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Section III – Sports and Physical Activity

The Role of Home-Court Advantage in Player Distances and Speeds in the NBA

by
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This study aimed to quantify and compare the external physical demands of NBA teams during games played at home and away, using data from video-based tracking systems. A dataset covering ten regular seasons (2013–2024, excluding 2019–2020) was compiled, including total, offensive, and defensive distances covered (Dist, Dist Off, Dist Def, respectively), as well as average speeds (Avg Speed, Avg Speed Off, Avg Speed Def, respectively). All data were standardized to metric units and analyzed using linear mixed models, with team as a random effect and venue as a fixed effect. The results showed no significant differences in distance-related variables between home and away games. However, a significant difference was observed in defensive average speed, with higher values recorded during away games ($p = 0.031$), suggesting increased defensive effort by visiting teams. No significant differences were found in total average speed or offensive speed. These findings indicate that, despite long-standing assumptions about home-court advantage, the playing venue has minimal impact on the external physical demands experienced by NBA teams during games. The consistent physical output across venues suggests that elite basketball players maintain high performance levels regardless of contextual factors, supporting the implementation of uniform conditioning strategies throughout the season. This insight may assist coaches and performance staff in tailoring training and recovery protocols without needing to adjust significantly for the game location.

Keywords: *team sports; tracking; local positioning system; load monitoring; game demands*

Introduction

The National Basketball Association (NBA) is widely regarded as the leading professional basketball league in North America, showcasing elite talent from across the globe and serving as a benchmark for high-level competition (Sampaio et al., 2015). Video-based tracking technology has become an essential tool in professional leagues with significant resources. By employing a network of high-resolution cameras strategically placed around the court, this technology provides precise, real-time data on players' movements and actions (Buchheit et al., 2014; Buchheit and Simpson, 2017). Video tracking systems, powered by advanced algorithms, offer highly accurate data on player positioning, velocity, and performance metrics. This non-invasive approach enables comprehensive monitoring without the use of wearable devices, enhancing player comfort while providing detailed and reliable performance insights (Bastida Castillo et al., 2018).

Thanks to this technology, it is now possible to better understand the demands of basketball and determine strategies to address them. Basketball is recognized as a team court sport where players spend the majority of game

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time (93%) engaged in low-intensity activities such as standing, walking (<7 km·h^{-1}), or jogging (7–14 km·h^{-1}) (Ibáñez et al., 2022; Sosa et al., 2021). These low intensity periods are interspersed with high intensity efforts and specific team skills involving continuous changes of direction, jumps, sprints, accelerations, decelerations, and physical contacts (Alonso et al., 2020).

Tactical and strategic aspects are critical in basketball, indicating that situational variables likely influence the external demands placed on teams (Piñar et al., 2022). Tracking external physical loads in relation to contextual factors can provide valuable insights for coaching staff, aiding in the design of tailored workloads during basketball-specific game-based drills, and ultimately optimizing match performance. Consequently, recent evidence examining the external peak demands (PDs) across full games found that external PDs remained consistent (small effects) regardless of the playing venue in U18 male basketball players. Accordingly, the playing venue may not be a key determinant of external PDs attained during official games (Alonso Pérez-Chao et al., 2023), with measurements taken using the Electronic Performance and Tracking System (EPTS) rather than video tracking. Another study analyzing internal average responses showed that the playing venue affected the player's pre-match hormonal responses at home as well as during away games despite the performance (Arruda et al., 2014). Nevertheless, the rating of perceived exertion (RPE) scores were not different between the home or away matches, suggesting that the RPE (used as a global indicator of match intensity) is independent of the playing venue (Arruda et al., 2014). Previous studies are limited by their emphasis on non-elite teams and their reliance on load data from a single team, rather than encompassing all teams involved in a league or a tournament. Therefore, the aim of this study was to quantify and compare the external demands recorded by tracking systems in NBA basketball players, based on the playing venue (home vs. away). Based on existing data (Alonso Pérez-Chao et al., 2023), it was hypothesized that the playing venue would not be a key determinant of external physical demands attained during games.

Methods

Sample

This study analyzed data from 10 seasons of a professional basketball league, spanning the years from 2013–2014 to 2023–2024. The 2019–2020 season was excluded due to the disruptions caused by the COVID-19 pandemic, which significantly altered the league's schedule and conditions, potentially impacting players' performance and team dynamics. The dataset comprised regular-season games only (n = 24,216), ensuring consistency in the context and competitiveness across the analyzed seasons.

