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MS INTERNATIONAL BASKETBALL COACHING AND MANAGEMENT

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FACTORS ASSOCIATED WITH FIELD GOALS DURING 2017 EUROPEAN MALE BASKETBALL CHAMPIONSHIP BY THE TOP3 TEAMS (SLOVENIA, SERBIA AND SPAIN)

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Annex 4

CONFIRMATION OF INDEPENDENT COMPOSITION OF THE THESIS

I hereby declare, that the present final Master's thesis FACTORS ASSOCIATED WITH FIELD GOALS DURING 2017 EUROPEAN MALE BASKETBALL CHAMPIONSHIP BY THE TOP3 TEAMS (SLOVENIA, SERBIA AND SPAIN).

1. Has been carried out by myself;
2. Has not been used in any other university in Lithuania or abroad;
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CONFIRMATION OF LIABILITY FOR THE REGULARITY OF THE LITHUANIAN/ FOREIGN LANGUAGE

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ABBREVIATIONS

2PTFG: 2-point field goal.

3PTFG: 3-point field goal.

2PTFGA: 2-point field goal attempt.

3PTFGA: 3-point field goal attempt**.**

FGM**:** Field Goal Made.

FGA: Field Goal Attempt.

ABSTRACT

FACTORS ASSOCIATED WITH FIELD GOALS DURING 2017 EUROPEAN MALE BASKETBALL CHAMPIONSHIP BY THE TOP3 TEAMS (SLOVENIA, SERBIA AND SPAIN).

Key words: European Male Basketball Championship 2017; shooting performance; notational analysis.

Research problem. Shooting performance is gaining great importance in modern basketball, where the quantity of players able to shoot from different distances and locations is constantly increasing. We want to analyse how the shooting performance is determined by the shooting conditions.

Research aim. The main objective of this study was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3-point and 2-point field goals attempts.

Hypothesis. Our hypothesis is that shooting performance is dependent on shooting conditions.

Research methods. Every field goal attempted by these teams have been classified according with criteria related with shot success, shot defence, shot location, shot success and shot previous situation or type of shot. Through game observation, we assessed a total of 1653 field goals attempts from 25 different games. 2-point field goals attempts and 3-point field goals attempts have been treated separately, primarily in absolute terms and secondly divided by teams. Descriptive analysis from data extracted consisted in absolute and relative values regarding our criteria established and inferential statistics were applied through Chi-Square test (significance levels were set at 5% and all statistics were performed through RStudioCloud) in order to find out the shot context with highest probability to be successful.

Results. In the case of the 3-point field goals attempts, statistically significant results show that the highest probability of success is observed when the shot is performed not contested, after pass and performed from the corner while for the 2-point field goals attempts, it would be the one performed not contested, from inside paint and performed in a movement shot.

Conclusions. Evidence shows the importance of shooting condition as a determinant factor of field goals made through games analysed.

SANTRAUKA

VEIKSNIAI, TURINTYS ĮTAKOS TOP3 VYRŲ KREPŠINIO KOMANDŲ (SLOVENIJA, SERBIJA IR ISPANIJA) METIMŲ Į KREPŠĮ VEIKSMINGUMUI 2017 M. EUROPOS VYRŲ KREPŠINIO ČEMPIONATE

Raktiniai žodžiai: 2017 m. Europos krepšinio čempionatas; metimai į krepšį; varžybinės veiklos analizė.

Tyrimo problema. Metimų į krepšį atlikimo galimybės įgyja didelę reikšmę šiuolaikiniame krepšinyje, o žaidėjų, galinčių atlikti metimus iš skirtingų atstumų ir vietų, skaičius nuolat auga. Norime išsiaiškinti, kaip metimų į krepšį veiksmingumą lemia metimo atlikimo sąlygos.

Tyrimo tikslas. Pagrindinis tyrimo tikslas buvo nustatyti TOP3 vyrų krepšinio komandų (Slovėnija, Serbija ir Ispanija) metimų į krepšį rodiklius, jų pasiskirstymą bei sąlygas 2017 m. Europos čempionate.

Hipotezė. Keliama hipotezė, kad metimų į krepšį veiksmingumas priklauso nuo metimų atlikimo sąlygų.

Tyrimo metodai. Kiekvienos komandos tikslus metimas buvo analizuojamas pagal kriterijus susijusius su metimo į krepšį sėkme, ar metimas dengiamas ar atliekamas be gynybos, atlikto metimo vieta ir metimo būdas. Stebėdami rungtynes, mes įvertinome iš viso 1653 atliktus metimus iš 25 skirtingų rungtynių. 2 taškų ir 3 taškų metimų skaičius bei tikslumas buvo nagrinėjami visų pirma absoliučiais skaičiais, o antra, atskirai komandų. Aprašomąją analizę iš gautų duomenų sudarė absoliučiosios ir santykinės mūsų nustatytų kriterijų reikšmės, taip pat buvo taikomas Chi-Square testas (reikšmingumo lygmuo buvo nustatytas 5%, o visa statistika buvo atlikta „RStudioCloud“), siekiant išsiaiškinti metimų į krepšį atlikimo sąlygų poveikį su didžiausia sėkmės tikimybe.

Rezultatai. Nustatyta, kad tikslių metimų iš 3 taškų zonos didžiausia sėkmės tikimybė yra tada, kai metimas atliekamas varžovui nedengiant, po perdavimo ir atlikus juos iš aikštelės kraštų, o tiksliems metimams iš 2 taškų zonos reikšmingos įtakos turėjo, kad metimas buvo atliekamas be pasipriešinimo, iš trijų sekundžių zonos bei atliktas judesyje.

Pagrindinė išvada. Nustatyta, kad metimų į krepšį sąlygų, kaip lemiamų žaidimo veiksnių, analizė rungtynėse turi ypatingos svarbos.

INTRODUCTION

During the last decade or so, the capacity to produce data that provide a substantial description of performance of individuals or teams in sport, to sustain decision-making by coaches and managers, has been largely improved by technological developments (Liebermann et al., 2002). Several studies have been found regarding factors being influent in shooting performance. Some researches study shooting performance from game-conditions perspectives, such as the point differences (Gómez et al., 2008; Lorenzo et al., 2010), the game place (García et al., 2014; Sampaio & Janeira, 2003; De Rose, 2004) or differences in shooting performance between consecutive games (Ibañez et al.,2009) Additionally, other studies focus in the shooting conditions at the shooting moment, aiming to determine how aspects such as the defence or the previous situation before the shot is taken, affect the shot effectiveness (Ciampolini, 2018; Csataljay et al., 2013). Finally, some other authors have attempted to build shot selection models to construct the ideal shooting situation (Suárez-Cadenas et al., 2013). Shooting performance is gaining great importance in modern basketball, where the quantity of players able to shoot from different distances and locations is constantly increasing. Our attempt in this study has to do with the shooting conditions as determinants of the shooting performance. We will study the shooting conditions according with criteria related with level of opposition, shot location, shot previous situation and type of shot. We base our study in the European Male Basketball Championship from 2017 and particularly in the top three teams from that Championship: Slovenia (gold), Serbia (silver) and Spain (bronze).

Aim. The main objective of this study was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3PTFGA and 2PTFGA among the TOP3 men's basketball teams in the European Championship 2017.

Objectives:

1. To determine and compare the situational indicators of 3-point field goals attempts: overall analysis plus comparison among teams studied.

2. To determine and compare the situation indicators of 2-point field goals attempts: overall analysis plus comparison among teams studied.

Our **hypothesis** is that shooting performance is directly affected by the shooting conditions and we aim to find the shooting conditions with highest probability to be successful.

By comparing the shooting conditions with the shooting performance, and further identifying the shooting conditions that present highest effectiveness rates, coaches could use this information by trying to provoke those situations that have resulted into higher effectiveness rates.

1. LITERATURE REVIEW

1.1. The game of basketball

Lamas, Barrera, Otranto and Ugrinowitsch (2014) made an approach to what is called "Invasion Team Sports", characterized by a dispute between two teams in a common field, where the main objectives are scoring a goal or point and preventing the opponent from scoring by means of individual, group and team actions. Additionally, they affirmed that "performance in invasion team sports (ITS) is highly dependent on the appropriate execution of an efficient team strategy by the players".

We must take into consideration then that rather to be an individual sport, basketball is conditioned by the team performance and strategy. We define teams as groups of individuals working collaboratively and in a coordinated manner towards a common goal be it winning a game, increasing productivity, or increasing a common good (Zaccaro, Rittman, Marks, 2001). The success of the team is rarely a simple summation of the tools each individual brings. Instead it must emerge from the dynamic interactions of the group as a whole (Eccles and Tenenbaum, 2004). Basketball is a complex sport, where team´s or player´s activities can´t be analysed without the relationship with another team (Bourbousson, Sève and McGarry, 2010).

Grehaigne, Godbout and Bouthier (1999) attempted to define key concepts in invasion team sports such as tactics and strategy. They defined strategy as all plan and action guidelines determined before a match to organize the actions of the team players in the confront whereas they defined tactics referring to activities executed by the players during a match to adapt to the constant changes that occur during the confront.

Further studies related with basketball performance would have to take into consideration all these aspects exposed; a team sports in which games will not depend on a certain individual. On the contrary, it will depend on the team performance, its plan before and during the game to achieve the objectives (strategy and tactics) as well as the level of opposition by the rival team (invasion team sports).

1.2. An approach to notational analysis

In the last decades, the ongoing search for understanding and interpreting the complex actions present in basketball has led researchers and coaches to use game statistics techniques (Peters, 2015). The study of basketball game-related statistics in competition has been used to

identify variables that can distinguish between successful teams and players, which can lead to better sport results (Sampaio, Ibañez, Feu, Lorenzo, Gómez and Ortega, 2008). The need for quality as much as quantity of information on the performance of players and teams has become paramount with the use of video and personal computers (Garefis, Tsitskaris, Mexas and Kyriakou, 2007). In theoretical performance analysis, the general aim is to explain sports behaviour using general models whose empirical foundations provide useful information for sports practice, such as informing on the long-term planning of training processes (Lames and McGarry, 2007). It is well known that to discover performance indicators are one of the keys to success in interaction sports (Hughes & Bartlett, 2002). A better understanding of tactical elements through collective behaviour assessment is of vital importance to improve performance, supporting the training process and preparation for the match (Lemmink & Frencken, 2013).

Oliver (2004) established four key factors concept when analysing basketball performance: shooting percentage from the field, offensive rebounding, turnovers and going to the foul line a lot and making those shots. Skinnes (2012) says that a successful play ends with some player from the offensive team being given the opportunity to take a reasonably high-percentage shot. At this moment player decision depends on three factors: the (perceived) probability that the shot will go in, the distribution of shot quality that the offense is likely to generate in the future, and the number of shot opportunities that the offense will have before it is forced to surrender the ball to the opposing team.

One method to be considered is notational analysis, characterized by being used during or after games through video recordings or specialized software to investigate athletes' performance (O'Donoghue, 2010). Hughes and Frank (2004), with the aim of generalizing the concept, defined notational analysis as a procedure that could be used in any discipline that requires assessment and analysis of performance. They assured that it has been demonstrated to be a valid tool to interpret technical and tactical aspects of performance in team sports. Ibáñez, García, Feu, Parejo and Cañadas (2013) define the concept of notational analysis as the result of the systematic study from annotations based on the previous observation of a sports event.

Overall, feedback provides both motivational and an informational role, encouraging repeated performance and performance directed to reducing discrepancy between a desired and an actual outcome (Hughes, 2004).

1.3. Determinant factors of the game between winning and losing teams

In the literature consulted, several aspects of the game have been analysed in order to further identify game indicators factors that differentiate winning teams from the losing teams in basketball. Parejo, García, Antúnez and Ibañez (2013) focused their study in a context of a semi-professional Spanish league (EBA), finding as key winning factors defensive rebounding, assists and two-points scored shots. Gómez, Lorenzo, Sampaio and Ibáñez (2006), based their study in the first Spanish women basketball league and found that winning teams were best at two and three-point field-goals percentages, steals and assists.

Puente, del Coso, Salinero and Abián-Vicén (2015) concluded that accuracy in 2-point field goals and the total number of assists were the variables that best correlated with the number of wins during the regular season in Spanish League between 2003 and 2013. Csataljay, O'Donoghue, Hughes, and Dancs, (2009) focused in the European Basketball Championship 2007. They show that in tight matches, winning teams had significantly less three-point attempts, higher shooting percentages, higher success in free throws, better free throw percentage and significantly higher number of defensive rebounds.

Ortega, Cárdenas, Sainz de Baranda and Palao (2006) focused in Spanish youth basketball games (14-16 years old). Winning teams had higher values in 2PTFGM, free throws made, dribbling opposition, time of movement, dribble time, use of screens, fast breaks, attack phases from 1-5 seconds, attack phases in which 2 players participated and attack phases in which 5 players participated. The results showed that the winning teams had patterns of play that use less dribbling, in general, and less dribbling with displacement, in particular; and they used fast attack phases (1-5 s) in which two players participate. Winning patterns of play were those that used either fast breaks or a long attack phase in which all players participated.

