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The effects of defensive style and final game outcome on the external training load of professional basketball players

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ABSTRACT: This study aimed to analyse the influence of different contextual factors (i.e., defensive style and game outcome) on basketball players' external load during games-based drills using ultrawideband (UWB) technology. Fourteen male professional basketball players belonging to an elite reserve Spanish club (ACB) participated in this study. The games-based drills consisted of one bout of 10 min played 5vs5 in which players were instructed to use man-to-man defence (MMD) and/or zone defence (ZD). In addition, the final game outcome (i.e., winning or losing) of the game-based drill was registered. External load variables per minute were recorded: total distance covered, distance covered in different speed zones, distance covered while accelerating and decelerating, maximum speed, steps, jumps and player load. A two-way ANOVA with the Tukey post hoc test was used to assess the impact of defensive style and final game outcome and the interaction of both factors on the external load encountered by basketball players. No meaningful differences (*unclear*) were found in the external loads between playing with MMD and with ZD and between winning and losing teams except for greater distance at high-speed running (18.0–24.0 km·h^{-1}) in winning teams ($p < 0.05$, ES = 0.68, moderate). A significant interaction between defensive style and final game outcome was found for high decelerations (> -2 m·s^{-2}) ($p = 0.041$; ES = 0.70) and jumps ($p = 0.037$; ES = 0.68). These results could potentially help coaching staff in prescribing an appropriate workload during basketball-specific game-based drills, and ultimately enhance the match performance.

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INTRODUCTION

Basketball is a highly demanding team sport characterized by intermittent and multidirectional high-intensity actions such as jumps, accelerations, decelerations, and changes of directions [1–4]. Basketball players cover approximately 64 m·min^{-1} and achieve a peak speed of ~18 km·h^{-1} during games-based drills in the Spanish First Division [3]. In addition, professional basketball players perform ~34 short-term and high-intensity actions per minute [5], of which 16.9 ± 0.4 actions are accelerating (> 1 m·s^{-2}) and 16.4 ± 0.5 are decelerating (< -1 m·s^{-2}) [3]. Moreover, it has been shown that players perform a total of 1.11 ± 0.53 jumps per minute accumulating a player load of about 11.13 ± 2.00 arbitrary units (AU) per min [2]. Understanding the external load encountered during basketball match-play and game-based drills is fundamental to design appropriate recovery strategies and training strategies in preparation for official matches.

Previous investigations have mainly focused on analysing players' external loads (e.g., total distance covered, distance covered at different speeds, distance covered at different intensities of accelerations and decelerations, player load, steps or jumps) in indoor team sports using video-based tracking systems or microtechnology such as accelerometers [6–8]. Video based-tracking (i.e., Amisco or Prozone) is a non-invasive system since players do not need to wear any sort of electronic tracking devices, but it has high costs and implies a time-consuming process for which a training period for the observer is needed [9, 10]. By contrast, accelerometers have facilitated the monitoring process of external load encountered in team sport match-play to be comprehensively quantified using several variables such as accelerations, changes of direction, jumps, collisions and player load, among others [8, 11]. Nevertheless, it is not possible to quantify the activity profiles of players in terms of total distance covered and distances at different ranges of speeds. To overcome the limitations of video-based time-motion analysis and accelerometers, ultrawideband (UWB) technology has been used to identify the positioning of players in indoor facilities thanks to the placement of six antennas to obtain radio frequencies that determine the nearly exact positioning of the player [12].

