ORIGINAL SCIENTIFIC PAPER

The Important Game-Related Statistics for Qualifying Next Rounds in Euroleague

Ilkay Dogan[1], Yasin Ersoz[2]

Affiliations: [1]Gaziantep University, Faculty of Medicine, Department of Biostatistics, Gaziantep, Turkey, [2]Mersin University, School of Physical Education and Sports, Mersin, Turkey

Correspondence: I. Dogan, Gaziantep University, Faculty of Medicine, Department of Biostatistics, 27310 Gaziantep, Turkey. E-mail: ilkaydogan@gantep.edu.tr

ABSTRACT Euroleague is one of the most popular professional indoor sports leagues in the world. It is globally ranked as the fifth-highest professional indoor sports league and the second-highest professional basketball league, just trailing behind the National Basketball Association (NBA). The objective of this study was to determine which game-related statistics can assist in predicting the team that will qualify for the next rounds of the Euroleague. The data used in the study were obtained from each team's official average box score on the Euroleague website for 2010-2017. The datasets were arranged into two groups depending on the qualification of the teams into the subsequent round. Discriminant analysis was applied to find the game-related statistics that better contribute to qualifying for the next round. A three-point field-goal percentage was considered to be an essential variable in every round. However, it was also observed that, contrary to expectations, offensive rebounds had a negative effect in the final four rounds. It is recommended these results be used to plan the team strategies and the player strategies accordingly in a long-term and demanding tournament like Euroleague.

KEY WORDS basketball, Euroleague, discriminant analysis, game-related statistics

@MJSSMontenegro
GAME-RELATED STATISTICS IN EUROLEAGUE
http://mjssm.me/?sekcija=article&artid=172

Introduction

Euroleague is one of the most popular professional indoor sports leagues in the world, and perhaps Euroleague is the most watched after the National Basketball Association (NBA, superior level) in the USA. In recent years, NBA teams have played pre-season matches with Euroleague teams, which is an indication that Euroleague is seen as competitive to the NBA. Euroleague Basketball is considered to be a global leader in sport and basketball. Euroleague is composed of 16 teams; each team plays each other twice, and in these two games, one game is played on the home court while the other game is played on the opponent's court. The games in Euroleague are played in a true league-style season format with a total of 30 games. The top eight teams at the end of the regular season advance to the playoffs, which are held as a five-game play-off series. The higher placed team in the regular season standings of each playoff match-up has home court advantage in each play-off series, playing three out of the five games at home. The winners of each four playoff series advance to the final four, which is held at a predetermined site. The final four games feature two semi-final games, a third-place game, and finally the championship game. Each team plays a maximum of 37 games per season, versus 31 games in the previous tournament format.

The European sports clubs make sizeable investments to join the Euroleague as well as to succeed in the competitions within this league. In order to qualify for the next rounds in Euroleague, even the slightest details on winning and losing a match become very important. The success of basketball teams in the competitions depends on several factors which include physiological fitness, psychological preparedness, biomechanical proficiency, anthropometric characteristics, and tactical awareness (Glazier, 2017). The results of a game or other sporting event depend not only on the skill of the participants but also on "luck" and randomness, and separating the contribution of skill from that of luck is not always easy (Severini, 2014). A high level of team features, including skill, tactical awareness, and anthropometric characteristics produce game-related statis-

Received: August 28 2018 | Accepted after revision: November 09 2018 | First published online: March 01 2019

Conflict of interest: None declared.

tics and help create success. The game-related statistics enable the preparation of prospective studies using statistical methods to build the team characteristics (skills, psychological preparedness, anthropometric characteristics, etc.) for success. Game-related statistics have been used to describe the variables that can help to differentiate the successful teams in the league versus the other teams. This allows relating the performance of teams using technical and tactical indicators derived during the game and, as a result, it improves the success of the training programmes (Ribas et al., 2011). Discovering unique situations in the game allows identifying the dispositions of the evolution of the game played by the players, and thus it helps to optimize the preparation process of the teams for the upcoming games (Hughes & Franks, 2004). Therefore, basketball and other sports cannot be considered separately from statistics.