Pojskic, Šeparović, Užičanin and Edin (2009) focused their study in the Olympics in Beijing in the year 2008. Results showed that those variables that made the most significant difference between winning and losing teams were assists, parameters related with shooting efficiency, defensive rebounding and points that came from players not from the first rotation.

We can generalize that factors differentiating winning and losing teams according to game-related statistics can have a wide variation depending on the level of competition. Overall, based on the literature exposed above, we can say that there is a general trend that shooting efficiency, steals and defensive rebounding are key determinant performance factors.

1.4. Determinants factors of the game according to game location and final score differences

Gómez et al. (2008), concluded that during the 2004-2005 regular season of the Spanish League, defensive rebounding had been a determinant factor between winning and losing teams in balanced games. However, during unbalanced games, they found that these factors were successful 2 points field-goals, the defensive rebounds and the assists. Overall, the statistical analysis identified two variables that discriminate winning and losing teams: defensive rebounds and assists.

Lorenzo et al. (2010) focused their study in 2004 and 2005 Under-16 European Championships. The winning teams exhibited lower ball possessions per game and better offensive and defensive efficacy coefficients than the losing teams. They performed discriminant analysis according with the point difference between teams. In close games (final score differences below 9 points), the discriminant variables were the turnovers and the assists. In balanced games (final score differences between 10 and 29 points), discriminant variables were successful 2-point field-goals and defensive rebounds, while in unbalanced games (above 30 points differences) the only discriminant variable was successful two-point field-goals.

De Rose (2004) study focused in Brazilian basketball indicated that home teams are better than visiting teams in shooting, rebounds, steals, assists and shooting efficiency. Home teams are also more aggressive in offense, shooting more than visiting teams and with a higher efficiency. García et al. (2014) centre their study in identifying the basketball performance indicators that best discriminated winning and losing teams according to game location and final score differences. They conclude that “the game-related statistics that best differentiated between home and away teams in balanced games were successful 2-point field-goals, defensive rebounds and assists”. Additionally, when the visitor team is the one winning in a balanced context game, they identify as key factors both assists and steals. When the game is unbalanced, however, these indicators turned out to be assists for the home winning team and assists and successful 3-point field goals in case of the away team winning in an unbalanced game.

Sampaio and Janeira (2003) identified different team performance profiles according to game type and location in balanced games context. During regular season, winning teams were best discriminated by successful free-throws, whereas during play-offs, it was best discriminated by offensive rebounding. According with game location, “home wins were best discriminated by committed fouls whereas successful free-throws discriminated away wins”.

García, Ibáñez, Martinez De Santos, Leite and Sampaio (2013) difference between the behaviour of teams according with the phase of the competition. They stressed the different

performance observed in teams according with the competition phase as well as point out different key factors that differentiate winning and losing teams. While during regular season “games were dominated by the importance of assists showing the importance of teamwork during this phase playoff games were dominated by the importance of effective defensive rebounding”.

Sampaio, Ibáñez, Ruano, Lorenzo and Ortega (2013), investigated the relationship between home advantages from an individual player's position. They also attempted to identify a subset of game-related statistics that could discriminate home and away performances according to each player's position. It was found that for the guards and forwards, the game-related statistics that differentiated most home and away performances were the successful two-point field-goals, defensive rebounds, assists, steals, blocks and committed fouls. However, results were not significant for centres.

We see that, based on the literature studied, there are significant differences observed depending on the point differences of the game as well as the game location. These differences could have its origin in many factors such as changes of strategy, different anxious and pressure level, different minutes distribution among players or different tactics.

1.5. Determinant factors of the game regarding shooting performance

Ciampolini (2018) focuses his study in the factors associated with basketball field goals made in an NBA context. He stresses “the importance of shooting condition (specifically passively guarded and wide-open situations) as a determining factor in predicting FGM in basketball”. The study does not find relationship between shooting efficacy and number of passes made per offense. Additionally, they point out that “fast breaks seem to lead to better shooting conditions (passively guarded and wide open) when compared to set and regained offenses”.

Ibañez et al. (2013) center their study in the analysis of the effectiveness of shooting. They stressed the different outcomes obtained depending on the competition. Overall, they conclude that center players tend to receive more fouls given the high defence level they suffer as well as being the worse free throw shooting than the rest of the players. About the NBA competition, they find out that the effectiveness of shooting depends on the game-phase. For instance, during the first quarter of the game the level of effectiveness is highest during game, while as the games goes by, the defence level increases, with the consequent increase of blocks and personal fouls, which makes a negative impact on the shooting effectiveness. They conclude that the closer to the basket the shot is taken, the higher the shooting effectiveness is (dunks, lay-ups and tips-in). They also

highlight the importance of the previous situation of the shot (after rebound tends to provoke more fouls while after pass tends to be more effective than after dribble).

Csataljay et al. (2013) investigate the potential relationship between the shooting performance from various distances with the level of defensive pressure on the shooting player in the context of team success. They point out that "the more effective shooting of winning teams was found as the consequence of better team cooperation as players could work out more opened scoring opportunities without any active defensive presence". Additionally, they recognise winners as being more capable of scoring when facing hard situations under high level of defensive pressure. Gómez, López and Toro (2015) analysed the shooting performance according with the match status. They find out that during balanced situations, the shooting effectiveness was higher when the shot was performed inside paint. On the other hand, in contexts of unbalanced game, they show higher shooting effectiveness in shots performed inside paint after 3-4 passes and with possessions longer than 10 seconds.

Erčulj and Štrumbelj (2015), investigated the relative frequencies of different types of basketball shots, its technical details based on the execution and the level of success in different five level of competitions, from youth categories to NBA. Differences are mostly between the Senior and Youth competitions: more shots executed jumping or standing on one leg, more uncategorised shot types and more dribbling or cutting to the basket in the Youth competitions. Looking at the senior basketball and comparing the NBA with European basketball, it was found that dunks are more frequent and hook shots are less frequent compared to European basketball, which can be attributed to better athleticism of NBA players.

Shooting performance could be a key factor when differentiating between winning and losing teams. Differences in shooting performances have been observed according with the level of competition, point difference, game phase, level of opposition and previous situation of the shot.

1.6. The impact of fast breaks between winning and losing teams

In the literature consulted, some authors also try to find out the impact of fast breaks in game performance as well as the aspects related to it.

Kozlowsky (1987) divides fast breaks between two different types. His study differentiates primary fast breaks with secondary fast breaks. Primary fast breaks are considered to be finished when "the first three attackers arriving to the frontcourt cannot score" while secondary fast breaks follow the primary fast breaks, and "it is executed before all the opponents manage to return and

arrange a proper defence". For instance, Cárdenas et al. (2013) studied the concluded that "nine out of ten fast breaks end as the primary break, whilst only 11.3% as the secondary one". Additionally, their results show that "winning teams achieved higher efficacy when ending in the primary break (57.5%), while the losing teams were more effective in the secondary break (55.6%)".

Conte, Favero, Niederhausen, Capranica and Tessitore (2017) made an attempt to analyse the determinants of the effectiveness of fast breaks actions. Defined as the fastest and most efficient way to make the transition from defence to offence (Krause, 2008), they highlighted that completion zone was the only predictor of a successful fast break in basketball, while the number of players involved did not predict fast break effectiveness.

Garefis et al. (2007) established as key elements for successful fast breaks situations the coach instructions regarding: an effort for finishing the fast breaks inside the point-area, the automatization of starting fast break after defensive rebound or steal, the practice work on 4vs3 and 1on1 situations as well as the long distance shots performed during transition.

Refoy, Durán, Uxia and Sampedro (2009), in a context of male basketball, found dependant relationship between the effectiveness of the fast break with the level of opposition, duration and completion area. On the contrary, in women's basketball they found weak association between the success of the fast break with the level of opposition to its completion.

Key elements about fast-breaks effectiveness could be point out when aiming to better perform. It has been observed that its success could guard a relationship with factors such as the completion zone, its level of opposition and the number of players involved. Coaches could use this information when trying to improve their team quality.

1.7. An approach to inside game

Mavridis, Evangelos, Alexandros and Athanasios (2009) purpose of study was to register the inside game and its determinants in both European and NBA teams. They conclude that the dominant pass to centers in Europe was the bounce pass while in NBA, the overhead pass. Additionally, they conclude that in Europe, 72.7% of the control offence concerned the outside game while in NBA, only 55.0% of the offence concerned the outside game.

Ibáñez, Cadenas, Ortega, Piñar and Vélez (2013), analyse the influence of inside pass in offensive success as well as the location of both passer and receiver and its immediate action after que successful inside pass. On the one hand, finding show that those attack phases in which inside

pass is done are more effective and achieve a larger amount of points. On the other hand, the outside pass with an inside reception was pointed to be the most effective option.

Courel-Ibáñez, McRobert, Ortega and Cárdenas (2018), studied the potential players' dynamics that increase game performance when using inside pass. Study was based in an NBA context. Results showed that interactions combining passer's previous actions (either dribbling or faking) with receiver's cuts towards the basket had the highest offensive effectiveness. Additionally, reducing the defensive pressure by performing screens in favour to the receiver was an effective alternative to increase inside passing options. They also mention as a key factor the good timing between player's actions prior to passing the ball with the receivers' displacements, especially when cutting to the basket.

Mavridis, Laios, Kyriakos and Tsiskaris (2004) registered the effectiveness of the control offense of basketball teams, after the ball has returned from the central to the guard and forward positions. Results showed that for both winners and losers, the effectiveness of the control offense is statistically more important when it occurs after the return of a pass from the central to the guard and forward positions.

Inside game could play a major role when differentiating winning and losing teams given the different possibilities that it could have. Focussing the attention in the inside game could lead to different options such as cuts to the basket, endings near the basket or wide-open shots after outside pass.

1.8. Other key combined factors of the game

Sampaio, Drinkwater and Leite (2010), centring their study in game-related statistics related with playing time and quality of the team, identify stronger teams being superior in terms of 2-point field-goal and passes while low quality teams were the worse at defensive rebounding. According with the player quality, they point out that those players more important commit less errors and that these player performances "appear to be independent of season period".

Gómez, Lorenzo, Ibañez and Sampaio (2013) centre their study in situational variables in different game periods differentiating between man's and women's basketball. They concluded that "in men's basketball the performance indicators are mostly dependent on game period, whereas in women's basketball the performance indicators are also dependent on situational variables (league stage and match status)".

Ibáñez et al. (2009) studied the potential effects that consecutive games might have in the team performance in a condensed tournament context. As result, “only the three-point field goals made contributed to discriminate teams in game three, suggesting a moderate effect of fatigue”.

García-Rubio, Gómez, Cañadas and Ibáñez (2015) focus their study in collective variables, aiming to “check the reliability of ecological dynamics to describe the dynamics of basketball contest as the interaction of two teams along time”. Ecological dynamics have to do with the study of complex systems that try to explain the coordinated sport behaviours (patterns of variability, stability and symmetry-breaking) that emerges from interactions of performances with environment (Vilar et al., 2012).

Suárez-Cadenas et al. (2013) in their attempt to build a shot selection quality model predictive of winning and losing games, show many interesting outcomes about combined aspects of the game. They find the shooting-distance to the basket as a crucial factor for its effectiveness as well as the “better disposition towards rebound to increase the chances of catching the rebound”. Additionally, Suarez et al. (2013) find statistically significance in better defensive balance dispositions in order to decrease the probabilities of receiving fast breaks.

Teramoto and Cross (2010) made a remarkably interesting study originated from what is commonly called as “small ball” and tried to relate the game performance with the average height of the team in the 2006–2007 through 2015–2016 NBA seasons. During regular season, rather than linking the height with the success (which they explained based on offensive and defensive strategies), they establish height “as a function of team strategy and specific players on each team”. However, during playoffs while the competition gets tougher and the opposition level of defences increase, they find weaker association between the game performance and team strategies, which could lead to a better importance of the average height of the team.

Gomes et al. (2013) analysed the potential relationship between anthropometric and physical performance variables with game-related statistics. However, this relationship was not found neither during regular season nor playoff, where findings showed even less correlations between the game-performance and the anthropometric and physical performance variables.

Some literature studied focus its attention on the impact of other aspects related to the game such as the level of previous physical charge (consecutive games), the effectiveness of the team according with the team initial construction, anthropometric variable impacts or ideal shooting situation. This information provided could also be used by coaches when trying to better perform.

2. RESEARCH METHODOLOGY AND ORGANIZATION

2.1. Research object

Our study will be based in all FGA by TOP3 teams (Slovenia, Serbia and Spain) during 2017 European Male Basketball Championship.

The object of the study is focused in two main ideas:

- The first one would be to analyse the shooting effectiveness and shooting distribution of all the 3PTFGA and 2PTFGA of the TOP3 teams during FIBA Male Eurobasket 2017 according with criteria related with shot location, shot defence and shot previous situation. We would analyse separately 3PTFGA and 2PTFGA, first as a whole and then comparing the different teams' performances.
- The second idea of the study would be to find out the potential statistical significant differences in distributions from our variables, aiming to find the shot context that show highest probability to be successful. We would analyse separately 3PTFGA and 2PTFGA, first as a whole and then comparing the different teams' performances.

