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# Examining the Turkish Men's Professional Basketball Team's Success According to Game-related Statistics with Discriminant Analysis

İlkay Doğan<sup>1</sup>, Özkan Işık<sup>2</sup> and Yasin Ersöz<sup>2</sup>

<sup>1</sup>Department of Biostatistics, Faculty of Veterinary Medicine, Afyon Kocatepe University, Afyonkarahisar/TURKEY, 03200, e-mail: ilkaydogan@aku.edu.tr

<sup>2</sup>School of Physical Education and Sports, Afyon Kocatepe University, Afyonkarahisar/TURKEY, 03200, e-mail: oisik@aku.edu.tr

<sup>2</sup>School of Physical Education and Sports, Afyon Kocatepe University, Afyonkarahisar/TURKEY, 03200, e-mail: yasin\_ersz@hotmail.com

## Abstract

*The aim of this study was to investigate the game-related statistics that discriminate between teams according to their league position in the Turkish Basketball League. Data were collected from the official box scores for 16 participated teams during the 2014-2015 regular season of the Turkish Basketball League. Teams were divided into two groups according to their league position; top 8 teams were called the top half teams and other 8 teams were called the bottom half teams. Players who played for less than one-quarter of the season or less than half a game period were omitted from the sample. The final data set obtained from 198 basketball players. The recorded game-related statistics were standardized according to a player's time on court. Independent samples t-tests were used to compare descriptive results from the game-related statistics. Also, discriminant analysis was applied to discover the statistical team variables that better discriminated between the two types of team. The mean differences between teams that were found to be statistically significant were assists, steals, defensive rebounds, turnovers and offensive rebounds. In the 2014-2015 regular season of Turkish Basketball League assists, steals, defensive rebounds, turnovers and offensive rebounds were the variables that had a major contribution to a team success. As a result, it was found that offensive rebounds, defensive rebounds, assists, steals and turnovers were more important game-related statistics than others. These results suggest that defense is more effective for team success than offense.*

**Keywords:** basketball, professional league, game-related statistics, discriminant analysis.

## **1. Introduction**

Game-related statistics in basketball can be used to define the distinction and variables between successful teams and players (Ibáñez et al., 2008). Indeed, game-related statistics guide coaches and scouts. This situation drew the attention of sports scientists and researchers have begun to be conducted in this area (Lorenzo et al., 2010; Sampaio et al., 2010a; Sampaio et al., 2010b).

The characteristics that distinguish between successful teams and unsuccessful teams have components such as the 2 and 3-points field-goals, assists, rebounds, free throw percentage, steals and turnovers (Akers et al., 1991). Generally, compared to the losing teams, percentage of 2 and 3 points field-goals and defensive rebounds in winning teams' shown to be higher than average (Ibáñez et al., 2008; Gómez et al., 2008; Lorenzo et al., 2010). The high percentage of 2 and 3 points field-goals in winning teams associated with the players' strategic and tactical decision-making ability and 2 and 3 points field-goals efficiency or effectiveness during competitions (Trninić et al., 2000). The defensive rebounds characteristics are related to muscular fitness and anthropometric characteristics, technical and tactical preparation of players before competitions (Carter et al., 2005). In addition, it has been reported in the studies that components such as assists, steals, offensive rebounds and turnovers are important to win a basketball game (Gómez et al., 2008; Ibáñez et al., 2008; Lorenzo et al., 2010; García et al., 2013).

Previous studies investigated that basketball leagues of various countries, continents and /or the game-related statistics of the world championship (Dežman et al., 2002; Gimenez and Janeira, 2003; Sampaio et al., 2004). However, studies on game-related statistics for teams in the Turkish Basketball League (TBL) had not been observed. In this context, the aim of this study was to investigate the game-related statistics that separate the top half teams from the bottom half teams according to their league position in the TBL.