In recent years statistical data collection during basketball games has been frequently used, and researchers use advanced statistical methods with an analysis of the performance of the games and the recognition of trends and models that are found to be dominant in the game (Sampaio et al., 2006; Sampaio et al., 2010a; Ergül, 2014; Čaušević, 2015; Doğan et al., 2016). With the utilization of notational analysis, basketball has become one of the most analysed sports in the world (Lorenzo et al., 2010) and the investigation on this subject has focused on discriminately identifying the winning and losing teams during the regular season and during the playoff games (Dogan et al., 2016; García et al., 2013; Ibánez et al., 2008; Ittenbach and Esters, 1995; Sampaio et al., 2010b; Taxildaris et al., 2001). Previously, studies on the performance analysis of some national basketball leagues were conducted (Dežman et al., 2002; Gimenez and Janeira, 2003; Sampaio et al., 2004).

García et al. (2013) suggested that the winning teams dominated in assists, defensive rebounds, and successful two- and three-point field goals in regular season games at the ACB Spanish League. However, they also showed that the superiority of the winning teams was observed only during the defensive rebounding in the playoff games. Other research examined the differences in game-related statistics between basketball guards, forwards, and centre players who were playing in three different professional leagues; it was observed that the game-related statistics of the players varied according to their position (Sampaio et al., 2006). For example, Ibáñez et al. (2008) conducted the game-related statistics that discriminated the winning and losing teams in basketball in the context of three consecutive games played in a condensed tournament format. The results of their study showed that the winning teams in this competition had better values in all of the game-related statistics, with the exception of three-point field goals, missed free throws, and turnovers.

Although discriminant game-related statistics show different variables, which depend upon the specific context of the games, there are certain variables for performance that are especially considered for the games in the regular season and the play-off period. Therefore, different game-related statistics may function as a discriminant in other specific contexts, such as three-point field goal attempts and assists (Gómez et al., 2008) in different style competitions (such as the world championships). For example, in the playoff games of the ACB Spanish Basketball League, it was observed that the superiority of the winning teams was only in defensive rebound situations (García et al., 2013).

There is a limited number of research studies about game-related statistics, despite Euroleague being such a high-level basketball organization (Sampaio et al., 2010b; Ribas et al., 2011; Marmarinos et al., 2016; Çene, 2018). Although game-related statistics can be influenced some characteristics; such as play-off games strategies, league structure, team dynamic, quality of the players; it may show differences for each round in the Euroleague season. It may help coaches who are competing in this quality and structure of the league to prepare team practice and game planning. In this context, the objective of this study was to identify which game-related statistics can assist in predicting the team that will qualify for the next rounds such as the first round, top sixteen, play-off, and final four of the Euroleague.

Methods

Sample and variables

The data for indicating team performance were obtained from each team's official average box score in the Euroleague's website for the 2010-2017 seasons (www.euroleague.net). In this context, game-related statistics such as two-point field-goal percentage (2FG), three-point field-goal percentage (3FG), free-throw percentage (FT), offensive rebound (OffReb), defensive rebound (DefReb), assists (As), steals (St), turnovers (To), blocks in favour (Fv), blocks against (Ag), fouls committed (Cm), and fouls received (Rv) were gathered. The average box scores of the teams for each round (first round, top sixteen, play-off, and final four) were evaluated separately. In the 2016-2017 season, the format of the tournament was changed, and the number of teams was reduced. Thus, the teams have directly competed in a single group of 16 teams (www.euroleague.net). Therefore, there is no data available for the 2016-2017 season in the first-round data set. During the study, the datasets were arranged into two groups according to whether the teams qualified for the next round. The data analysis was carried out by categorizing these two groups as "qualified (represented as F1)" and "eliminated (represented as F2)".

