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Training to Compete: Are Basketball Training Loads Similar to Competition Achieved?

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Abstract: Basketball players should train at intensities similar to those recorded in competition, but are the intensities really similar? This study aimed to quantify and compare the internal and external intensities assimilated by professional basketball players, both in training and in competition, according to context and the specific player position. Players from the same team in the Spanish ACB competition were monitored for three weeks. The sample recorded intensities in 5 vs. 5 game situations in both training (n = 221) and competition (n = 32). The intensities, as dependent variables, were classified into kinematic external workload demands (distances, high-intensity displacements, accelerations, decelerations, the acceleration:deceleration ratio, jumps, and landings), neuromuscular external workload demands (impacts and player load), and internal workload demands (heart rate). They were measured using inertial measurement devices and pulsometers. The playing positions, as independent variables, were grouped into guard, forward, and center. According to the context, the results reported a significant mismatch of all training intensities, except jumps, with respect to competition; these intensities were lower in training. According to the playing position, inside players recorded more jumps and landings per minute than point guards and outside players in training. In turn, inside players recorded a higher average heart rate per minute than outside players in this same context. There were no significant differences in intensity according to the playing position in the competition. Considering the context–position interaction, no differences were observed in the intensities. Adjusting and optimizing training intensities to those recorded in competition is necessary.

Keywords: inertial devices; workload; playing positions; professional players; male; official tournament

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1. Introduction

Basketball is considered an invasion game [1]. The physiological loads placed on basketball players result from the execution of individual technical–tactical skills and collective gameplay [2]. In professional sports, analyzing player performance during competition is essential for adjusting and optimizing the training process [3]. Invasion games should be viewed as dynamic and complex systems where two opposing teams interact [4,5]. Therefore, they should be analyzed from a holistic perspective focused on the process, examining dynamic actions within the context of the game [6]. Recently, Ibáñez et al. [2] argued that, due to the high demands of neuromuscular external load, basketball should be considered a high-demand sport related to variation in acceleration in all three planes of motion and its interaction with gravity.

The control of demands [7], also known as workload demands, along with the analysis of gameplay actions, is one of the most important research topics in sports sciences [8,9].

Quantifying demands allows for the recording of the workload that players experience during training and competition [10]. This enables monitoring and evaluating player performance to optimize the training process, design strategies for training and competition, reduce the risk of overtraining, and prevent injuries [11–13].

Research on load control has distinguished two concepts or types of demand: internal workload demands (iTL) and external workload demands (eTL) [14]. iTL has been defined as the biological stress response of an athlete's body manifested at physiological and psychological levels as a result of eTL (training and competition tasks) [10,15]. The impact of iTL can be measured through parameters like heart rate; training impulse (TRIMP); blood lactate levels; biochemical, hormonal, and immunological assessments; oxygen consumption; subjective perceived effort (subjective measurement); sleep quality; and more [11,16]. eTL is defined as the mechanical and locomotor stress caused by sports practice [15]. Objective eTL, the physical load, can be analyzed from both a kinematic perspective, such as displacements and accelerations, and a neuromuscular perspective [11], including player load (PL) and impacts. Information about iTL and eTL can be used to individualize training programs and optimize training time, load, and volume. This ensures that training becomes more efficient and aligns with the pace of competition [17].

Microtechnology has introduced instruments with sensors for real-time measurement. These instruments include heart rate monitors and systems with inertial measurement units (IMUs). IMUs integrate various sensors like triaxial accelerometers, gyroscopes, magnetometers, and more. They also incorporate global positioning systems (GPS) and ultra-wideband (UWB) technology [18]. In the case of indoor sports like basketball, IMU devices allow for the collection of extensive data, particularly when used with local positioning systems (LPS). IMU technology has been employed in invasion sports [15,19,20] and, specifically, in basketball [15,21,22].

Data on competition workload demands are becoming increasingly common. Basketball loads have been monitored in official competitions across different categories and leagues [17,23,24]. In these studies, baseline values and the comparison of mean values between different groups could be seen. The high speed and deceleration variables are significantly different when it comes to finding differences according to sex, with higher values found in men for all variables except the acceleration:deceleration ratio. These differences are also found when adding the covariate specific positions, being generally higher in the forwards. The load placed on basketball players during competition vary depending on the game phase [13], game period [21,25], and specific player positions [25–28].

On the other hand, the loads reported during basketball training tasks have been studied in both amateur [29] and professional sports [2,3,5]. These studies show reference values in 5 × 5 exercises for acceleration variables (3.50 m/s^2 on average), player load (around 11 au/min on average), and heart rate (144 bpm on average). Differences in the load have been found based on player position, experience, and session phase, both in professional and amateur sports [3,30–32], as well as in youth basketball [33,34]. The training method and task selection may explain the variation in iTL and eTL, and the correlation between both types of loads [35].

There is little research that provides objective information on the training and competition loads of professional basketball teams. The difficulty in obtaining data in real competition situations caused by regulatory restrictions limits coaches to prepare training tasks that resemble the scenarios caused by competition. Therefore, it is necessary to obtain objective information on the training demands of professional basketball players during real competition. The monitoring of training sessions and competition matches can assist coaches' intervention by designing more realistic training sessions. The workload demands in basketball resulting from training and competition have been studied, confirming that the load on basketball players is greater during competition than during training, both in amateur basketball [8,36] and in semi-professional and professional settings [37–39]. A recent literature review highlights the lack of studies reporting on load during training and their comparison with competition load [15,24].

Therefore, the question of whether we train as we compete remains relevant [40], and this is a research topic that needs to be addressed as technology allows for precise measurement of load in both contexts. Therefore, the aim of this study was to quantify and compare workload demands (iTL and eTL) assimilated by professional basketball players in both training and competition, taking into account the context and specific player positions. We hypothesized that training loads in professional basketball teams would be similar to competition loads, and there would be differences in workload demands based on player positions in both training and competition.

2. Materials and Methods

2.1. Design

An associative strategy with a comparative and cross-sectional design was employed [41]. The variables determining exercise load in basketball practice were analyzed based on the measurement context (competition or training) and the specific player positions. It is important to note that the research was conducted in the natural sports context, with no manipulation of the variables by the research team. The training sessions' design and control were solely in the hands of the team's coaching staff, with researchers performing an ex post facto analysis [42].

2.2. Participants

The sample comes from the monitoring of a professional team during three weeks of pre-season training and three matches of a preparation tournament during the 2022/2023 season. The participants were twelve players from a professional team of the Spanish basketball first division (Liga ACB). The players occupied the following positions: four shooting guards, four forwards (shooting guard and small forward) and four pivots (power forward and center).

The monitoring of the training period was agreed to by the coaching staff. The pre-season period, prior to the start of the initial competition, was considered ideal because it minimally altered the organizational structure of the training sessions. The pre-season matches monitored correspond to an official preparatory tournament that was played before the start of the competition. These two realities are the most similar to what a team can face during the season, as during the season, the top-level teams are not very accessible.

A non-probabilistic convenience sample was used due to the difficulty of conducting research in professional teams. All the team members were informed prior to the research about the possible risks and benefits of participating in this study. An informed consent form was signed by the coaches, managers, and basketball players of the team.

2.3. Sample

The sample consisted of load records (iTL and eTL) in 5 vs. 5 situations both in training (n = 221 cases) and in competition (n = 32 cases). Although the coach and fitness trainer set a range of tasks across different training sessions, this study only analyzed 5 vs. 5 opposition training tasks, as they exhibited the same subjective eTL as in competition. All the tasks involved in the training were monitored, although only the comparison of tasks similar in the number of participants, i.e., 5 vs. 5 in training and 5 vs. 5 in competition, has been included. Professionals can preemptively know the subjective eTL of tasks using the comprehensive system for training task analysis in invasion sports [43] before application.

