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Inter-player Variability Within the Same Positional Status in High-level Men's Volleyball
Variabilidad entre jugadores dentro del mismo estado posicional en voleibol masculino de alto nivel

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Abstract. In sports, there may be multiple players for the same positional status (e.g., in volleyball, there are two outside hitters, one near the setter and the other away from the setter), and there may be relevant differences within the same positional status. We analyzed inter-player variability within the same positional status in high-level men's volleyball, through Social Network Analysis (through Gephi© 0.9.2 software). Attack actions of the outside hitters near (OHN) and away (OHA) from the setters were analyzed in ten matches from the 2019 Volleyball Nations League Finals (278 plays). Two Eigenvector Centrality networks were created. Results: (a) in side-out under non-ideal setting conditions, OHNs preferred the strong attack while OHAs alternated between the strong attack and the tip; (b) after a prior action, OHNs attacked via exploration of the block while OHAs preferred the tip; (c) after consecutive errors, OHNs play more in the opponent's error; (d) after a previous defense action, OHNs preferred the strong attack and exploration of the block while OHAs preferred the strong attack; (e) in transition, OHNs were solicited under non-ideal setting conditions while OHAs were solicited in ideal and non-ideal conditions. Our findings demonstrate variability between players of the same team and having the same positional status. This allows coaches to understand the key differences of players with the same position, and thus better assign the sub-functions. Researchers should be cautious of aggregating data from players of different positional status, and even from players within the same positional status.
Keywords: performance analysis; match analysis; variability; team sports; game patterns.

Resumen. En los deportes, puede haber varios jugadores para el mismo estado posicional (por ejemplo, en voleibol, hay dos bateadores externos, uno cerca del colocador y el otro lejos del colocador), y puede haber diferencias relevantes dentro del mismo estado posicional. Analizamos la variabilidad entre jugadores dentro del mismo estado posicional en voleibol masculino de alto nivel, a través del Análisis de Redes Sociales (a través del software Gephi© 0.9.2). Las acciones de ataque de los bateadores externos cerca (OHN) y fuera (OHA) de lo colocador se analizaron en diez partidos de las Finales de la Liga de Naciones de Voleibol 2019 (278 jugadas). Se crearon dos redes de centralidad de vectores propios. Resultados: (a) en el lado hacia afuera en condiciones de ajuste no ideales, los OHN preferían el ataque fuerte, mientras que los OHA alternaban entre el ataque fuerte y la punta; (b) después de una acción previa, los OHN atacaron a través de la exploración del bloque, mientras que los OHA prefirieron la punta; (c) después de errores consecutivos, los OHN juegan más en el error del oponente; (d) después de una acción de defensa previa, los OHN preferían el ataque fuerte y la exploración del bloque, mientras que los OHA preferían el ataque fuerte; e) en transición, se solicitaron OHN en condiciones de colocación no ideales, mientras que las OHA se solicitaron en condiciones ideales y no ideales. Nuestros hallazgos demuestran la variabilidad entre jugadores del mismo equipo y que tienen el mismo estado posicional. Esto permite a los entrenadores comprender las diferencias clave de los jugadores con la misma posición y, por lo tanto, asignar mejor las subfunciones. Los investigadores deben tener cuidado al agregar datos de jugadores de diferente estado posicional, e incluso de jugadores dentro del mismo estado posicional.
Palabras clave: análisis del rendimiento; análisis de partidos; variabilidad; deportes de equipo; patrones de juego.

Introduction

In team sports, Match Analysis (MA) refers to the processes of recording game actions in real performance contexts (Hughes & Franks, 2008). MA has a key role in structuring information and supporting the development of players (Butterworth et al., 2013). Several studies using MA have investigated variability in the performance of teams competing at different competitive levels (Méndez et al., 2019; Yi et al., 2019) as well as within the same competitive level (Castelão et al., 2015; Laporta et al., 2021). Other studies have provided evidence of performance variability as a function of player positional status. Such studies have focused on the demands of the various positional statuses in soccer (Clemente et al., 2020; Gonçalves et al., 2014; Moura et al., 2015) and the tactical-technical performances of the various positional statuses (Liu et al., 2016).

Studies on variability between players with different positional statuses have revealed specificities in movement behaviors between defenders, midfielders, and forwards (Gonçalves et al., 2014). Specifically, all players were closer and more coordinated with their centroid of positional status, although this coupling effect was

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strongest in the midfielders and weakest in forwards. In football, research has studied the organization of teams during competition, with differences being identified between midfielders and defenders (Moura et al., 2015). Liu et al. (2016) has identified inter-positional differences in football technical performance. Notably, defenders had more attacking and pass-related actions, midfielders had greater relational organization, and forwards were superior in attack actions. Finally, a recent study by Clemente et al. (2020) has shown inter-positional variability in the performance of pass actions in football.