Statistical Analysis

Discriminant analysis was applied to find the game-related statistics that better contribute to qualifying for the next round. Discriminant analysis is a method that develops distinguishing functions between the group mean vectors for separating the groups entered into each other with common features (Özdamar, 2013). The

DOI 10.26773/mjssm.190307

interpretation of the obtained discriminant functions was based on the examination of the structure coefficients greater than |0.30| which means that the variables with higher absolute values have a stronger contribution to discriminate between the groups (Tabachnick & Fidell, 2000). Discriminant analysis is categorized into two main groups: as linear and quadratic discriminant analysis. The linear discriminant analysis assumes that the covariance matrices of all groups are homogenous. The quadratic discriminant analysis does not use the assumption that the covariance matrices of all the groups are homogenous (Özdamar, 2013). In the present study, it was found that the group's covariance matrices were homogeneous for each dataset as a result of a Box'M test (p>0.05). Therefore, the linear discriminant analysis was selected to be used in this study. The statistical analyses were performed using SPSS software, and significance was set at p<0.05.

Results

The results of the discriminant analysis for qualifying from the first round are represented in Table 1. According to Table 1, the discriminant function for determining (separating) the group based on the data has a significant separation (p<0.05). Moreover, the correct classification rate of the discriminant function is 75.0%. Considering the discriminant functions' coefficients, discriminant functions can be written as follows,

$$F_1 = -618.628 + 7.025\,2FG + 3.423\,3FG + 3.486\,FT + 9.472\,OffReb + 4.999\,DefReb - 2.471\,As + 4.095\,St + 3.709\,To - 0.843\,Fv + 8.113\,Ag + 6.377\,Cm + 3.795\,Rv$$

$$F_2 = -583.641 + 6.825\,2FG + 3.261\,3FG + 3.471\,FT + 9.038\,OffReb + 4.693\,DefReb - 2.433\,As + 4.026\,St + 3.814\,To - 1.373\,Fv + 8.728\,Ag + 6.567\,Cm + 3.194\,Rv$$

From 2010 to 2017 in the Euroleague seasons, the two-point field-goal percentage (SC=0.501), defensive rebound (SC=0.495), fouls received (SC=0.486), and blocks in favour (SC=0.466) are the game-related statistics that have the major contribution to the teams' qualifying to the top sixteen. Furthermore, the other variables that contribute to the qualifying of the team are assists (SC=0.345) and the three-point field-goal percentage (SC=0.302), respectively.

TABLE 1 Discriminant analysis results for the first round

Discriminant Function Coefficients			**Structure Coefficients**
Variables	**Function 1 (Qualified)**	**Function 2 (Eliminated)**	**Function 1**
2-point field-goal percentage (2FG)	7.025	6.825	**0.501**
3-point field-goal percentage (3FG)	3.423	3.261	**0.302**
Free-throw percentage (FT)	3.486	6.471	0.150
Offensive rebound (OffReb)	9.472	9.038	0.152
Defensive rebound (DefReb)	4.999	4.693	**0.495**
Assists (As)	-2.471	-2.433	**0.345**
Steals (St)	4.095	4.026	0.109
Turnovers (To)	3.709	3.814	-0.119
Blocks in favour (Fv)	-0.843	-1.373	**0.466**
Blocks against (Ag)	8.113	8.728	-0.224
Fouls committed (Cm)	6.377	6.567	-0.175
Fouls received (Rv)	3.795	3.194	**0.486**
(Constant)	-618.628	-583.641	
Box's M test		F=1.024; p=0.420	
Wilks' Lambda		0.609	
Eigenvalue		0.641	
Chi-Square		67.386	
p		0.000	
Canonical Correlation		0.625	
Reclassification (%)		75.0	

The results of the discriminant analysis for qualifying from the top sixteen are represented in Table 2. The discriminant function for determining (separating) the group based on the data has a significant separation (p<0.05). Moreover, the correct classification rate of the discriminant function is 84.8%. Discriminant functions can be written as follows,

$$F_1 = -811.544 + 10.538\,2FG + 5.144\,3FG + 3.918\,FT + 10.423\,OffReb + 10.263\,DefReb - 6.586\,As + 6.958\,St + 4.747\,To - 6.282\,Fv + 18.594\,Ag + 5.172\,Cm + 4.941\,Rv$$

$$F_2 = -783.897 + 10.284\,2FG + 4.882\,3FG + 3.979\,FT + 10.375\,OffReb + 9.758\,DefReb - 6.213\,As + 6.169\,St + 5.334\,To - 6.686\,Fv + 18.643\,Ag + 5.373\,Cm + 4.502\,Rv$$