2.4. Variables

The study analyzed the following iTL and eTL variables, regarded as the study's dependent variables (Table 1). All the variables were normalized per minute.

Table 1. Load variables used in the study.

Load	Variable	Abbreviation	Description
eTL kinematic	Distance/min.	DIST/MIN	Distance covered in meters per minute.
	High-intensity Actions	HIA/MIN	Number of high-demand actions. It is the sum of the following variables: take-off (>3G), landings (>5G), impacts (>8G), accelerations (>3 m/s2), decelerations (<−3 m/s2), relative sprints (>95% max speed), and relative HSR (>75.5% max speed).
	Accelerations	ACC + 2/MIN	Average accelerations exceeding 2 m/s^2, per minute.
	Decelerations	DEC + 2/MIN	Average decelerations below −2 m/s^2, per minute.
	Difference/min. ACC-DEC/MIN.	ACC-DEC/MIN	Average difference of accelerations and decelerations above 3 m/s^2 per minute.
	Jumps/min.	J + 3G/MIN	Take-offs and jumps per minute. This involves lifting off the court with an impulse representing more than 400 ms of flight time before ground contact, using more than 3G.
	Landings/min.	L + 5/MIN	Landings over 5G per minute.
eTL neuromuscular	Impacts	IMP + 8/MIN	Impacts per minute, which are the vector sum of the G forces a player experiences in all three planes (x, y, z), per minute.
	Player load/min.	PL/MIN	Vector magnitude derived from triaxial accelerometry data.
iTL	Average heart rate	HRAVG/MIN	The average heart rate is established using the arithmetic mean of beats per minute.
	Maximum heart rate	HRMAX/MIN	The maximum heart rate is established using the arithmetic mean of the maximum beats per minute.

eTL: external training load; iTL: internal training load.

2.5. Instruments

The measurements were conducted in indoor facilities. IMU technology with ultra-wideband (UWB) tracking at 33 Hz was employed, with the purpose of collecting data on distances traveled at varying speeds, as well as accelerations and decelerations. This monitoring system has demonstrated high reliability and validity for data collection in indoor spaces [44]. For this, eight interconnected portable radiofrequency antennas were installed, following the same protocol as similar studies [45]).

Each athlete was equipped with a GARMIN™ (Garmin Ltd., Olathe, KS, USA) heart rate strap and a WIMU-PRO™ (RealTrack Systems, Almería, Spain) inertial device. The heart rate strap was synchronized to the inertial device using ANT+ methodology. The data were retrieved through S-PRO™ software (V.990, RealTrack Systems, Almería, Spain). Subsequently, the data were exported to statistical software.

For data collection on the impacts, accelerations, decelerations, jumps, and landings, the inertial device comprised various microsensors (four accelerometers: 2 of 16 g, 1 of 32 g, and 1 of 400 g; three gyroscopes of 2000°/s; and one magnetometer). These microsensors were set to 100 Hz and displayed nearly perfect validity in the raw accelerometer data.

2.6. Procedure

The club and the team's technical management were contacted to inform them about the study's purpose, and they were invited to participate. Once acceptance was secured, the rest of the coaching staff and players were informed. The study adhered to the ethical provisions of the 1975 Helsinki Declaration (with subsequent amendments) [46] and the Organic Law 3/2018, of December 5th, on Personal Data Protection and Guarantee of Digital Rights (BOE, 294, of 6 December 2018), and received approval from the University Bioethics Committee (reference 233/2019).

Three training weeks were monitored, along with three official competition matches set during the preseason 2022–2023. Before the onset of training, portable antennas were set up around the playing area. The antennas were placed in accordance with the manufacturer's suggested arrangement, starting with the master antenna placement (Antenna 0). Two antennas were positioned on one side of the court (A0 and A7), two on one baseline (A2 and A3), two opposite the first set on the opposite side (A3 and A4), and two opposite the other baseline (A5 and A6), forming an octagon and positioned at a height of 3 meters (Figure 1).

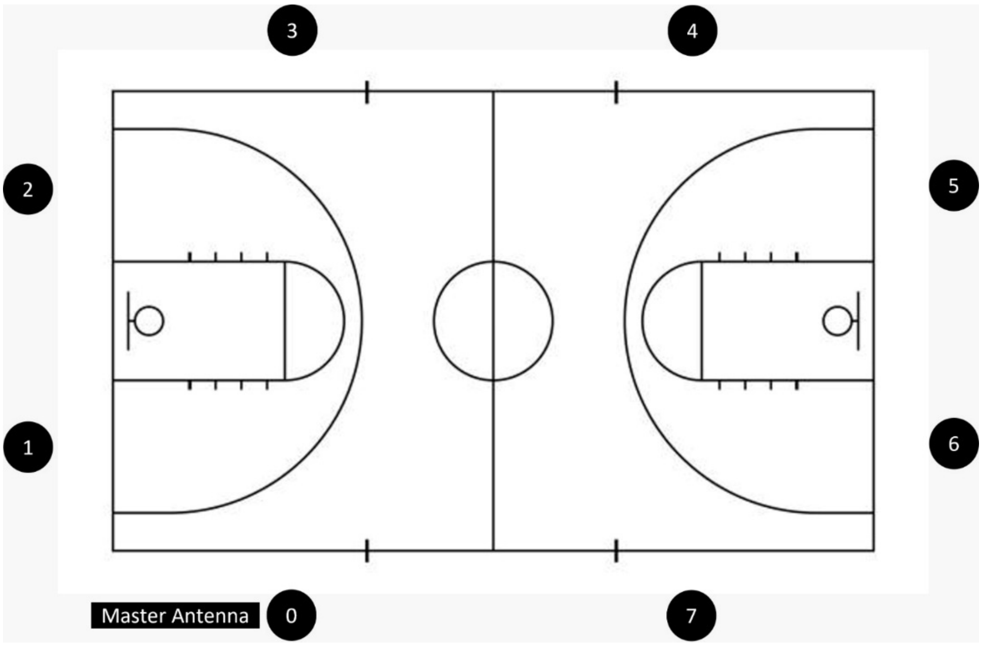

Figure 1. Placement of UWB antennas on the playing field, both during training and competition.

Sixty minutes prior to the commencement of each training session and competition, the players were equipped with an anatomical vest at the scapular level, between T2–T4, into which the inertial device (WIMU-PRO^{TM}) was inserted, along with a heart rate monitor strap. The specialized software S-VIVO^{TM} (v0) was utilized throughout the training sessions and competitions. This software enabled the selection of time intervals for each training task and competition period (start and end of each period). Consequently, the data were not collected from players during times of no motor engagement (e.g., breaks, explanations, etc.) that might influence the final results.

At the conclusion of each training session and competitive match, the data were downloaded onto a laptop. Subsequently, these data were input into the manufacturer's software S-PRO^{TM} to export the iTL and eTL variables. These variables were then stored in the WIMU cloud. An informational dossier was generated from each training session and competitive match, which was forwarded to the team's technical staff for detailing pertinent information from each session and match.

For the statistical analysis, specific positions were recoded into three groups: point guards, perimeter players (shooting guards, small forwards), and inside players (power forwards, centers).

Table 2 shows the summary data of the players' averages per session, including the days where there was a double session in a segmented way. Four matches were included, one of which was not authorized for monitoring. In week four, prior to the official tournament, no data collection was allowed in the training sessions, either. Data from off-court training sessions (strength and individual technical skills sessions) are not presented.

