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Regional Differences in Game-Related Statistics Across to Top European Basketball Leagues

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Abstract

The analysis was performed on all matches (n = 1239) in the five national leagues (France, Greece, Italy, Spain, and Turkey) of the 2018-2019 season. A one-way welch analysis of variance followed by a Games-Howell post hoc test was performed to assess differences in game-related statistics between the leagues. Game-related statistics that discriminate among the leagues were assessed by factorial discriminant analysis. France and Spain, most similar leagues but Italy and Turkey most differed leagues regarding GRS. Fouls and assists were the most distinguished among the leagues and demonstrated the most significant effect size. The discriminant analysis yielded four significant functions. The results of this study suggest that professional basketball games were played differently in each designated leagues of Europe.

Introduction:

Sports performance is acknowledged as a presentation of the complex interaction of variables, such as physiological fitness, psychological readiness, physical development, biomechanical dexterity, and tactical awareness, amongst others (genetics, maturation, nutrition, wellness, fitness, sociocultural factors). Although sports performance is multifactorial, research on sports performance tends to be mono-disciplinary.

It leans towards being conducted within the borders of one of the subdisciplines of sports science, usually sports physiology, sports biomechanics, or sports psychology (Abernethy *et al.,* 2013). However, the theoretical foundation and the philosophical premise of the studies in sports performance science concurs in three ultimate theoretical frameworks.

First, Newels' Great Unified Theory (GUT), as a central tenet, claims that the confluence of the interacting organism, environment, and task, construct and govern the structures of coordination and control patterns. These are accepted as direct determinants of the performance outcome, both the intra- and inter-personal levels (Newell, 1986). Then, environmental determinism, inclusive of the disciplines of geography, sociology, and history, asserts that some environmental conditions create individual propensities being passed to successive generations. Environmentalism was frequently used to clarify variations in such qualities as vigor, health, and energy, all concepts firmly connected, and imply ability in sports. Though not initially linked to the athletic body, environmental determinism became distinct or covertly related to athletic sports and was used to 'explain' apparent group and national differences in sports performances (Blaut, 2000). Third, the primary assumption in ecological psychology is that vision depends on the brain. In the condition of no restrictions in the visual system, people look around, walk towards something exciting, and move to see from all directions and move from one landscape to another (Gibson, 1979). In this sense, the demand or natural movement is implicitly or explicitly based on ecology and visual perception. A vary of performance analysis studies could be endorsed by the mentioned theories from a holistic perspective.

Basketball at a competitive level differs among the regions of the world. Some nations and clubs dominate the competitions some championships. Since the result of a basketball game is influenced by numerous factors such as anthropometric, physiological, and tactical factors, basketball has been studied by multiple methods (Esteves *et al.,* 2016; Fujii *et al.,* 2014). In recent years game-related statistics (GRS) that objectively reflect individual and collective team performance, also considered as referrals have been used in many studies to analyze training and match performance in NBA and European basketball (Garcia *et al.,* 2013; Mikolajec *et al.,* 2013; Ziv *et al.,* 2010).

Specifically, former examinations broadly contemplated the GRS as mostly assessing team

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performance to determine the followings: the importance of specific player positions (Sampaio *et al.,* 2006), the impact of rule changes (Ibanez *et al.,* 2018), the effect of home advantage (Pollard & Pollard, 2005), the importance of starters and bench players (Sampaio *et al.,* 2006), the scoring strategies in women's basketball (Conte & Lukonaitiene, 2018), which strategies most affect the game outcome (Ibanez *et al.,* 2018), comparison of different leagues (Sampaio & Leite, 2013). A list of the most influential GRS such as points per game (PPG), field goals made (FGM), rebounds, assists, turnovers, blocks, fouls, and steals were substantiated by Yu *et al.,* (2008). Sampaio *et al.,* also included free throws as an essential technical performance indicator (Sampaio & Leite, 2013). The GRS with the most impact on the outcome of a season in Spanish first division (ACB) teams were shooting percentage (both 2- point and 3-point percentage), assists, and rebounds (Garcia *et al.,* 2013; Angel-Gomez *et al.,* 2008).