From 2010 to 2017 in the Euroleague seasons, the two-point field-goal percentage (SC=0.462), blocks in favour (SC=0.458), and turnovers (SC= -0.401) are the game related statistics that have the major contribution to teams' qualifying for the play-offs. Furthermore, the other variables that contribute to the qualifying of the team are the three-point field-goal percentage (SC=0.372), defensive rebound (SC=0.362), and fouls received (SC=0.314), respectively.

TABLE 2 Discriminant analysis results for the top sixteen

Discriminant Function Coefficients			**Structure Coefficients**
Variables	**Function 1 (Qualified)**	**Function 2 (Eliminated)**	**Function 1**
2-point field-goal percentage (2FG)	10.538	10.284	**0.462**
3-point field-goal percentage (3FG)	5.144	4.882	**0.372**
Free-throw percentage (FT)	3.918	3.979	0.010
Offensive rebound (OffReb)	10.423	10.375	-0.105
Defensive rebound (DefReb)	10.263	9.758	**0.362**
Assists (As)	-6.586	-6.213	0.271
Steals (St)	6.958	6.169	0.259
Turnovers (To)	4.747	5.334	**-0.401**
Blocks in favour (Fv)	-6.282	-6.686	**0.458**
Blocks against (Ag)	18.594	18.643	-0.221
Fouls committed (Cm)	5.172	5.373	-0.197
Fouls received (Rv)	4.941	4.502	**0.314**
(Constant)	-811.544	-783.897	
Box's M test		F=0.978; p=0.534	
Wilks' Lambda		0.549	
Eigenvalue		0.821	
Chi-Square		62.349	
p		0.000	
Canonical Correlation		0.672	
Reclassification (%)		84.8	

According to Table 3, the discriminant function for determining (separating) the group based on the data has a significant separation ($p<0.05$). Moreover, the correct classification rate of the discriminant function is 82.1%. Discriminant functions can be written as follows,

$$F_1 = -502.589 + 5.565\,2FG + 3.703\,3FG + 3.578\,FT + 7.120\,OffReb + 8.849\,DefReb - 4.422\,As + 5.589\,St - 5.414\,To + 1.603\,Fv + 16.745\,Ag + 2.724\,Cm + 0.722\,Rv$$

$$F_2 = -461.627 + 5.409\,2FG + 3.393\,3FG + 3.433\,FT + 6.636\,OffReb + 8.443\,DefReb - 4.340\,As + 5.014\,St - 4.762\,To + 0.957\,Fv + 16.937\,Ag + 2.814\,Cm + 0.564\,Rv$$

From 2010 to 2017 in the Euroleague seasons, the three-point field-goal percentage (SC=0.494) is the game related statistic that has the major contribution to teams qualifying for the final four. Furthermore, the other variables that contribute to the qualifying of the team are assists (SC=0.333), blocks in favour (SC=0.308), and defensive rebound (SC=0.300), respectively.

TABLE 3 Discriminant analysis results for play-off

Discriminant Function Coefficients			**Structure Coefficients**
Variables	**Function 1 (Qualified)**	**Function 2 (Eliminated)**	**Function 1**
2-point field-goal percentage (2FG)	5.565	5.409	0.238
3-point field-goal percentage (3FG)	3.703	3.393	**0.494**
Free-throw percentage (FT)	3.578	3.433	0.196
Offensive rebound (OffReb)	7.120	6.636	0.063
Defensive rebound (DefReb)	8.849	8.443	**0.300**
Assists (As)	-4.422	-4.340	**0.333**
Steals (St)	5.589	5.014	0.066
Turnovers (To)	-5.414	-4.762	-0.223
Blocks in favour (Fv)	1.603	.957	**0.308**
Blocks against (Ag)	16.745	16.937	-0.294
Fouls committed (Cm)	2.724	2.814	-0.107
Fouls received (Rv)	.722	.564	0.050
(Constant)	-502.589	-461.627	
Box's M test		F=0.874; p=0.779	
Wilks' Lambda		0.465	
Eigenvalue		1.153	
Chi-Square		36.804	
p		0.000	
Canonical Correlation		0.732	
Reclassification (%)		82.1	

