom prvenstvu. [Analysis of certain performance indicators of the youth handball national team at the 7th World Championship. In Slovenian.] *Trener*, Rokomet 1, 25(3/582), 3-42.

Vuleta, D., Milanović, D., & Sertić, H. (2003). The relationship between variables of shooting on goal with the final result in handball match of the European Champ. in 2000 for men. *Kinesiology, 35*(2), 168-183.

Vuleta, D., Milanović, D., Gruić, I., & Ohnjec, K. (2005). Influence of the goals scored on final outcomes of matches of the 2003 World Handball Championships for Men in Portugal. In D. Milanović & F. Prot (Eds.), Proceedings Book of the 4th International Scientific Conference on Kinesiology “Science and Profession – Challenge for the Future”, Opatija, Croatia, 7-11 September, 2005 (pp. 470-473). Zagreb: Faculty of Kinesiology, University of Zagreb.