

MODERN EVOLUTIONARY CHANGES IN FIELD GOAL SHOOTING PATTERNS WITHIN PROMINENT EUROPEAN BASKETBALL LEAGUES

Raúl Nieto-Acevedo¹, Anthony S. Leicht², Pierpaolo Sansone^{3,4},
Sergio L. Jiménez-Sáiz⁵, and Enrique Alonso-Pérez-Chao^{1,6}

¹*Faculty of Sports Sciences, Universidad Alfonso X el Sabio, Villanueva de la Cañada, Spain*

²*Sport and Exercise Science, James Cook University, Townsville, Australia*

³*Department of Theoretical and Applied Sciences, eCampus University, Novedrate, Italy*

⁴*Department of Movement, Human and Health Sciences,
University of Rome "Foro Italico", Rome, Italy*

⁵*Sport Sciences Research Centre, Universidad Rey Juan Carlos, Madrid, Spain*

⁶*Faculty of Sports Science, Universidad Europea de Madrid, Villaviciosa de Odón, Spain*

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Abstract:

The aims of this study were to identify the evolution of field goal shooting trends within leading European basketball leagues, and the subsequent impact of a change in 3-point line distance on these trends, providing valuable information for coaches and strategists. Data were collected from the 2002-2003 to the 2022-2023 season (21 seasons) from the prominent basketball leagues of Spain, Italy, France, and Greece. The analyzed variables were: 2-point field goals made (2PM), 2-point field goal attempts (2PA), 2-point field goal percentage (2P%), 3-point field goals made (3PM), 3-point field goal attempts (3PA), and 3-point field goal percentage (3P%). One-way repeated-measures ANOVA or Friedman's test were used to determine evolutionary changes in variables over time. Additionally, comparisons between variables before and after the change in 3-point line distance were also conducted via independent t-tests. Over the past 21 seasons, 3PA and 3PM significantly increased from an average of 20.80 to 25.17 per match. In contrast, 2PA, 2PM, 2P% and 3P% remained unchanged during the same period. Following the change in distance of the 3-point line, 3PA and 3PM increased over 5%, while no change in 3P%, 2PA, 2PM and 2P%. Over the past 21 seasons, there were substantial increases in 3PA and 3PM, especially since the change in 3-point line distance in 2010-2011, without changes in 2-point shooting trends and efficiency (i.e., 2P%, 3P%), within the leading basketball leagues of Europe. Collectively, these results demonstrated substantial evolutionary change in 3-point shooting behavior, requiring offensive and defensive upskilling of athletes and coaches for successful match-play, and potentially informing the development of new training paradigms in modern basketball.

Keywords: trend analysis, match outcomes, males, scoring, team sport

Introduction

In basketball, game-related statistics are considered crucial resources for obtaining valuable insights into team and player performance (Puente, Coso & Salinero 2015). These statistics have been collected and analyzed using various methods throughout the years, ranging from simple statistic sheets to the now widely adopted box-score format (Mandić, Jakovljević, Frerlj & Štrumbelj 2019). Notably, several game-related statistics have been shown to discriminate winning and losing basketball teams (Gomez, Lorenzo, Barakat, Ortega & Palao 2008;

Leicht, Gomez, & Woods, 2017), making it an essential aspect for coaches and analysts (Zajac, et al., 2023) to consider when developing game strategies. The evaluation of game-related statistics should be adapted to relevant contextual factors that can affect game-play, such as leagues and their different rules, season phases, and game location (Gomez, et al., 2008; Lorenzo, J., Lorenzo, A., Conte & Giménez 2019).