Some sports, including volleyball and football, have more than one player per positional status (i.e., two outside hitters and two middle blockers). Consequently, for these sports, it is possible to study variability in performance between players with the same positional status. While studies have considered variability in players of different positional statuses, research on inter-player variability within the same positional status or function is scarce. In addition, there are game scenarios where inter-player positional variability may be of greater interest, such as critical game moments, which correspond to instants that may change the state of the game (such as unbalances in score) at specific intervals of time of the game, and that have a greater impact on the outcome and the final action of the player and the game (Ferreira et al., 2014).

The volleyball becomes a collective modality with an ecological and systemic game approach, as it presents a systematization of game logic, with a sequence of game complexes (K's). Existing literature has evolved in the mapping of game actions and game complex's (Costa et al., 2012; Laporta et al., 2015; Martins et al., 2021), defending an approach such as the following: complex 0 corresponds only to the serve action, while complex I (side-out) stands out for the reception to the serve, setting and attack. While complex II (side-out transition) consists of block, defense and counterattack, complex that presents itself with a strong connection with complex 0 and I. Already, complex III corresponds to the transition, also block-defense-counterattack. Complex IV (attack cover) and KV and KIV, correspondingly freeball and downball are also counter-attacking aspects from the block bounce or from the defense of a ball with less difficulties and its counterattack.

In this line, volleyball becomes a sport with its own internal logic, which has walked in an evolution game sense as well as in science regarding the performance variability. The investigation on inter-player variability has focused on the differences between positional status in football (Clemente et al., 2020; Gonçalves et al., 2014; Moura et al., 2015),, however in volleyball, few studies address the issues of inter-team and inter-player variability (Laporta et al., 2021; Martins et al., 2022; Martins et al., 2021). Laporta et al. (2021) in its research into inter-team variability within the same competitive level, the main objective was to understand how different models of play can coexist at the same competitive level in women's volleyball. In the studies of Martins et al. (2021; 2022) advocated an identical approach to understand the variability between selections under non-ideal setting conditions and also between players of the same position, in men's and women's volleyball correspondingly, because there may be a subtle variability between players within a single positional state.

Social Network Analysis (SNA) is an appropriate tool that provides a systemic view of game patterns (Wäsche et al., 2017) and allows studying inter-team variability in match analysis because it offers an understanding of the interactions between relevant variables. This tool allows a map of inter- and intra-system connections (Walter et al., 2007), allowing the creation of networks that expose relationships between variables of interest (Boulding et al., 1956). For example, game actions are an integral part of the game complexes and as such correspond to a node and they make connections with another game action, which makes a connection, and then the weight of each variable and its influence on the volleyball game of the teams are then calculated. In this regard, Eigenvector Centrality is one of the types of centrality and has the benefit of weighting direct connections based on their indirect connections (Bonacich, 2007). This method has been applied successfully to volleyball (Hurst et al., 2016; Laporta et al., 2019), and has shown to be suitable for analyzing the relationships between game actions. In summary, the overall objective of this study was to assess variability in performance between players of the same position status during critical game moments. We investigated the context of elite-level men's volleyball, using SNA.

Material and methods

Participants

We analyzed 10 matches (35 sets) from the final phase of the 2019 men's Volleyball Nations League (VNL), which involved the national teams from Russia, the USA, Poland, Brazil, Iran, and France. We examined 258 plays in 'critical moments' with the outside hitter (near vs. away). All actions analyzed were only specifically of this position, both holders and non-holder's players. We defined critical moments as the attack from 16 points (from the 1st to the 4th sets) or 10 points (only in the 5th set) (Marcelino et al., 2011). The present study was approved by the Ethics Committee at the Centre of Research, Education, Innovation, and Intervention in Sport of the University of Porto (09 2020 CEFADE).

Measures

Study variables are presented in Table 1. Volleyball presents several game phases, defined as game complexes (Hurst et al., 2016; Laporta et al., 2019). Volleyball is organized in seven interdependent game complexes with distinct game flow characteristics (Hurst et al., 2016): Complex 0 (K0) or serve, Complex I (KI) or side-out, Complex II (KII) or side-out transition, Complex III (KIII) or transition, Complex IV (KIV) or attack coverage, Complex V (KV) or freeball, and Complex VI (KVI) or downball. We chose not to analyze K0 because our analysis focused on attack actions. Figure 1 illustrates the cycle of actions within the volleyball game and the game complexes where they occur.

The independent variable for this study was *function of the attacker*: (Millán-Sánchez et al., 2017): outside hitter near the setter (OHN) and outside hitter away from the setter (OHA). In KI to KVI, the following dependent variables were studied:

(a) *Setting conditions* (Laporta et al., 2018a): (i) all attack options available (SCA), (ii) quick game, but no combined moves available (SCB), and (iii) only attackers from the extremities or background court available (SCC).