Table 2. Distribution of the training sessions and mean values of the load variables throughout the monitored period.

WEEK 1			Monday	Tuesday	Wednesday	Thursday	Friday	Friday	Saturday	Sunday
		Match Day	>−5 MD	>−5 MD	>−5 MD	>−5 MD	>−5 MD	>−5 MD	>−5 MD	
	-	Duration (min)	88.92	103.72	100.90	96.68	106.72	56.79	97.23	Rest
	eTLk	Dist/min (m/min)	39.79	49.10	36.40	51.49	35.96	36.59	36.27	Rest
		HIA/min (count/min)	2.95	3.08	3.31	2.95	3.64	3.42	3.74	Rest
		Acc (+2 m/s^2)/min (count/min)	1.34	1.43	1.56	1.37	1.71	1.67	1.80	Rest
		Dec (+2 m/s^2)/min (count/min)	1.39	1.27	1.42	1.17	1.60	1.45	1.65	Rest
		Difference/min (acc-dec/min)	−0.33	6.17	3.46	4.75	6.92	7.08	6.42	Rest
		Jmp + 3G/min (count/min)	0.06	0.11	0.09	0.15	0.09	0.13	0.10	Rest
		Landings + 5G/min (count/min)	0.11	0.20	0.11	0.17	0.11	0.13	0.09	Rest
	eTLn	Imp + 8G/min (count/min)	80.89	101.79	62.64	108.25	62.75	71.96	65.21	Rest
		PL/min (a.u./min)	0.64	0.85	0.62	0.92	0.63	0.59	0.62	Rest
	iTL	Average heart rate (bpm)	137.75	141.33	136.69	137.50	133.85	130.00	127.83	Rest
		Maximum heart rate (bpm)	181.25	186.33	185.08	183.92	182.62	171.50	181.50	Rest
WEEK 2			Monday	Tuesday	Wednesday	Wednesday	Thursday	Friday	Saturday	Sunday
		Match Day	−5 MD	−4 MD	−3 MD	−3 MD	−2 MD	−1 MD	F. G.	+1 MD
	-	Duration (min)	99.60	100.95	101.05	43.95	63.28	61.87	134.60	Rest
	eTLk	Dist/min (m/min)	36.06	55.75	33.02	36.39	36.36	42.44	37.99	Rest
		HIA/min (count/min)	3.61	3.80	3.72	3.10	3.37	3.79	3.56	Rest
		Acc (+2 m/s^2)/min (count/min)	1.67	1.67	1.74	1.58	1.65	1.84	1.66	Rest
		Dec (+2 m/s^2)/min (count/min)	1.54	1.67	1.59	1.30	1.47	1.60	1.51	Rest
		Difference/min (acc-dec/min)	9.17	7.55	8.92	2.82	4.36	7.3	3.64	Rest
		Jmp + 3G/min (count/min)	0.12	0.15	0.13	0.08	0.09	0.11	0.12	Rest
		Landings + 5G/min (count/min)	0.12	0.20	0.12	0.11	0.09	0.13	0.17	Rest
	eTLn	Imp + 8G/min (count/min)	64.33	104.13	59.41	59.85	71.12	80.03	77.23	Rest
		PL/min (a.u./min)	0.65	0.93	0.59	0.49	0.63	0.73	0.62	Rest
	iTL	Average heart rate (bpm)	135.25	137.27	125.75	116.27	126.27	131.70	119.09	Rest
		Maximum heart rate (bpm)	183.00	181.09	178.58	153.64	173.45	178.20	172.55	Rest
WEEK 3			Monday	Tuesday	Wednesday	Wednesday	Thursday	Friday	Saturday	Sunday
		Match Day	−5 MD	−4 MD	−3 MD	−3 MD	−2 MD	−1 MD	F. G.	+1 MD
	-	Duration (min)	100.05	87.58	96.30	42.62	81.35	58.70	ND	Rest
	eTLk	Dist/min (m/min)	29.12	44.02	34.01	27.48	40.73	36.64	ND	Rest
		HIA/min (count/min)	3.05	3.16	3.21	2.31	3.62	3.96	ND	Rest
		Acc (+2 m/s^2)/min (count/min)	1.45	1.43	1.54	1.06	1.74	1.91	ND	Rest
		Dec (+2 m/s^2)/min (count/min)	1.31	1.38	1.39	0.92	1.54	1.72	ND	Rest
		Difference/min (acc-dec/min)	5.17	8.92	6.36	1.92	7.36	6.73	ND	Rest
		Jmp + 3G/min (count/min)	0.10	0.09	0.10	0.11	0.11	0.11	ND	Rest
		Landings + 5G/min (count/min)	0.10	0.19	0.09	0.21	0.13	0.13	ND	Rest
	eTLn	Imp + 8G/min (count/min)	53.76	86.31	63.20	54.20	74.27	75.73	ND	Rest
		PL/min (a.u./min)	0.53	0.76	0.59	0.41	0.69	0.63	ND	Rest
	iTL	Average heart rate (bpm)	124.92	124.08	123.00	111.83	126.36	125.09	ND	Rest
		Maximum heart rate (bpm)	178.58	174.08	177.36	157.25	177.73	168.73	ND	Rest
WEEK 4			Monday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
		Match Day	−4 MD	−4 MD	−3 MD	−2 MD	−1 MD	O. G.	O. G.	+1 MD
	-	Duration (min)	ND	ND	ND	ND	ND	143.18	147.22	Rest
	eTLk	Dist/min (m/min)	ND	ND	ND	ND	ND	36.68	35.59	Rest
		HIA/min (count/min)	ND	ND	ND	ND	ND	3.05	3.28	Rest
		Acc (+2 m/s^2)/min (count/min)	ND	ND	ND	ND	ND	1.38	1.50	Rest
		Dec (+2 m/s^2)/min (count/min)	ND	ND	ND	ND	ND	1.31	1.49	Rest
		Difference/min (acc-dec/min)	ND	ND	ND	ND	ND	6.83	−1.08	Rest
		Jmp + 3G/min (count/min)	ND	ND	ND	ND	ND	0.11	0.10	Rest
		Landings + 5G/min (count/min)	ND	ND	ND	ND	ND	0.17	0.20	Rest
	eTLn	Imp + 8G/min (count/min)	ND	ND	ND	ND	ND	79.55	78.86	Rest
		PL/min (a.u./min)	ND	ND	ND	ND	ND	0.60	0.58	Rest
	iTL	Average heart rate (bpm)	ND	ND	ND	ND	ND	120.00	105.92	Rest
		Maximum heart rate (bpm)	ND	ND	ND	ND	ND	179.58	166.17	Rest

MD = match day; **eTLk** = external kinematic load; **eTLn** = external neuromuscular load; **iTL** = internal training load; **ND** = no data available. **F. G.** = friendly games; **O. G.** = official games.

2.7. Statistical Analysis

Initially, the descriptives, including the mean, median, and standard deviation, were computed to characterize the demand variables. The data normality was analyzed through the Kolmogorov–Smirnov test [47], confirming non-normality ($p < 0.05$). The demand variables, based on context, were analyzed using the Mann–Whitney U test (2 categories). The demand variables, according to specific positions in both training and competition, were analyzed using the Kruskal–Wallis H test (>2 categories). The statistical analysis was conducted using SPSS, version 27 (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27, IBM Corp, Armonk, NY, USA). The differences were deemed significant when $p < 0.05$. After failing to achieve data normality through transformations, a robust ANOVA was conducted with post hoc tests, using context and the specific positions as factors for each studied iTL and eTL variable. This utilized the Walrus add-on (Team, 2021) provided by the JAMOVI software (V2.3.28) (The_jamovi_Project, 2022).