## **2. Methods**

### **2.1. Variables and sample**

In order to carry out this study, data were collected from official box scores for all 263 games played by the 16 participated teams in the 2014-2015 regular season of the TBL. In this context, game-related statistics such as 2 and 3 points field-goals (both successful and unsuccessful), free-throws (both successful and unsuccessful), offensive and defensive rebounds, blocks, assists, turnovers and steals were gathered. The data set consisting of a total of 290 basketball players in 16 teams gathered from Turkish Basketball Federation (TBF) web page (<http://www.bsl.org.tr/bsl/istatistikler/arsiv> accessed 10th March 2016). Game-related statistics were collected by experienced statistic company working for the TBF. In order to provide evidence of reliability of data, we watched 10 games randomly and collected game-related statistics for comparing our values for the variables with what is on the website for these same 10 games. This showed a 100% agreement for all variables used in the study. In this way it was determined that the reliability of data obtained from the official web page. Players

who played for less than one-quarter of the season (eight games) or less than half a game period (5 min) were omitted from the sample (Sampaio et al., 2006; Sampaio et al. 2010a). The final data set obtained from 198 basketball players. Consequently, the recorded game-related statistics were standardized according to a player's time on court (Sampaio et al. 2006, Sampaio et al. 2010a). Namely, the variables which were used in analyses were derived-rate variables (because the original game-related statistics were divided by the time played by each player). Teams were divided into two groups according to their league position during the 2014-2015 regular season of TBL; teams located within the top 8 teams (the remaining teams in the playoffs) and located in the bottom 8 teams (teams cannot remain playoffs). The "remaining teams" in the playoffs were called the "top half teams", whereas the teams could not remain in the playoffs were called the "bottom half teams". The data analysis was carried out considering these two groups.

## **2.2. Statistical analysis**

Independent samples t-tests were used to compare the descriptive results from the game-related statistics belonging to two groups. Also, discriminant analysis was applied to discover the statistical team variables that better contribute to discriminate both groups. Discriminant analysis is a method which develops distinguishing functions between the group mean vectors for separating the groups entered into each other with common features (Özdamar, 2010). The comment of the obtained discriminant functions depended on examination of the structure coefficients greater than  $|0.30|$ . It inferred that variables with higher absolute values have a greater contribution to discriminate between groups (Tabachnick and Fidell, 2000). Discriminant analysis is categorized into two main groups: linear and quadratic discriminant analyses. Linear discriminant analysis assumed that all group's covariance matrices are homogenous. Quadratic discriminant analysis does not use the assumption that all groups' covariance matrices are homogenous (Özdamar, 2010). In this study it was found that the group's covariance matrix were not homogeneous as a result of Box'M test ( $F=2.399$ ,  $p<0.05$ ). Therefore, quadratic discriminant analysis was used in this study. The statistical analysis were applied using SPSS software program and significance level was specified at  $p<0.05$ .

## **3. Results**

Descriptive results derived from game related statistics for the top half teams and the bottom half teams are presented in Table 1. As shown in Table 1, the mean differences between two groups are found to be statistically significant in terms of offensive rebounds, defensive rebounds, assists, turnovers and steals ( $p<0.05$ ). Accordingly, the top half teams' offensive rebounds, defensive rebounds, assists, steals and turnovers mean are higher than the bottom half teams. However, the mean differences between two groups are not statistically significant in terms of successful 2-point field goals, successful 3-point field goals, successful free-throws, blocks, unsuccessful 2-point field goals, unsuccessful 3-point field goals, unsuccessful free-throws ( $p>0.05$ ).

Table 1. Descriptive results derived from the game-related statistics for “the top half teams” and “the bottom half teams”