However, as far as is known, only a few studies have been focused on regional differences in basketball, but no previous researches assessed national leagues' game-related statistics across five prominent countries of European basketball (Ibanez-Godoy *et al.,* 2018; Madarame, 2018). Knowing the national tendencies in GRS might be an advantage for international games and tournaments. Besides, GRS might be a reference guide to the federations' education committee for the preparation and revision of their long-term athletic development models. Therefore, studies concentrating on this issue are essential. This study aims to describe the 2018-2019 seasons GRS of the five national leagues and compare the possible performance trends.

Materials and Methods:

This retrospective study analyzed 1239 regular season (playoffs were not included) games of the five (France, Greece, Italy, Spain, and Turkey), national basketball leagues of Europe, for the 2018-2019 season. The data of 2478 GRS was gathered from official web pages of the federation, and these sources are considered valid and reliable for basketball statistics and research (Paulauskas *et al.,* 2018). The distribution of the cases and proportions were presented in Table-1.

Table 1. Cases, Games, and Percentages of the Leagues

	Cases	Games	%
France	612	306	24,70
Greece	356	178	14,37
Italy	478	239	19,29
Spain	612	306	24,70
Turkey	420	210	16,95
Total	2478	1239	100

To fully explain the structure of basketball, the following 15 GRS recorded and analyzed as the dependent variables of the study: points scored (PNT), ball possessions (POS), successful 2-point field-goals (2PS), unsuccessful 2-point field-goals (2PU), successful 3-point field-goals (3PS), unsuccessful 3-point field-goals (3PU), successful free-throws (FTS), unsuccessful free-throws (FTU), offensive rebounds (ORB)and defensive rebounds (DRB), steals (ST), turnovers (TO), assists(AS), blocks performed (BL), and personal fouls-committed (FLC). All the variables were normalized for 100 ball possessions per match (Garcia *et al.,* 2013). The ball possession equation (BP) was mostly calculated by the following equation (Oliver, 2004).

BP = (field-goals attempted) – (offensive rebounds) + (turnovers) + 0.4 x (free-throws attempted).

Descriptive analysis of GRS was performed to reveal that each of the national basketball leagues of the five nations has different basketball characteristics by using mean and standard deviation. Welch's ANOVA was conducted to compare means between national leagues in the GRS elements since the data holds the assumption of normality but violates the assumption of homogeneity of variances. For the post-hoc analysis, the Games-Howell test was conducted because of unequal variances and sample sizes (Moder, 2010). Cohen's d assessed the volume of effect sizes for the post hoc comparisons analysis. The effect size between 0.20–0.49 were considered small, between 0.50–0.79 were considered medium, and higher than 0.79 were considered large effect sizes (Thalheimer & Cook, 2002). Lastly, discriminant analysis was carried out to identify GRS, which best describes each national basketball league's (Ntoumanis, 2003). The structural coefficients (SCs) greater than |.30| were interpreted as meaningful contributors and the higher the SC value, the better the contribution of this performance indicator to the discriminant function to identify the variables that best contributed to differentiating among the national basketball leagues (Tabachnick *et al.,* 2007). A level of significance was set at $p < 0.05$, and IBM SPSS 26.0 statistical package was used for all the analyses (IBM Corp., Armonk, NY, USA).

Results:

Descriptive results derived from GRS for the five leagues of Europe were presented in Table-2. In detail, GRS of the European leagues shows us some information such as France leading in successful two-point field-goals and steals, and Greece leading in successful and unsuccessful free-throws and fouls. Furthermore, Italy, which has the most possession and points scored, was leading in unsuccessful two-point field-goals, defensive and offensive rebounds, Spain in unsuccessful three-point field-goals and blocking shoots and Turkey in successful three-point field-goals, assists, and fewer turnovers.

