

Article

Influence of Fatigue and Defensive Pressure on Three-Point Jump-Shot Kinematics in Basketball

Feng Li ¹, Vedran Dukarić ², Mateja Očić ², Zheng Li ^{1,*} and Damir Knjaz ²¹ China Basketball College, Beijing Sport University, Beijing 100084, China² Faculty of Kinesiology, University of Zagreb, 10000 Zagreb, Croatia

* Correspondence: lizheng2005@126.com

Abstract: This study examines the influence of fatigue and defensive pressure on the kinematic parameters of the three-point jump shot in basketball. Fourteen male collegiate basketball players (age: 21 ± 3 years old, body height: 186.35 ± 7.02 cm, body mass: 82.20 ± 10.99) participated in the study. Each participant performed three-point jump shots under four conditions: without defense, with defense, without defense after a fatigue protocol, and with defense after a fatigue protocol. Kinematic data were collected using the Xsens MVN inertial suit system and the OptoJump Next system. The analysis focused on various parameters including jump height, center of mass, release height, shoulder angle, and segment velocities. The repeated-measures ANOVA was used to observe the differences between each shot condition (fatigue, defense). Results indicated significant changes in the kinematic parameters due to both fatigue and defensive pressure. Fatigue notably changed shooting performance, affecting jump height and release mechanics. The defensive pressure altered shooting technique, leading to quicker ball release and higher release points. These findings highlight the importance of incorporating fatigue and defensive scenarios in training, suggesting that coaches develop more targeted training plans to improve performance under conditions of fatigue and defensive pressure.

Keywords: jump-shot analysis; 3D kinematics; physiological load; defensive pressure



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1. Introduction

In order to be a successful basketball player, it is essential to develop high-level performance factors, particularly a player's technical-tactical skill set, which must adapt to different game situations, such as fatigue and defensive pressure [1,2]. The primary goal of players and teams is to score, and shooting is the most effective individual technique in basketball games, directly influencing overall success [3,4]. Achieving precise shooting requires mastering a technique that respects the form and optimal kinematic and dynamic structure of movement patterns. Additionally, successful shooting performance depends on numerous factors, including biomechanical parameters and the body's ability to adapt to different levels of physiological load [5,6].

While there are various types of basketball shots, the jump shot is regarded as the most important and complex shooting technique [7,8]. Researchers have identified distance from the basket, fatigue, defensive pressure, and contextual factors as key influences on jump-shot accuracy [9,10]. Basketball coaches continually strive to optimize players' jump-shot technique, which is traditionally evaluated subjectively based on the coach's experience and expertise. However, to accurately diagnose a player's technique, every detail must be examined, a task that cannot be achieved through subjective assessment alone. Basketball demands maximum accuracy in performing motor tasks like shooting, making it crucial to conduct precise and objective analyses of the factors that influence performance. Kinematic analysis, supported by modern diagnostic technologies, offers a deeper understanding of movement patterns in the basketball jump-shot technique, enabling coaches to enhance

players' performance [11,12]. This detailed analysis provides valuable insights that help in refining shooting techniques.

Today's basketball game requires players to possess highly refined shooting techniques and accuracy, especially in high-pressure situations and under intense physiological stress [13,14]. Long-distance shots, in particular, demand precise coordination of various factors, such as eye-foot coordination, center of mass positioning, segment velocity, and the proximity of the defender [15,16]. All of these factors significantly influence shooting success.

Previous studies have reported that fatigue tends to impair both technical skills and kinematic parameters during the jump shot [17,18]. As fatigue increases, shooting accuracy tends to decrease [19]. The physical demands of basketball games are constantly growing, making fatigue an unavoidable aspect of competition [20,21]. Some players may have advanced basketball skills, but fatigue can impair their coordination and technique, ultimately reducing their performance efficiency. Fatigue affects kinematic parameters such as ball trajectory, joint angles in the upper and lower extremities, and the center of mass, particularly during long-range shots [6,18]. In addition to fatigue, defensive pressure also plays a significant role in altering jump-shot performance. Studies by Rojas et al. [8] and Kambič et al. [22] highlighted changes in shooting technique under defensive pressure, such as quicker ball release and higher release points. These findings suggest that variability in practice conditions is essential, and coaches should integrate scientific research into their training methods to produce top-performing basketball players.