Game-related statistics	The Top Half Teams (n=102)	The Bottom Half Teams (n=96)	t	p
	$\bar{X} \pm s$	$\bar{X} \pm s$		
Successful 2-point field goals	3.24±1.76	2.84±1.80	1.562	0.120
Successful 3-point field goals	1.62±1.39	1.58±1.17	0.248	0.804
Successful free-throws	4.12±2.37	3.85±2.64	0.749	0.455
Offensive rebounds	1.26±0.95	0.99±0.85	2.056	0.041*
Defensive rebounds	3.07±1.63	2.45±1.27	2.954	0.004*
Assists	2.18±1.37	1.60±1.04	3.384	0.001*
Steals	0.83±0.50	0.63±0.34	3.258	0.001*
Turnovers	1.59±0.69	1.32±0.59	2.897	0.004*
Blocks	0.31±0.39	0.25±0.41	1.020	0.309
Unsuccessful 2-point field goals	3.19±2.09	3.17±2.62	0.083	0.934
Unsuccessful 3-point field goals	4.81±3.17	4.43±3.22	0.830	0.407
Unsuccessful free-throws	2.32±2.86	2.16±2.92	0.380	0.705

\*p<0.05

The results of the discriminant analysis are represented in Table 2. According to Table 2, the discriminant function for determining (separating) the group based on the data has significant separation ( $p<0.05$ ). In addition, the correct classification rate of the discriminant function was found to be 58.6%. Considering the discriminant function coefficients, a discriminant function can be written as equation (1),

$$Y_1 = -3.676 + 0.359 X_1 - 0.171 X_2 + 0.139 X_3 + 0.153 X_4 + 0.436 X_5 + 0.825 X_6 + 0.228 X_7 - 0.508 X_8 - 0.069 X_9 - 0.017 X_{10} \quad (1)$$

While finding the discriminant function, “unsuccessful 3-point field goals” and “unsuccessful free-throws” variables were not used in the analysis.

In the 2014-2015 regular season of TBL, assists (SC=0.552) and steals (SC=0.532) were the variables that had the major contribution to team success. In addition, the other variables that contribute to the success of the team were defensive rebounds (SC=0.482), turnovers (SC=0.473) and offensive rebounds (SC=0.336), respectively.

Table 2. Structure coefficients (SC) obtained from the discriminant analysis results for game-related statistics and tests of statistical significance

Discriminant Function Coefficients		Structure Coefficients
Variables	Coefficients	Function 1
Successful 2-point field goals (X <sub>1</sub> )	0.359	0.255
Successful 3-point field goals (X <sub>2</sub> )	-0.171	0.041
Successful free-throws (X <sub>3</sub> )	0.139	0.122
Offensive rebounds (X <sub>4</sub> )	0.153	<b>0.336</b>
Defensive rebounds (X <sub>5</sub> )	0.436	<b>0.482</b>
Assists (X <sub>6</sub> )	0.825	<b>0.552</b>
Steals (X <sub>7</sub> )	0.228	<b>0.532</b>
Turnovers (X <sub>8</sub> )	-0.508	<b>0.473</b>
Blocks (X <sub>9</sub> )	-0.069	0.166
Unsuccessful 2-point field goals (X <sub>10</sub> )	-0.017	0.014
Unsuccessful 3-point field goals*		0.136
Unsuccessful free-throws*		0.062
(Constant)	-3.676	
Wilks' Lambda	0.839	
Eigenvalue	0.191	
Chi-Square	33.465	
p	0.000	
Canonical Correlation	0.401	
Reclassification (%)	58.6	

\* This variable not used in the analysis.

#### 4. Discussion

The aim of this study was to investigate the game-related statistics that discriminate the top half teams and the bottom half teams according to their league position (remaining playoff or not) in the TBL. Under this purpose, discriminant analysis was applied to the data and results obtained were evaluated. Ergül et al. (2014) reported that basketball game is a defensive game even though it is known for offense. In this context, when our findings are considered as a whole, the importance of defensive side of basketball is observed. Moreover, the findings of our study were compared with the findings of other researchers.

In this study, it was determined that there was no difference between the top half teams and the bottom half teams in terms of successful 2 and 3-point field goals and successful free-throws. Ibáñez et al. (2008) for the successful 2 and 3-point field goals; Sampaio and Janeira (2003) for the successful 2-point field goals; Ergül et al. (2014) for the successful 3-point field goals and successful free-throws; Gómez et al. (2008) for the successful free-throws show similarities with our study. In addition; it was determined that there was no difference between the top half teams and the bottom half teams in terms of unsuccessful 2 and 3-point shots and unsuccessful free-throws. Ibáñez et al. (2008) for unsuccessful 2 and 3-point field goals, unsuccessful free-throws; Lorenzo et

al. (2010) for unsuccessful 3-point field goals, unsuccessful free-throws shows similarity with our study. It is assumed that this situation is yielded because there is no major difference between the qualities of the teams located during the 2014-2015 regular season of the TBL.