One of the main challenges for basketball coaches and practitioners is to ensure an adequate stimulus to develop the players' optimal performance, including greater transfer of physiological adaptations when the exercises simulate sport-specific movement patterns [4, 13]. Previous studies have demonstrated that it is necessary to consider many variables influencing the physical responses of basketball-specific drills and/or games-based drills, such as the pitch size [3, 14], the number of players involved [8, 14], the duration of repetitions, recovery time and total duration of the drill [15], the effective playing time [2, 5], ball possession [16], time pressure [17] and the type of marking-defence [18–20]. Considering this last variable, the time-motion variables in term of game-activity intensities and high-intensity frequencies presented similar results between different defensive conditions in under 16 basketball players [20]. Hence, an understanding of the external load encountered by senior professional players during games-based drills will help to inform about the players' specific physical training loads aimed at maximizing on-court performance for this specific basketball population [21].

Another parameter which could influence the technical actions, tactical strategies and external load of basketball players is the final game outcome after the development of match-play as previous studies investigated in other team sports [22–24]. Previous research has identified some game-related statistics, such as turnovers, rebounds, points from turnover and the second chance points, as performance indicators to differentiate between winning and losing basketball teams [25, 26]. Additionally, a previous study addressed the influence of the game outcome on the external load encountered by starter players during basketball gameplay showing greater number of jumps, high-intensity accelerations and decelerations and changes of direction during losses in semi-professional basketballers [27]. This knowledge would be of great interest for coaching staff in order to understand the stimulus of the official basketball games and to accurately prescribe the workload within the training week (i.e., microcycle). As such, while the knowledge of external load comparing winning and losing basketball teams during competition has been investigated, scarce literature is available regarding the impact of the outcome during games-based drills on players' external load. Since this contextual factor influences the collective behaviour and external load encountered by basketballers during matches [25–27], modulating the score during games-based drills might be important to resemble game situations.

Therefore, the aim of this study was to analyse the influence of the different contextual factors (i.e., defensive style and final game outcome) on the basketball players' external load measured through UWB technology during games-based drills. Since previous studies focused on basketball [20] and other team sports [23, 24] evidenced similar external loads when using different defensive styles, and an influence of the final match outcome on players' external loads, we hypothesized that the defensive style will not impact the players' external load, while the outcome during games-based drills will have an influence on the external loads in professional basketball players.

MATERIALS AND METHODS

Experimental design

A cross-sectional field study was used to identify the effects of defensive style and final game outcome on physical responses in professional basketball players. The data were collected during regular team training sessions over the mid-season period during the 2018–19 competitive season in an elite reserve team. A total of 8 basketball games-based drills, performed over an 8-week period (between March and April), were chosen for the analysis (representing a total of 896 observations). The games-based drills consisted of one bout of 10 min played by 5vs5 in which players were instructed to use man-to-man defence (MMD) and/or zone defence (ZD). In addition, the final game outcome of the games-based drill was registered. Data included measures of external load (total distance covered, distance covered at different speeds, distance covered at different intensities of accelerations and decelerations, player load, steps and jumps) measured by UWB technology.

Participants

Fourteen male professional basketball players (age: 20 ± 2.3 years; height: 189.7 ± 5.3 cm; body mass: 86.6 ± 6.3 kg; basketball experience: 6.8 ± 1.1 years), who belonged to an elite reserve Spanish Club (ACB) participated in this study. With regard to the participants' playing positions, the teams were composed of 3 guards, 8 forwards and 3 centres. Players attended 4 training sessions per week (8 hours per week basketball practice and 4 hours per week physical conditioning) and completed one official match per week during weekends. The inclusion criteria were to participate in all training sessions involved in the investigation, to not have been injured during the last month before the investigation and to have taken part in the basketball games-based drills for at least 80% of the training volume. All players and coaches were informed of the procedures, methods, benefits, and possible risks before beginning the study and had the opportunity to withdraw at any time from the investigation without any penalty. The study was performed in accordance with the Declaration of Helsinki (2013) and approved by the Ethics Committee of University Isabel I.