2.2. Research strategy and logic

Modern basketball is increasingly producing versatile players able to perform well in different aspects of the game rather than one-role players. Particularly, we are facing an increase of the percentage of players able to shoot from long distances and in different contexts. The research topic was chosen given the increasing importance of shooting performance in modern basketball. There were no previous studies based in the European Male Basketball Championship 2017 regarding neither the shooting performance nor factors discriminating between winner and losing teams.

We would analyse three factors affecting the shooting performance: shooting location, defence and previous situation (or type of shot for inside paint shots). Among these variabales and based in our literature review, we initially consider that level of opposition is the most determinant one given that it is the unique one aiming directly in reducing the shot effectiveness.

After game visualization and data-extraction, we would be able to perform descriptive analysis based in the overall effectiveness rates and in the differences registered in effectiveness rates when considering one, two or all criteria. Then, through statistical methods we would find out

the dependant statistical differences in distributions between our criteria as well as the shots conditions with highest probability to be successful, primarily in general terms and then discriminating by teams.

2.3. Nature of research

The study would consist in quantitative analysis. We would perform descriptive analysis based on our results registered as well as comparative analysis between teams. Then, we will further analyse through statistical methods potential statistical significant differences in distributions between our variables, first without discrimination among teams and then also individually by teams.

2.4. Contingent of research subjects

In this study, our data sample consists in all the field goals taken by TOP3 FIBA Male Eurobasket 2017 (Slovenia, Serbia and Spain). The FIBA Statisticians Manual (2018) makes a clear statement for those situations in which the player is fouled in the act of shooting. "A player fouled in the act of shooting is not charged with a FGA unless the field goal is made". Therefore, those shots not made in which the shooter receives a foul while shooting have not been taken into consideration. Additionally, those shots taken from before half court due to quarter endings have not been registered in the study given that it is assumed that these shots do not contribute to understand neither the shot performance of teams nor the game-decisions from the team referred to shooting.

In total, our sample consists in 1653 field goals attempts:

***Table 1**. Total number of field goals attempts.*

Number of throws	2pt			3pt		
	Group phase	Final phase	Totals	Group phase	Final phase	Totals
Slovenia	197	154	351	128	98	226
Serbia	213	158	371	92	73	165
Spain	202	148	350	102	88	190
Totals	612	460	1072	322	259	581
Total of field goals	**1653**					

All shots taken have been classified according with criteria related with shot location, shot defence and shot previous situation/kind of shot:

3-POINT FIELD GOALS ATTEMPTS

All 3PTFGA will be registered and classified according with the following criteria:

- ***Shot location***: "Corner", "45 degree" or "Front location".
- ***Shot defence***: "Contested" or "Not Contested".

It is considered that a shot is contested when the attacker shot is considerably affected by the defence. We consider that a shot is not contested when the attacker can take a three-point shot without or very little opposition from a defender.

- ***Previous situation:*** "After pass" or "After dribble".

Those shots whose origin has not been either a pass from a player or a dribble from the shooter such as dead balls, have been considered as "after pass" shots. To clarify, "after dribble situations" are just the ones in which the shooter takes a three-point shot after one or more dribbles himself.

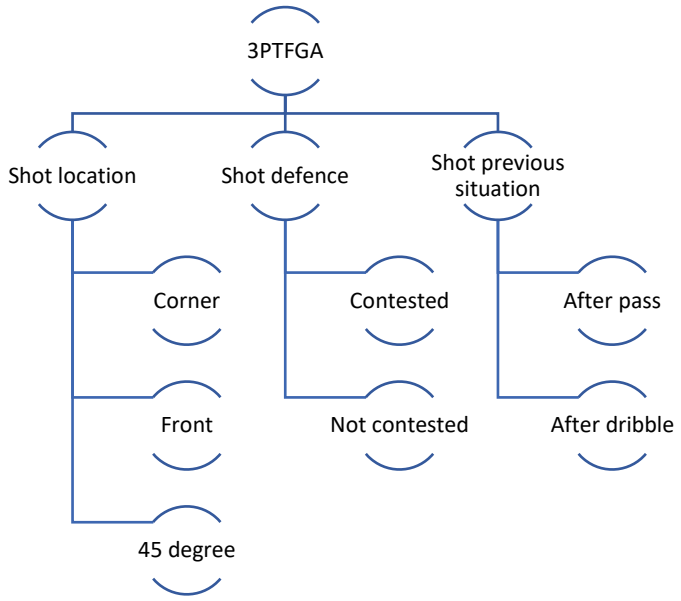

Figure 1*. 3PTFGA sample procedure.*

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2-POINT FIELD GOALS ATTEMPTS

All 2PTFGA will be registered and classified according with the following criteria:

- ***Shot location***: "Inside paint" or "Outside Paint".
- ***Shot defence***: "Contested", "Half Contested" or "Not Contested".

It is considered that a shot is contested when the defender is located between the attacker and the basket, in legal defence position and being totally able to affect the shot with his opposition.

It is considered that a shot is “half contested” when the defender is able to partially affect the shot but the attacker is still with superiority to the basket. It is considered that a shot is “not contested” when the shot has no opposition and the attacker is not conditioned by any defender.

- **Previous situation/type of shot**: Depending on the shot location, we would have different alternatives for these criteria:

For those shots located ***outside paint***, we would divide shots between shots taken “after pass” or “after dribble”, in the same way we did with 3PTFGA.

For shots located ***inside paint,*** we would divide shots in two different categories attending with the kind of shot, either “Static shot” or “Movement shot”. It is considered a static shot those with one or two feet stepped in (low post shots situations, shots without movement, tips in, set shots, shots after static reception). It is considered a movement shot those in which the shot is done in a dynamic situation (lay-ups, fast breaks, cuts to the basket, penetrations, spin-in shots).

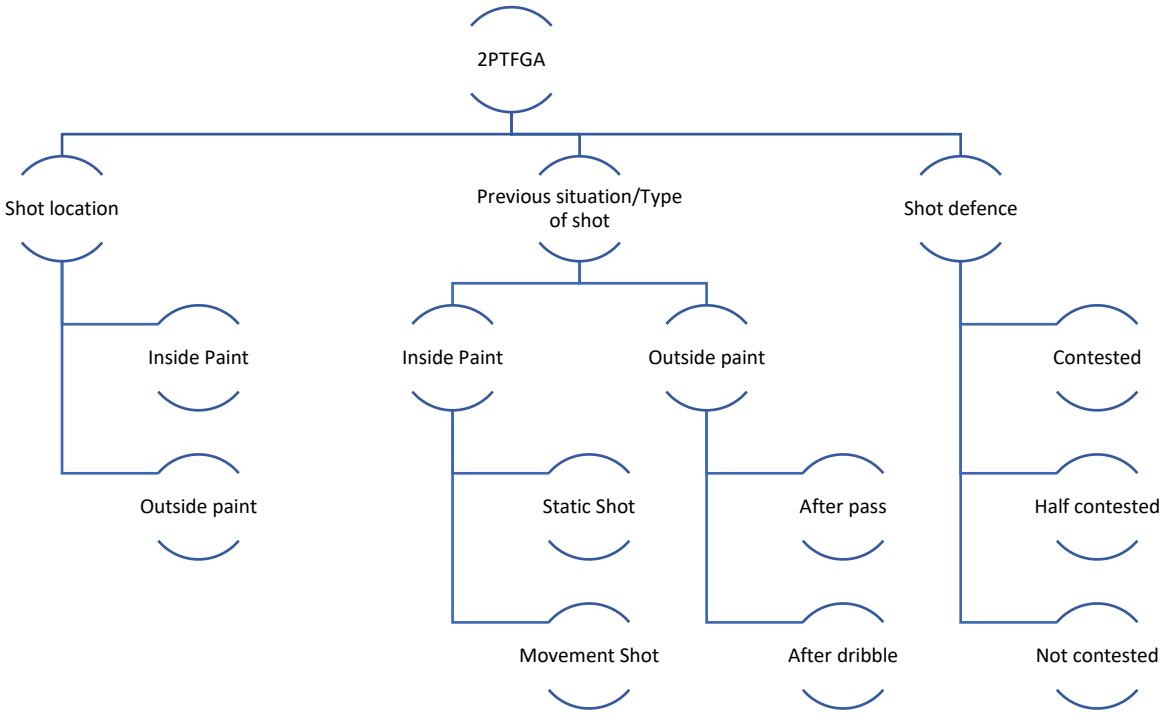

Figure 2*. 2PTFGA sample procedure.*

2.5 Research methods:

1. Statistical analysis of the official game score sheets. With the aim of deciding the appropriate size sample from our study, the official website from the European 2017 male Basketball championship has been used: http://www.fiba.basketball/es/eurobasket/2017

Looking at the individual statistical score sheet from each game, we were able to decide about the amount of games that would be the object of our study.

2. Game observation. All games from FIBA European 2017 Male Championship are available in YouTube platform in the official channel from FIBA. In total, each of the three teams that take part in the study play a total of nine games, corresponding five of them to the first or qualification phase and four of them to the final phase (round 16, quarter-finals, semi-finals and final). In the case of Spain, given that they were eliminated in semi-finals, we have taken into consideration the game for the third place. In total and as previously expressed, it has been analysed a total of nine offensive games for each of the TOP3 teams (Slovenia, Serbia and Spain).

All data extracted from the visualization of games has been gathered in an excel file. In total, 1653 field goals attempts have been classified according with our four criteria (level of shot opposition, shot success, prior shot situation or shot type and shot location). If any situation was unclear, the official play-by-play archives provided by FIBA for each game has been used.

2.6 Research organization

Our study required the permission to carry out research issued by the University Ethics Committee. The study was approved by the Lithuanian Sports University Ethics Committee and meets the ethical standards (2020-3-27 Nr. SMTEK-20).

2.7 Methods of statistical analysis

All data extracted from games visualization have been recorded in an excel file. Each shot taken into consideration has its own shots characteristics according with the criteria established. With the Statistical Analysis Software Package RStudio Cloud we have been able to perform Chi Square tests and further identify the statistically significant differences in the distributions of our variables, with significance level set at $p < 0.05$ (Yates' continuity correction has not been used)

Firstly, we have analysed the potential significant differences in distributions between the shot success and the remaining variables. Null hypothesis would be that there are no differences in variables distributions and therefore the variables studied would be independent. If p-value is < 0,05 then we can reject the null hypothesis of independence and we could say that there is a difference in the variable distribution. Conclusions based on p-values lower than 0,05 regarding shot success

distribution and any other variables, would be based in the option variable that present highest effectiveness rate.

Secondly, we would then analyse the potential significant differences in distributions between those variables that have been proved to be associated with shot success and those who does not. In this case, if the null hypothesis regarding the independence between variables is rejected, conclusions would have to do with the differences in shots distributions, aiming to see which option variable present a higher percentage of shots performed in the previously statistically significant best situation.

3. RESEARCH FINDINGS

3.1 Descriptive analysis of total 3PTFGA

All 3PTFGA attempted by Slovenia, Serbia and Spain have been classified according with criteria related with shot success, level of opposition, shot location and shot previous situation.

Table 2 show the data box obtained for all the 3PTFGA registered, a total of 581 shots.

Table 2. *Total 3PTFGA data-box.*

	FRONT		45 DEGREES		CORNER		TOTAL
	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	
Contested	38	56	71	39	24	5	233
Success	10	16	24	10	6	1	67
% Success	26.32%	28.57%	33.80%	25.64%	25.00%	20.00%	28.76%
Not contested	92	37	117	30	69	3	348
Success	42	14	47	9	29	2	143
% Success	45.65%	37.84%	40.17%	30.00%	42.03%	66.67%	41.09%
Total shots	130	93	188	69	93	8	581

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

Analysis regarding shot success and level of opposition of 3PTFGA.

We have registered a 36.14% of effectiveness out of the 581 3PTFGA registered. When taking into consideration the shot defence, we see that this percentage is lower when the shot is contested (28.76%) compared with when the shot is not contested (41.09%).

According with the shot distribution, 59.90% of the 3PTFGA were performed not contested while 40.10% contested.

Analysis regarding shot success, shot location and level of opposition of 3PTFGA.

We apparently do not observe big differences in the 3PTFGA effectiveness according with the shot location: 36.77% from the front, 35.02% from the 45-degree position and 37.62% for shots located in corner positions. It can be observed that effectiveness of the 3PTFGA is always higher when the shot is performed not contested compared with when the shot is contested, regardless of the shot location.

According with the shot distribution, we have registered that 44.23% of the 3PTFGA were performed from the 45-degree position, 38.38% from the front position and just 17.38% of all 3PTFGA registered were performed from the corner. Comparing the shot distribution regarding shot location and shot defence, we observe that the biggest differences resides in 3PTFGA performed

from the corner: just 28.71% were performed contested while 71.29% of the shots were not contested.

Analysis regarding shot success, previous situation and level of opposition of 3PTFGA.