The Welch ANOVA produced significant F-values for all GRS except for steals. Table-3 reveals that the most similar leagues regarding GRS were those of France and Spain, but the leagues which differed most were those of

Italy and Turkey. Besides, fouls and assists demonstrated the most significant effect size among the leagues other than GRS. The GRS that distinguished least among the different teams were blocks and steals, which is already showed no statistically significant differences. When the effect size differences between the continents are scrutinized, the only large effect size was discovered in fouls between Greece and Turkey. However, moderate effect size differences between leagues were found in all possessions (France-Italy, Greece -Italy, Italy-Spain, and Italy-Turkey), successful two-point field-goals (France-Greece), unsuccessful two-point field-goals (Italy-Spain), successful three-point field-goals (Greece-Spain), unsuccessful three-point field-goals (France-Spain), unsuccessful free-throw field-goals (Greece-Turkey, Greece-Spain), defensive rebounds (Italy-Spain), assists (Greece-Turkey, Italy-Turkey, Spain-Turkey), fouls-committed (France-Greece, Spain-Turkey).

functions can discriminate among leagues, and they are ranked by successive capacity size from function 1 to function 4 (Function 1 > Function 2 > Function 3> Function 4). Moreover, 43.0% of original grouped cases classified correctly.

Table-4: Discriminant functions with structural coefficients (SC) for each variable.

	F-1	F-2	F-3	F-4
PTS	.06	-.24	.30	.44
POSS	.24	.01	.69	-.07
2PS	-.17	.17	.47	.38
2PU	.08	.37	.48	-.01
3PS	-.12	-.59	.01	-.15
3PU	.37	-.38	-.04	-.16
FTS	.29	.15	-.06	.15
FTU	.26	.39	-.04	-.34
OFF	.15	-.09	.17	-.16
DEF	.22	.28	.46	-.34
AS	-.49	.08	.06	.20
FLC	.49	.19	-.31	-.11
ST	.01	.16	.00	.07
BL	.13	.00	-.01	.20
TO	.18	.18	-.04	-.09
Eigen value	.24	.12	.08	.06
Wilks' Lambda	.64	.78	.88	.95
Chi-square	1121.44	600.97	327.89	135.37
P	.001	.001	.001	.001
Prop. of Trace (%)	48	23.9	16.6	11.5
Canonical Corr.	.44	.32	.27	.23

According to function 1, Turkish league discriminated between the other leagues in fouls-committed, assists, and unsuccessful three-point field-goals. Function 2 discriminated between the Spanish league and the French, Greek and Italian leagues, in successful and unsuccessful three-point field-goals, unsuccessful two-point field-goals, and unsuccessful free-throws. However, Function 3 discriminated between the Italian league and other leagues with the discriminating GRS scored points, ball possessions, successful two-point field-goals, unsuccessful two-point field-goals s, defensive rebounds, and fouls-committed.

Table 2. Mean $\pm$ SD of the GRS for the five leagues

GRS	France Mean	SD	Greece Mean	SD	Italy Mean	SD	Spain Mean	SD	Turkey Mean	SD
PTS	80.88	10.99	76.84	11.68	82.44	11.14	81.86	10.97	79.61	11.85
POSS	73.56	4.18	73.54	4.83	76.30	5.05	73.49	4.89	73.28	5.59
2PS	21.53	4.18	19.31	4.79	21.12	4.32	19.70	4.39	20.57	4.46
2PU	18.75	4.91	18.51	4.58	19.58	5.01	17.07	4.64	17.52	5.06
3PS	8.12	2.87	7.88	2.88	8.74	3.30	9.44	3.06	9.85	4.78
3PU	14.23	3.70	15.60	4.09	16.10	3.96	16.48	3.90	14.83	4.27
FTS	13.43	5.09	14.28	5.40	13.96	5.29	13.85	5.30	11.78	5.09
FTU	4.90	2.63	6.17	3.14	5.34	2.89	4.72	2.61	4.42	2.49
OFF	8.44	3.24	8.92	3.28	9.40	3.38	8.93	3.18	8.70	3.27
DEF	22.93	4.35	24.08	4.44	24.80	4.60	22.33	4.33	22.63	4.61
AS	18.35	4.64	16.01	5.01	16.20	4.87	16.35	4.30	18.69	4.58
FLC	19.52	3.65	21.55	3.76	20.26	3.89	20.54	3.33	18.43	3.71
ST	6.82	2.83	6.76	2.77	6.61	2.72	6.47	2.53	6.42	2.57
BL	2.33	1.67	2.29	1.66	2.38	1.61	2.43	1.65	2.04	1.56
TO	11.96	3.58	12.76	3.88	12.29	3.47	12.00	3.34	11.44	3.41