Procedures

All training sessions presented the same structure. The basketball games-based drills were played with different defensive style strategy (i.e., MMD and ZD) following a 10-min standardized warm-up based on dynamic exercises without the ball, ball dribbling, specific mobility and dynamic stretching exercises and preceding 15-min tactical drills designed by the coach staff. The standardized warm-up and the tactical drills were excluded from the analysis. All training sessions were designed, directed, and supervised by the coaching staff and completed on the same regular-sized basketball court (i.e., 28x15 m). For each games-based drill, the game outcome was recorded (i.e., winning or losing) at the end. The games-based drills were performed the same day of the week (i.e. Thursday) with the same time to the next and previous official match (4 days after the last match and 2 days before the next).

Basketball games-based drills

The games-based drills were played using the same format: 5vs5 in 28x15 m. The players of both teams were instructed to use MMD during 4 games-based drills and ZD during 4 games-based drills. MMD was defined such that the players defend their direct opponent only when he is positioned in the offensive 1/4-court and ZD when each defender is responsible for preventing any player in an assigned zone of the court from scoring. MMD and ZD were considered when the defence system was employed ≥ 80% of the live time [18]. The players were divided into 2 teams using the coaches' evaluations of playing performance and positional role [29] and they were always facing the same opponents and always facing the same opponents [30]. During games-based drills, official basketball rules were used together with a regular-stop dynamic including live and stoppage time phases [2]. The games-based drills were played on an indoor official surface court and started at 19:30 h on all occasions.

External load

Players' movements during games were measured using a portable local positioning system (LPS) (WIMU PRO; Realtrack Systems SL, Almeria, Spain). The system was composed of 6 UWB antennas placed 4.5 m from the perimeter line of the field, and the sampling frequency for positioning data was 20 Hz. For UWB technology, a coefficient of variation (CV) (test-retest reliability) between 0.23% and 0.78% and a percentage typical error of measurement (%TEM) of 2 were found in a previous study with basketball players [31]. Also, the accuracy (x-axis = 5.2 ± 3.1 cm; y-axis 5.8 ± 2.3 cm) and reliability (x-axis, intraclass correlation coefficient, ICC = 0.65; y-axis, ICC = 0.85) of the indoor tracking system technology were reported [32, 33]. All UWB antennas were located at a height of 3 m and held by a tripod. Once installed, they were switched on one-by-one making sure that the master antenna was the last, and then a process of autocalibration of the antennae was carried out for 5 s [31]. Each player was fitted with a device (85x48x15 mm, 65 g) including accelerometer, magnetometer and gyroscope on the upper back using an adjustable harnesses, which was turned on and placed 15 min before the warm-up. The beginning and end of each games-based drill were marked to determine the drill duration for the subsequent analysis. The device calculates the time required to receive the signal and derives the unit position (coordinates X and Y), using one of the antennas as a reference [3]. Data were analysed using the system-specific software (S PRO WIMU Software; Realtrack Systems SL, Almeria, Spain). To analyse the differences in the external load according to the defensive style employed (i.e., MMD vs. ZD) and the final game outcome (i.e., winning vs. losing), the following variables were selected per minute ($m \cdot min^{-1}$): total distance covered and distance covered in different speed zones, walking (< 6.0 $km \cdot h^{-1}$), jogging (6.1–12.0 $km \cdot h^{-1}$), cruising (12.1–18.0 $km \cdot h^{-1}$), high-speed running (18.1–24.0 $km \cdot h^{-1}$) and sprinting (> 24.1 $km \cdot h^{-1}$). These arbitrary speed zones have been used in previous basketball studies [34, 35, 36]. In addition, the distance covered while accelerating and decelerating was taken as a key outcome measure, with further distance measures derived for different intensity categories: low accelerations (< 2.0 $m \cdot s^{-2}$), high accelerations (> 2.0 $m \cdot s^{-2}$), low decelerations (> -2.0 $m \cdot s^{-2}$) and high decelerations (> -2.0 $m \cdot s^{-2}$) [3].

TABLE 1. The external loads (mean ± SD) encountered by basketball players during games-based drills according to the defensive style with mean differences and effect sizes.