DOI 10.26773/mjssm.190307

The discriminant function for determining (separating) the group based on the data does not have a significant separation (p>0.05). Besides, the correct classification rate of the discriminant function is 82.1% (Table 4). Discriminant functions can be written as follows,

$$F_1 = -417.038 + 3.931\,2FG + 4.422\,3FG + 1.536\,FT + 10.336\,OffReb + 7.774\,DefReb - 4.059\,As + 12.291\,St + 9.768\,To - 7.198\,Fv + 0.330\,Ag - 3.461\,Cm + 1.154\,Rv$$

$$F_2 = -402.515 + 3.887\,2FG + 4.232\,3FG + 1.525\,FT + 10.837\,OffReb + 7.828\,DefReb - 4.113\,As + 12.540\,St + 9.753\,To - 7.635\,Fv + 0.022\,Ag - 3.605\,Cm + 0.905\,Rv$$

In the Euroleague seasons, the three-point field-goal percentage (SC=0.541) is the game-related statistic that has the major contribution to teams' being the Euroleague champion. Furthermore, the other variables that contribute to the teams' being the Euroleague champion are offensive rebounds (SC= -0.379), and the two-point field-goal percentage (SC=0.352), respectively.

TABLE 4 Discriminant analysis results for the final four

Discriminant Function Coefficients			**Structure Coefficients**
Variables	**Function 1 (Qualified)**	**Function 2 (Eliminated)**	**Function 1**
2-point field-goal percentage (2FG)	3.931	3.887	**0.352**
3-point field-goal percentage (3FG)	4.422	4.232	**0.541**
Free-throw percentage (FT)	1.536	1.525	0.161
Offensive rebound (OffReb)	10.336	10.837	**-0.379**
Defensive rebound (DefReb)	7.774	7.828	0.249
Assists (As)	-4.059	-4.113	0.298
Steals (St)	12.291	12.540	-0.191
Turnovers (To)	9.768	9.753	-0.076
Blocks in favour (Fv)	-7.198	-7.635	0.161
Blocks against (Ag)	.330	.022	0.156
Fouls committed (Cm)	-3.461	-3.605	0.249
Fouls received (Rv)	1.154	.905	0.287
(Constant)	-417.038	-402.515	
Wilks' Lambda		0.589	
Eigenvalue		0.698	
Chi-Square		10.596	
p		0.565	
Canonical Correlation		0.641	
Reclassification (%)		82.1	

Discussion and conclusions

Many studies to determine game-related statistics that influence success in basketball have been carried out by various researchers (Dežman, Erčulj, & Vučković, 2002; Doğan, Işik, & Ersöz, 2016; Gómez et al., 2008; Ibáñez et al., 2008; Lorenzo et al., 2010). However, these studies usually were conducted on national leagues around the world. It is also interesting to note that the various studies conducted about the Euroleague have been increasing in number recently (Çene, 2018; Ribas et al., 2011). This study has been the first to report the influence of game-related statistics on the box scores of Euroleague games.

The results of the study indicated that the two-point field-goal percentage, defensive rebound, fouls received, and blocks in favour were the game-related statistics that have the most contribution for analysing the teams qualifying to the top sixteen. Furthermore, it was observed that the other variables that contributed to the qualifying of the team were the assists and the three-point field-goal percentage (Table 1). The major contributing game-related statistics on teams' qualifying for the play-offs were the two-point field-goal percentage, blocks in favour, and turnovers. The other variables that contributed to the qualifying team were found to be the three-point field-goal percentage, defensive rebounds, and fouls received (Table 2). As shown in Table 2, it was observed that turnovers have a negative effect on qualification. This can be interpreted by stating that having a lesser number of turnovers will lead to having better chances to qualify for the final four teams. It was also observed that in order to qualify for the final four teams, the three-point field-goal percentage was the most important game-related statistic. Furthermore, the other variables that contributed to the qualifying of the team were found to be assists, blocks in favour, and defensive rebounds (Table 3). Most importantly, in the end, the three-points field-goal percentage was the major game-related statistic for determining the Euroleague champion. Additionally, offensive rebounds and the two-point field-goal percentage were the other variables that contributed to being the Euroleague champion (Table 4). As shown in Table 4, offensive rebounds had a negative effect on becoming the Euroleague champion. This suggests that having fewer offensive rebounds can lead to a greater chance to be the Euroleague champion.