The discriminant analysis evinced four discriminant functions (Table 4). The value of Wilks' Lambda ranges from 0 to 1, which means the closer to zero, the higher discriminating ability. Also, a significant chi-square rejects the null hypothesis that the function has no discriminating ability. Thus, the results were interpreted that all four

Table 3. Results of Welch Anova and post hoc comparison between each league

GRS	F	P	France-Greece p	D	France-Italy p	d	France-Spain p	d	France-Turkey p	d	Greece-Italy p	d	Greece-Spain p	d	Greece-Turkey p	d	Italy-Spain p	d	Italy-Turkey p	d	Spain-Turkey p	d
PTS	15.26	0.001	0.001	0.36	0.145	-0.14	0.517	-0.09	0.41	0.11	0.001	-0.49	0.001	-0.45	0.01	-0.24	0.916	0.05	0.002	0.25	0.017	0.20
POSS	30.52	0.001	1.000	0.00	0.001	-0.60	0.999	0.02	0.906	0.06	0.001	-0.56	1.000	0.01	0.958	0.05	0.001	0.57	0.001	0.57	0.972	0.04
2PS	22.23	0.001	0.001	0.50	0.503	0.10	0.001	0.43	0.004	0.22	0.001	-0.40	0.712	-0.09	0.002	-0.27	0.001	0.33	0.331	0.13	0.017	-0.20
2PU	22.24	0.001	0.944	0.05	0.049	-0.17	0.001	0.35	0.001	0.25	0.013	-0.22	0.001	0.31	0.035	0.20	0.001	0.52	0.001	0.41	0.595	-0.09
3PS	28.43	0.001	0.738	0.08	0.009	-0.20	0.001	-0.45	0.001	-0.46	0.001	-0.28	0.001	-0.52	0.001	-0.49	0.003	-0.22	0.001	-0.27	0.517	-0.11
3PU	32.74	0.001	0.001	-0.36	0.001	-0.49	0.001	-0.59	0.133	-0.15	0.389	-0.12	0.009	-0.22	0.085	0.18	0.492	-0.10	0.001	0.31	0.001	0.41
FTS	15.39	0.001	0.109	-0.16	0.445	-0.10	0.607	-0.08	0.001	0.32	0.912	0.06	0.749	0.08	0.001	0.48	0.997	0.02	0.001	0.42	0.001	0.40
FTU	21.70	0.001	0.001	-0.45	0.068	-0.16	0.754	0.07	0.025	0.19	0.001	0.28	0.001	0.51	0.001	0.62	0.002	0.23	0.001	0.34	0.339	0.12
OFF	5.96	0.001	0.185	-0.15	0.001	-0.29	0.059	-0.15	0.726	-0.08	0.231	-0.14	1.000	0.00	0.885	0.07	0.137	0.14	0.014	0.21	0.784	0.07
DEF	26.15	0.001	0.001	-0.26	0.001	-0.42	0.114	0.14	0.824	0.07	0.162	-0.16	0.001	0.40	0.001	0.32	0.001	0.56	0.001	0.47	0.842	-0.07
AS	36.50	0.001	0.001	0.49	0.001	0.45	0.001	0.45	0.773	-0.07	0.981	-0.04	0.816	-0.07	0.001	-0.56	0.983	-0.03	0.001	-0.53	0.001	-0.53
FLC	40.94	0.001	0.001	-0.55	0.012	-0.20	0.001	-0.29	0.001	0.30	0.001	0.34	0.001	0.29	0.001	0.84	0.713	-0.08	0.001	0.48	0.001	0.61
ST	2.09	0.08	0.998	0.02	0.744	0.08	0.163	0.13	0.139	0.15	0.938	0.05	0.487	0.11	0.403	0.13	0.908	0.05	0.823	0.07	0.998	0.02
BL	4.14	0.002	0.997	0.02	0.989	-0.03	0.811	-0.06	0.041	0.18	0.941	-0.05	0.695	-0.09	0.215	0.15	0.981	-0.03	0.014	0.21	0.001	0.24
TO	7.02	0.001	0.014	-0.22	0.557	-0.09	1.000	-0.01	0.123	0.15	0.361	0.13	0.017	0.21	0.001	0.36	0.64	0.09	0.002	0.25	0.069	0.17