External load responses	MMD	ZD	Mean difference (%)	ES; ± CL
Total distance ($m \cdot min^{-1}$)	87.89 ± 16.25	82.34 ± 24.32	-6.32	0.28; ± 0.58 unclear
Walking ($m \cdot min^{-1}$)	34.36 ± 8.22	33.05 ± 8.95	-3.82	0.15; ± 0.54 unclear
Jogging ($m \cdot min^{-1}$)	33.95 ± 7.49	30.18 ± 11.59	-11.09	0.40; ± 0.61 unclear
Cruising ($m \cdot min^{-1}$)	15.50 ± 5.39	15.38 ± 8.09	-0.74	0.02; ± 0.50 unclear
High-Speed running ($m \cdot min^{-1}$)	2.58 ± 2.27	2.07 ± 2.00	-19.86	0.24; ± 0.57 unclear
Sprinting ($m \cdot min^{-1}$)	0.88 ± 1.95	1.48 ± 2.55	67.80	0.27; ± 0.57 unclear
Maximum speed ($km \cdot h^{-1}$)	19.18 ± 1.96	18.73 ± 1.88	-2.35	0.23; ± 0.57 unclear
Low accelerations ($m \cdot min^{-1}$)	4.75 ± 2.23	4.53 ± 3.06	-4.71	0.09; ± 0.52 unclear
High accelerations ($m \cdot min^{-1}$)	1.71 ± 0.87	1.41 ± 0.76	-17.75	0.37; ± 0.60 unclear
Low decelerations ($m \cdot min^{-1}$)	4.37 ± 2.00	4.18 ± 2.31	-4.34	0.09; ± 0.52 unclear
High decelerations ($m \cdot min^{-1}$)	2.02 ± 0.95	1.77 ± 0.77	-2.35	0.29; ± 0.58 unclear
Player load ($AU \cdot min^{-1}$)	1.37 ± 0.32	1.33 ± 0.35	-3.13	0.13; ± 0.54 unclear
Steps ($n \cdot min^{-1}$)	49.95 ± 12.52	47.02 ± 15.39	-5.87	0.21; ± 0.56 unclear
Jumps ($n \cdot min^{-1}$)	3.80 ± 2.20	3.91 ± 2.24	2.95	0.05; ± 0.51 unclear

SD: standard deviation; MMD: man-to-man defense; ZD: zone defense. ES: effect size; CL: confident limits; AU: arbitrary units.

The absolute values recorded were: maximum speed (km·h^{-1}), steps (n·min^{-1}) and jumps (n·min^{-1}). Player load (AU· min^{-1}), a vector magnitude expressed as the square root of the sum of the squared instantaneous rates of change in acceleration in each of the 3 planes divided by 100, was also recorded [34].

Statistical analysis

Date are expressed as mean ± standard deviations (SD). Normal distribution of data was tested using the Kolmogorov-Smirnov test and statistical parametric techniques were applied. The two-way ANOVA with the Tukey post hoc test was used to assess the impact

TABLE 2. The external loads (mean ± SD) encountered by basketball players during games-based drills according to the final game outcome with mean differences and effect sizes.