The effect size was calculated using Rosenthal's r formula for the Mann–Whitney U test and the Epsilon-squared (E2R) coefficient for the Kruskal–Wallis H test [48,49]. Rosenthal's r interpretation employed the following criteria [50]: between 0.10 and 0.29 as a small effect; between 0.30 and 0.49 as a moderate effect; between 0.50 and 0.69 as a strong effect; and ≥0.70 as a very strong effect. Similarly, for the Epsilon-squared coefficient interpretation, the following criteria were assumed [49]: between 0.01 and <0.04 as a weak effect; between 0.04 and <0.16 as a moderate effect; between 0.16 and <0.36 as a relatively strong effect; between 0.36 and <0.64 as a strong effect; and ≥0.64 as a very strong effect.

3. Results

In Table 3, the descriptive results of the kinematic eTL, neuromuscular eTL, and iTL variables are presented. Additionally, values from the normality tests ($p < 0.05$) are displayed.

Table 3. Descriptives and normality tests of demand variables.

		Min.	*Max.*	$\overline{X}$	*SD*	*Median*	*K-S*	*p*
eTL kin	DIST/MIN	22.80	71.76	41.67	11.24	39.1	0.11	<0.01 **
	HIA/MIN	1.31	11.86	3.85	1.35	3.55	0.16	<0.01 **
	ACC + 2/MIN	0.56	9.56	1.75	0.75	1.59	0.17	<0.01 **
	DEC + 2/MIN	0.49	10.53	1.57	0.76	1.45	0.16	<0.01 **
	ACC-DEC/MIN	1.17	11.45	3.27	1.08	2.99	0.14	<0.01 **
	J + 3G/MIN	0.00	0.50	0.11	0.08	0.09	0.14	<0.01 **
	L + 5/MIN	0.00	0.73	0.14	0.11	0.12	0.15	<0.01 **
eTL neu	IMP + 8/MIN	0.00	2.62	0.20	0.38	0.07	0.31	<0.01 **
	PL/MIN	0.34	1.40	0.71	0.22	0.67	0.14	<0.01 **
iTL	HR_{AVG}/MIN	0	179	131	18	131	0.07	0.01 *
	HR_{MAX}/MIN	0	206	177	17	179	0.14	<0.01 **

Note: Min = minimum; Max = maximum; $\overline{X}$ = mean; SD = standard deviation; K-S = Kolmogórov–Smirnov; eTL kin = kinematic external load; eTL neu = neuromuscular external load; iTL = internal load. * $p < 0.05$; ** $p < 0.01$.

Except for one variable, significant differences were observed in the demand values with a strong effect size, except for the DEC + 2/MIN and HRAVG/MIN variables, which exhibited a moderate effect size, and L + 5/MIN and HRMAX/MIN with a small effect size (Table 4). No significant differences were found for the J + 3G/MIN variable ($p > 0.05$) (Figure 2).

Table 5 presents the analysis of the demand variables based on the players' specific positions, both in training and competition. Significant differences were only observed in some demand variables related to training: J + 3G/MIN ($p < 0.01$) with a relatively strong effect size, L + 5/MIN ($p < 0.01$), and HRAVG/MIN ($p < 0.05$), both with a moderate effect size. Comparisons between the specific positions indicate that inside players exhibited higher workload demand in these three variables.

Table 4. Inferential analysis of demand variables by context.

		Training (n = 221)			Competition (n = 32)						
		$\bar{X}$	*SD*	*Median*	$\bar{X}$	*SD*	*Median*	*U*	*z*	*p*	*r*
eTL cine	DIST/MIN	38.77	8.24	38.20	61.70	8.47	64.15	6873.00	−8.390	<0.01	53
	HIA/MIN	3.50	0.92	3.40	6.33	1.30	6.46	6800.00	−8.438	<0.01	0.53
	ACC + 2/MIN	1.58	0.44	1.55	2.87	1.30	2.85	6837.00	−8.533	<0.01	0.54
	DEC + 2/MIN	1.44	0.44	1.37	2.52	1.53	2.33	6541.00	−7.767	<0.01	0.49
	ACC-DEC/MIN	3.02	0.86	2.92	4.97	0.88	4.98	6733.00	−8.263	<0.01	0.52
	J + 3G/MIN	0.11	0.08	0.09	0.14	0.11	0.12	4215.50	−1.759	0.08	0.11
	L + 5/MIN	0.13	0.11	0.12	0.18	0.12	0.14	4459.00	−2.388	0.02	0.15
eTL neur	IMP + 8/MIN	0.08	0.08	0.06	1.00	0.62	0.86	6907.00	−8.730	<0.01	0.55
	PL/MIN	0.66	0.15	0.64	1.10	0.20	1.12	6698.00	−8.175	<0.01	0.51
iTL	HR_{AVG}/MIN	129	13	130	145	33	153	6112.50	−5.767	<0.01	0.36
	HR_{MAX}/MIN	177	13	178	178	35	186	4582.50	−3.046	<0.01	0.19

Note: $\bar{X}$ = mean; SD = standard deviation; U = Mann–Whitney U test; z = z-score; r = Rosenthal's r; eTL kin = kinematic external load; eTL neu = neuromuscular external load; iTL = internal load.

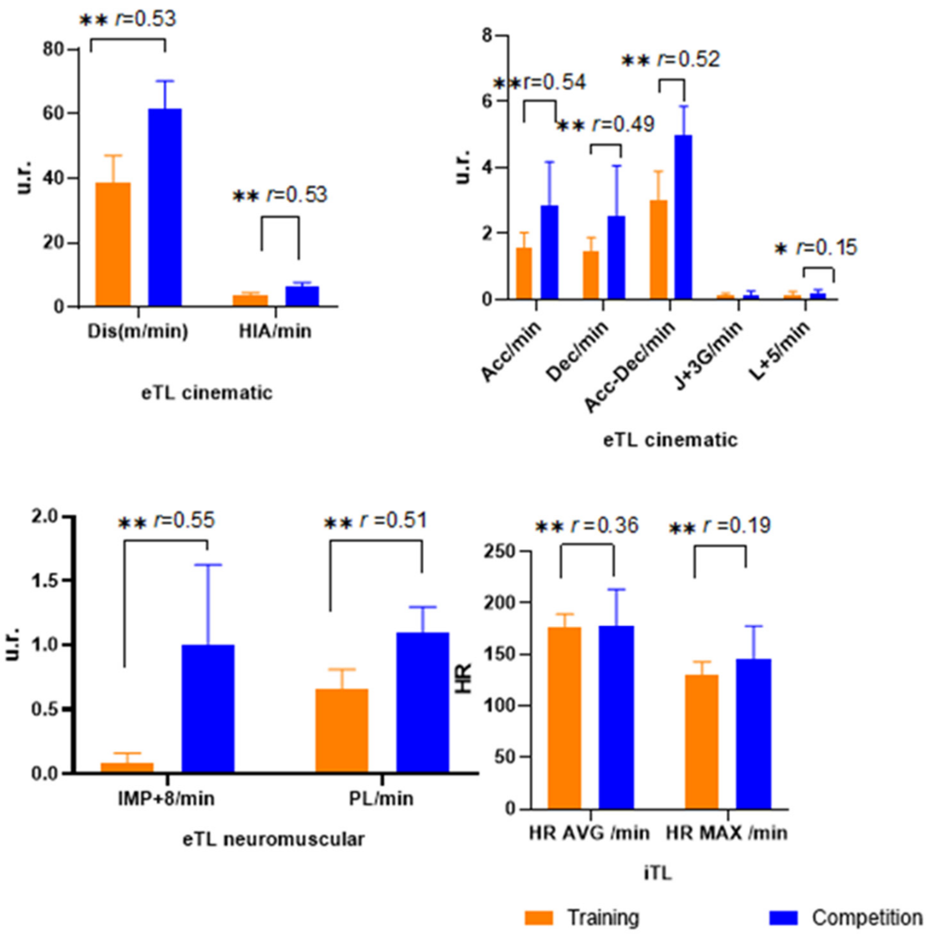

Figure 2. Comparison of demand variables based on context. Note: eTL kin = kinematic external load; iTL = internal load. * $p < 0.05$; ** $p < 0.01$.