p < 0.05 and d > 0.49 are presented in bold.

Function 4 discriminated between the Greek league and other leagues. The discriminating GRS were points scored, successful two-point point field-goals, unsuccessful free-throws, and defensive rebounds.

Fig.-1 presents the territorial map of all the cases as a function of the national leagues. Turkey differentiated from each other's in function 1, and Spain and Greece differentiated from each other's in function 2. Function three discriminates Italy to each other league and function four discriminates Greece from each other leagues.
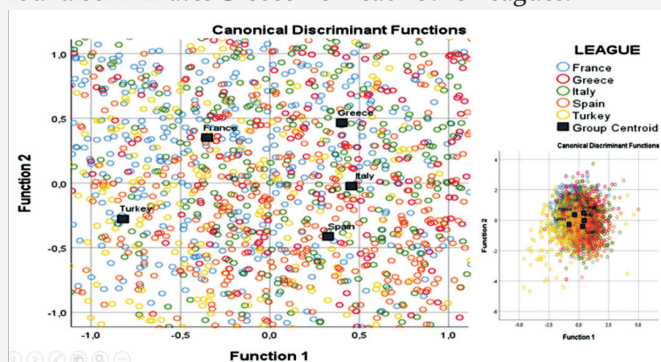
Figure-1: Territorial map of all the GRS from 5 Europe leagues.

Discussion:

This article aimed to identify the regional differences in basketball GRS for the 2018-2019 season between the five professional leagues of Europe: France, Greece, Italy, Spain, and Turkey. The results revealed that even though performance profiles are very similar, significant differences were found among all the national leagues. Thus, it is introducing that top-level basketball games are played in a different character in some regions of Europe. However, the discriminant analysis results showed that the correct classification rate for the five European leagues was low (43.0). This result indicates that the GRS in European leagues is not homogenous, and some of the cases have similar characteristics.

The Turkish national league was clearly discriminated against from other European leagues in the high number of assists, the low number of fouls-committed, and the low number of unsuccessful three-point point field-goals. Assists have been acknowledged as a pointer of well-organized team performance, away from individual play, and its contribution to winning in European leagues and tournaments has been exposed in previous studies (Garcia *et al.,* 2013; Lorenzo *et al.,* 2010). According to Trninic *et al.,* (2006), assist is a factor that produces "easy shots." A higher number of assists produce greater shoot efficiency, making a significant number of successful throws for two points and three points. Particularly in this study, assists may contribute to the lower level of unsuccessful three-point point field-goals performance of Turkish League even though the success of the field goal attempts were determined not only by team basketball character in terms of assists but also by defensive pressure and players'

shooting skills (Ciampolini *et al.,* 2017; Csataljay *et al.,* 2013). The success of field goal attempts and the low number of fouls can be considered an indication of a non-physical and aggressive game style, and it may label Turkey as an offensive-oriented league.

In this half of the current decade, like other sports, there has been a remarkable evolution in basketball, especially in the use of quick 3 points in NBA (Fichman & O'Brien, 2018). This situation was also observed in its closest follower, European basketball. Spanish league discriminated from other leagues, especially from the Greek and French leagues, with a high number of successful and unsuccessful three-points, and unsuccessful free-throws and unsuccessful two points. The success of close-range finishing skills such as lay-ups or pivots, middle-distance shots, and pull-ups, and 3 points are estimated by the capability of the players, the influence of body size and, defensive aggressivity and pressure (Paulauskas *et al.,* 2018; Ciampolini *et al.,* 2017; Csataljay *et al.,* 2013). On the other hand, it is known that psychological factors are essential performance determinants as well as the ability to shoot a free throw, which is the only closed skill in the game (Gomez *et al.,* 2018). Leaning to these studies, Spain, which is world number two in the Fiba ranking, may be separated from other countries' scoring skills.