The importance of three-point jump shots in modern basketball is clear due to its influence on game results. To win games, players must maintain a high level of technical proficiency throughout the match, even when fatigued or facing defensive pressure [23,24]. However, there is limited research, according to the literature, focusing on how fatigue affects three-point shooting performance, especially when combined with defensive pressure. Given this gap, more attention should be devoted to understanding how these factors together affect players' performance, particularly under conditions of fatigue and defensive intensity. To assist coaches in better planning and integrating this knowledge into training, it is crucial to provide them with objective insights into the factors affecting shooting performance. Therefore, this research aims to determine the specific influence of fatigue and defensive pressure on the kinematic parameters of the jump shot.

The hypothesis of this study was: (1) kinematic parameters will differ significantly between fatigued and non-fatigued conditions; (2) kinematic parameters will differ significantly between scenarios with and without defensive pressure; and (3) kinematic parameters will be most impaired under the combined conditions of fatigue and defensive pressure compared to all other conditions.

2. Materials and Methods

2.1. Participants

The sample consisted of 14 collegiate athletes (age: 21 ± 3 years old, body height: 186.35 ± 7.02 cm, body mass: 82.20 ± 10.99) who played in the Chinese University Basketball League. All participants reported no injuries in the past 6 months and provided written informed consent to participate in the testing procedure. The G* power analysis indicated that a sample size of 13 participants would be sufficient, with an effect size of 0.35; 1 group; 4 conditions (measurements); a power level of 0.8; and alpha error set at 0.5. The study was approved by the Beijing Sport University Ethics Committee (code: 2023036H) and conducted in accordance with the ethical standards outlined in the Declaration of Helsinki.

2.2. Variables

Basic anthropometric measurements (body height; body weight; age) were conducted at the beginning of the testing. The variables presented in present study consisted of parameters for evaluating the jump-shot technique. During jump-shot performance, jump height (Jump_H) was measured from the take-off phase to landing. The minimum center of mass in the catch phase (COM_C) and the minimum center of mass during the jump shot

(COM_sh) were measured. COM_C is the point where a player touches the ball for the first time during the catch phase, and COM_sh is the lowest point of the center of mass during the shooting phase. During the shot phase, release height (Rel_H); shoulder angle in the release phase (Shoulder_A); and velocities of shoulder (Shoulder_V), upper arm (Upper arm_V), and forearm (Forearm_V) were measured. Rel_H represents the highest point of the hand while releasing the ball, while Shoulder_A is the angle of release in shoulder joint; Shoulder_V, Upper arm_V, and Forearm_V are the maximum velocities achieved in shoulder angle during a jump shot. After the shot release, horizontal displacement was observed (Hor_D). Hor_D is measured from the tip of the toes during take-off till the first touch of the toes in the landing phase. Duration and arc of the shot were observed from the smart sensor basketball (Sh_T; Arc). Sh_T is the time from the first touch of the ball until the release of the ball, while the Arc variable represents the angle of the ball approaching the basket. For the level of fatigue, heart rate (HR) was measured during all testing conditions. To induce fatigue, the 300-m shuttle run (15×20 m) was used. This fatigue protocol was employed due to having similarities with actual game situations in which a player runs forward and backward consecutively, and its reliability was previously verified [25]. The maximum heart rate and time on the 300 m running test were measured.