The results indicate that there were no significant interactions between the context-specific position factors ($p > 0.05$) (Table 6).

Table 5. Inferential analysis of demand variables based on specific position.

Variable of Intensity	Specific Position	Training					Competition				
		$\bar{X}$	*SD*	X^2	p (E^2_R)	*Comp-*	$\bar{X}$	*SD*	X^2	p (E^2_R)	*Comp-*
DIST/MIN	Guard Forward Center	38.89 37.89 39.30	8.19 7.64 8.73	1.20	0.55 (0.01)	-	61.66 63.20 60.77	7.30 8.06 9.44	0.46	0.80 (0.01)	-
HIA	Guard Forward Center	3.52 3.39 3.55	0.74 0.70 1.15	0.72	0.70 (0.00)	-	7.13 6.26 6.06	1.95 0.56 1.30	1.96	0.38 (0.06)	-
ACC + 2/MIN	Guard Forward Center	1.64 1.57 1.54	0.33 0.36 0.55	5.69	0.06 (0.03)	-	2.65 3.39 2.62	0.71 2.20 0.39	0.77	0.68 (0.02)	-
DEC + 2/MIN	Guard Forward Center	1.49 1.44 1.39	0.35 0.35 0.55	5.54	0.06 (0.03)	-	2.65 3.07 2.12	0.49 2.64 0.46	4.15	0.13 (0.13)	-
ACC-DEC/MIN	Guard Forward Center	3.14 3.00 2.94	0.67 0.69 1.08	5.74	0.06 (0.03)	-	5.31 5.11 4.75	1.18 0.83 0.78	1.39	0.50 (0.01)	-
J + 3G/MIN	Guard Forward Center	0.08 0.07 0.15	0.06 0.05 0.08	49.82	<0.01 ** (0.23)	C > G C > F	0.08 0.07 0.15	0.06 0.05 0.08	4.00	0.14 (0.13)	-
L + 5/MIN	Guard Forward Center	0.11 0.11 0.17	0.11 0.08 0.11	29.14	<0.01 ** (0.13)	C > G C > F	0.13 0.20 0.18	0.07 0.12 0.13	1.330	0.514 (0.04)	-
IMP + 8/MIN	Guard Forward Center	0.06 0.07 0.10	0.06 0.06 0.09	5.51	0.06 (0.03)	-	0.06 0.07 0.10	0.06 0.06 0.09	4.23	0.12 (0.14)	-
PL/Min	Guard Forward Center	0.67 0.64 0.66	0.17 0.14 0.15	0.831	0.66 (0.00)	-	1.16 1.08 1.08	0.17 0.27 0.15	0.76	0.69 (0.02)	-
HR_{AVG}/MIN	Guard Forward Center	129 126 132	16 15 10	10.40	0.01 * (0.05)	C > F	159 149 137	16 22 41	0.70	0.68 (0.25)	-
HR_{MAX}/MIN	Guard Forward Center	177 177 177	134 13 11	0.12	0.94 (0.00)	-	188 187 168	10 9 49	1.10	0.58 (0.04)	-

Note: $\bar{X}$ = mean; SD = standard deviation; X^2 = Kruskal–Wallis H test; E^2_R = Epsilon-squared coefficient; Specific positions: G = Guard, F = Forward, C = Center. * $p < 0.05$; ** $p < 0.01$.

Table 6. Differences in demand variables according to the context-specific position interaction.

Variable of Intensity	Context		Position		Context * Position	
	Q	*p*	*Q*	*p*	*Q*	*p*
DIST/MIN	306.657	<0.01 **	0.772	0.70	3.725	0.21
HIA/MIN	97.280	<0.01 **	0.973	0.66	0.784	0.71
ACC + 2/MIN	86.501	<0.01 **	0.729	0.73	0.409	0.84
DEC + 2/MIN	125.69	<0.01 **	7.97	0.06	2.96	0.30
ACC-DEC/MIN	110.0542	<0.01 **	1.7206	0.49	0.0947	0.96
J + 3G/MIN	1.660	0.22	11.282	0.02 *	0.159	0.93
L + 5/MIN	5.47	0.03 *	8.53	0.04 *	1.35	0.545
IMP + 8/MIN	52.40	<0.01 **	3.12	0.28	3.58	0.24
PL/Min	169.717	<0.01 **	0.623	0.76	1.921	0.45
HR_{AVG}/MIN	39.559	<0.01 **	0.546	0.78	4.729	0.17
HR_{MAX}/MIN	6.144	0.03 *	0.631	0.75	0.684	0.73

Note: Method of trimmed means (level 0.2). * $p < 0.05$; ** $p < 0.01$.

4. Discussion

The aim of this study was to quantify and compare the demands experienced by professional basketball players in both training and competition, considering context and specific positions. Initially, the values of kinematic external workload (eTL), neuromuscular external workload (eTL), and minute-weighted internal workload (iTL) were established. These values were weighted to avoid errors in data interpretation, as is recommended for parameters like distance [51].

The description of the internal and external load demands during training was carried out from the 5 vs. 5 game simulation situations and official 5 vs. 5 matches. In all the monitored training sessions, 5 vs. 5 competition situations were recorded with different objectives (learning the attacking movement, teaching defensive organizations, etc.). In Table 2, it can be seen that the values of the variables are high in the training sessions, with the vast majority showing an increase as the training sessions progress, quite noticeable in the first two weeks of monitoring.

In response to the question of whether training mirrors competition, it should be noted that in the studied sample, this was not the case. The results indicate significant differences in all the eTL variables, except for the J + 3G/MIN (jumps) variable. Additionally, there were significant differences in the iTL variables, with higher demand values in competition. Similar results have been found in other studies in women's basketball [40] and in semi-professional and professional male players [38,39]. However, some of the literature reports that training demands in semi-professional basketball exceed those of competition [37]. Competition demands are higher than those of training. Factors such as pressure for results, stress from facing an unknown opponent, and the presence of spectators can increase a player's stress and demand during competition, which can be measured with next-generation sensors.

Regarding the distance covered in this study, the players achieved an average of 61.70 ± 8.47 m/min in competition. These results were lower than a previous study with players from different national category teams, where 82.6 ± 7.8 m/min was recorded [27]. Professional players move more efficiently, as they need to cover less distance to achieve game objectives.

The accelerations, decelerations, and acceleration-to-deceleration ratios per minute were higher in competition than in training. Accelerations and decelerations, which are implicit in actions like changes of direction, drives to the basket, fast breaks, etc., are explosive actions that can lead to injuries. It is necessary to plan and monitor appropriate training situations with high-demand game-specific actions and opposition. Moreover, it is crucial to establish an adequate acute-to-chronic workload ratio [12].

In terms of the neuromuscular external workload, PL/MIN was much higher in competition compared to training, with a strong effect size. Similar findings were reported in Australian semi-professional basketball [39]. However, another study in Australian semi-professional basketball found higher arbitrary PL units in training than in competition [37]. PL represents the change in accelerations and decelerations in the body and is the unit that largely indicates the objective eTL supported by players [37], hence the importance of this variable, along with heart rate and high workload demands, for coaches and fitness trainers [52].