According with the shot previous situation (either performed after pass or after dribble) we observe that the effectiveness is 38.44% for the shots performed after pass and slightly lower (30.59%) for the shots performed after dribble. Additionally, we observe that shots performed not contested tend to have a higher effectiveness compared with shots performed contested. According with the shot distribution, 70.74% of all the 3PTFGA were performed after pass while 29.26% after dribble. For the shots performed after pass, 32.36% were contested and 67.64% were not contested while for the shots performed after dribble, these percentages are considerably different, being 58.82% of the shots performed contested and 41.18% not contested.

Shot distribution regarding shot location and shot previous situation

According with the shot distribution and regarding the shot previous situation and shot location we observe that the biggest difference obtained is for the corner shots. Out of all 101 3PTFGA registered from the corner, 92.08% were performed after pass and just 7.92% after dribble.

Overall, the shot which has presented the highest percentage of effectiveness is the shot performed from the front, not contested and after pass with 45.65% of success (shots performed from the corner, not contested and after dribble have not been considered given that this type of shot represents just 0.52% of the total sample). However, according with the shot distribution, data shows that the 3PTFGA most used has been the shot performed from the corner, contested and after pass.

3.2 Descriptive 3PTFGA comparative analysis by teams

Below, tables 3, 4 and 5 show the 3PTFGA data-box obtained from the three teams studied respectively: Slovenia, Serbia and Spain.

***Table 3**. Slovenia 3PTFGA.*

	FRONT		45 DEGREES		CORNER		TOTAL
	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	
Contested	20	26	31	20	13	1	111
Success	7	9	11	6	4	0	37
% Success	35.00%	34.62%	35.48%	30.00%	30.77%	0.00%	33.33%
Not contested	23	8	39	11	32	2	115
Success	12	2	18	0	11	1	44
% Success	52.17%	25.00%	46.15%	0.00%	34.38%	50.00%	38.26%
Total shots	43	34	70	31	45	3	226

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

Table 4. *Serbia 3PTFGA.*

	FRONT		45 DEGREES		CORNER		TOTAL
	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	
Contested	10	19	25	6	6	2	68
Success	0	3	7	1	2	1	14
% Success	0.00%	15.79%	28.00%	16.67%	33.33%	50.00%	20.59%
Not contested	32	17	28	10	10	0	97
Success	15	8	9	4	5	0	41
% Success	46.88%	47.06%	32.14%	40.00%	50.00%	0.00%	42.27%
Total shots	42	36	53	16	16	2	165

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

Table 5. *Spain 3PTFGA.*

	FRONT		45 DEGREES		CORNER		TOTAL
	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	
Contested	8	11	15	13	5	2	54
Success	3	4	6	3	0	0	16
% Success	37.50%	36.36%	40.00%	23.08%	0.00%	0.00%	29.63%
Not contested	37	12	50	9	27	1	136
Success	15	4	20	5	13	1	58
% Success	40.54%	33.33%	40.00%	55.56%	48.15%	100.00%	42.65%
Total shots	45	23	65	22	32	3	190

Note: Aft. Pass – After Pass. Aft. Dribble – After Dribble.

We do not observe big differences in total effectiveness rates, being Spain the highest with 38.95%. Regarding the defence, all teams present higher effectiveness when the shot is not contested rather than contested, being differences considerably bigger in Serbia and Spain. Spain is the one that was able to perform a higher percentage of 3PTFGA not contested (71.58%) compared with Serbia (58.79%) and Slovenia (50.88%). Additionally, Spain was also the one who presents the highest percentage of shots performed after pass (70.74%). The highest effectiveness according with shot location are Serbia and Spain from the corner, with effectiveness rates above 40.00%. All three teams present considerably less 3PTFGA from the corner compared with from the front and 45-degrees position. Shots performed after pass tend to have higher effectiveness than those after dribble. Slovenia`s case in the one which presents highest differences (39.87% after pass and 26.47% after dribble).

According with the shot distribution, there is a general trend among the three teams in which the biggest differences between the percentages of 3PTFGA performed after pass or after dribble

are observed in shots performed from the corner. For corner 3PTFGA, all three teams present shot distribution percentages around 90% for shots performed after pass.

3.3 Descriptive analysis of total 2PTFGA

All 2PTFGA attempted by Slovenia, Serbia and Spain have been classified according with criteria related with shot success, level of opposition, shot location and shot previous situation or type of shot. Table 6 show the data box obtained for all the 2PTFGA registered, a total of 1072 shots.

Table 6. *Total 2PTFGA**.***

	INSIDE PAINT		OUTSIDE PAINT		TOTAL
	Static Shot	Movement Shot	Aft. Pass	Aft. Dribble	
Contested	202	137	18	42	399
Success	61	46	4	10	121
% Success	30.20%	33.58%	22.22%	23.81%	30.33%
Half contested	131	100	27	42	300
Success	80	69	12	22	183
% Success	61.07%	69.00%	44.44%	52.38%	61.00%
Not contested	132	163	36	42	373
Success	108	132	18	24	282
% Success	81.82%	80.98%	50.00%	57.14%	75.60%
Total shots	465	400	81	126	1072

Note: Aft. Pass – After Pass. Aft. Dribble – After Dribble.

Analysis regarding shot success and level of opposition of 3PTFGA.

It has been registered an average efficiency of 54.66% out of the total sample of 1072 2PTFGA. If we pay attention to the shot defence, this effectiveness decreases as the defence level increases. 37.22% of all 2PTFGA were performed contested, 27.99% half contested and 34.79% not contested.

Analysis regarding shot success, shot location and level of opposition of 3PTFGA.

2PTFGA performed inside paint present an effectiveness of 57.34% while those performed outside paint 43.48%. It can be observed that effectiveness of the 2PTFGA is a highest when the shot is performed not contested and lowest when it is contested, regardless of the shot location.

According with the shot distribution, we have registered big differences. 80.69% of shots were performed inside paint while just 19.31% were performed outside paint. Whereas the most common shot performed inside paint is performed contested (39.19%), the one not contested is the most common from outside paint (37.68%).

Analysis regarding shot success, level of opposition and previous situation or type of shot.

Regarding the 2PTFGA previous situation effectiveness (just for shots performed outside paint) we

observe that the effectiveness is slightly higher for the shots performed after dribble compared with after pass (44.44% vs 41.98%). Additionally, we observe that effectiveness increases as the shot defence level decreases regardless of the shot previous situation.

According with the 2PTFGA distribution from outside paint, 60.87% were performed after dribble and 39.13% after pass. The shot distribution regarding the level of defence and shot previous situation presents same values for the shots performed after dribble. However, for the shots performed after pass, the volume of 2PTFGA increases as the level of defence decreases.

For the 2PTFGA performed from inside paint, we observe that the effectiveness is higher when the shot is performed in a movement shot (61.75%) than when it is a static shot (53.55%). Additionally, we observe that effectiveness increases as the shot defence level decreases regardless of the type of shot. According with the 2PTFGA distribution from inside paint, 53.76% were static shots while 46.24% were movement shots. Taking defence into consideration, the most common static shot is the one contested (43.44%) while the most common movement shot is the one not contested (40.75%).

Overall, the 2PTFGA who has presented the highest percentage of effectiveness are the ones with no opposition performed from inside paint. According with the shot distribution, data shows that the 2PTFGA most common is the static shot, contested from inside paint.

3.4 Descriptive 2PTFGA comparative analysis by teams

Below, tables 7, 8 and 9 show the 2PTFGA data-box obtained from the three teams studied respectively: Slovenia, Serbia and Spain.

Table 7. *Slovenia 2PTFGA.*

	INSIDE PAINT		OUTSIDE PAINT		TOTAL
	Static Shot	Movement Shot	Aft. Pass	Aft. Dribble	
Contested	56	47	3	20	126
Success	15	15	0	4	34
% Success	26.79%	31.91%	0.00%	20.00%	26.98%
Half contested	42	43	12	22	119
Success	29	30	6	11	76
% Success	69.05%	69.77%	50.00%	50.00%	63.87%
Not contested	29	51	10	16	106
Success	26	42	5	9	82
% Success	89.66%	82.35%	50.00%	56.25%	77.36%
Total shots	127	141	25	58	351

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

Table 8. *Serbia 2PTFGA.*

	INSIDE PAINT		OUTSIDE PAINT		TOTAL
	Static Shot	Movement Shot	Aft. Pass	Aft. Dribble	
Contested	82	48	6	15	151
Success	25	17	3	5	50
% Success	30.49%	35.42%	50.00%	33.33%	33.11%
Half contested	49	25	5	8	87
Success	27	19	4	4	54
% Success	55.10%	76.00%	80.00%	50.00%	62.07%
Not contested	62	47	14	10	133
Success	52	39	7	5	103
% Success	83.87%	82.98%	50.00%	50.00%	77.44%
Total shots	193	120	25	33	371

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

Table 9. *Spain 2PTFGA.*

	INSIDE PAINT		OUTSIDE PAINT		TOTAL
	Static Shot	Movement Shot	Aft. Pass	Aft. Dribble	
Contested	64	42	9	7	122
Success	21	14	1	1	37
% Success	32.81%	33.33%	11.11%	14.29%	30.33%
Half contested	40	32	10	12	94
Success	24	20	2	7	53
% Success	60.00%	62.50%	20.00%	58.33%	56.38%
Not contested	41	65	12	16	134
Success	30	51	6	10	97
% Success	73.17%	78.46%	50.00%	62.50%	72.39%
Total shots	145	139	31	35	350

Note: Aft. Pass – After Pass, Aft. Dribble – After Dribble.

All teams studied present similar values for average effectiveness: 53.43% (Spain), 54.70% (Slovenia) and 55.80% (Serbia). All teams show a decrease in effectiveness as the defence level increases, regardless of shot location, shot previous situation or type of shot.

Spain is the one that was able to perform a higher percentage of 2PTFGA not contested (38,29%). Additionally, Serbia is the one with a higher percentage of shots performed contested (40,70%). This could be a consequence of Serbia's shot distribution, being the one with the highest percentage of 2PTFGA performed inside paint (84.37%), followed by Spain (81.14%) and Slovenia (76.35%).

Similar values of effectiveness have been observed regarding the shots performed inside paint (between 56% and 59%). Serbia shows the highest effectiveness from outside paint 2PTFGA

(48.28%). For the shots performed inside paint, all teams present higher effectiveness values in movement shots compared with static shots. For shots performed outside paint, Spain presents the highest effectiveness in shots performed after dribble (51.43%) while Serbia presents the highest after pass (56.00%).

According with shot distribution and shot location, Serbia is the one that shows bigger differences in the inside paint shots (61.66% static shot). For outside paint shots, general trend is observed of higher amount of shots taken after dribble than after pass, being Slovenia the team that presents higher differences (69.88%) of shots outside paint performed after dribble.

3.5. Statistical analysis of all 3PTFGA

Based on our results obtained, we are going to analyse the potential statistical significant differences in distributions among our different criteria regarding the shot performance. Below, table 10 analyses the potential statistical significant differences in distribution between the defence and the success of the 3PTFGA.

Table 10. *Chi-square test: success & defence 3PTFGA.*

	Contested	%	Not Contested	%	Total	X^2	p-value	df
Missed/ Blocked	166	71.2%	205	58.9%	371	9.2026	0.002417	1
Made	67	28.8%	143	41.1%	210			
Total	233	100.0%	348	100.0%	581			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 10 shows that there is a significant association in 3PTFGA between defence and success of the shot (p-value < 0.05). Based on these results, there will be a strict relationship between the success of the shot and how the shot has been defended (Not contested 3PTFGA present an overall effectiveness rate of 41,09% while contested 3PTFGA 28,76%).

Table 11 shows the potential differences in distribution between the location of the 3PTFGA and the success of the shot.

Table 11. *Chi square test: success and shot location 3PTFGA.*

	Front	%	45 degrees	%	Corner	%	Total	X^2	p-value	df
Missed/Blocked	141	63.2%	167	65.0%	63	62.4%	371			
Made	82	36.8%	90	35.0%	38	37.6%	210	0.27466	0.8717	2
Total	223	100.0%	257	100.0%	101	100.0%	581			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 11 shows that there is not a significant association in 3PTFG between location and success of the shot (p-value>>0.05) and the null hypothesis of independence between variables is not rejected. Based on this result, the success of the shot and the location where it has been taken guards no statistical association.

Table 12 relates the previous situation of the 3PTFGA with the success of the shot.

Table 12*. Chi square test: success and previous situation 3PTFGA.*

	After pass	%	After dribble	%	Total	X^2	p-value	df
Missed/ Blocked	253	61.6%	118	69.4%	371			
Made	158	38.4%	52	30.6%	210	3.2146	0.07299	1
Total	411	100.0%	170	100.0%	581			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Although table 12 shows that there is no significant statistical association between the success of the shot and the previous situation (p-value>0.05), given that the p-value is very near to 0.05 we could expect that with a bigger amount of data registered there could be an statistical significant association between the success of the 3PTFGA and the previous situation (either after pass or after dribble).