2.3. Measuring Devices

For the purpose of measuring body weight and body height, a portable stadiometer (SECA 213) and a scale (TANITA BC545-n) were used. To analyze specific kinematic variables of jump shots, the MNV BIOMECH Awinda inertial system (Xsens Technologies B.V., Enschede, The Netherlands) was utilized. The player wore a full-body suit with 17 wireless motion trackers, sampling at 60 Hz, to enable comprehensive 3D motion analysis. Movement data were processed using the MVN Studio BIOMECH software (Xsens Technologies B.V., Enschede, The Netherlands). Sensor calibration was conducted in an N-pose, and if the calibration was not deemed successful, it was repeated. After successful calibration and prior to measuring or executing each shot, the subject was asked to raise their arms to approximately 90° and 180° to verify correct system operation, sensor positioning, and calibration accuracy. The Xsens system was used in previous studies for different kinematic data in the field of basketball [6]. Furthermore, the reliability and validity for evaluating angular velocity and other kinematic parameters in different basketball techniques was determined [26]. The OptoJump Next system (Microgate, Italy) was used to determine the height of each jump shot. The Witty timing system (Microgate, Italy) was used for measuring time on the 300 m running test. For tracking fatigue, the Polar H10 sensor with connection to a mobile app was used. Using systems like Xsens and OptoJump for sports diagnostics has distinct advantages compared to alternative devices due to their precision, versatility, and the richness of data they provide. Specifically, Xsens provides detailed 3D kinematic data, capturing complex movement patterns with high accuracy. Unlike optical systems that require a controlled environment and cameras, Xsens uses inertial sensors that allow testing in any location, whether indoors or outdoors; it allows for precise tracking of joint angles, velocity, and acceleration in real-time, and the system is wireless so athletes can perform movement freely. The OptoJump system requires minimal setup and does not interfere with an athlete's natural movement, which makes it preferable for tests requiring real-time analysis in training environments. Also, this system enables high-precision analysis of vertical jump performance. The reliability and validity of photocells were proved and used by previous studies [27,28]; additionally, the OptoJump system was used in previous studies and testing protocols, and it demonstrated strong concurrent validity and excellent test-retest reliability for the estimation of vertical jump height [29,30]. The Dr Dish shooting machine was used to standardize the speed of the pass (8 m/s) and the time between the shots (6 s).

2.4. Testing Protocol

All players underwent the same protocol. The measurement protocol starts with a uniformed warm-up that consists of forward running, basic athletic drills, and dynamic stretching. At the end of warm-up, a series of jump shots (5 min duration) were performed. After the completion of the warm-up, H10 and kinematic sensors were put on the participant. Furthermore, the participant was introduced to a measurement protocol that consisted of three-point line shooting from the run up. Shooting was conducted without defense (condition 1—CON1); with defense (condition 2—CON2); without defense after fatigue protocol (condition 3—CON3); and with defense after fatigue protocol (condition 4—CON4). After conducting shots in CON1 and CON2, players underwent the fatigue protocol (i.e., performed 300 m running). Players were instructed to sprint as fast as possible during the fatigue protocol. Participants conducted 6 shots in each condition. The defensive player stood at the center of the free-throw line. When the shooter received the ball from the shooting machine positioned on the lower right wing, the defensive player ran toward the shooter, raising their left hand (or right hand if the shooter was left-handed), without making contact or jumping. The defensive player was instructed not to run beyond the three-point line and was required to box out after the shooter released the ball (Figure 1).

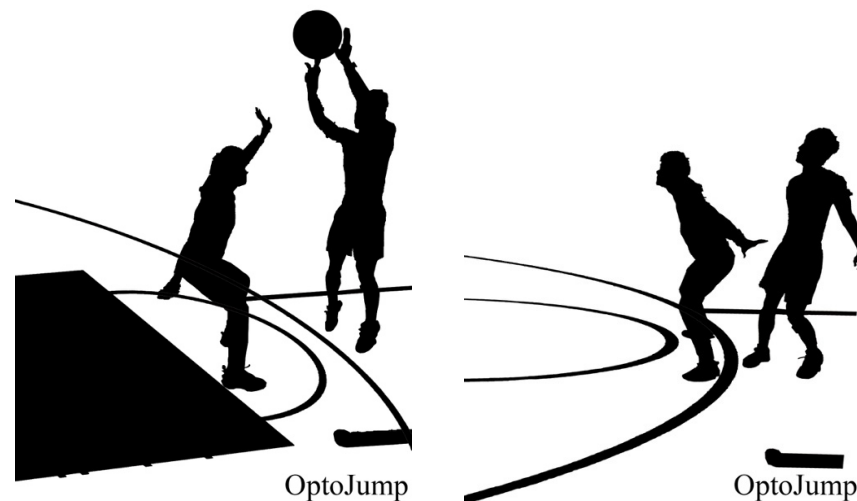


Figure 1. Display of shooting with a defensive player.