Procedures

The data for this study were extracted from the official NBA website on November 29, 2024, ensuring access to the most up-to-date and comprehensive dataset for the analyzed seasons. For each of the 10 included seasons, data were collected for all teams, focusing exclusively on regular-season games. The data were then organized into customized Microsoft Excel spreadsheets (version 16.0, Microsoft Corporation, Redmond, WA) for further analysis. Teams in each competition were categorized by a playing venue for each season, with the venue determined based on the game location (home or away).

Variables

Several performance-related variables were collected for each team (Table 1). The data were originally extracted in miles and miles per hour from the NBA website. To ensure consistency in the units used for analysis, distances were converted to kilometers by multiplying by 1.609344, and speeds were converted to kilometers per hour using the same factor.

Statistical Analysis

The mean and standard deviation (SD) were calculated for all distance and velocity variables with normal distributions. For variables with non-normal distributions, the median and Interquartile range (IQR) were reported. The Kolmogorov-Smirnov test was used to assess data distribution. Variables with normal distributions were compared using an independent t-test, and their effect sizes (ES) were calculated using Cohen's d. Variables with non-normal

distributions were compared using the non-parametric Mann-Whitney U test, and their ES were calculated using rank correlation (*r*). The ES thresholds were interpreted as follows: Cohen's *d*: $d < 0.2$, trivial; $d = 0.2–0.6$, small; $d = 0.6–1.2$, moderate; $d = 1.2–2.0$, large; and $d > 2.0$, very large. Rank correlation were interpreted according to the following thresholds: $r = 0.1$ = small; $r = 0.3$ = medium; $r = 0.5$ = large (Hopkins et al., 2009). All analyses were conducted using IBM SPSS for Windows (version 23, IBM Corporation, Armonk, New York), except for ES for which calculation a customized Microsoft Excel spreadsheet was used (version 16.0, Microsoft Corporation, Redmond, WA). Figures were performed using JASP (Version 0.14.1, JASP Team, 2020).

Results

Descriptive analysis is presented in Table 2, while comparison analyses are illustrated in Figure 1. No significant differences were observed for Dist ($p = 0.835$; ES: $r = 0.495$; medium), Dist Off ($p = 0.496$; ES: r = 0.484; medium) and Dist Def ($p = 0.538$; ES: $r = 0.515$, large). Regarding average speeds, significantly higher values were observed for away Avg Speed Def compared when playing at home ($p = 0.031$; ES: $r = 0.449$; medium). However, no significant differences were found for Avg Speed ($p = 0.741$; ES: $d = −0.027$; trivial) nor Avg Speed Off ($p = 0.423$; ES: $d = 0.065$; trivial).

Table 1. Description of physical variables collected.

Distance Variables	Speed Variables
Dist (km): Total distance covered by all players on the team (in kilometers) during the game.	Avg Speed (km/h): The average speed (in kilometers per hour) of the team throughout the game.
Dist Off (km): Distance covered by the team in offensive plays.	Avg Speed Off (km/h): The average speed of the team during offensive plays.
Dist Def (km): Distance covered by the team in defensive plays.	Avg Speed Def (km/h): The average speed of the team during defensive plays.

Table 2. Descriptive analysis.

	Variable	Playing Venue	Mean ± SD ǀ Median (IQR)	Max	Min
Distance	**Dist (km)**	Home	28.1 (1.75)	30.9	26.0
		Away	28.1 (1.75)	30.6	25.7
	Dist Off (km)	Home	15.2 (0.68)	16.7	13.6
		Away	15.2 (0.69)	16.8	13.5
	Dist Def (km)	Home	13.0 (0.50)	14.4	12.0
		Away	13.0 (0.49)	13.3	11.8
Speed	**Avg Speed (km/h)**	Home	6.77 ± 0.15	7.1	6.4
		Away	6.78 ± 0.15	7.1	6.3
	Avg Speed Off (km/h)	Home	7.29 ± 0.23	7.8	6.7
		Away	7.27 ± 0.24	7.9	6.6
	Avg Speed Def (km/h)	Home	6.26 (0.14)	6.6	5.9
		Away	6.29 (0.14)	6.6	5.9