Given that it has been found that the success of the 3PTFGA has statistical significant difference in distribution just with one criteria (defence of the shot) among the three remaining, Chi square test has been performed between the defence of the shot and the two remaining criteria, previous situation and shot location.

Table 13. *Chi square test: defence and previous situation 3PTFGA.*

	After pass	%	After dribble	%	Total	X^2	p-value	df
Contested	133	32.4%	100	58.8%	233	35.061	3.195×10^{-9}	1
Not Contested	278	67.6%	70	41.2%	348			
Total	411	100.0%	170	100.0%	581			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 14. *Chi square test: defence and shot location 3PTFGA.*

	Front	%	45 degrees	%	Corner	%	Total	X^2	p-value	df
Contested	94	42.2%	110	42.8%	29	28.7%	233	6.6241	0.03644	2
Not Contested	129	57.8%	147	57.2%	72	71.3%	348			
Total	223	100.0%	257	100.0%	101	100.0%	581			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Although it was not found statistically significant association between success of the 3PTFGA and the variables “previous situation” and “location”, we do have found significant statistical association between defence of the shot and previous situation (p-value= 3.191×10^{-9} <<< 0.05) but also between defence of the shot and location of the shot (p-value=0.03644<0.05).

With the results obtained we could conclude the following: it has been found that the only significant association with the success of the shot is the defence of the shot. Looking deeper on the data obtained, those 3PTFGA not contested have higher probability to be successful than those contested (41.1% vs 28.8%).

Regarding the previous situation of the shot and given that it has been found significant association with the defence of the shot, we could conclude that those shots performed after pass are more likely to be performed not contested compared with shots performed after dribble (67,54% vs 41,18%).

Finally, regarding the significant statistical association between the defence and the location of the shot, we could conclude that shots performed from the corner are more likely to be performed not contested (71,29%) compared with either from the front (57,85%) or from the 45-degree position (57,20%).

Overall, we would conclude that the 3PTFGA with highest probability to be successful would be the one performed not contested, after pass and performed from the corner position.

3.6. Statistical 3PTFGA comparative analysis by teams

Slovenia

Table 15 shows the chi square coefficients between the success of the shot and the three remaining variables.

Table 15*. Slovenia 3PTFGA chi square coefficients between success and remaining variables*

Variable	X^2	p-value	df
Previous situation	3.7138	0.05397	1
Location	0.51917	0.7714	2
Defence	0.5964	0.44	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

Although the p-value between previous situation and shot success is slightly bigger than 0,05 (our significance level), we could expect that with a bigger amount of data there would be statistical significant difference in distribution between previous situation and shot success. Additionally, results show that "previous situation" has statistical significance association with location (p-value = $4{,}05 \times 10^{-5} < 0.05$) as well as with the defence of the shot (p-value = $7{,}944 \times 10^{-5} < 0.05$).

3PTFGA performed after pass have higher probability to be successful than those performed after dribble (39.87% vs 26.47%). Shots performed from the corner are more likely to be performed after pass (93,75%) than those performed either from the 45-degree position (69,31%) or from the front (55,84%). Finally, not contested shots are more likely to be performed after pass (81,74%) than those performed contested (57,66%).

Serbia

Table 16 shows the chi square coefficients between the success of the shot and the three remaining variables.

Table 16. *Serbia 3PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Previous situation	0.12387	0.7249	1
Location	1.2609	0.5324	2
Defence	8.4551	0.00364	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

Results point out that the unique statistical significance difference in distribution with the success of the shot resides in its defence (p-value= 0.00364<0.05). Additionally, no statistical

association has been found neither between defence and location (p-value=0.6083>0,05) nor between defence and previous situation (p-value=0.1097>0.05).

Regarding the shot defence, there exists higher probability for a 3PTFGA to be successful when it is not contested (42.27%) than when it is contested (20.59%). No further affirmations could be done according with the data obtained.

Spain

Table 17 shows the chi square coefficients between the success of the shot and the three remaining variables:

Table 17*. Spain 3PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Previous situation	0.3367	0.5617	1
Location	0.031458	0.9844	2
Defence	2.7545	0.09698	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

None of the chi square test coefficients result statistically significant related with the success of the 3PTFGA (all p-values>0.05 and none of the null hypothesis is rejected). The reason behind this non significances relies in the big variability present in our variables. Spain performs 74.74% of shots after pass rather than after dribble and 71.58% of the shots are performed not contested rather than contested. Finally, regarding the location of the shot, Spain performs 45.79% of the 3PTFGA from the 45-degrees position, 35.79 from a front position and 18.42% of the 3PTFGA from the corner. This low representation of some variables ends up in very high variability, and that is why we do not find statistical significance.

3.7. Statistical analysis of all 2PTFGA

Table 18 below shows the chi square test coefficient and the level of statistical significance (p-value) between the variable success and defence regarding all the 2PTFGA registered (a total of 1072 shots).

***Table 18**. Chi-square test: success & defence 2PTFGA.*

	C	%	HC	%	NC	%	Total	X^2	p-value	df
Missed/ Blocked	278	69.7%	117	39.0%	91	24.4%	486	166.22	2.2×10^{-16}	2
Made	121	30.3%	183	61.0%	282	75.6%	586			
Total	399	100.0%	300	100.0%	373	100.0%	1072			

Note: C-Contested, HC- Half contested, NC – Not contested, X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 18 shows that there is a statistically significant difference in distributions in 2PTFGA between defence and success of the shot (p-value < 0.05). Based on these results, there will be a strict relationship between the success of the shot and how the shot has been defended (Differences in effectiveness rates: not contested shots 75,60%, half contested 61,00% and contested shots 30,33%).

Table 19 below shows the chi square test coefficient and the level of statistical significance (p-value) between the variable success and location regarding all the 2PTFGA registered (a total of 1072 shots).

***Table 19**. Chi-square test: success & shot location 2PTFGA.*

	Inside Paint	%	Outside Paint	%	Total	X^2	p-value	df
Missed/ Blocked	369	42.7%	117	56.5%	486	12.952	0.0003195	1
Made	496	57.3%	90	43.5%	586			
Total	865	100.0%	207	100.0%	1072			

Note: C-Contested, HC- Half contested, NC – Not contested, X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

According with the results obtained in table 19, there exists significant statistical difference in distribution between success of the shot and its location (p-value< 0.05).

Table 20 below shows the chi square test coefficient and the level of statistical significance (p-value) between the variable success and type of shot for those shots performed inside paint (a total of 865 shots).

***Table 20.** Chi-square test: success & type of shot 2PTFGA.*

	Static Shot	%	Movement Shot	%	Total	X^2	p-value	df
Missed/ Blocked	216	46.5%	153	38.3%	369	5.9132	0.01503	1
Made	249	53.5%	247	61.8%	496			
Total	465	100.0%	400	100.0%	865			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 20 shows that there exist statistically significant association between the success of the shot and the type of shot for those shot taken from inside paint (p-value= 0.01503<0.05).

Table 21 below shows the chi square test coefficient and the level of statistical significance (p-value) between the variable success and the previous situation for those 2PTFGA performed outside paint (a total of 207 shots).

Table 21. *Chi-square test: success & previous situation (outside paint) 2PTFGA.*

	After pass	%	After dribble	%	Total	X^2	p-value	df
Missed/ Blocked	34	42.0%	70	55.6%	104			
Made	47	58.0%	56	44.4%	103	0.12232	0.7265	1
Total	81	100.0%	126	100.0%	207			

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Results show that there is not statistically significance difference in distributions between the success of the shot and its previous situation for those 2PTFGA taken from outside paint (p-value=0.7265>0.05)

With the results obtained we could conclude the following: Regarding the statistical significance between the success and defence, we have registered higher effectiveness for not contested shots (75.60%). Regarding the statistical significance between success and shot location, we have registered higher effectiveness for inside paint shots (57.34%). Finally, regarding the statistical significance between the success of the shot and the type of shot, it has been registered higher effectiveness rate for the movement shots (61.75%).

Overall, we would conclude that the 2PTFGA with highest probability to be successful would be the one performed not contested, from inside paint and performed in a movement shot.

3.8. Statistical 2PTFGA comparative analysis by teams

Slovenia

Table 22 show the chi square coefficients between the success of the shot and the three remaining variables.

Table 22. *Slovenia 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	65,058	$7{,}46 \times 10^{-15}$	2
Location	6,89	0,0087	1
Previous Situation (for outside paint shots)	0,0492	0,8245	1
Type of shot (for inside paint shots)	1,1938	0,2746	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence and location (p-values < 0.05) but also between the defence and the type of shot (p-value=0.04657<0.05). Regarding the shot defence and shot location, there exists higher probability for a 2PTFGA to be successful when it is not contested (77.36%) and from inside paint (58.58%). Finally, according with the statistical significance between defence and type of shot, we can conclude that movement shots are more likely to be performed not contested (36,17%) compared with static shots (22,83%).

Serbia

Table 23 show the chi square coefficients between the success of the shot and the three remaining variables.

Table 23*. Serbia 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	58.159	2.349×10^{-13}	2
Location	1.576	0.2093	1
Previous Situation (for outside paint shots)	1.0499	0.3055	1
Type of shot (for inside paint shots)	2.2425	0.1343	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence (p-value < 0.05). There exists higher probability for the shot to be successful when the shot is performed not contested (77.44%).

It could be pointed out that Serbia performs 84.37% of total 2PTFGA from inside paint. This low representation of this variable ends up in very high variability, and that is why we do not find statistical significances.

Spain

Table 24 show the chi-square coefficients between the success of the shot and the three remaining variables.

***Table 24**. Spain 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	45,853	$1{,}105 \times 10^{-10}$	2
Location	5,1236	0,0236	1
Previous Situation (for outside paint shots)	3,4111	0,06476	1
Type of shot (for inside paint shots)	2,5639	0,1093	1

Note: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence and location (p-values < 0.05) but also between the defence and the type of shot (p-value= 0.004592<0.05).

Regarding the shot defence and shot location, there exists higher probability for the 2PTFGA to be successful when it is not contested (72.39%) and from inside paint (56.34%). Finally, according with the statistical significance between defence and type of shot, we could conclude that movements shots are more likely to be performed not contested (46,76%) rather than static shots (28,28%).

4. CONSIDERATIONS

In our study, we attempt to determine the impact of the shooting conditions in the shooting performance from the point of view of the strict game situations before and during the moment of shooting. Based in our data gathered, the main objective of this study was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3-point and 2-point field goals attempts among the TOP3 men's basketball teams in the European Championship 2017. We have attempted to find out the potential relationship between the shooting performance with concrete shooting conditions. Our main hypothesis was that these shooting conditions have a direct impact in the shooting performance. We have performed overall and team analysis regarding all 2PTFGA and 3PTFGA registered. Wide variation of results have been recorded, and results obtained are more accurate than others in terms of statistical significant associations (this could have its reason in the high variability present in part of our data). Overall, we can say that our results obtained confirm the initial hypothesis, and shooting conditions have a direct effect in the shooting performance. In some situations, just one variable has been found to have direct impact on the shooting performance (for instance, in the case of 2PTFGA by Serbia, just the shot defence was found to be statistically related with the shot success) but in other situations, all three variables have been proven to have direct effect in the shooting performance (for instance, Slovenian 3PTFGA).

No previous performance studies have been found centralized in the 2017 European Male Basketball Championship, neither regarding shooting performances nor about other aspects of the game. However, we do have found literature that distinguish between winner and losing teams regarding the shooting performance. Ciampolini (2018) stresses “the importance of shooting condition (specifically passively guarded and wide-open situations) as a determining factor in predicting FGM in basketball” and Csataljay et al. (2013) observed higher effectiveness rates when team cooperation could work out more opened scoring opportunities without any active defensive presence. In our study we have observed a general trend in which shot defence has direct effect in the shooting performance (for instance, in overall analysis of both 3PTFGA and 2PTFGA). Ibáñez et al. (2013) concludes that center players tend to receive more fouls given the high defence level they suffer. In our study, we have registered that in the three teams studied, the most common shot performed from inside paint regarding the level of opposition are the ones contested, which could be intimately linked with the fact that center players tend to receive more fouls than the others. Ibáñez et al. (2013) also points out that the closer to the basket the shot is taken, the higher the

shooting effectiveness is. Based in our data, higher effectiveness rates of success have been registered in shots performed inside paint compared with 2PTFGA performed outside paint or 3PTFGA. Finally, they also point out that after pass situations tend to be more effective than after dribble, which was also observed in all teams studied regarding the 3PTFGA and in all teams except Spain regarding the 2PTFGA.

Gómez et al. (2015) analysed the shooting performance according with the match status and registered higher effectiveness rates from inside paint. Although we have not taken into consideration the game situation in our study, we do have registered higher effectiveness rates in inside paint shots compared with outside paint shots regardless of the level of opposition. Erčulj et.al (2015) investigated the relative frequencies of different types of basketball shots at different competitive levels, and observed that dribbling or cutting to the basket was more common in the Youth competitions compared with the professional European basketball or the NBA. In our study, we have also observed a general trend in which after dribble situations tend to be less common compared with shots performed after pass.