2.5. Statistical Analysis

Statistical analysis was performed with the use of Statistica 14.0.1.25 (TIBCO software, Inc., Palo Alto, CA, USA). For each player, six correctly performed shots were analyzed for each test condition. Shots that involved errors, such as dropping the ball, airballs, or stepping over the three-point line, were excluded from the analysis and replaced by new attempts. Normality assumptions were checked using the Shapiro–Wilk test, and homogeneity of variances were assessed through Levene’s test. Descriptive statistics were used to determine mean and standard deviation (SD) values of the observed variables. Assumptions of sphericity were evaluated using the Mauchly’s test. When sphericity was violated ($p \leq 0.05$), the Greenhouse–Geisser correction factor was applied. Repeated-measures ANOVA was used to observe the differences between each shot condition. Interactions between conditions (fatigue, defense) were determined with the Tukey post-hoc test. When conducting the repeated-measures ANOVA, general statistically significant difference was determined ($F = 13.43$; $p < 0.01$). Also, effect size (η^2) calculations (eta squared; small ($\eta^2 \geq 0.01$), medium ($\eta^2 \geq 0.06$), and large ($\eta^2 \geq 0.14$)) were used to estimate the magnitude of the result. The significance was determined at $p < 0.05$. Additionally, the percentage of made shots was calculated.

3. Results

The descriptive parameters of heart rate among conditions and the 300 m protocol are presented in Table 1. In the 300 m running test, the average result was 76.22 s. Heart rate during this test was at 187.07 beats per minute (BPM). In condition 1 (CON1_HR), which was shooting without influence of fatigue and defense, athletes had an average 148.81 BPM. CON2_HR showed similar values as CON1_HR. After the fatigue protocol, HR was 33–38 BPM higher. Considering that HR in the 300 m test was at 187 BPM, in CON4_HR the heart rate was nearly maximal.

Table 1. Descriptive parameters of 4 conditions and 300 m fatigue protocol.

	300 m_T	300 m_HR	CON1	CON2	CON3	CON4
Mean	76.22	187.07	148.81	150.09	183.09	186.66
Min	65.54	174	114.00	113.00	174.00	177.00
Max	86.14	203	178.00	179.00	196.00	201.00
St.Dev.	5.01	8.78	18.97	21.26	6.36	6.47

300 m_T—time of 300 m running test; 300 m_HR—heart rate during 300 m running test; Mean—mean values; Min—minimum values; Max—maximum values; St.Dev.—standard deviation.

In Table 2, mean and standard deviation values were presented for each observed condition. The highest values of the jump height were determined in CON4 (16.44 cm). Furthermore, the height of the center of mass during ball catching was highest in CON4. The lowest point of the center of mass during the jump-shot performance was in CON1. The release height was highest in CON2. The shoulder angle was higher in the no-fatigue condition, whilst under the influence of defense it did not show differences. The slowest velocity of segments was determined in the upper arm during shooting in CON1 (1.13 m/s). In the horizontal displacement variable, the longest distance was covered in CON1 (37.10 cm) and CON2 (36.99 cm). The shot time was quickest in the condition without fatigue and with a defensive player. In the same condition, the arc of the ball was the highest (45.35).

Table 2. Descriptive parameters of observed kinematic variables in different jump-shot conditions.