External load responses	Winning	Losing	Mean difference (%)	ES; ± CL
Total distance (m·min^{-1})	88.44 ± 21.80	82.91 ± 18.33	-6.25	0.28; ± 0.58 unclear
Walking (m·min^{-1})	34.71 ± 9.26	32.78 ± 7.79	-4.98	0.20; ± 0.56 unclear
Jogging (m·min^{-1})	31.99 ± 9.82	32.67 ± 9.43	2.12	0.07; ± 0.52 unclear
Cruising (m·min^{-1})	17.00 ± 7.62	14.05 ± 5.27	-17.32	0.45; ± 0.62 small
High-Speed running (m·min^{-1})	3.10 ± 2.61	1.70 ± 1.37	-45.19	0.68; ± 0.68 moderate
Sprinting (m·min^{-1})	0.69 ± 1.65	1.54 ± 2.60	122.14	0.38; ± 0.61 unclear
Maximum speed (km·h^{-1})	19.20 ± 1.53	18.80 ± 2.22	-2.09	0.21; ± 0.56 unclear
Low accelerations (m·min^{-1})	5.11 ± 2.69	4.25 ± 2.47	-16.73	0.33; ± 0.59 unclear
High accelerations (m·min^{-1})	1.72 ± 0.83	1.46 ± 0.83	-15.39	0.32; ± 0.59 unclear
Low decelerations (m·min^{-1})	4.63 ± 1.89	3.98 ± 2.29	-13.94	0.31; ± 0.59 unclear
High decelerations (m·min^{-1})	1.91 ± 0.73	1.91 ± 1.02	0.07	0.01; ± 0.50 unclear
Player load (AU·min^{-1})	1.41 ± 0.33	1.29 ± 0.32	-8.69	0.37; ± 0.60 unclear
Steps (n·min^{-1})	51.31 ± 14.02	46.02 ± 13.22	-10.31	0.39; ± 0.61 unclear
Jumps (n·min^{-1})	3.94 ± 2.09	3.75 ± 2.34	-4.63	0.08; ± 0.52 unclear

SD: standard deviation; ES: effect size; CL: confident limits; AU: arbitrary units.

TABLE 3. Total distance, distance covered at different locomotor intensities and maximum speed achieved by basketball players during games-based drills according to the to the defensive style and final game outcome.

External load responses	Defensive style	Winning	Losing	F	df	p
Total distance (m·min^{-1})	MMD	88.77 ± 15.54	87.20 ± 17.19	0.968	1	0.329
	ZD	88.08 ± 28.06	76.11 ± 18.73			
Walking (m·min^{-1})	MMD	34.07 ± 8.62	34.58 ± 8.12	1.494	1	0.227
	ZD	35.45 ± 10.25	40.45 ± 6.78			
Jogging (m·min^{-1})	MMD	32.80 ± 6.56	34.85 ± 8.21	0.597	1	0.443
	ZD	31.07 ± 12.84	29.22 ± 10.54			
Cruising (m·min^{-1})	MMD	15.50 ± 5.83	14.70 ± 5.03	0.622	1	0.434
	ZD	17.56 ± 9.51	13.02 ± 5.70			
High-Speed running (m·min^{-1})	MMD	3.73 ± 2.81	1.67 ± 1.16	1.789	1	0.187
	ZD	2.37 ± 2.25	1.74 ± 1.72			
Sprinting (m·min^{-1})	MMD	0.24 ± 0.62	1.39 ± 2.46	0.248	1	0.620
	ZD	1.21 ± 2.26	1.78 ± 2.91			
Maximum speed (km·h^{-1})	MMD	19.43 ± 1.76	18.99 ± 2.12	0.000	1	0.993
	ZD	18.95 ± 1.24	18.50 ± 2.43			

MMD: man-to-man defense; ZD: zone defense; df: degrees of freedom; AU: arbitrary units; p: level of significance.

TABLE 4. Short-term and high-intensities actions encountered by basketball players during games-based drills according to the to the defensive style and final game outcome.