Research limitations. As in any other research, some limitations of the study have been identified:

1) The first limitation that it has being identified relates with the sample size. Data has been gathered from top 3 teams from 2017 European Male Championship, which allow us to analyse the most successful teams in the competition. However, we have not been able to make a comparative analysis with the rest of the teams in the competition and therefore we have not been able to specify if our findings have been crucial when differentiating between winning and losing teams in the competition.
2) The second limitation identified if the study relates the sampling procedure. For some cases, due firstly to the limited amount of data and secondly to the high variability present in it, we have not been able to end up with significant statistical differences in distributions between our variables. For instance, when attempting to classify 2PTFGA according with shot location, we have faced that the percentage of 2PTFGA performed from inside paint is considerably bigger than those performed outside paint, which ends up in big variability in our data.
3) The third limitation has to do with the shot defence classification criteria, particularly for the 2PTFGA. Although our other criteria established does not seem to have issues regarding its objectiveness (shot location, shot success or shot previous situation), it is true that the shot defence classification criteria (either contested, half contested or not contested) may not have its limits perfectly delimitated between the different shooting defence options. Either

way, we assume that this little sense of author's subjectivity regarding shot defence selection have not affected our final conclusions.

Opportunities for research development. Based on our work, we could further establish some other research paths regarding our study:

1) As previously expressed, performing same analysis with the rest of the teams presents in the competition would allow us to see if our conclusions based in the top 3 teams are determinant when differentiating successful teams in the competitions and not successful ones. Additionally, it could also be seen the differences in performances between first phase and final phase, analysing teams individually but also, making the comparison between teams.
2) Our smallest unit of analysis has been the teams. We have performed analysis of all 3PTFGA and all 2PTFGA gathered and then we have also performed the individual analysis by teams. The next step would be to look deeply into the players performance, aiming to analyse the players shot selection criteria and how dependant is their shoot success with the variables analysed.
3) Further research studies could also take into consideration fast breaks, which have not been considered as a specific case in our study.

CONCLUSIONS

1) Regarding the 3PTFGA, the unique statistically significant difference in distribution compared with the shot success was found with the shot defence. Additionally, statistical significance association was found between the shot defence and both the shot previous situation and shot location. Overall, it was found that the 3PTFGA with highest probability to be successful would be the one performed not contested, after pass and performed from the corner.

   Regarding the 3PTFGA by teams, the statistical significant differences in distributions compared with the shot success were found with the previous situation for the case of Slovenia, with higher effectiveness rates in after pass shots and the shot defence for the case of Serbia, with higher effectiveness rates in not contested shots. Additionally, for the Slovenian case, it was found statistical significant association between the previous situation and both the shot location and shot defence (higher percentages of after pass shots when the shots are performed from the corner and not contested).

2) Regarding the 2PTFGA, shot success was found to be statistical significant associated with the shot defence, with shot location and for those shots performed from inside paint, with the type of shot. Overall, we would conclude that the 2PTFGA with highest probability to be successful would be the one performed not contested, from inside paint and performed with a movement shot.

   Regarding the 2PTFGA by teams, in the three teams studied it was found statistical significant differences in distribution between the shot success and the shot defence, being the shot with highest effectiveness rates the one performed not contested. Additionally, in the Slovenian and the Spanish case, there was also found statistical significant association between defence and the type of shot (in both cases, movement shots were more likely to be performed not contested rather than half contested or contested shots).

SUGGESTIONS OR RECOMMENDATIONS

1) Future studies may consider interviewing coaches to see how important they consider our variables studied and what shooting situations are they aiming to provoke through their offensive building.
2) Shooting conditions regarding the level of opposition should be re-considered given the increasingly ability of player's success regardless of the level of opposition, particularly in the 3PTFGA.
3) Same studies could be performed at different competitive levels, from youth basketball, to semi-professional leagues or even in NBA, with the objective of seeing how they perform and evolve. Therefore, we could establish the possible differences regarding our study variables between top European and NBA Basketball. Additionally, this comparison could also be done between actual (modern) successful basketball and "antique" successful basketball, for instance Michael Jordan's Chicago Bulls during 90s.

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ANNEXES

FACTORS ASSOCIATED WITH FIELD GOALS DURING 2017 EUROPEAN MALE BASKETBALL CHAMPIONSHIP BY THE TOP3 TEAMS (SLOVENIA, SERBIA AND SPAIN)

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Abstract

The aim of this study *was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3-point and 2-point field goals attempts.*

Methods. *Every field goal attempted by these teams have been classified according with criteria related with shot success, shot defence, shot location, shot success and shot previous situation or type of shot. Through game observation, we assessed a total of 1653 field goals attempts from 25 different games. 2-point field goals attempts and 3-point field goals attempts have been treated separately, primarily in absolute terms and secondly divided by teams. Descriptive analysis from data extracted consisted in absolute and relative values regarding our criteria established and inferential statistics were applied through Chi-Square test (significance levels were set at 5% and all statistics were performed through RStudioCloud) in order to find out the shot context with highest probability to be successful.*

.

Results. *In the case of the 3-point field goals attempts, statistically significant results show that the highest probability of success is observed when the shot is performed not contested, after pass and performed from the corner while for the 2-point field goals attempts, it would be the one performed not contested, from inside paint and performed in a movement shot.*

Conclusion. *Evidence shows the importance of shooting condition as a determinant factor of field goals made through games analysed.*

Key words*: European Male Basketball Championship 2017; shooting performance; notational analysis.*

Introduction

During the last decade or so, the capacity to produce data that provide a substantial description of performance of individuals or teams in sport, to sustain decision-making by coaches and managers, has been largely improved by technological developments (Liebermann et al., 2002). Several studies have been found regarding factors being influent in shooting performance. In the last decades, the ongoing search for understanding and interpreting the complex actions present in basketball has led researchers and coaches to use game statistics techniques (Almas, 2015). The study of basketball game-related statistics in competition has been used to identify variables that can distinguish between successful teams and players, which can lead to better sport results (Sampaio, Ibañez, Feu, Lorenzo, Gómez and Ortega, 2008). The need for quality as much as quantity of information on the performance of players and teams has become paramount with the use of video and personal computers (Garefis, Tsitskaris, Mexas and Kyriakou, 2007). In theoretical performance analysis, the general aim is to explain sports behaviour using general models whose empirical foundations provide useful information for sports practice, such as informing on the long-term planning of training processes (Lames and McGarry, 2007). It is well known that to discover performance indicators are one of the keys to success in interaction sports (Hughes & Bartlett, 2002). A better understanding of tactical elements through collective behaviour assessment is of vital importance to improve performance, supporting the training process and preparation for the match (Lemmink & Frencken, 2013).

Oliver (2004) established four key factors concept when analysing basketball performance: shooting percentage from the field, offensive rebounding, turnovers and going to the foul line a lot and making those shots. Skinnes (2012) says that a successful play ends with some player from the offensive team being given the opportunity to take a reasonably high-percentage shot. At this moment player decision depends on three factors: the (perceived) probability that the shot will go in, the distribution of shot quality that the offense is likely to generate in the future, and the number of shot opportunities that the offense will have before it is forced to surrender the ball to the opposing team. One method to be considered is notational analysis, characterized by being used during or after games through video recordings or specialized software to investigate athletes' performance (O'Donoghue, 2010). Hughes and Frank (2004), with the aim of generalizing the concept, defined notational analysis as a procedure that could be used in any discipline that requires assessment and analysis of performance. They assured that it has been demonstrated to be a valid tool to interpret technical and tactical aspects of performance in team sports. Ibáñez, García, Feu, Parejo and Cañadas (2013) define the concept of notational analysis as the result of the systematic study from annotations based on the previous observation of a sports event. Overall, feedback provides both motivational and an informational role, encouraging repeated performance and performance directed to reducing discrepancy between a desired and an actual outcome (Hughes, 2004).

Several studies have been found regarding the shooting performance (Ciampolini, 2018) focuses his study in the factors associated with basketball field goals made in an NBA context. He stresses "the importance of shooting condition (specifically passively guarded and wide-open situations) as a determining factor in predicting FGM in basketball". The study does not find relationship between shooting efficacy and number of passes made per offense. Additionally, they point out that "fast breaks seem to lead to better shooting conditions (passively guarded and wide open) when compared to set and regained offenses". Ibañez et al. (2013) center their study in the analysis of the effectiveness of shooting. They stressed the different outcomes obtained depending on the competition. Overall, they conclude that center players tend to receive more fouls given the high defence level they suffer as well as being the worse free throw shooting than the rest of the players. About the NBA competition, they find out that the effectiveness of shooting depends on the game-phase. For instance,

during the first quarter of the game the level of effectiveness is highest during game, while as the games goes by, the defence level increases, with the consequent increase of blocks and personal fouls, which makes a negative impact on the shooting effectiveness. They conclude that the closer to the basket the shot is taken, the higher the shooting effectiveness is (dunks, lay-ups and tips-in). They also highlight the importance of the previous situation of the shot (after rebound tends to provoke more fouls while after pass tends to be more effective than after dribble). Csataljay et al. (2013) investigate the potential relationship between the shooting performance from various distances with the level of defensive pressure on the shooting player in the context of team success. They point out that "the more effective shooting of winning teams was found as the consequence of better team cooperation as players could work out more opened scoring opportunities without any active defensive presence". Additionally, they recognise winners as being more capable of scoring when facing hard situations under high level of defensive pressure. Gómez, López and Toro (2015) analysed the shooting performance according with the match status. They find out that during balanced situations, the shooting effectiveness was higher when the shot was performed inside paint. On the other hand, in contexts of unbalanced game, they show higher shooting effectiveness in shots performed inside paint after 3-4 passes and with possessions longer than 10 seconds. Erčulj and Štrumbelj (2015), investigated the relative frequencies of different types of basketball shots, its technical details based on the execution and the level of success in different five level of competitions, from youth categories to NBA. Differences are mostly between the Senior and Youth competitions: more shots executed jumping or standing on one leg, more uncategorised shot types and more dribbling or cutting to the basket in the Youth competitions. Looking at the senior basketball and comparing the NBA with European basketball, it was found that dunks are more frequent and hook shots are less frequent compared to European basketball, which can be attributed to better athleticism of NBA players.

Shooting performance could be a key factor when differentiating between winning and losing teams. Differences in shooting performances have been observed according with the level of competition, point difference, game phase, level of opposition and previous situation of the shot. It is gaining great importance in modern basketball, where the quantity of players able to shoot from different distances and locations is constantly increasing. Our attempt in this study has to do with the shooting conditions as determinants of the shooting performance. We will study the shooting conditions according with criteria related with level of opposition, shot location, shot previous situation and type of shot. We base our study in the European Male Basketball Championship from 2017 and particularly in the top three teams from that Championship: Slovenia (gold), Serbia (silver) and Spain (bronze).

The aim of the study. The main objective of this study was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3PTFGA and 2PTFGA among the TOP3 men's basketball teams in the European Championship 2017.

Our hypothesis is that shooting performance is directly affected by the shooting conditions and we aim to find the shooting conditions with highest probability to be successful.

By comparing the shooting conditions with the shooting performance, and further identifying the shooting conditions that present highest effectiveness rates, coaches could use this information by trying to provoke those situations that have resulted into higher effectiveness rates.

Research object. Our study will be based in all FGA by TOP3 teams (Slovenia, Serbia and Spain) during 2017 European Male Basketball Championship.

The object of the study is focused in two main ideas:

- The first one would be to analyse the shooting effectiveness and shooting distribution of all the 3PTFGA and 2PTFGA of the TOP3 teams during FIBA Male Eurobasket 2017 according with criteria related with shot location, shot defence and shot previous situation. We would analyse separately 3PTFGA and 2PTFGA, first as a whole and then comparing the different teams' performances.

- The second idea of the study would be to find out the potential statistical significant differences in distributions from our variables, aiming to find the shot context that show highest probability to be successful. We would analyse separately 3PTFGA and 2PTFGA, first as a whole and then comparing the different teams' performances.

Table 1 below shows the total number of field goals attempts analysed.

Table 1. *Total number of field goals attempts*.

	2pt			3pt		
	Group phase	Final phase	Totals	Group phase	Final phase	Totals
Slovenia	197	154	351	128	98	226
Serbia	213	158	371	92	73	165
Spain	202	148	350	102	88	190
Totals	612	460	1072	322	259	581
Total of field goals	**1653**					

The research methods

1.Scientific literature and methodology review.
2. Game observation and data extraction
3. Statistical analysis of the official game score sheets (RStudio Cloud)

Organization.

All 3-point field goals attempts will be registered and classified according with the following criteria:

- ***Shot location***: "Corner", "45 degree" or "Front location".
- ***Shot defence***: "Contested" or "Not Contested".

It is considered that a shot is contested when the attacker shot is considerably affected by the defence. We consider that a shot is not contested when the attacker can take a three-point shot without or very little opposition from a defender.

- ***Previous situation:*** "After pass" or "After dribble".

Those shots whose origin has not been either a pass from a player or a dribble from the shooter such as dead balls, have been considered as "after pass" shots. To clarify, "after dribble situations" are just the ones in which the shooter takes a three-point shot after one or more dribbles himself.