Condition	1		2		3		4		η^2
Descriptive Stat.	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Jump_H	12.46	7.1	14.24	6.44	14.22	6.91	16.44	6.91	0.09
COM_C	100.11	5.67	99.34	6.88	101.84	5.44	102.26	5.44	0.09
COM_Sh	87.93	6.07	88.06	14.46	90.21	5.94	89.82	5.94	0.09
Rel_H	221.78	14.42	223.89	10.26	220.42	15.64	220.83	15.64	0.06
Shoulder_A	120.44	6.24	121.13	5.64	118.12	7.77	118.25	7.77	0.06
Shoulder_V	1.20	0.64	1.32	0.69	1.29	0.61	1.38	0.61	0.03
Upper arm_V	1.13	0.78	1.25	0.57	1.25	0.79	1.29	0.79	0.02
Forearm_V	1.62	0.75	1.66	0.61	1.69	0.89	1.68	0.89	0.00
Hor_D	37.10	18.45	36.99	16.58	21.85	22.72	27.46	22.72	0.27
Sh_T	0.93	0.12	0.87	0.08	0.97	0.10	0.91	0.10	0.24
Arc	45.13	3.34	45.35	2.89	45.24	3.54	44.82	3.54	0.01

Condition 1—shooting without defense; Condition 2—shooting with defense; Condition 3—shooting without defense after fatigue protocol; Condition 4—shooting with defense after fatigue protocol; Jump_H—height of the jump shot; COM_C—center of mass during catch phase; COM_Sh—minimum center of mass during jump shot; Rel_H—maximum point of ball release; Shoulder_A—shoulder angle during ball release; Shoulder_V—highest shoulder velocity during jump shot; Upper arm_V—highest upper arm velocity during jump shot; Forearm_V—highest forearm velocity during jump shot; Hor_D—horizontal displacement; Sh_T—shot time; Arc—angle of ball entering the rim; Mean—mean values; SD—standard deviation.

When conducting the repeated-measures ANOVA, general statistically significant difference was determined ($F = 13.43$; $p < 0.01$). As differences were established in repeated-measures ANOVA, the Tukey post-hoc (Table 3) test was used to further analyze the interactions between the conditions. In the Jump_H variable, conditions 1, 2, and 3 presented significant differences in relation to condition 4 ($p = 0.03$). The center of mass in the catching and shooting phases differed significantly between CON2 and both conditions after the fatigue protocol. Moreover, CON1 presented differences in relation to CON4 in these two variables. Maximum height release of non-fatigue conditions showed significant differences ($p < 0.01$) in relation to CON4. The shoulder angle during ball release showed differences between CON2 and conditions after the fatigue protocol. In the Hor_D variable, significant differences were determined between non-fatigue and fatigue conditions ($p < 0.00$ and 0.02). The duration of shot (Sh_T) did not differ only between CON1 and CON4. With other variables (Shoulder_V; Upper arm_V; Forearm_V; and Arc), statistics did not present any differences.

Table 3. The results of the Tukey post-hoc test.

Jump_H				COM_C					
	{1}	{2}	{3}	{4}		{1}	{2}	{3}	{4}
1		0.12	0.12	<0.01 *	1		0.67	0.05	0.01 *
2	0.12		1.00	0.03 *	2	0.67		<0.01 *	<0.01 *
3	0.12	1.00		0.03 *	3	0.05	<0.01 *		0.93
4	<0.01 *	0.03 *	0.03 *		4	0.01 *	<0.01 *	0.93	
COM_Sh				Rel_H					
	{1}	{2}	{3}	{4}		{1}	{2}	{3}	{4}
1		1.00	<0.01 *	0.01 *	1		0.98	0.77	0.01 *
2	1.00		<0.01 *	0.02 *	2	0.98		0.52	<0.01 *
3	<0.01 *	<0.01 *		0.91	3	0.77	0.52		0.15
4	0.01 *	0.02 *	0.91		4	0.01 *	<0.01 *	0.15	
Shoulder_A				Shoulder_V					
	{1}	{2}	{3}	{4}		{1}	{2}	{3}	{4}
1		0.89	0.07	0.10	1		0.38	0.65	0.07
2	0.89		0.01 *	0.01 *	2	0.38		0.97	0.83
3	0.07	0.01 *		1.00	3	0.65	0.97		0.57
4	0.10	0.01 *	1.00		4	0.07	0.83	0.57	
Upper arm_V				Forearm_V					
	{1}	{2}	{3}	{4}		{1}	{2}	{3}	{4}
1		0.43	0.44	0.20	1		0.97	0.90	0.92
2	0.43		1.00	0.97	2	0.97		0.99	1.00
3	0.44	1.00		0.97	3	0.90	0.99		1.00
4	0.20	0.97	0.97		4	0.92	1.00	1.00	
Hor_D				Sh_T					
	{1}	{2}	{3}	{4}		{1}	{2}	{3}	{4}
1		1.00	<0.01 *	<0.01 *	1		<0.01 *	0.01 *	0.20
2	1.00		<0.01 *	<0.01 *	2	<0.01 *		<0.01 *	0.01 *
3	<0.01 *	<0.01 *		0.02 *	3	0.01 *	<0.01 *		<0.01 *
4	<0.01 *	<0.01 *	0.02 *		4	0.20	0.01 *	<0.01 *	