When evaluating all rounds, the three-point field-goal percentage was seen to be an important variable in every round. However, it was also observed that as a team came closer to the finals, the importance of this variable increased. Hence, the three-point field-goal percentage was the most important game-related statistics for the play-offs as well as for the final fours. Gómez et al. (2008) emphasized the importance of three-point shots, stating that this variable can make a major difference between the winning and the losing teams. Csataljay, O'Donoghue, Hughes, and Dancs, (2009) also reported that a higher three-point shooting percentage can make the difference between winning and losing teams.

In the final four rounds, the offensive rebound was one of the most important variables. Contrary to expectations, offensive rebounds had a negative effect on becoming a Euroleague champion. This may be due to the fact that in the final four rounds, teams and coaches may have thought that it is more important to have a heavier reliance on defensive strategies. The number of positions may be fewer as a result of this strategy. Hence, the teams may have had fewer rebound positions, since they played for successful field goals. The major game-related statistics in the final four rounds (three-point field-goal percentage) supports this situation by showing the importance of successful field goals. Thus, since the final four competitions have been played as a single match, coaches may prefer these tactics exclusively for the final four rounds. These preferences and results change during the regular season of Euroleague and in the national basketball leagues. Many studies about the game-related statistics in regular seasons have shown that defensive rebounds may influence team success (Akers, Wolff, & Buttross, 1991; Sampaio and Janeira, 2003; Gómez et al. 2008; Pojskić, Šeparović, & Užičanin, 2009; García et al., 2013; Čaušević, 2015). Sampaio and Janeira (2003) pointed out the importance of defensive rebounds and also highlighted that the increase in the number of ball possessions resulted in an increase in the opportunity of offensive actions.

The other variables contributing to the qualifying of the teams to the top sixteen were fouls received and blocks in favour during the game. Despite this, in some studies, there were no differences observed between the top half teams and the bottom half teams in terms of blocks (Doğan et al., 2016; Gómez et al., 2008; Ergül, 2014). In many studies, there were also no significant results related to fouls received. Furthermore, Kozar, Vaughn, Whitfield, Lord, & Dye, (1994) revealed that, according to the data obtained from close games, the number of fouls and effectiveness of free throws were the most significant variables. García et al. (2013) reported that the winning teams dominated assists, defensive rebounds, successful two- and three-point field-goals during the regular season. However, in play-off games, the superiority of the winning teams was observed to be only in defensive rebounds. Gómez et al. (2008) suggested that in the balanced games of the regular season, the analysis emphasized defensive rebounds and successful two-point field-goals. Another study for discriminating successful and unsuccessful teams showed that the biggest contribution to the teams' discrimination were defensive rebound, two-point percentages, a number of successful two-point shots, number of assists and nonstarters points (Pojskić et al., 2009). The study by Čaušević (2015) reported that the winners could be determined from the statistics related to defensive rebounds, successful three-points, unsuccessful two-points, biggest lead, and offensive rebounds.

According to these findings, the turnovers were significant for qualifying from the top sixteen position to the play-off. Although it did not seem important for other rounds, teams needed to play with fewer turnovers in order to qualify for the play-offs. It is clear that play-off games have fewer ball possessions compared to the other games within the regular season, and that the game speed is also slower (Sampaio & Janeira, 2003) during the play-off games. Playing at a higher speed causes more unintentional errors and, hence, coaches try to minimize turnovers in important games (like the finals or the playoffs). Thus, it seems clear that in playoff games there are fewer actions due to the lower game speed; thus, every action becomes more crucial for the outcome of the game.