Over the past two decades, there have been notable rule changes in international basketball. For example, in season 2010-2011, the interna-

tional 3-point line was moved further away from the basket (i.e., from 6.25 to 6.75 meters away from the basket compared with 7.25 meters in the National Basketball Association (NBA). Rule changes can lead to significant changes in game-play that significantly impact athlete development and team strategies (Štrumbelj, Vračar, Robnik-Sikonja, Dežman & Erčulj, 2013). For example, the introduction of the 3-point line in the NBA changed the style of play, with changing the number of 3-point shots attempted by a team per match in the NBA (Zajac, et al., 2023) from 2.8 in 1979 to 32.0 in 2018-2019, an ~1100% increase (Zajac, et al., 2023). This style of play has not only increased the points scored in games (Zajac, et al., 2023) but also extended the field of play for basketball players, which required their enhanced physical fitness qualities to cover the extended court area compared to those in the past (Sliz, 2017). Similarly, the reduction of the shot clock from 30 to 24 seconds (year 2000) has substantially increased the game pace, which is higher in more competitive leagues (i.e., NBA) (Mandić, Jakovljević, Erčulj & Štrumbelj, 2019). Such changes have also required adaptations in perspectives of coaches and game analysts in order to properly prepare players and teams for competition and optimize their production on the court (Puente, et al., 2015).

Determining the key factors for victory in basketball is a complex task as successful performance results from a range of multiple elements (Pérez-Chao, et al., 2023). For example, defensive rebounds, turnovers and field goal (i.e., 2- and 3-point) shooting were reported to be crucial for success at the elite level (Leicht, et al., 2017; Zhang, et al., 2020). Specifically, field goal shooting effectiveness (i.e., shots made/shots attempted) has been reported to be a prominent contributor to elite match success (Li, et al., 2025). Teams with a greater field goal shooting efficiency than their opponents tended to win ~81% of matches during the regular season with winning efficiency increased to 90% in the playoffs (Mandić, Jakovljević, Erčulj & Štrumbelj, 2019). Since many of these studies were conducted within unique competitions (e.g., Olympics' tournaments), the applicability to other competitions (e.g. European leagues) that may have different styles of play might be limited (Leicht, et al., 2017). Furthermore, due to the progressive changes in the 3-point line distance and the continuous evolution of offensive strategies in basketball, it is essential to quantify the historical trends in shooting performance. Several studies have shown how regulatory modifications can lead to strategic adaptations and long-term changes in shot selection and game dynamics (Caporale & Collier, 2015; Sliz, 2017; Štrumbelj, et al., 2013). To our knowledge, this is one of the first studies to longitudinally examine field goal shooting

behavior across multiple top-tier European leagues with a clear division based on a rule change—the extension of the 3-point line. By comparing trends before and after this modification, the present study offers novel insights into how regulatory adjustments can shape tactical and performance-related behaviors in elite basketball over time. Therefore, the main aim of the current study was to identify the evolution of field goal shooting trends within the principal European basketball leagues. As the distance of the 3-point line had changed during the past 20 seasons (Sliz, 2017), differences between seasons before the change (2002-2010), and seasons after the change (2011-2023) were examined as a secondary aim. Based on earlier work that demonstrated similar offensive activities between the NBA and Euroleague competitions (Selmanović, Škegro, & Milanović, 2015), we hypothesized that field goal shooting trends in Europe will vary due to the change in the three-point line. Understanding shooting pattern changes in European basketball may help coaches and athletes with strategic development and recruitment of players, as well as game strategies to optimize team success.

Materials and methods

Study design

A longitudinal observational design was used to examine the evolution of shooting performance across two decades in elite European basketball. The study focused on identifying trends over time and comparing performance before and after a major rule change—the extension of the 3-point line.

Sample

The sample comprised a total of 2,546 official matches from senior men's professional basketball across four leading European leagues: Spain, Italy, France, and Greece. These matches were selected from 21 consecutive seasons, spanning from season 2002-2003 to 2022-2023.

These four leagues were selected due to the consistent availability of detailed, reliable, and standardized match statistics throughout the entire study period. While other prominent European leagues (e.g., Turkey, Israel) have also achieved notable international success, they were not included in this analysis due to limited historical data availability. This should be considered a limitation of the present study.