External load responses	Defensive style	Winning	Losing	F	df	p
Low accelerations (m·min^{-1})	MMD	5.04 ± 1.40	4.52 ± 2.73	0.376	1	0.179
	ZD	5.18 ± 3.74	3.82 ± 2.01			
High accelerations (m·min^{-1})	MMD	1.93 ± 0.79	1.54 ± 0.91	0.267	1	0.608
	ZD	1.49 ± 0.83	1.32 ± 0.71			
Low decelerations (m·min^{-1})	MMD	4.82 ± 1.11	4.01 ± 2.46	0.087	1	0.770
	ZD	4.41 ± 2.55	3.94 ± 2.11			
High decelerations (m·min^{-1})	MMD	1.80 ± 0.68	2.19 ± 1.11	4.388	1	0.041*
	ZD	2.04 ± 0.79	1.47 ± 0.66			
Player load (AU· min^{-1})	MMD	1.41 ± 0.31	1.33 ± 0.32	0.665	1	0.418
	ZD	1.42 ± 0.37	1.22 ± 0.32			
Steps (n·min^{-1})	MMD	52.58 ± 12.67	47.44 ± 12.12	0.010	1	0.191
	ZD	49.73 ± 15.78	43.94 ± 14.87			
Jumps (n·min^{-1})	MMD	3.42 ± 1.96	4.16 ± 2.40	4.528	1	0.037*
	ZD	4.58 ± 2.11	3.15 ± 2.20			

MMD: man-to-man defense; ZD: zone defense; df: degrees of freedom; AU: arbitrary units; p: level of significance. *Significant differences at $p < 0.05$.

of defensive style and final game outcome and the interaction of both factors on the external load encountered by basketball players. Practical significance was assessed by calculating Cohen's effect size (ES) [37] with the following thresholds for interpretation: trivial, ≤ 0.20; small, 0.20–0.59; moderate, 0.60–1.19; large, 1.20–1.99; very large, 2.00–3.99; extremely large, > 4.00 [38]. If the 90% confidence limits (CLs) overlapped positive and negative values, the magnitude was deemed unclear. The statistical package SPSS+ V.24.0 (Armonk, NY: IBM Corporation) was used. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 shows the differences in external loads encountered by basketball players during games-based drills according to the defensive style (i.e., MMD and ZD). No meaningful differences (*unclear*) were found in the external loads encountered by basketball players when playing with MMD and with ZD.

Table 2 shows the differences in external loads encountered by basketball players according to the final game outcome of the games-based drills (i.e., winning and losing). No meaningful differences (*small to unclear*) were observed in total distance, distance covered at walking, jogging and cruising, distance at low and high accelerations and decelerations, player load, number of steps and jumps between winning and losing teams.

A two-way ANOVA revealed a significant ($p < 0.05$) interaction of the factors defensive style and final game outcome on the high decelerations (> -2 m·s^{-2}) ($F = 4.388$, $df = 1$, $p = 0.041$) and jumps ($F = 4.528$, $df = 1$, $p = 0.037$) showing that teams performed fewer high decelerations (ES = 0.70; 0.75) and jumps (ES = 0.68; 0.68) when playing with ZD and losing in comparison with playing with ZD and winning (Table 3 and Table 4).

DISCUSSION

The aim of this study was to analyse the influence of the different contextual factors (i.e., defensive style and final game outcome) on the basketball players' external during games-based drills using UWB technology. The main results showed that the defensive style and the final game-based drill outcome did not influence the external load in professional basketball players nor the interaction of the factors. High-speed running (18.0 - 24.0 km·h^{-1}) was the only external load variable showing differences between the winning and losing teams during games-based drills. In addition, significant interaction of the factors defensive style and final game-based drill outcome was found in high decelerations (> -2 m·s^{-2}) and jumps.