A closer look at the statistics shows that the Italian league is at the top in many GRS, but this league differs from others in the high number of following elements; point scored, possessions, both successful and unsuccessful two-points, defensive rebounds, and fouls-committed. A high number of ball possessions directs that the pace of the game was relatively faster, and a low number of assists indicates that most of the points were comparatively scored by individual skills (Madarame, 2018). The high number of possessions, in other words, the high game pace, may also imply that teams make more turnovers than in matches at a slower pace. Defense rebounds mainly depend on somatic characters and physical fitness levels of the players that discriminated between the Italian league and other leagues (Sampaio & Janeira, 2003). It is a crucial tactical element because it removes the opponent a second shot chance and terminates the possession of the ball and ignites his team to offense and players a discriminant role in final game results (Angel-Gomes *et al.,* 2008; Lorenzo *et al.,* Csataljay *et al.,* 2013).

Free throws are a key element that determines success in competitive basketball. Previous research done on NCAA division one men's basketball games shows that 20% of all points were scored from the free-throw line. The free throws scored by winning teams were significantly higher than those of the losing teams. It has been observed that there are more fouls in the close games, however, the home team fouls less. Teams' fouls are opportunities for the opponent to score from the free-throw line and risk the

team to lose its player due to the disqualification rule. On the other hand, it seems that teams with higher defensive performances foul less. However, whether their defensive efficiency, opponent's offensive inefficiency, or both because this is not certain. The number of fouls in playoffs was higher. It is also likely to take more defensive precautions since the offense is to be stopped right away through fouling. That can cause a team to score more points from free-throws and increase the significance of this statistic (Sampaio & Janeira, 2003).

The Greek league was discriminated against from other European leagues, with a high number of unsuccessful free-throws, a high number of defensive rebounds and points, and successful two-points. Despite having a relatively higher point average than others, the point-assist ratio indicates a relatively low level of team cooperation for the Greek league. The relatively higher number of successful two-points may be explained by national basketball style, players finishing skills, and defensive weakness(Ciampolini *et al.,* 2017; Csataljay *et al.,* 2013; Fichman & O'Brien, 2018). The highest number of unsuccessful free-throws average may be related to some psychological factors (Gomez *et al.,* 2018). Relatively higher mean scores in defensive rebound may indicate the somatic character of the players, fitness levels of players, and unsuccessful field goal attempts. This situation explained by that winning teams forced losing teams for a higher number of challenged and missed shots from the game and created a higher possibility for defensive rebounds (Bray & Widmeyer, 2000).

Conclusion:

Basketball is played with the same rules in all professional leagues in the world and Europe, but slight differences in GRS between the countries' observed in this study. These results show that there are differences in style and understanding among the countries regarding the way basketball is played. In particular Turkish league discriminated between the other leagues in fouls, assists, and unsuccessful three-points. Spanish league discriminated between the French, Greek and Italian leagues in successful and unsuccessful three-points, unsuccessful two-points, and unsuccessful free-throws. Italian league discriminated between the other leagues in scored points, ball possessions, successful two-points, unsuccessful two-points, defensive rebounds, and fouls committed. Greek league discriminated between the other leagues in scored points, successful two-points, unsuccessful free-throws, and defensive rebounds. From a practical aspect, the study gives the perspective of the basketball coaches, scouting staff, and players. By analyzing the discriminant game-related statistics (GRS), and its association with the technical and tactical dynamics of the leagues, coaches, staff, and players can develop a tactical understanding of the international games. Besides, the results of this study would be valuable and may contribute to federations as part of scientific knowledge in the field of constructing or modifying a long-term athletic development model.

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