Data collection procedure

Match statistics were obtained from open-access archives hosted on www.basketball-reference.com (accessed on September 10, 2023), which have been previously reported as reliable sources for

long-term basketball performance analysis (Belk, Marshall, McCarty, & Kraeutler, 2017; Zając, et al., 2023). The specific field goal-related variables extracted included the following:

- 2-point field goals made (2PM)
- 2-point field goal attempts (2PA)
- 2-point field goal percentage (2P%)
- 3-point field goals made (3PM)
- 3-point field goal attempts (3PA)
- 3-point field goal percentage (3P%).

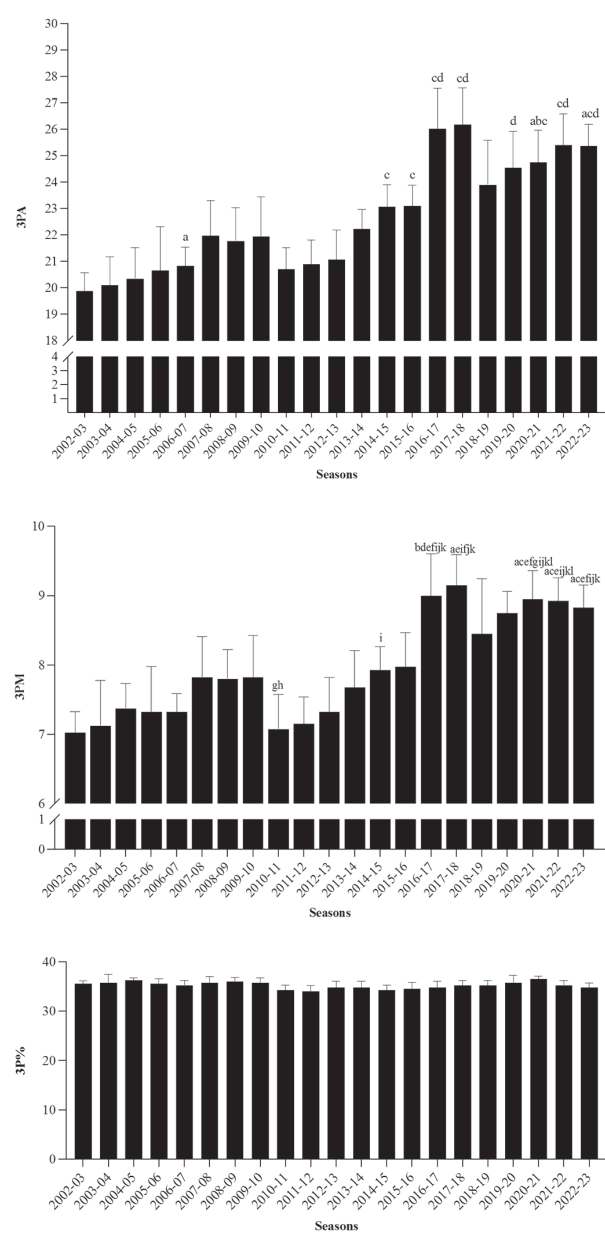
These indicators have been associated with success in elite basketball competitions and were thus selected as key outcome variables (Casals & Martinez, 2013; Puente, et al., 2015; Zhang, et al., 2020).

Statistical analysis

All data were screened prior to analysis. Missing values were handled using listwise deletion to ensure consistency across variables. Outliers were identified as values exceeding three standard deviations from the mean and were subsequently examined on a case-by-case basis. Outliers attributable to recording or tracking errors were removed. All results were expressed as mean (M) ± standard deviation (SD). To examine within-subject changes across time and conditions, we employed repeated measures ANOVA and paired-sample *t*-tests. Prior to the analysis, assumptions of normality and homogeneity of variances (homoscedasticity) were assessed using the Shapiro-Wilk and Mauchly's tests, respectively. Additionally, as there had been changes in the distance of the 3-point line during this period, differences between seasons before the change (2002-2010), and seasons after the change (2011-2023), were compared using Student's *t*-tests. When appropriate, pairwise comparisons with a Bonferroni correction or a Durbin-Conover test were used as *post hoc* tests. All analyses were performed using Jamovi (version 2.3, Sydney, Australia) or GraphPad Prism 9 (Boston, USA).