The iTL of both training and competition was analyzed using the average and maximum heart rate reached by the players [51]. The HRAVG obtained in competition, HRAVG = 145 ± 33, was lower than that reported in other studies: HRAVG = 169 ± 8 [27] and HR = 158 ± 10 [5]. Professional players have better adaptation to competition demands.

The HRMAX results were lower than those reported in another study [5]. Both HRAVG and HRMAX reached significantly higher values in competition than in training, with a moderate effect size for HRAVG. Similar to this study, iTL was also higher in competition than in training in other studies [39,53]. Competition generates a physiological response greater than that of training. This increase may be due to the stress of competition and the outcome. This implies a higher workload demand. In training, it is necessary to propose tasks adjusted in demand and motivate player engagement to achieve average maximum heart rate values similar to those in competition. Training intensity is determined by the level of opposition and not just the playing space [29], making it necessary to design tasks with situations similar to real gameplay.

The demands of ITL and eTL on specific positions were different in competition [51]. Therefore, these demands should be adjusted in training. To do this, iTL and eTL were analyzed based on the specific positions of the players. The specific positions were classified as guards, forwards, and centers. The results show a trend of higher demands in competition compared to training in most demand variables for each specific position. However, no significant differences were found in any demand variables in the context (training * competition) and specific position interaction. Studies with professional players have shown differences between training and competition based on specific positions [38].

In competition, no differences in eTL were found between the specific positions, whereas in training, differences were only observed in the J + 3G/MIN (jumps) and L + 5/MIN (landings) variables, with higher magnitudes for inside players compared to forwards and guards. These results could be consistent with the actions performed by inside players, as they are the ones who may perform more jumps and landings when collecting offensive and defensive rebounds. Even though players may perform seemingly similar tasks in basketball, there are different eTL demands based on their specific positions in the game [54]. For example, inside players make more jumps and static efforts [25]. However, some studies have not found differences in variables like jumps or impacts based on position in official competition matches [38].

In training, no differences were found in specific positions for movements, high-demand movements, or accelerations and decelerations ($p > 0.05$). However, other studies have determined that inside players (centers) covered less distance in training, and guards moved at higher speeds than inside players (centers) [27]. Additionally, higher speed peaks have been observed in guards and inside players [26]. Ferioli et al. [55] observed that guards performed more activities in all movement demands than forwards and centers when in possession of the ball. However, high-demand actions in ball possession were greater for forwards and centers than for guards [55]. The type of action and ball possession influence the training load.

In the present study, no significant differences in accelerations were found during training, consistent with another study involving professional players [26]. However, in other non-professional contexts, it was determined that perimeter players, including guards and forwards, performed more accelerations and decelerations than inside players [27,56,57]. The disparities in accelerations and decelerations between perimeter and inside players could be attributed to differences in playing style due to their proximity to the basket [28]. Modern professional basketball is beginning to transcend the traditional classifications of players into specific positions. The results underscore that there are no differences in the demands they face. While theoretical gameplay roles exist, similar actions are performed during competition, and distinct profiles are not identified. It is essential to continue monitoring these variables during competition based on specific positions, gameplay systems, and critical moments in games.

During training sessions, external load variables, such as J + 3G/MIN (jumps) and L + 5/MIN (landings), displayed significant differences, with inside players achieving higher values than forwards and guards. These results might align with the actions typically performed by inside players, specifically centers, who are more likely to execute more jumps and landings during offensive and defensive rebound attempts. While basketball players may appear to perform similar tasks, there are distinct external load requirements depending on their specific positions within the game [54]. For instance, inside players engage in more jumps and static efforts [2,25]. However, some studies have not found differences in variables like jumps or impacts based on the playing position [26]. During training sessions, coaches emphasize tactical and technical actions linked to specific positions, encouraging players to focus on actions related to jumps, including rebounds and blocks.

Regarding the neuromuscular external load (PL/MIN), no differences were found based on specific playing positions. The literature contains studies that did not observe position-based differences in PL [26], while others have determined that guards exhibited higher PL/MIN values than forwards and centers [3]. These contradictory results may stem from variations in methodologies employed by researchers, the instruments used, and the target populations under study.

Regarding the internal workload (iTL), the results reveal a higher HRAVG in inside players compared to outside players during training sessions. Puente et al. [27] did not find differences in HRMAX. These findings do not align with those of Gocentas et al. [58], where perimeter players displayed higher VO2MAX values. Heart rate is a commonly used objective variable for monitoring workload in invasion sports in general and basketball in particular; however, this variable must be used cautiously, as the autonomic nervous system's involvement can lead to variations in heart rate response [59], which may not be consistent with the effort required during competition. Nevertheless, it is necessary to customize the workload based on specific playing positions.

As for the study's limitations, it should be noted that the sample size of professional players was limited, although the recording units were sufficient. Additionally, the analyzed competition period could be considered a limitation since data for the entire competition were not available. Finally, discussing the findings with some consulted studies was challenging due to the absence of minute-weighted demand variable data.

5. Practical Implications

In light of the findings from this research, several practical contributions can be made. Competitive basketball demands higher levels of intensity compared to training sessions. Therefore, coaches should design full game scenarios with stressors and conditions to elicit responses similar to those required during competition. This can be achieved by repeating sequences of attack–defense at the competition's pace, including defensive balance and fast breaks, while imposing minimum demands that can be monitored in real time. It is considered necessary to assess various indicators of external and internal workload (PL/min, high-intensity movements, HRavg, and HRmax) to evaluate player intensity during both training and competition.

Traditional position-specific classifications applied to workload demands appear to need revision, given the presence of more versatile players with evolving roles. Task design should be adapted to accommodate the new and diverse roles that a player may assume.

6. Conclusions

Monitoring training and competition demands has seen significant development in the last decade; however, it is essential to compare the demand parameters obtained during training with those recorded during competition. This will allow for the adjustment and optimization of training demands. In the context of this study, the results highlight a significant mismatch in training demands, except in the case of jumps, in comparison to competition, with training demands being lower. Concerning specific positions, inside players record more jumps and landings per minute than guards and outside players during training. Furthermore, inside players exhibit a higher average heart rate per minute than outside players in the same context. Lastly, no differences have been observed in the external and internal demands analyzed concerning specific positions in interaction with the context. It is essential to monitor players during training sessions to train as we aim to compete by adjusting the workload based on specific positions.

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Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Universidad de Extremadura (no. 233/2019).

Informed Consent Statement: Informed consent was obtained from all the subjects involved in the study.