Although some of the defensive features in the first rounds and the top sixteen rounds were in the forefront; as the rounds progresses, the offensive features become more important. It is expected that the defensive features will be an essential element in the long season. In short tournaments, like a single game elimination system, offensive features play a decisive role for the teams. Especially when approaching the finals at senior leagues like the Euroleague, the defensive features of the teams are similar, and teams that are able to forefront offensive features are found to be more successful.

In the light of our findings, the importance of offensive and defensive features change in different rounds such long and demanding tournaments. Coaches should consider their long-term strategy carefully, and they should prepare their teams to function both for defence and offense as necessary. It may guide different aspects of team staff ,like tactical assistant coaches, team physical fitness coaches, and players' individual preparation. Coaches should form the teams in the pre-season player transfers by taking the goals of the end of the season into consideration. Coaches and players should be aware of these different viewpoints in order to increase knowledge and, therefore, to evaluate specificity at the time of practice and game planning. Coaches also should prepare their players stepwise according to Euroleague rounds. Consequently, there are several factors influencing the team success, including skill, physiological fitness, psychological preparedness, biomechanical proficiency, anthropometric characteristics, and tactical awareness. These factors can be improved with the player selection, tactical selection, and training periods. Furthermore, the result of the study may guide to coaches about in which round and how much these factors should be improved. It is recommended to form the teams, prepare the players and set the team strategies according to these results in order to achieve success in a long and demanding tournaments like Euroleague.

DOI 10.26773/mjssm.190307

Acknowledgements

We are very grateful to Euroleague Media Communication Office for allowing us to use the game-related statistics between 2010-2017 seasons of the Euroleague.

REFERENCES

Akers, M. D., Wolff, S., & Buttross, T. E. (1992). An empirical examination of the factors affecting the success of NCAA Division I College Basketball teams. *Journal of Business and Economic Studies*, *1*(2), 57-70.

Čaušević, D. (2015). Game-related statistics that discriminate winning and losing teams from the World championships in Spain in 2014. *Homo Sporticus*, *17*(2), 16-19. doi:10.1155/2012/490647

Çene, E. (2018). What is the difference between a winning and a losing team: insights from Euroleague basketball. *International Journal of Performance Analysis in Sport, 18*(1), 55-68. doi: 10.1080/24748668.2018.1446234

Csataljay, G., O'Donoghue, P., Hughes, M., & Dancs, H. (2009). Performance indicators that distinguish winning and losing teams in basketball. *International Journal of Performance Analysis in Sport*, *9*(1), 60-66. doi: 10.1080/24748668.2009.11868464

Dežman, B., Erčulj, F., & Vučković, G. (2002) Differences between winning and losing teams in playing efficiency. *Acta Kinesiologiae Universitatis Tartuensis, 7*(Supplement), 71-74.

Doğan, İ., Işik, Ö., & Ersöz, Y. (2016). Examining the Turkish men's professional basketball team's success according to game-related statistics with discriminant analysis. *International Journal of Performance Analysis in Sport*, *16*(3), 829-836. doi: 10.1080/24748668.2016.11868931

Ergül, B. (2014). Classification of NBA league teams using discriminant and logistic regression analyses. *Pamukkale Journal of Sport Sciences*, *5*(1), 48-60.

García, J., Ibáñez, S. J., Martinez De Santos, R., Leite, N., & Sampaio, J. (2013). Identifying basketball performance indicators in regular season and playoff games. *Journal of Human Kinetics,* 36(1), 161-168. doi: 10.2478/hukin-2013-0016

Gimenez, J., & Janeira, M. (2003). Game statistics discriminating the final outcome of junior world basketball championship matches (Portugal 1999). *Journal of Human Movement Studies*, 45, 1-19.