Results

Results of ANOVAs or Friedman's tests are shown in Table 1. During the last 21 Eurobasketball seasons, 3PA significantly increased from 20.80 to 25.17 per match (~21%) with comparable increasing trends for 3PM that resulted in a maintenance of 3P% across the study period (Figure 1). In contrast, 2PM and 2P% remained unaffected from 2002 to



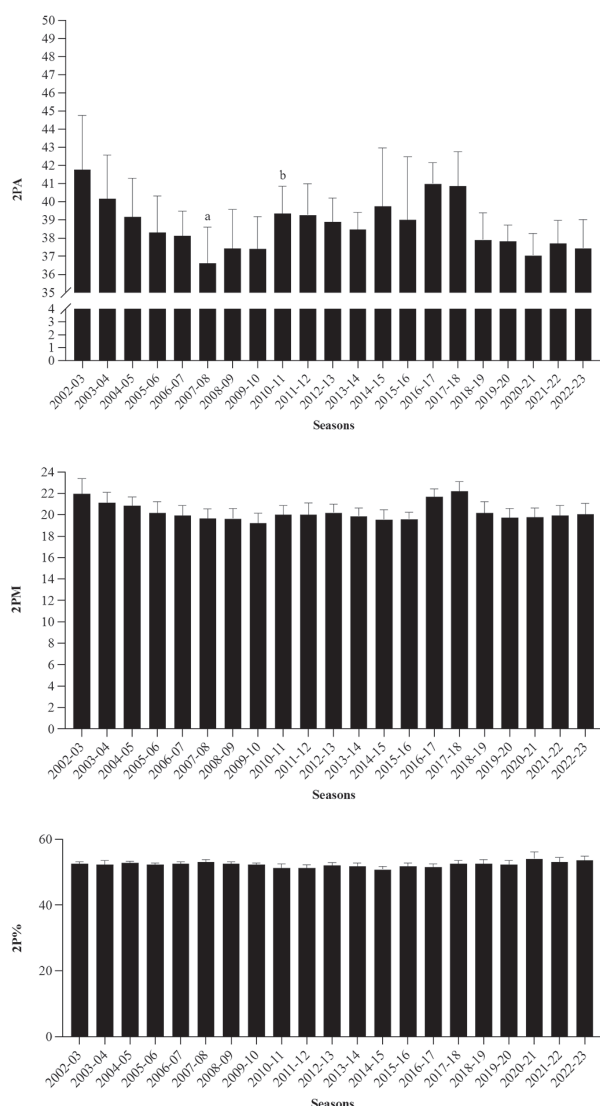
Note. ^a*p*<.05 vs. 2002-2003; ^b*p*<.05 vs. 2003-2004; ^c*p*<.05 vs. 2004-2005; ^d*p*<.05 vs. 2005-2006. ^e*p*<.05 vs. 2006-2007; ^f*p*<.05 vs. 2007-2008; ^g*p*<.05 vs. 2008-2009; ^h*p*<.05 vs. 2009-2010; ⁱ*p*<.05 vs. 2010-2011; ^j*p*<.05 vs. 2011-2012; ^k*p*<.05 vs. 2012-2013; ^l*p*<.05 vs. 2014-2015.

Figure 1. Total 3-point attempts (3PA), 3-point shots made (3PM), and 3-point shooting percentages (3P%) per match over the past 21 Eurobasketball seasons.

2023, despite minor fluctuations in 2PA across the study period (Figure 2).

Table 1. Results of ANOVAs or Friedman tests between decades for 3PA, 3PM and 2PA, 2PM

Variable	M	SD	ANOVA or Friedman test	p-value
3PA	22.61	229	Test =70.85	<.001
3P%	0.35	0.011	Test =30.62	.061
2PA	38.33	4.75	Test = 56.18	<.001
2P%	0.52	0.01	F= 2.30	.007



Note. ^a $p < .05$ vs. 2002-2003; ^b $p < .05$ vs. 2006-2007. ^c

Figure 2. Total 2-point attempts (2PA), 2-point shots made (2PM) and 2-point shooting percentages (2P%) per match for the past 21 Eurobasketball seasons.