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References

1. Almond, L. Reflecting on themes: A games classification. In *Rethinking Games Teaching*; Thorpe, D.B.L.A.R., Ed.; Department of Physical Education and Sport Science, University of Technology: Loughborough, UK, 1986; pp. 71–72.
2. Ibáñez, S.J.; Piñar, M.I.; García, D.; Mancha-Triguero, D. Physical Fitness as a Predictor of Performance during Competition in Professional Women's Basketball Players. *Int. J. Environ. Res. Public Health* **2023**, *20*, 988. [CrossRef] [PubMed]
3. Salazar, H.; Castellano, J.; Svilar, L. Differences in External Load Variables Between Playing Positions in Elite Basketball Match-Play. *J. Hum. Kinet.* **2020**, *75*, 257–266. [CrossRef] [PubMed]
4. Garcia-Rubio, J.; Gómez, M.A.; Cañadas, M.; Ibáñez, S.J. Offensive Rating-Time coordination dynamics in basketball. Complex systems theory applied to Basketball. *Int. J. Perform. Anal. Sport* **2015**, *15*, 513–526. [CrossRef]
5. Torres-Ronda, L.; Ric, A.; Llabres-Torres, I.; de Las Heras, B.; Schelling I Del Alcázar, X. Position-Dependent Cardiovascular Response and Time-Motion Analysis During Training Drills and Friendly Matches in Elite Male Basketball Players. *J. Strength Cond. Res.* **2016**, *30*, 60–70. [CrossRef] [PubMed]
6. Lord, F.; Pyne, D.B.; Welvaert, M.; Mara, J.K. Methods of performance analysis in team invasion sports: A systematic review. *J. Sports Sci.* **2020**, *38*, 2338–2349. [CrossRef]
7. Staunton, C.A.; Abt, G.; Weaving, D.; Wundersitz, D.W.T. Misuse of the term 'load' in sport and exercise science. *J. Sci. Med. Sport* **2022**, *25*, 439–444. [CrossRef]
8. Reina, M.; García-Rubio, J.; Feu, S.; Ibáñez, S.J. Training and Competition Load Monitoring and Analysis of Women's Amateur Basketball by Playing Position: Approach Study. *Front. Psychol.* **2019**, *9*, 2689. [CrossRef]
9. Ziv, G.; Lidor, R. Physical attributes, physiological characteristics, on-court performances and nutritional strategies of female and male basketball players. *Sports Med.* **2009**, *39*, 547–568. [CrossRef]
10. Scanlan, A.T.; Wen, N.; Tucker, P.S.; Dalbo, V.J. The relationships between internal and external training load models during basketball training. *J. Strength Cond. Res.* **2014**, *28*, 2397–2405. [CrossRef]
11. Bourdon, P.C.; Cardinale, M.; Murray, A.; Gastin, P.; Kellmann, M.; Varley, M.C.; Gabbett, T.J.; Coutts, A.J.; Burgess, D.J.; Gregson, W.; et al. Monitoring Athlete Training Loads: Consensus Statement. *Int. J. Sports Physiol. Perform.* **2017**, *12*, S2161–S2170. [CrossRef]
12. Gabbett, T.J. The training-injury prevention paradox: Should athletes be training smarter and harder? *Br. J. Sports Med.* **2016**, *50*, 273–280. [CrossRef] [PubMed]
13. Pernigoni, M.; Ferioli, D.; Butautas, R.; La Torre, A.; Conte, D. Assessing the External Load Associated with High-Intensity Activities Recorded During Official Basketball Games. *Front. Psychol.* **2021**, *12*, 668194. [CrossRef] [PubMed]
14. Akubat, I.; Barrett, S.; Abt, G. Integrating the internal and external training loads in soccer. *Int. J. Sports Physiol. Perform.* **2014**, *9*, 457–462. [CrossRef] [PubMed]
15. Gómez-Carmona, C.D.; Bastida-Castillo, A.; Ibáñez, S.J.; Pino-Ortega, J. Accelerometry as a method for external workload monitoring in invasion team sports. A systematic review. *PLoS ONE* **2020**, *15*, e0236643. [CrossRef] [PubMed]
16. Halson, S.L. Monitoring training load to understand fatigue in athletes. *Sports Med.* **2014**, *44* (Suppl. S2), S139–S147. [CrossRef]

17. Portes, R.; Navarro, R.M.; Sosa, C.; Trapero, J.J.; Jiménez, S.L. Monitoring and Interpreting External Load in Basketball: A Narrative Review. *Rev. Psicol. Deporte* **2019**, *28*, 119–131.
18. Malone, J.J.; Lovell, R.; Varley, M.C.; Coutts, A.J. Unpacking the Black Box: Applications and Considerations for Using GPS Devices in Sport. *Int. J. Sports Physiol. Perform.* **2017**, *12*, S218–S226. [CrossRef]
19. Bastida-Castillo, A.; Gómez-Carmona, C.D.; De la Cruz-Sanchez, E.; Pino-Ortega, J. Accuracy, intra- and inter-unit reliability, and comparison between GPS and UWB-based position-tracking systems used for time-motion analyses in soccer. *Eur. J. Sport Sci.* **2018**, *18*, 450–457. [CrossRef]
20. Cussaría, J.A.L.; Gálvez, M.J.O.; Álvarez, J.P.; González, J.G. Demandas físicas y fisiológicas en el Hockey hierba femenino: Diferencias entre los tiempos de juego. *Retos. Nuevas Tend. Educ. Física Deporte Recreación* **2019**, *35*, 273–277.
21. Pino-Ortega, J.; Rojas-Valverde, D.; Gómez-Carmona, C.D.; Bastida-Castillo, A.; Hernández-Belmonte, A.; García-Rubio, J.; Nakamura, F.Y.; Ibáñez, S.J. Impact of Contextual Factors on External Load During a CongestedFixture Tournament in Elite U'18 Basketball Players. *Front. Psychol.* **2019**, *10*, 1100. [CrossRef]
22. Russell, J.L.; McLean, B.D.; Impellizzeri, F.M.; Strack, D.S.; Coutts, A.J. Measuring Physical Demands in Basketball: An Explorative Systematic Review of Practices. *Sports Med.* **2021**, *51*, 81–112. [CrossRef] [PubMed]
23. Portes, R.; Jiménez, S.L.; Navarro, R.M.; Scanlan, A.T.; Gómez, M.A. Comparing the External Loads Encountered during Competition between Elite, Junior Male and Female Basketball Players. *Int. J. Environ. Res. Public Health* **2020**, *17*, 1456. [CrossRef] [PubMed]
24. Power, C.J.; Fox, J.L.; Dalbo, V.J.; Scanlan, A.T. External and Internal Load Variables Encountered During Training and Games in Female Basketball Players According to Playing Level and Playing Position: A Systematic Review. *Sports Med. Open* **2022**, *8*, 107. [CrossRef] [PubMed]
25. Delextrat, A.; Badiella, A.; Saavedra, V.; Matthew, D.; Schelling, X.; Torres-Ronda, L. Match activity demands of elite Spanish female basketball players by playing position. *Int. J. Perform. Anal. Sport* **2017**, *15*, 687–703. [CrossRef]
26. García, F.; Vázquez-Guerrero, J.; Castellano, J.; Casals, M.; Schelling, X. Differences in Physical Demands between Game Quarters and Playing Positions on Professional Basketball Players during Official Competition. *J. Sports Sci. Med.* **2020**, *19*, 256–263. [PubMed]
27. Puente, C.; Abián-Vicén, J.; Areces, F.; López, R.; Del Coso, J. Physical and Physiological Demands of Experienced Male Basketball Players During a Competitive Game. *J. Strength Cond. Res.* **2017**, *31*, 956–962. [CrossRef] [PubMed]
28. Vázquez-Guerrero, J.; Suarez-Arrones, L.; Casamichana, D.; Rodas, G. Comparing external total load, acceleration and deceleration outputs in elite basketball players across positions during match play. *Kinesiology* **2018**, *50*, 228–234. [CrossRef]
29. Ballesta, A.S.; Abrunedo, J.; Caparrós, T. Accelerometry in Basketball. Study of External Load during Training. *Apunt. Educ. Física Deportes* **2019**, *135*, 100–117. [CrossRef]
30. Piñar, M.I.; García, D.; Mancha-Triguero, D.; Ibáñez, S.J. Effect of Situational and Individual Factors on Training Load and Game Performance in Liga Femenina 2 Basketball Female Players. *Appl. Sci.* **2022**, *12*, 7752. [CrossRef]
31. Sánchez-Castillo, C.; Pons, T.C. External training load by accelerometery analysis during pick and roll in male amateur basketball. *E-Balonmano Com* **2022**, *18*, 105–116.
32. Sansone, P.; Gasperi, L.; Tessitore, A.; Gómez, M.A. Training load, recovery and game performance in semiprofessional male basketball: Influence of individual characteristics and contextual factors. *Biol. Sport* **2021**, *38*, 207–217. [CrossRef] [PubMed]
33. Gutiérrez-Vargas, R.; Pino-Ortega, J.; Ugalde-Ramírez, A.; Sánchez-Ureña, B.; Blanco-Romero, L.; Trejos-Montoya, J.; Gutiérrez-Vargas, J.C.; Rojas-Valverde, D. Physical and physiological demands according to gender, playing positions, and match outcomes in youth basketball players. *RICYDE Rev. Int. Cienc. Deporte* **2021**, *18*, 15–28. [CrossRef]
34. Sansone, P.; Ceravolo, A.; Tessitore, A. External, Internal, Perceived Training Loads and Their Relationships in Youth Basketball Players Across Different Positions. *Int. J. Sports Physiol. Perform.* **2022**, *17*, 249–255. [CrossRef] [PubMed]
35. McLaren, S.J.; Macpherson, T.W.; Coutts, A.J.; Hurst, C.; Spears, I.R.; Weston, M. The Relationships Between Internal and External Measures of Training Load and Intensity in Team Sports: A Meta-Analysis. *Sports Med.* **2018**, *48*, 641–658. [CrossRef]
36. Reina, M.; García-Rubio, J.; Antúnez, A.; Courel-Ibáñez, J.; Ibáñez, S.J. Load Variability of Training Sessions and Competition in Female Basketball. *Rev. Psicol. Deporte* **2019**, *28*, 93–99.
37. Fox, J.L.; Stanton, R.; Scanlan, A.T. A Comparison of Training and Competition Demands in Semiprofessional Male Basketball Players. *Res. Q. Exerc. Sport* **2018**, *89*, 103–111. [CrossRef]
38. García, F.; Schelling, X.; Castellano, J.; Martín-García, A.; Pla, F.; Vázquez-Guerrero, J. Comparison of the most demanding scenarios during different in-season training sessions and official matches in professional basketball players. *Biol. Sport* **2022**, *39*, 237–244. [CrossRef]
39. Williams, M.N.C.; Dalbo, V.J.; Fox, J.L.; O'Grady, C.J.; Scanlan, A.T. Comparing Weekly Training and Game Demands According to Playing Position in a Semiprofessional Basketball Team. *Int. J. Sports Physiol. Perform.* **2021**, *16*, 772–778. [CrossRef]
40. Reina, M.; Mancha, D.; Feu, S.; Ibáñez, S.J. Is training carried out the same as competition? Analysis of load in women's basketball. *Rev. Psicol. Deporte* **2017**, *26*, 9–13.
41. Ato, M.; López-García, J.J.; Benavente, A. Un sistema de clasificación de los diseños de investigación en psicología. *An. Psicol.* **2013**, *29*, 178511. [CrossRef]
42. Montero, I.; León, O.G. A guide for naming research studies in Psychology. *Int. J. Clin. Health Psychol.* **2007**, *7*, 847–862.