Table 3. Cont.

Arc				
	{1}	{2}	{3}	{4}
1		0.94	0.99	0.84
2	0.94		0.99	0.49
3	0.99	0.99		0.67
4	0.84	0.49	0.67	

* $p < 0.05$; Jump_H—height of the jump shot; COM_C—minimum center of mass during catch phase; COM_Sh—minimum center of mass during jump shot; Rel_H—maximum point of ball release; Shoulder_A—shoulder angle during ball release; Shoulder_V—highest shoulder velocity during jump shot; Upper arm_V—highest upper arm velocity during jump shot; Forearm_V—highest forearm velocity during jump shot; Hor_D—horizontal displacement; Sh_T—shot time; Arc—angle of ball entering the rim.

Figure 2 shows that participants performed highest shooting precision in CON4 and lowest in CON1. Additionally, the shooting precision was the same between CON2 and CON3.

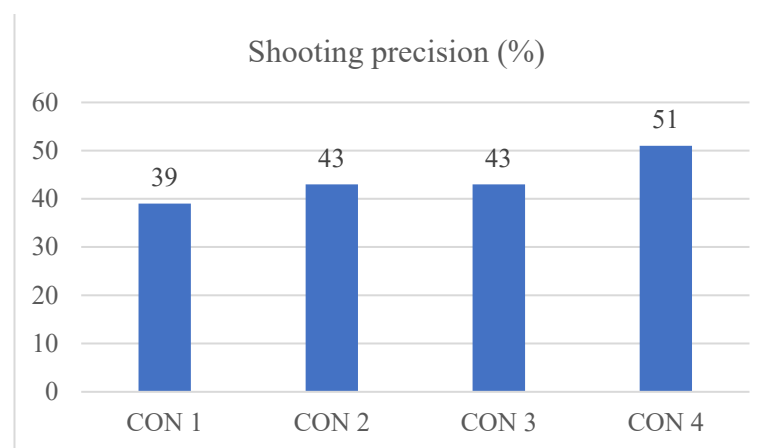


Figure 2. The shooting performance among each condition.

4. Discussion

The aim of this study was to investigate the influence of fatigue and defensive pressure on the kinematic parameters of the three-point jump shot in basketball. The results of this study provide valuable insights into the effects of fatigue and defensive pressure on the kinematic parameters of the three-point jump shot in basketball. Both factors significantly influenced various aspects of shooting mechanics, reinforcing the importance of considering these conditions in training and game preparation.

The fatigue protocol required maximal effort from the players, resulting in an average heart rate (HR) of 187.07 beats per minute (BPM) at the end of the test. The highest HR during shooting was observed in condition 4 (CON4), where players shot after reaching fatigue and faced a defensive player, with an average HR of 186.66 BPM. Previous studies reported that peak HR during live game situations can reach approximately 180 BPM [20,31], confirming that the fatigue levels induced in this test are comparable to those experienced in real-game scenarios.

4.1. Impact of Fatigue on Shooting Performance and Kinematic Adjustments

Fatigue had a pronounced effect on several kinematic parameters. Notably, the height of the jump increased in the fatigued conditions (CON3 and CON4), which contrasts with the expectation that fatigue would reduce physical output. This increase might be attributed to compensatory strategies employed by the players, who likely adjusted their mechanics to overcome the fatigue-induced decline in lower limb power. This adaptation is consistent with

previous research suggesting that athletes may alter their movement patterns under fatigue to maintain performance [32,33]. While fatigue generally reduces physical performance, the combination of adrenaline, increased focus, psychological pressure, and muscle compensation often leads players to jump higher in critical moments during a shot, especially when facing defensive pressure (CON4). Furthermore, when tired, players may activate core and upper body muscles more intensely to aid the jump. This finding highlights the need for coaches to design game-situational drills that help players adapt to fatigue and defensive pressure, which can minimize the decline in their performance.