Changing the distance of the 3-point line (i.e., 2003-2010 vs. 2011-2023 matches) resulted in significantly greater 3PA and 3PM with no change in 3P%, 2PA, 2PM, and 2P% (Figure 3).

Discussion and conclusions

The present study aimed to examine the evolutionary change of shooting trends within the leading basketball leagues of Europe. Across 21 seasons, there was a significant increase in 3PA and 3PM, while no statistically significant changes were evident for 3P%, 2PA, 2PM, and 2P%. Further, significant increases in 3PA and 3PM occurred following the 3-point line rule change with no significant differences in other shooting variables. Extending the 3-point line distance significantly increased 3-point shooting behavior but not efficiency within the European Basketball Leagues

that has extended the competitive region of the court for athletes. These relevant changes in strategies require athletes and coaches to modify technical-tactical plans, which better adapt to the novel shooting trends.

The extension of the 3-point line for international basketball competition around the year 2010 resulted in a court arrangement similar to that of the NBA. Subsequently, it was no surprise that such a change in European Basketball Leagues would result in a similar NBA result of increased 3PA (Zajac, et al., 2023). Interestingly, the 3PA increase was not as pronounced for the European Leagues compared to the NBA (21% vs. 1100%), which may reflect differences in athlete ability and match strategies between the competitions. Further, the shooting change may reflect a greater use of advanced analytics (Zajac, et al., 2023) where European teams are engaging novel analytical techniques to enhance offensive efficiency (Caporale & Collier, 2015; Sliz, 2017). Consequently, European coaching staff may have adapted their traditional team strategies, recognizing the 3-point shot as a match-changing element for the modern basketball competition. This strategic shift has ushered in an increased focus on perimeter play, emphasizing the value of spacing and outside shooting (Caporale & Collier, 2015). Curiously, such focus did not result in changes in 2-point shooting trends or 3-point efficiency, which hints toward the importance of the number of ball possessions per match (Selmanović, et al., 2015), which has been shown to increase for most elite basketball leagues in the past years. Teams may develop a greater focus on maximizing the scoring potential of each possession (i.e., reward of 3-points), regardless of the risk (i.e., a greater risk of missing a shot from a further distance, which can facilitate fast-breaks and easier scoring opportunities for the opponent team). This greater risk-reward behavior underscores the evolving nature of strategic decision-making in modern basketball. Coaches and athletes alike may adapt to a dynamic style of play that place greater focus on offensive efficiency and creating more scoring opportunities by increasing the pace and the number of ball possessions beyond traditional methods (Zhang, Gomez, Yi, Dong, Leicht & Lorenzo, 2025). By embracing the 3-point shot as a high-reward option, teams may be challenging conventional norms and redefining offensive strategies. This trend may lead to a more dynamic and unpredictable style of play, forcing opponents to adjust defensively, which altogether contributes to the ongoing evolution of basketball tactics (Mandić, Jakovljević, Erčulj & Štrumbelj, 2019).

As highlighted previously, 2- and 3-point shooting accuracy remained relatively consistent over the past 21 seasons within the leading European Basketball Leagues. This constant accuracy,