All 2PTFGA will be registered and classified according with the following criteria:

- ***Shot location***: "Inside paint" or "Outside Paint".
- ***Shot defence***: "Contested", "Half Contested" or "Not Contested".

It is considered that a shot is contested when the defender is located between the attacker and the basket, in legal defence position and being totally able to affect the shot with his opposition. It is considered that a shot is "half contested" when the defender is able to partially affect the shot but the attacker is still with superiority to the basket. It is considered that a shot is "not contested" when the shot has no opposition and the attacker is not conditioned by any defender.

- **Previous situation/type of shot**: Depending on the shot location, we would have different alternatives for these criteria:

For those shots located *outside paint*, we would divide shots between shots taken "after pass" or "after dribble", in the same way we did with 3PTFGA.

For shots located *inside paint*, we would divide shots in two different categories attending with the kind of shot, either "Static shot" or "Movement shot". It is considered a static shot those with one or two feet stepped in (low post shots situations, shots without movement, tips in, set shots, shots after static reception….). It is considered a movement shot those in which the shot is done in a dynamic situation (lay-ups, fast breaks, cuts to the basket, penetrations, spin-in shots...).

The research results.

Descriptive analysis of 3PTFGA.

Table 2 show the data box obtained for all the 3PTFGA registered, a total of 581 shots.

Table 2. *Total 3PTFGA data-box.*

	FRONT		45 DEGREES		CORNER		TOTAL
	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	Aft. Pass	Aft. Dribble	
Contested	38	56	71	39	24	5	233
Success	10	16	24	10	6	1	67
% Success	26.32%	28.57%	33.80%	25.64%	25.00%	20.00%	28.76%
Not contested	92	37	117	30	69	3	348
Success	42	14	47	9	29	2	143
% Success	45.65%	37.84%	40.17%	30.00%	42.03%	66.67%	41.09%
Total shots	130	93	188	69	93	8	581

Legend: Aft. Pass – After Pass. Aft. Dribble – After Dribble.

We have registered a 36.14% of effectiveness out of the 581 3PTFGA registered. When taking into consideration the shot defence, we see that this percentage is lower when the shot is contested (28.76%) compared with when the shot is not contested (41.09%).

According with the shot distribution, 59.90% of the 3PTFGA were performed not contested while 40.10% contested. We apparently do not observe big differences in the 3PTFGA effectiveness according with the shot location: 36.77% from the front, 35.02% from the 45-degree position and 37.62% for shots located in corner positions. It can be observed that effectiveness of the 3PTFGA is always higher when the shot is performed not contested compared with when the shot is contested, regardless of the shot location.

According with the shot distribution, we have registered that 44.23% of the 3PTFGA were performed from the 45-degree position, 38.38% from the front position and just 17.38% of all 3PTFGA registered were performed from the corner. Comparing the shot distribution regarding shot location and shot defence, we observe that the biggest differences resides in 3PTFGA performed from the corner: just 28.71% were performed contested while 71.29% of the shots were not contested.
According with the shot previous situation (either performed after pass or after dribble) we observe that the effectiveness is 38.44% for the shots performed after pass and slightly lower (30.59%) for the shots performed after dribble. Additionally, we observe that shots performed not contested tend to have a higher effectiveness compared with shots performed contested. It has been observed that 70.74% of all the 3PTFGA were performed after pass while 29,26% after dribble. For the shots performed after pass, 32.36% were contested and 67.64% were not contested while for the shots performed after dribble, these percentages are considerably different, being 58.82% of the shots performed contested and 41.18% not contested. Regarding the shot previous situation and shot location we observe that the biggest difference obtained is for the corner shots. Out of all 101 3PTFGA registered from the corner, 92.08% were performed after pass and just 7.92% after dribble.

Overall, the shot which has presented the highest percentage of effectiveness is the shot performed from the front, not contested and after pass with 45.65% of success (shots performed from the corner, not contested and after dribble have not been considered given that this type of shot represents just 0.52% of the total sample). However, according with the shot distribution, data shows that the 3PTFGA most used has been the shot performed from the corner, contested and after pass.

Regarding the team descriptive analysis comparison, we do not observe big differences in total effectiveness rates, being Spain the highest with 38.95%. Regarding the defence, all teams present higher effectiveness when the shot is not contested rather than contested, being differences considerably bigger in Serbia and Spain. Spain is the one that was able to perform a higher percentage of 3PTFGA not contested (71.58%) compared with Serbia (58.79%) and Slovenia (50.88%). Additionally, Spain was also the one who presents the highest percentage of shots performed after pass (70.74%). The highest effectiveness according with shot location are Serbia and Spain from the corner, with effectiveness rates above 40.00%. All three teams present considerably less 3PTFGA from the corner compared with from the front and 45-degrees position. Shots performed after pass tend to have higher effectiveness than those after dribble. Slovenia`s case in the one which presents highest differences (39.87% after pass and 26.47% after dribble). According with the shot distribution, there is a general trend among the three teams in which the biggest differences between the percentages of 3PTFGA performed after pass or after dribble are observed in shots performed from the corner. For corner 3PTFGA, all three teams present shot distribution percentages around 90% for shots performed after pass.

Descriptive analysis of 2PTFGA.

Table 3 show the data box obtained for all the 2PTFGA registered, a total of 1072 shots.

Table 3. *Total 2PTFGA.*

	INSIDE PAINT		OUTSIDE PAINT		TOTAL
	Static Shot	Movement Shot	Aft. Pass	Aft. Dribble	
Contested	202	137	18	42	399
Success	61	46	4	10	121
% Success	30.20%	33.58%	22.22%	23.81%	30.33%
Half contested	131	100	27	42	300
Success	80	69	12	22	183
% Success	61.07%	69.00%	44.44%	52.38%	61.00%
Not contested	132	163	36	42	373
Success	108	132	18	24	282
% Success	81.82%	80.98%	50.00%	57.14%	75.60%
Total shots	465	400	81	126	1072

Legend: Aft. Pass – After Pass. Aft. Dribble – After Dribble.

It has been registered an average efficiency of 54.66% out of the total sample of 1072 2PTFGA. If we pay attention to the shot defence, this effectiveness decreases as the defence level increases. 37.22% of all 2PTFGA were performed contested, 27.99% half contested and 34.79% not contested. 2PTFGA performed inside paint present an effectiveness of 57.34% while those performed outside paint 43.48%. It can be observed that effectiveness of the 2PTFGA is a highest when the shot is performed not contested and lowest when it is contested, regardless of the shot location. According with the shot distribution, we have registered big differences. 80.69% of shots were performed inside paint while just 19.31% were performed outside paint. Whereas the most common shot performed inside paint is performed contested (39.19%), the one not contested is the most common from outside paint (37.68%). Regarding the 2PTFGA previous situation effectiveness (just for shots performed outside paint) we observe that the effectiveness is slightly higher for the shots performed after dribble compared with after pass (44.44% vs 41.98%). Additionally, we observe that effectiveness increases as the shot defence level decreases regardless of the shot previous situation.

According with the 2PTFGA distribution from outside paint, 60.87% were performed after dribble and 39.13% after pass. The shot distribution regarding the level of defence and shot previous situation presents same values for the shots performed after dribble. However, for the shots performed after pass, the volume of 2PTFGA increases as the level of defence decreases. For the 2PTFGA performed from inside paint, we observe that the effectiveness is higher when the shot is performed in a movement shot (61.75%) than when it is a static shot (53.55%). Additionally, we observe that effectiveness increases as the shot defence level decreases regardless of the type of shot. According with the 2PTFGA distribution from inside paint, 53.76% were static shots while 46.24% were movement shots. Taking defence into consideration, the most common static shot is the one contested (43.44%) while the most common movement shot is the one not contested (40.75%).

Overall, the 2PTFGA who has presented the highest percentage of effectiveness are the ones with no opposition performed from inside paint. According with the shot distribution, data shows that the 2PTFGA most common is the static shot, contested from inside paint.

Regarding the team descriptive analysis comparison, All teams studied present similar values for average effectiveness: 53.43% (Spain), 54.70% (Slovenia) and 55.80% (Serbia). All teams show a decrease in effectiveness as the defence level increases, regardless of shot location, shot previous situation or type of shot. Spain is the one that was able to perform a higher percentage of 2PTFGA not contested (38,29%). Additionally, Serbia is the one with a higher percentage of shots performed contested (40,70%). This could be a consequence of Serbia's shot distribution, being the one with the

highest percentage of 2PTFGA performed inside paint (84.37%), followed by Spain (81.14%) and Slovenia (76.35%). Similar values of effectiveness have been observed regarding the shots performed inside paint (between 56% and 59%). Serbia shows the highest effectiveness from outside paint 2PTFGA (48.28%). For the shots performed inside paint, all teams present higher effectiveness values in movement shots compared with static shots. For shots performed outside paint, Spain presents the highest effectiveness in shots performed after dribble (51.43%) while Serbia presents the highest after pass (56.00%). According with shot distribution and shot location, Serbia is the one that shows bigger differences in the inside paint shots (61.66% static shot). For outside paint shots, general trend is observed of higher amount of shots taken after dribble than after pass, being Slovenia the team that presents higher differences (69.88%) of shots outside paint performed after dribble.

Statistical analysis of 3PTFGA.

Below, table 4, 5 and 6 analyses the potential statistical significant differences in distributions between the success of the 3PTFGA and the remaining variables.

Table 4. *Chi-square test: success & defence 3PTFGA.*

	Contested	%	Not Contested	%	Total	X^2	p-value	df
Missed/ Blocked	166	71.2%	205	58.9%	371	9.2026	0.002417	1
Made	67	28.8%	143	41.1%	210			
Total	233	100.0%	348	100.0%	581			

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 5. *Chi square test: success and shot location 3PTFGA.*

	Front	%	45 degrees	%	Corner	%	Total	X^2	p-value	df
Missed/ Blocked	141	63.2%	167	65.0%	63	62.4%	371	0.27466	0.8717	2
Made	82	36.8%	90	35.0%	38	37.6%	210			
Total	223	100.0%	257	100.0%	101	100.0%	581			

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 6*. Chi square test: success and previous situation 3PTFGA.*

	After pass	%	After dribble	%	Total	X^2	p-value	df
Missed/ Blocked	253	61.6%	118	69.4%	371	3.2146	0.07299	1
Made	158	38.4%	52	30.6%	210			
Total	411	100.0%	170	100.0%	581			

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 3 shows that there is a significant association in 3PTFGA between defence and success of the shot (p-value < 0.05). Based on these results, there will be a strict association between the success of the shot and how the shot has been defended. Table 4 shows that there is not a significant association in 3PTFG between location and success of the shot (p-value>>0.05). Based on this result, the success of the shot and the location where it has been taken guards no statistical association. Although table 6 shows that there is no significant statistical association between the success of the shot and the previous situation (p-value>0.05), given that the p-value is very near to 0.05 we could expect that with a bigger amount of data registered there could be an statistical significant association between the success of the 3PTFGA and the previous situation (either after pass or after dribble).

Given that it's been found that the success of the 3PTFGA has statistical significance just with one criteria (defence of the shot) among the three remaining, Chi square test has been performed between the defence of the shot and the two remaining criteria, previous situation and shot location. Although it was not found statistically significant association between success of the 3PTFGA and the variables "previous situation" and "location", we do have found significant statistical association between defence of the shot and previous situation (p-value= 3.191×10^{-9} <<< 0.05) but also between defence of the shot and location of the shot (p-value=0.03644<0.05). With the results obtained we could conclude the following: it has been found that the only significant association with the success of the shot is the defence of the shot. Looking deeper on the data obtained, those 3PTFGA not contested have higher probability to be successful than those contested (41.1% vs 28.8%). Regarding the previous situation of the shot and given that it has been found significant association with the defence of the shot, we could conclude that those shots performed after pass are more likely to be performed not contested compared with shots performed after dribble (67,54% vs 41,18%). Finally, regarding the significant statistical association between the defence and the location of the shot, we could conclude that shots performed from the corner are more likely to be performed not contested (71,29%) compared with either from the front (57,85%) or from the 45-degree position (57,20%). Overall, we would conclude that the 3PTFGA with highest probability to be successful would be the one performed not contested, after pass and performed from the corner position.

Statistical analysis of 3PTFGA (team comparison)

Slovenia

Table 7 shows the chi square coefficients between the success of the shot and the three remaining variables:

Table 7*. Slovenia 3PTFGA chi square coefficients between success and remaining variables*

Variable	X^2	p-value	df
Previous situation	3.7138	0.05397	1
Location	0.51917	0,7714	2
Defence	0.5964	0.44	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

Although the p-value between previous situation and shot success is slightly bigger than 0,05 (our significance level), we could expect that with a bigger amount of data there would be statistical significant difference in distribution between previous situation and shot success. Additionally, results show that "previous situation" has statistical significance association with location (p-value = 4,05 x 10-5<0.05) as well as with the defence of the shot (p-value = 7,944 x 10-5 <0.05). 3PTFGA performed after pass have higher probability to be successful than those performed after dribble (39.87% vs 26.47%). Shots performed from the corner are more likely to be performed after pass (93,75%) than those performed either from the 45-degree position (69,31%) or from the front (55,84%). Finally, not contested shots are more likely to be performed after pass (81,74%) than those performed contested (57,66%).