43. Ibáñez, S.J.; Feu, S.; Cañadas, M. Integral analysis system of training tasks, SIATE, in invasion games. *E-Balonmano.com Rev. Cienc. Del Deporte* **2016**, *12*, 3–30.
44. Bastida-Castillo, A.; Gómez-Carmona, C.D.; De la Cruz-Sanchez, E.; Reche-Royo, X.; Ibáñez, S.J.; Pino-Ortega, J. Accuracy and Inter-Unit Reliability of Ultra-Wide-Band Tracking System in Indoor Exercise. *Appl. Sci.* **2019**, *9*, 939. [CrossRef]
45. Reina, M.; Mancha-Triguero, D.; Ibáñez, S.J. Monitorización de un Microciclo Competitivo En Baloncesto Femenino Profesional Mediante Dispositivos Inerciales. *Rev. Int. Med. Cienc. Act. Física Deporte* **2022**, *22*, 663–685. [CrossRef]
46. Harriss, D.J.; Atkinson, G. Ethical Standards in Sport and Exercise Science Research: 2016 Update. *Int. J. Sports Med.* **2015**, *36*, 1121–1124. [CrossRef] [PubMed]
47. Field, A. *Discovering Statistics Using IBM SPSS Statistics*, 5th ed.; SAGE Publications: Newcastle upon Tyne, UK, 2013.
48. Fritz, C.O.; Morris, P.E.; Richler, J.J. Effect size estimates: Current use, calculations, and interpretation. *J. Exp. Psychol. Gen.* **2012**, *141*, 2–18. [CrossRef]
49. Tomczak, M.; Tomczak, E. The need to report effect size estimates revisited. An overview of some recommended measures of effect size. *Trends Sport Sci.* **2014**, *21*, 19–25.
50. Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed.; Erlbaum: Hillsdale, NJ, USA, 1988.
51. Petway, A.J.; Freitas, T.T.; Calleja-González, J.; Medina Leal, D.; Alcaraz, P.E. Training load and match-play demands in basketball based on competition level: A systematic review. *PLoS ONE* **2020**, *15*, e0229212. [CrossRef]
52. Vázquez-Guerrero, J.; Fernández-Valdés, B.; Jones, B.; Moras, G.; Reche, X.; Sampaio, J. Changes in physical demands between game quarters of U18 elite official basketball games. *PLoS ONE* **2019**, *14*, e0221818. [CrossRef]
53. Alonso, E.; Ribas, C.; Gómez, M.A.; Portes, R.; Jiménez, S.L.; Lorenzo, A. Should we train as we compete? Games might be the best scenario to reach the internal peak demands in professional basketball players. *Med. Sport* **2022**, *75*, 45–58. [CrossRef]
54. Svilar, L.; Castellano, J.; Jukic, I.; Casamichana, D. Positional Differences in Elite Basketball: Selecting Appropriate Training-Load Measures. *Int. J. Sports Physiol. Perform.* **2018**, *13*, 947–952. [CrossRef] [PubMed]
55. Ferioli, D.; Rampinini, E.; Martin, M.; Rucco, D.; Torre, A.; Petway, A.; Scanlan, A. Influence of ball possession and playing position on the physical demands encountered during professional basketball games. *Biol. Sport* **2020**, *37*, 269–276. [CrossRef] [PubMed]
56. Reina, M.; García-Rubio, J.; Pino-Ortega, J.; Ibáñez, S.J. The Acceleration and Deceleration Profiles of U-18 Women's Basketball Players during Competitive Matches. *Sports* **2019**, *7*, 165. [CrossRef] [PubMed]
57. Vázquez-Guerrero, J.; Jones, B.; Fernández-Valdés, B.; Moras, G.; Reche, X.; Sampaio, J. Physical demands of elite basketball during an official U18 international tournament. *J. Sports Sci.* **2019**, *37*, 2530–2537. [CrossRef] [PubMed]
58. Gocentas, A.; Jascaniniene, N.; Poprzecki, S.; Jaszczanin, J.; Juozulynas, A. Position-related differences in cardiorespiratory functional capacity of elite basketball players. *J. Hum. Kinet.* **2011**, *30*, 145–152. [CrossRef]
59. Aubert, A.E.; Seps, B.; Beckers, F. Heart rate variability in athletes. *Sports Med.* **2003**, *33*, 889–919. [CrossRef]