Glazier, P. S. (2017). Towards a grand unified theory of sports performance. *Human movement science*, *56*, 139-156. doi:10.1016/j.humov.2015.08.001

Gómez, A.M., Lorenzo, A., Sampaio, J., José Ibáñez, S., & Ortega, E. (2008). Game-related statistics that discriminated winning and losing teams from the Spanish men's professional basketball teams. *Collegium Antropologicum*, *32*(2), 451-456.

http://www.euroleague.net/competition/teams (Accessed 09.03.2018).

Hughes, M., & Franks, I. M. (Eds.). (2004). *Notational analysis of sport: Systems for better coaching and performance in sport*. London, UK: Routledge

Ibáñez, S. J., Sampaio, J., Feu, S., Lorenzo, A., Gómez, M. A., & Ortega, E. (2008). Basketball game-related statistics that discriminate between teams' season-long success. *European journal of sport science*, *8*(6), 369-372. doi: 10.1080/17461390802261470

Ittenbach, R. F., & Esters, I. G. (1995). Utility of team indices for predicting end of season ranking in two national polls. *Journal of Sport Behavior*, *18*(3), 216-224.

Kozar, B., Vaughn, R. E., Whitfield, K. E., Lord, R. H., & Dye, B. (1994). Importance of free-throws at various stages of basketball games. *Perceptual and Motor skills*, *78*(1), 243-248.

Lorenzo Calvo, A., Gómez Ruano, M. Á., Ortega Toro, E., Ibañez Godoy, S. J., & Sampaio, J. (2010). Game related statistics which discriminate between winning and losing under-16 male basketball games. *Journal of Sports Science and Medicine*, 9(4), 664-668.

Marmarinos, C., Apostolidis, N., Kostopoulos, N., & Apostolidis, A. (2016). Efficacy of the "pick and roll" offense in top level European basketball teams. *Journal of human kinetics*, *51*(1), 121-129. doi:10.1515/hukin-2015-0176

Özdamar, K. (2013). *Paket Programlar ile İstatistiksel Veri Analizi.* Eskişehir, TR: Nisan Kitabevi.

Pojskić, H., Šeparović, V., & Užičanin, E. (2009). Differences between successful and unsuccessful basketball teams on the final Olympic tournament. *Acta Kinesiologica*, *3*(2), 110-114.

Ribas, R. L., Navarro, R., Tavares, F., & Gómez, M. A. (2011). Analysis of number of players involved in rebound situations in Euroleague basketball games. *Open Sports Sciences Journal*, *4*, 10-13.

Sampaio, J., Godoy, S.I., & Feu, S. (2004). Discriminative power of basketball game related statistics by level of competition and sex. *Perceptual and Motor Skills*, 99, 1231-1238. doi: 10.2466/pms.99.3f.1231-1238

Sampaio, J., Janeira, M., Ibanez, S., & Lorenzo, A. (2006). Discriminant analysis of game-related statistics between basketball guards, forwards and centres in three professional leagues. *European Journal of Sport Science*, 6(3), 173-178. doi:10.1080/17461390600676200

Sampaio, J., Lago, C., & Drinkwater, E. J. (2010a). Explanations for the United States of America's dominance in basketball at the Beijing Olympic Games (2008). *Journal of Sports Sciences*, 28(2), 147-152. doi: 10.1080/02640410903380486

Sampaio, J., Drinkwater, E. J., & Leite, N. M. (2010b). Effects of season period, team quality, and playing time on basketball players' game-related statistics. *European Journal of Sport Science*, 10(2), 141-149. doi: 10.1080/17461390903311935

Severini, T. A. (2014). Analytic methods in sports: Using mathematics and statistics to understand data from baseball, football, basketball, and other sports. Chapman and Hall/CRC.

Tabachnick, B. G., & Fidell, L. S. (2001). *Computer-assisted research design and analysis.* Allyn & Bacon, Boston.

Taxildaris, K., Papadimitriou, K., Alexopoulos, P., Fatouros, I. G., Kambas, A., Karipidis, A., ... & Barbas, I. (2001). Factors characterizing the offensive game of the playmaker position in basketball. *Journal of Human Movement Studies*, *40*(6), 405-421.

DOI 10.26773/mjssm.190307