Serbia

Table 8 shows the chi square coefficients between the success of the shot and the three remaining variables:

Table 8. *Serbia 3PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Previous situation	0.12387	0.7249	1
Location	1.2609	0.5324	2
Defence	8.4551	0.00364	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

Results point out that the unique statistical significance with the success of the shot resides in its defence (p-value= 0.00364<0.05). Additionally, no statistical significance has been found neither between defence and location (p-value=0.6083>0,05) nor between defence and previous situation (p-value=0.1097>0.05). Regarding the shot defence, there exists higher probability for a 3PTFGA to be successful when it is not contested (42.27%) than when it is contested (20.59%). No further affirmations could be done according with the data obtained.

Spain

Table 9 shows the chi square coefficients between the success of the shot and the three remaining variables:

Table 9*. Spain 3PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Previous situation	0.3367	0.5617	1
Location	0.031458	0.9844	2
Defence	2.7545	0.09698	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test.

None of the chi square test coefficients result statistically significant related with the success of the 3PTFGA (all p-values>0.05). The reason behind this non significances relies in the big variability

present in our variables. Spain performs 74.74% of shots after pass rather than after dribble and 71.58% of the shots are performed not contested rather than contested. Finally, regarding the location of the shot, Spain performs 45.79% of the 3PTFGA from the 45-degrees position, 35.79 from a front position and 18.42% of the 3PTFGA from the corner. This low representation of some variables ends up in very high variability, and that is why we do not find statistical significance.

Statistical analysis of 2PTFGA.

Below, table 10, 11, 12 and 13 analyse the potential statistical significant differences in distribution between the success of the 2PTFGA and the remaining variables.

***Table 10**. Chi-square test: success & defence 2PTFGA.*

	C	%	HC	%	NC	%	Total	X^2	p-value	df
Missed/ Blocked	278	69.7%	117	39.0%	91	24.4%	486	166.22	2.2×10^{-16}	2
Made	121	30.3%	183	61.0%	282	75.6%	586			
Total	399	100.0%	300	100.0%	373	100.0%	1072			

Legend: C-Contested, HC- Half contested, NC – Not contested, X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

***Table 11**. Chi-square test: success & shot location 2PTFGA.*

	Inside Paint	%	Outside Paint	%	Total	X^2	p-value	df
Missed/ Blocked	369	42.7%	117	56.5%	486	12.952	0.0003195	1
Made	496	57.3%	90	43.5%	586			
Total	865	100.0%	207	100.0%	1072			

Legend: C-Contested, HC- Half contested, NC – Not contested, X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

***Table 12.** Chi-square test: success & shot location 2PTFGA.*

	Static Shot	%	Movement Shot	%	Total	X^2	p-value	df
Missed/ Blocked	216	46.5%	153	38.3%	369	5.9132	0.01503	1
Made	249	53.5%	247	61.8%	496			
Total	465	100.0%	400	100.0%	865			

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

***Table 13.** Chi-square test: success & previous situation (outside paint) 2PTFGA.*

	After pass	%	After dribble	%	Total	X^2	p-value	df
Missed/ Blocked	34	42.0%	70	55.6%	104	0.12232	0.7265	1
Made	47	58.0%	56	44.4%	103			
Total	81	100.0%	126	100.0%	207			

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Table 10 shows that there is a significant association in 2PTFGA between defence and success of the shot (p-value < 0.05). Based on these results, there will be a strict relationship between the success of the shot and how the shot has been defended. According with the results obtained in table 11, there exists significant statistical association between success of the shot and its location (p-value< 0.05). Table 12 shows that there exist statistically significant association between the success of the shot and the type of shot for those shot taken from inside paint (p-value= 0.01503<0.05). Results show that there is not statistically significance between the success of the shot and its previous situation for those 2PTFGA taken from outside paint (p-value=0.7265>0.05)

With the results obtained we could conclude the following: Regarding the statistical significance between the success and defence, we have registered higher effectiveness for not contested shots (75.60%). Regarding the statistical significance between success and shot location, we have registered higher effectiveness for inside paint shots (57.34%). Finally, regarding the statistical significance between the success of the shot and the type of shot, it has been registered higher effectiveness rate for the movement shots (61.75%). Overall, we would conclude that the 2PTFGA with highest probability to be successful would be the one performed not contested, from inside paint and movement shot.

Statistical analysis of 2PTFGA (team comparison)

Slovenia

Table 14 show the chi square coefficients between the success of the shot and the three remaining variables:

Table 14. *Slovenia 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	65,058	$7{,}46 \times 10^{-15}$	2
Location	6,89	0,0087	1
Previous Situation (for outside paint shots)	0,0492	0,8245	1
Type of shot (for inside paint shots)	1,1938	0,2746	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence and location (p-values < 0.05) but also between the defence and the type of shot (p-value=0.04657<0.05). Regarding the shot defence and shot location, there exists higher probability for a 2PTFGA to be successful when it is not contested (77.36%) and from inside paint (58.58%). Finally, according with the statistical significance between defence and type of shot, we could say that there is a higher probability for the shot to be not contested when it is performed as an movement shot (36.17% out of all movement shots. Static shots 22.83%).

Serbia

Table 15 show the chi square coefficients between the success of the shot and the three remaining variables:

Table 15*. Serbia 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	58.159	2.349×10^{-13}	2
Location	1.576	0.2093	1
Previous Situation (for outside paint shots)	0.57657	0.4477	1
Type of shot (for inside paint shots)	2.2425	0.1343	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence (p-values < 0.05). There exists higher probability for the shot to be successful when the shot is performed not contested (77.44%). It could be pointed out that Serbia performs 84.37% of total 2PTFGA from inside paint. This low representation of this variable ends up in very high variability, and that is why we do not find statistical significances.

Spain

Table 16 show the chi-square coefficients between the success of the shot and the three remaining variables:

Table 16*. Spain 2PTFGA chi square coefficients between success and remaining variables.*

Variable	X^2	p-value	df
Defence	45,853	$1{,}105 \times 10^{-10}$	2
Location	5,1236	0,0236	1
Previous Situation (for outside paint shots)	3,4111	0,06476	1
Type of shot (for inside paint shots)	2,5639	0,1093	1

Legend: X^2 – Chi Square test coefficient, p-value – level of statistical significance of Chi Square test, df- degrees of freedom.

Statistical significant values have been obtained between the success of the 2PTFGA and the shot defence and location (p-values < 0.05) but also between the defence and the type of shot (p-value= 0.004592<0.05). Regarding the shot defence and shot location, there exists higher probability for the 2PTFGA to be successful when it is not contested (72.39%) and from inside paint (56.34%). Finally, according with the statistical significance between defence and type of shot, we could say that there is a higher probability for the shot to be not contested when it is performed as an movement shot (46.76% out of all movement shots. Static shots 28.28%).

Discussion

In our study, we attempt to determine the impact of the shooting conditions in the shooting performance from the point of view of the strict game situations before and during the moment of shooting. Based in our data gathered, the main objective of this study was to find out the shooting conditions with highest probability to be successful according with the data extracted, both in 3-point and 2-point field goals attempts among the TOP3 men's basketball teams in the European Championship 2017. We have attempted to find out the potential relationship between the shooting

performance with concrete shooting conditions. Our main hypothesis was that these shooting conditions have a direct impact in the shooting performance. We have performed overall and team analysis regarding all 2PTFGA and 3PTFGA registered. Wide variation of results have been recorded, and results obtained are more accurate than others in terms of statistical significant associations (this could have its reason in the high variability present in part of our data). Overall, we can say that our results obtained confirm the initial hypothesis, and shooting conditions have a direct effect in the shooting performance. In some situations, just one variable has been found to have direct relationship on the shooting performance (for instance, in the case of 2PTFGA by Serbia, just the shot defence was found to be statistically related with the shot success) but in other situations, all three variables have been proven to have direct effect in the shooting performance (for instance, Slovenian 3PTFGA).

No previous performance studies have been found centralized in the 2017 European Male Basketball Championship, neither regarding shooting performances nor about other aspects of the game. However, we do have found literature that distinguish between winner and losing teams regarding the shooting performance. Ciampolini (2018) stresses "the importance of shooting condition (specifically passively guarded and wide-open situations) as a determining factor in predicting FGM in basketball" and Csataljay et al. (2013) observed higher effectiveness rates when team cooperation could work out more opened scoring opportunities without any active defensive presence. In our study we have observed a general trend in which shot defence has direct effect in the shooting performance (for instance, in overall analysis of both 3PTFGA and 2PTFGA). Ibáñez et al. (2013) concludes that center players tend to receive more fouls given the high defence level they suffer. In our study, we have registered that in the three teams studied, the most common shot performed from inside paint regarding the level of opposition are the ones contested, which could be intimately linked with the fact that center players tend to receive more fouls than the others. Ibáñez et al. (2013) also points out that the closer to the basket the shot is taken, the higher the shooting effectiveness is. Based in our data, higher effectiveness rates of success have been registered in shots performed inside paint compared with 2PTFGA performed outside paint or 3PTFGA. Finally, they also point out that after pass situations tend to be more effective than after dribble, which was also observed in all teams studied regarding the 3PTFGA and in all teams except Spain regarding the 2PTFGA. Gómez et al. (2015) analysed the shooting performance according with the match status and registered higher effectiveness rates from inside paint. Although we have not taken into consideration the game situation in our study, we do have registered higher effectiveness rates in inside paint shots compared with outside paint shots regardless of the level of opposition. Erčulj et.al (2015) investigated the relative frequencies of different types of basketball shots at different competitive levels and observed that dribbling or cutting to the basket was more common in the Youth competitions compared with the professional European basketball or the NBA. In our study, we have also observed a general trend in which after dribble situations tend to be less common compared with shots performed after pass.

Some limitations have been identified in our study: the first limitation relates with the sample size. Data has been gathered from top 3 teams from 2017 European Male Championship, which allow us to analyse the most successful teams in the competition. However, we have not been able to make a comparative analysis with the rest of the teams in the competition and therefore we have not been able to specify if our findings have been crucial when differentiating between winning and losing teams in the competition. Second limitation relates the sampling procedure. For some cases, due firstly to the limited amount of data and secondly to the high variability present in it, we have not been able to end up with significant statistical associations between our variables. For instance, when attempting to classify 2PTFGA according with shot location, we have faced that the percentage of 2PTFGA performed from inside paint is considerably bigger than those performed outside paint, which ends up in big variability in our data. Third limitation has to do with the shot defence classification criteria, particularly for the 2PTFGA. Although our other criteria established does not seem to have issues regarding its objectiveness (shot location, shot success or shot previous situation),

it is true that the shot defence classification criteria (either contested, half contested or not contested) may not have its limits perfectly delimitated between the different shooting defence options. Either way, we assume that this little sense of author's subjectivity regarding shot defence selection have not affected our final conclusions.

Regarding the further research opportunities, performing same analysis with the rest of the teams presents in the competition would allow us to see if our conclusions based in the top 3 teams are determinant when differentiating successful teams in the competitions and not successful ones. Additionally, it could also be seen the differences in performances between first phase and final phase, analysing teams individually but also, making the comparison between teams. Additionally, our smallest unit of analysis has been the teams. We have performed analysis of all 3PTFGA and all 2PTFGA gathered and then we have also performed the individual analysis by teams. The next step would be to look deeply into the players performance, aiming to analyse the players shot selection criteria and how dependant is their shoot success with the variables analysed.

Conclusions

Regarding the 3PTFGA, the unique statistically significant difference in distribution compared with the shot success was found with the shot defence. Additionally, statistical significance association was found between the shot defence and both the shot previous situation and shot location. Overall, it was found that the 3PTFGA with highest probability to be successful would be the one performed not contested, after pass and performed from the corner.

Regarding the 3PTFGA by teams, the statistical significant differences in distributions compared with the shot success were found with the previous situation for the case of Slovenia, with higher effectiveness rates in after pass shots and the shot defence for the case of Serbia, with higher effectiveness rates in not contested shots. Additionally, for the Slovenian case, it was found statistical significant association between the previous situation and both the shot location and shot defence (higher percentages of after pass shots when the shots are performed from the corner and not contested).

Regarding the 2PTFGA, shot success was found to be statistical significant associated with the shot defence, with shot location and for those shots performed from inside paint, with the type of shot. Overall, we would conclude that the 2PTFGA with highest probability to be successful would be the one performed not contested, from inside paint and performed with a movement shot.

Regarding the 2PTFGA by teams, in the three teams studied it was found statistical significant differences in distribution between the shot success and the shot defence, being the shot with highest effectiveness rates the one performed not contested. Additionally, in the Slovenian and the Spanish case, there was also found statistical significant association between defence and the type of shot (in both cases, movement shots were more likely to be performed not contested rather than half contested or contested shots).

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