Note: Abbreviations used are explained in Table 1

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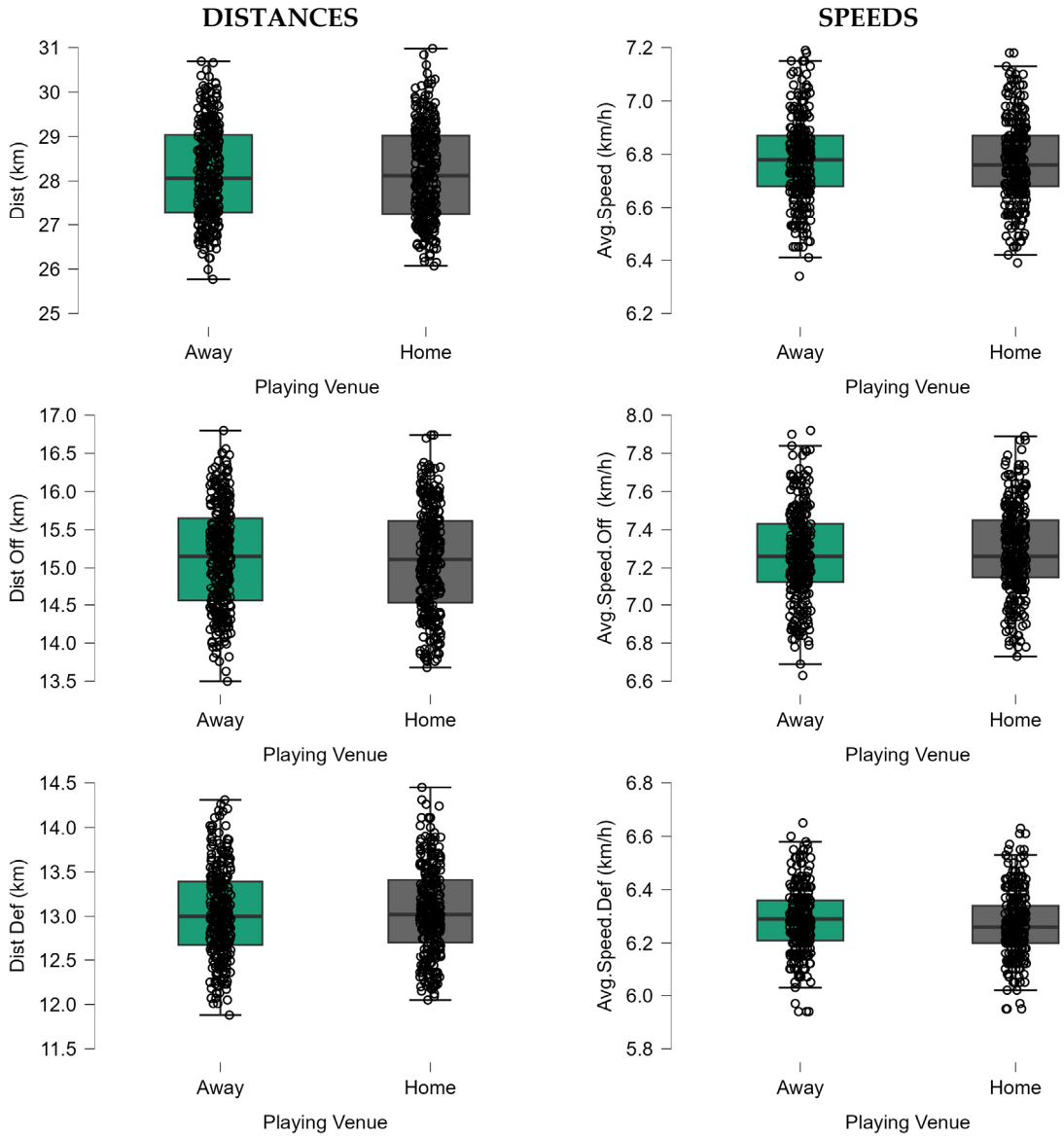


Figure 1. Comparative analysis for all physical variables by playing venue.
Note: Abbreviations used are explained in Table 1

Discussion

The aim of this study was to quantify and compare the external demands recorded by tracking systems in NBA basketball players, based on the playing venue (home vs. away). The main findings were: (1) no significant differences for distance variables (Dist, Dist Def and Dist Off), although effect sizes indicated medium to large magnitude; and (2) in terms of average speeds, significantly higher values were observed for away Avg Speed Def compared to when playing at home (ES = medium). However, no significant differences were found for Avg Speed nor Avg Speed Off.