Furthermore, in our study, it was determined that there was no difference between the top half teams and the bottom half teams in terms of blocks. Gomez et al. (2008) and Ergül et al. (2014) obtained similar results with our study.

Unlike this game-related statistics, it was determined that there was a difference between the top half teams and the bottom half teams in terms of offensive rebounds, defensive rebounds, assists, steals and turnovers. It has been seen that the top half teams' offensive rebounds, defensive rebounds, assists and turnovers were higher than the bottom half teams'. Gomez et al. (2008), Ibáñez et al. (2008) and Lorenzo et al. (2010) for the defensive rebounds, steals and assists; Ergül et al. (2014) for the steals and assists were similar to our study.

While Gomez et al. (2008) and Lorenzo et al. (2010) stated that the winning team's turnovers were lower than the losing team; Ibáñez et al. (2008) found that there was no difference between the winning teams and losing teams in terms of turnovers. However Sampaio and Janeir (2003) determined that the winning home team's turnovers were higher than the losing home team's in regular season. Moreover, Sampaio and Janeir (2003) and García et al. (2013) reported that winning team's turnover is higher than losing teams in play-off games. In our study, we found that a difference between the top half teams and the bottom half teams in terms of turnovers and the numbers of turnovers of the top half teams were found to be higher than the bottom half team. As far as the reason, it is considered that assists and offensive rebounds of the top half teams are higher than the bottom half teams. More offensive rebounds and assists showed that they attacked more and they shared the ball more. Accordingly, this increases the likelihood of turnovers. Although the bottom half teams have a chance to attack after turnovers, they are generally unable to handle the ball effectively.

When examining the structure coefficients of previous studies that applied discriminant analysis, Ibáñez et al. (2008) determined assists, steals and blocks; Gómez et al. (2008) determined defensive rebounds and assists; Trninić et al. (2000) determined defensive rebounds effect on success. A study that compared the basketball leagues of three different countries found that there was no effect of offensive rebounds on success in Liga Portuguesa de Basquetebol in Portugal (LCB), but there was an effect of offensive rebounds on success for Asociacion de Clubs de Baloncesto in Spain (ACB) and the National Basketball Association in the USA (NBA) (Sampaio et al., 2006). In our research, we found that the game-related statistics such as offensive rebounds, defensive rebounds, assists, steals and turnovers have the greatest effect on a team's success.

Gómez et al. (2008), Ibáñez et al. (2008), Ergül et al. (2014) and García et al. (2013) found the reclassification ratio as 87.4%, 82.4%, 86.7% and 86.7%; respectively. The study that compared the basketball leagues of three different countries; NBA, LCB and ACB leagues reclassification ratio determined as 76.97%, 70.33% and 64.63% (Sampaio et al., 2006). Present study, the reclassification ratio is determined to be

58.6%. Our study's re-classification ratio is low compared to other studies; this is considered because of the quality of the teams which were participated 2014–2015 regular season in the TBL. After this season, for the next year, first 10 teams qualified the different European Cups organizations. This indicates that TBL league had high quality standards.

## 5. Conclusion

As a result, it was found that offensive rebounds, defensive rebounds, assists, steals and turnovers were more important for game-related statistics than the others. This situation means that defense is more effective on team success than offense. It is recommended for the coaches to focus on defensive strategies, turnovers and sharing the ball on offense in order to improve the assist ratio. Thus, efficiency and effectiveness of the teams in the game can be increased.

## 6. Acknowledgement

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### Corresponding Author

Yasin Ersöz

Address: School of Physical Education and Sports, Afyon Kocatepe University, Afyonkarahisar/TURKEY, 03200

E-mail: yasin\_ersz@hotmail.com