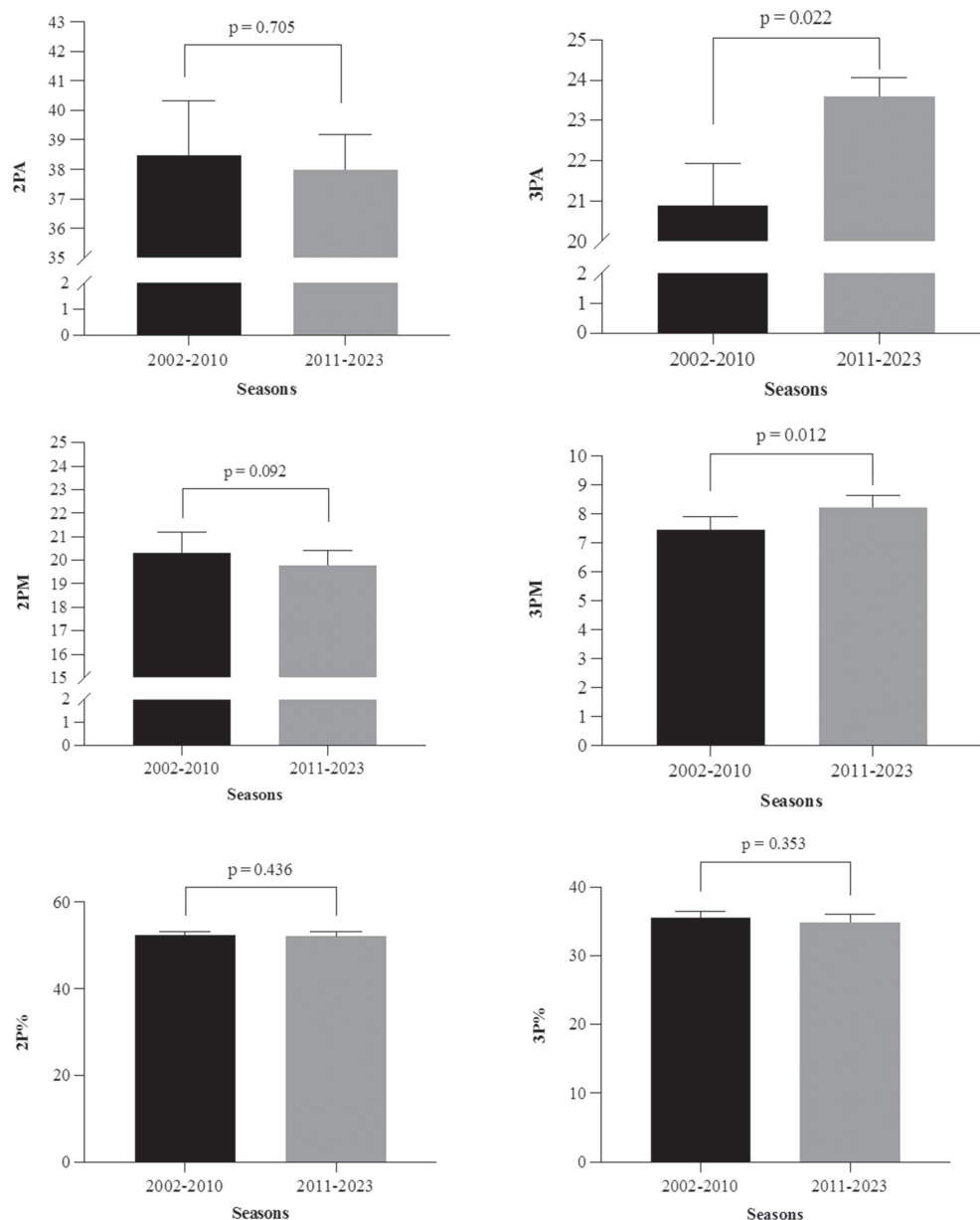


Figure 3. Effect of change in 3-point line distance (i.e., 2002-2010 vs. 2011-2023) on 3-point attempts (3PA), 3-point shots made (3PM), 3-point shooting percentage (3P%), 2-point attempts (2PA), 2-point shots made (2PM), and 2-point shooting percentage (2P%) per Eurobasketball match.