The use of different defensive styles has been studied in basketball, addressing their effect on tactical, technical, physical and physiological aspects [19, 20, 28]. However, few studies [18, 20] have analysed the differences of the physical responses encountered by players between MMD and ZD during game-based drills or match-play, and no investigation has performed this comparison through the use of UWB technology. In line with our study, Ben Abdelkrim et al. [18] showed that high-intensity actions during basketball match-play were not affected by different defence strategies used in elite junior players. Moreover, Sampaio et al. [20] found no differences in the total distance covered by semi-professional male players when adopting MMD (89.04 ± 11.27 $m \cdot min^{-1}$) and ZD (89.84 ± 7.46 $m \cdot min^{-1}$). These results were similar to those obtained in our study showing that players covered 87.89 ± 16.25 $m \cdot min^{-1}$ in MMD and 82.34 ± 24.32 $m \cdot min^{-1}$ in ZD with no differences between them (ES = 0.28 ± 0.58, unclear). Additionally, Sansone et al. [15] reported that the physical and physiological demands, measured as player load values and percentage of maximum heart rate, respectively, were moderately higher in offensive tasks compared to defensive ones during a 3 vs. 3 situation with a duration of 12 min (i.e., training regime: 3 x 4 min with 2 min recovery) in semi-professional basketball players. Although offensive phases during game-based drills exhibited a higher workload in comparison to defensive phases [15], coaches might rely on the use of defensive phases as well for conditioning purposes due to their high physical demand. Moreover, we found that modifying the defensive style might allow the development of different defensive technical and tactical abilities without increasing the external load. Thus, basketball coaching staff might consider using different defensive strategies to train players from a tactical perspective with no possible changes in players' external load.

Although the influence of the final game outcome on the external load encountered by players has been analysed in other team sports [24, 39, 40], to the best of our knowledge, only one study has analysed whether the match outcome has an influence on the external load in basketball players [28]. Nevertheless, this analysis was carried out only during official matches and without including the same external load variables analysed in our study such as distances at different speeds [28]. Our results revealed that winning teams during the game-based drills covered a greater distance at high speed in comparison to losing teams (3.10 ± 2.61 $m \cdot min^{-1}$ vs 1.70 ± 1.37 $m \cdot min^{-1}$; ES = 0.68, moderate) but no differences were found in the other external load measures. In this sense, it seems that covering greater distances at high speed could discriminate between winning and losing teams within the training context. This outcome might indicate the necessity for basketball practitioners to monitor this specific external load variable during game-based drills and if necessary implement a training session for players belonging to the losing team with high-speed exercises. When the two contextual factors (i.e., defensive style and final game-based drill outcome) were analysed together, players performed fewer high decelerations (> -2 $m \cdot s^{-2}$) and jumps when playing with ZD and losing in comparison with playing with ZD and winning. This result suggests that coaching staff should consider monitoring high decelerations (> -2 $m \cdot s^{-2}$) and jumps during game-based drills played with ZD and to use an appropriate manipulation of the investigated contextual factors in designing the training drills.

This study is not without limitations, the main ones being the number of games-based drills and sample size analysed. However, our results are unique, since they are representative of a professional basketball team investigated during their typical training week. Moreover, given that the substitutions during the games-based drills are unpredictable, and this is common practice in sports training and in basketball games, the average time for the 14 players measured was used for the analysis [3]. In this sense, not all the participants played for the same time, because each team was made up of 7 basketball players and the coach decided the substitutions. Nevertheless, this is the design that best replicates the training situation dynamics and, therefore, respects ecological validity. Finally, we were unable to quantify the effects of these contextual variables on internal load measures. Therefore future studies should further investigate the effects of game-based drills' outcome and defensive style on objective and subjective internal load measures.

CONCLUSIONS

The obtained findings contribute to our understanding of the external load encountered by professional basketball players through UWB technology during games-based drills. The results revealed external load values when using MMD and ZD defences and for winning and losing teams, except for the high-speed running (18.0 - 24.0 $km \cdot h^{-1}$) when comparing winning and losing. Moreover, significant differences in high decelerations and jumps when considering the interaction of the factors defensive style and game-based drills outcome were found. These results could be considered when designing training drills and establishing the weekly periodization contents, since monitoring the external loads according to contextual factors could inform and potentially help coaching staff in prescribing an appropriate workload during basketball-specific game-based drills, and ultimately enhance the match performance.

Conflict of interests

The authors declared no conflict of interests regarding the publication of this manuscript. There are no funding sources and are no conflicts of interest surrounding this scientific investigation.

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