Arruda et al. (2014) found differences for player hormonal status when comparing home and away games, with higher testosterone levels in

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home team players, which could help them perform better during games. Such internal mechanisms offer useful background for interpreting performance differences, but the present study concentrated on external physical demands derived from tracking data.

These findings could relate to the present study, as the higher away Avg Speed Def observed here may reflect the increased efficiency and aggressiveness typically shown by home teams, which previous research associated with hormonal status (Miloski et al., 2015). However, these internal mechanisms are only a partial explanation, and the main point for practitioners is that external running demands did not consistently differ by venue.

Alonso-Pérez-Chao et al. (2023) found no differences in external PDs between home and away games during U18 FIBA rules basketball, although PDs were slightly higher at home. This suggests that venue-related effects may depend on the competition level and the context, reinforcing that findings from youth categories cannot be directly extrapolated to the NBA or other professional leagues. Thus, the playing venue does not appear to be a determining factor for the external load at the elite level, where tactical, technical, and contextual elements may play a larger role.

The general findings and conclusions of Alonso-Pérez-Chao et al. (2023) comparing home and away games external PDs of a U18 basketball teams are in line with the ones shown in this study, as the playing venue did not seem to affect external physical demands experienced by NBA players during games, and therefore does not seem to be a competitive differentiating factor between teams. Regarding physical constraints that could influence the home-court advantage (Swartz and Arce, 2014) in the NBA, previous studies highlighted the altitude as one of the possible factors to determine home-court advantage in the league that could positively influence home teams through chronic adaptations when playing at home (as teams with the higher advantage in the mentioned study were Denver and Utah), but as those authors highlighted, these factors were static and did not change over time, a fact that could also explain why the home advantage factors dissipated through recent years (Jones, 2007; Smith, 2003; Swartz and Arce, 2014), together with others such as the increased use of three point shots (Harris and Roebber, 2019; Zając et al., 2023). All these circumstances could be aligned with the findings of the present study, where results point to the direction of home team advantage dissipating in the NBA in recent seasons, especially considering distances ran at different intensities by NBA players during games, and bearing in mind the increase in three-point shots attempted during games, which could directly condition running demands, as previous research (D'Amelio, 2020) has highlighted relationships between technical and physical factors in the NBA.

From an applied perspective, these findings suggest that coaches in professional basketball (e.g., NBA, Euroleague) can maintain consistent external load monitoring and training prescriptions regardless of the playing venue. Instead of adapting running-based workloads to home or away contexts, greater emphasis should be placed on individual roles, the opponent's playing style, and contextual modifiers such as travel and schedule congestion. This approach allows practitioners to prioritize recovery and tactical preparation, while ensuring that physical conditioning remains stable across the season.

A potential limitation of this study is the lack of control for contextual factors such as travel fatigue, cross-time zone effects, and the game score context. These variables might influence players' external physical demands and could interact with the effect of the playing venue. However, their inclusion in the current analysis was not possible due to data availability constraints and the retrospective nature of the dataset. Consequently, the results should be interpreted with caution, as these factors may partially explain some of the observed differences. Future research with access to detailed travel schedules, time zone changes, and in-game contextual information could provide a more comprehensive understanding of their impact on home-away performance differences. Moreover, the scope of the performance variables analyzed in this study was limited to distances covered and average speeds, as additional indicators such as high-speed running, accelerations/decelerations, changes of direction, and vertical activity were not available in the public NBA dataset. Although incorporating these metrics would allow for a more comprehensive evaluation of players' external physical demands,

their absence constrains the depth of the present analysis. Together with the previously noted contextual factors (e.g., travel fatigue, cross-time zone effects, and the game score context), this limitation should be considered when interpreting the results. Future studies with access to more detailed tracking data and contextual information could offer a more complete picture of how the playing venue influences performance.

Conclusions

The study concludes that the playing venue (home or away) does not significantly influence the external physical demands experienced by NBA players during games. While previous research indicated potential hormonal variations related to the venue, the external demands remained consistent, aligning with the hypothesis. The use of advanced video tracking systems confirmed that physical load metrics, such as distances covered and average speeds, were largely unaffected by the venue context. These findings reinforce the notion that the NBA's elite level of play imposes similar physical requirements regardless of the location, offering valuable insights for training and game preparation strategies.

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