despite a greater 3PA, possibly occurred as a result of adaptations in athletes' ability as well as team strategic approaches. For example, athletes would have trained to enhance their 3-point shooting ability while extending their defensive skills to a greater court area to cover to counteract the increasing number of 3-point shots taken by the opposition. Likewise, improvements in both offensive and defensive skills in athletes could underpin for the maintenance of shooting accuracy despite the increased 3PA. Since training strategies are developed for teams to be well-prepared for official matches, it is plausible that the attention and time dedicated to developing the players' 3-point shooting abilities have increased in modern basketball teams. Further, teams may have implemented

cohesive team strategies that focus on creating and defending open shot opportunities, while exploiting defensive weaknesses (Wang & Zheng, 2022). An important note to add to the current study was the lack of a significant increase in 3PA and 3PM following the impact of COVID-19 (2019-2021). The pandemic brought about unprecedented challenges, leading to disruptions in regular training schedules, altered game dynamics, and psychological stress for players (Alonso, Lorenzo, Ribas, & Gómez, 2022). In fact, players faced a prolonged break from training in high-quality facilities and from playing official games, with plausible negative influences for physical qualities and technical-tactical abilities (Santos & Janeira, 2009). Further, the uncertainty and anxiety caused by the pandemic

could have affected coaches and players' focus and confidence during games. The altered game atmosphere, with matches often played in empty arenas or with limited spectators, might have also impacted players' comfort levels and shooting performances. The extraordinary circumstances brought about by the COVID-19 pandemic likely influenced the unusual trends observed in 3-point shooting during that period. However, as the world gradually recovers from the pandemic, we are beginning to see a return to more typical patterns in 3-point shooting in the years following COVID-19.

While the observed shift in shooting patterns highlights the importance of 3-point shooting in the modern game, coaches must also consider the potential advantage of recruiting athletes who excel at shooting from the 2-point range. Subsequently, coaching staff must determine the appropriate team composition for 2- and 3-point shooting abilities of athletes when developing tactical strategies, which increases chances of success.

Limitations of the study and directions for further research

This study has several limitations that should be taken into account when interpreting the findings. Firstly, only shooting metrics were examined, without linking them to match outcomes (e.g., wins or losses). This limits our ability to assess the actual impact of the observed changes in shooting behavior on competitive success. Secondly, the analysis was restricted to the regular seasons of men's professional basketball in four European leagues (Spain, Italy, France, and Greece). As such, the results may not be generalized to playoff contexts—where tactical intensity and player rotations often differ—or to women's competitions, semi-professional and amateur leagues, or other geographic regions with different playing styles.

Another important limitation is that the variables were not adjusted for the number of possessions. Consequently, some observed increases (e.g., in three-point attempts) might reflect a general

acceleration in pace rather than an intentional strategic shift. This may overestimate the degree of behavioral change in shooting patterns. While we chose to analyze absolute values to describe raw trends over time, future studies should normalize performance metrics per possession to better isolate tactical and technical developments.

Overall, these limitations suggest caution in overgeneralizing the results. Nonetheless, they also highlight important avenues for future research, which should include broader samples and normalized data to confirm the robustness of the trends identified and to better understand the evolution of shooting behavior in international basketball. Additionally, the study focused on four specific European leagues, excluding other competitive leagues such as Turkey or Israel due to data availability constraints. This may limit the generalizability of the results across the full spectrum of the European basketball.

In conclusion, our study documented the evolution of 2- and 3-point shooting performance within the leading Eurobasketball leagues from 2002 to 2023. During this time, a greater reliance on 3-point shots has been demonstrated, especially after extending the 3-point line distance. Despite this significant rule change, overall shooting accuracy was maintained, which highlights the evolution of tactical strategies and increased pacing in elite male basketball. These findings have important practical implications: coaches can leverage this knowledge to design training programs that prioritize developing players' long-range shooting skills and conditioning for faster-paced games. Players may benefit from adapting their decision-making to embrace higher-risk, higher-reward shot selections. Basketball analysts and strategists can use these insights to better understand game trends and inform real-time tactical adjustments. Coaches and players may be adapting to a novel style based on higher-risk shooting strategies that emphasize scoring efficiency and a more dynamic style of play, thus reshaping traditional basketball tactics.

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Correspondence to:

Sergio L. Jiménez-Sáiz, Ph.D.
Sport Sciences Research Centre
Universidad Rey Juan Carlos
Madrid, Spain

E-mail: sergio.jimenez.saiz@urjc.es