Additionally, the reduction in shoulder angle and release height under fatigue indicates a biomechanical adjustment that may compromise shooting accuracy over time. Previous studies have suggested that a lower shoulder angle during the release phase reduces the optimal shooting arc, potentially decreasing shot success [34,35]. However, interestingly, our study found no significant decline in shooting percentage between CON3 (43%) and CON1 (39%). This may suggest that while the players altered their mechanics under fatigue, their familiarity with game-like fatigue conditions allowed them to maintain shooting accuracy.

4.2. Impact of Defensive Pressure on Shooting Performance and Kinematic Adjustments

Defensive pressure also led to notable changes in shooting mechanics. Players tended to release the ball more quickly and from a higher release point when a defender was present (CON2 and CON4) due to a psychological phenomenon [36]. These adjustments are likely an effort to avoid being blocked, as has been noted in prior research [15]. The quicker release time observed in the defensive conditions aligns with previous findings that suggest players adopt faster, more compact shooting motions when under pressure [37]. Despite these changes, the overall shooting success rate did not significantly differ between defensive and non-defensive conditions, possibly due to the relatively low defensive pressure in this study (the defensive player did not contact and jump to block the shooter) in this study. Additionally, it might indicate that the skilled players are able to effectively adapt their shooting techniques in response to defensive pressure.

4.3. Combined Effect of Fatigue and Defense

The most significant changes in kinematic parameters were observed in the condition combining both fatigue and defensive pressure (CON4). In this scenario, players demonstrated the highest jump height and maintained relatively high shooting accuracy (51%). The elevated jump height in CON4 may be a response to the combined challenge of fatigue and defense, with players likely using the extra elevation to counterbalance the defensive player's position. This finding underscores the adaptability of skilled players, who are capable of modifying their techniques to sustain performance under demanding conditions [38].

However, the reduction in horizontal displacement in CON4 suggests that while players were able to jump higher, their overall forward movement was constrained, likely due to fatigue. This could have implications for shot selection during games, where players may need to rely more on vertical movement when fatigued, particularly under defensive pressure.

4.4. Limitations

This study examined only a low level of defensive pressure, characterized by non-contact and without the defender jumping. In real-game situations, defensive pressure can vary significantly, including aggressive contact and active contesting of shots. Future research should explore a range of defensive intensities, including more dynamic and realistic defensive actions, to better understand how players' shooting mechanics are affected under varying degrees of pressure.

The study did not account for differences in players' skill levels, which may influence how they adapt to fatigue and defensive pressure. Elite and novice players may react differently to these conditions, with more experienced players potentially demonstrating

more effective compensatory mechanisms. Future studies should include participants from various skill levels to determine how playing experience impacts shooting mechanics under fatigue and defensive pressure.

4.5. Practical Implications

The findings of this study emphasize the importance of training under game-like conditions that replicate the combined effects of fatigue and defensive pressure. Coaches should consider incorporating drills that simulate these scenarios to help players develop strategies for maintaining shooting accuracy and efficiency under stress. Additionally, the use of kinematic analysis tools, as demonstrated in this study, can offer coaches a more objective method for evaluating and refining shooting mechanics.

5. Conclusions

This study demonstrates that both fatigue and defensive pressure significantly influence the kinematic parameters of the three-point jump shot. Players exhibit various compensatory strategies, such as increased jump height and altered release mechanics, to maintain performance under these conditions. The obtained information can provide critical insight for the development and monitoring of training. Specifically, the findings highlight the importance of incorporating fatigue and defensive scenarios in training, suggesting that coaches develop more targeted training plans to improve performance under conditions of fatigue and defensive pressure.

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

Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors on request.

Conflicts of Interest: The authors declare no conflicts of interest.

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