(b) *Attack zone/Combination* (AZ/Comb) (Data Volley, 2019): (i) quick tempo in Z4 (CombX4), (ii) high tempo in Z4 (CombV4), (iii) quick tempo in Z2 (CombX2), and (iv) high tempo in Z2 (CombV2).

(c) *Action preceding the attack* (pa): (i) receiving or defending (Awpa), and (ii) no prior action – without receiving or defending (Anpa).

(d) *Type of attack* (TpA) (Data Volley, 2019): (i) strong attack (TpSA), (ii) directed attack (TpDA), (iii) tip (TpTip), and (iv) exploration of the block (TpExpB).

(e) *Effect of previous attacks* (pAE/pTE): (i) no error (AaNOE), (ii) one previous same attacker error (1psAE), (iii) two previous errors of the same attacker (2psAE), (iv) one previous team error (1pTE), (v) two previous team errors (2pTE), and (vi) loss of three consecutive points (Aa3PC).

(f) *Distance of the attacker to the net* (An): (i) close to the net, from the net until 2.5 m (ACn), (ii) far from the net, from 2.5 m to end of the court (AAn).

(g) *Attack efficacy* (AE) (Data Volley, 2019): (i) perfect (AE#), (ii) positive (AE+), (iii) exclamatory (AE!), (iv) negative (AE-), (v) poor (AE/), and (vi) error (AE=).

(h) *Block opposition* (BOp) (adapted from Costa et al., 2014): (i) without blockers (B0), (ii) simple block (B1), (iii) double block (B2), and (iv) triple block (B3).

Design and Procedures

We developed a spreadsheet in Microsoft Excel 2018 for Windows (Microsoft Office 365 ProPlus, EUA) that included «Macros» controls to list the necessary codes into appropriate cells. Data collection was achieved in a timeline comprising the whole game actions system with the individual complex preceding the variable. Three of the authors, with more than five years' experience of practice in volleyball training, were trained to use this instrument. We conducted two reliability tests, the first after four months of testing the instrument and the second five months later, to ensure consistency when applying the criteria. During the months of training, weekly conferences were

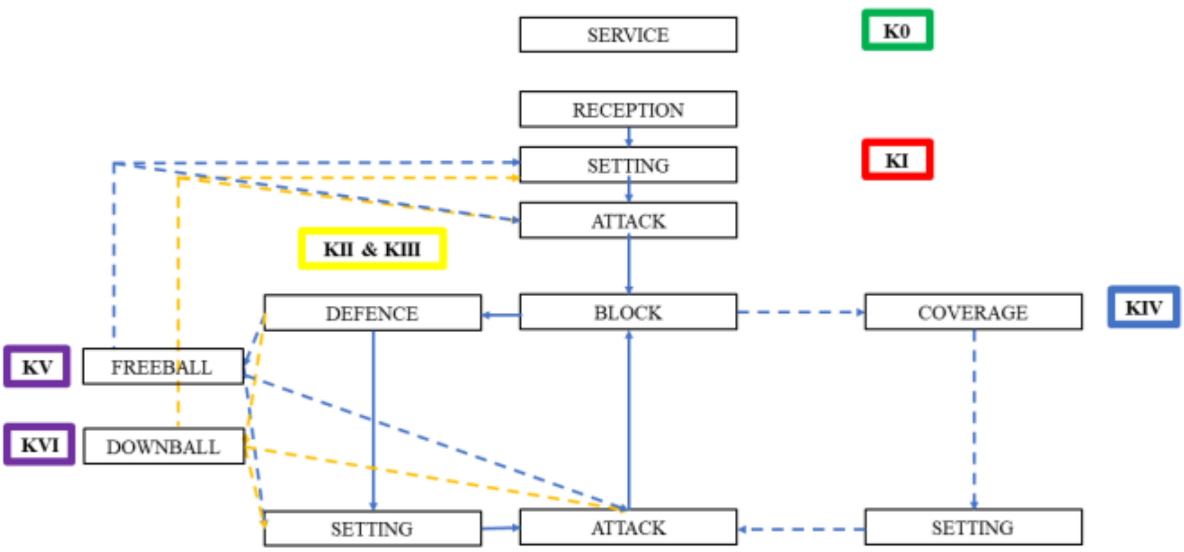

Figure 1. The seven functional game complexes of volleyball

Table 1.
Synthesis of variables and categories

Variables	Category/Description		Complex
	Game actions		
Function of the attack player (FNC)	Outside hitter near setter (OHN)	Outside hitter away setter (OHA)	KI to KVI
Setting Conditions (SC)	A (SCA) B (SCB)	C (SCC)	KI to KVI
Attack Zone/Combination (AZ/Comb)	X4 (CombX4) V4 (CombV4)	X2 (CombX2) V2 (CombV2)	KI to KVI
Action preceding the attack (pa)	With previous action (Awpa)	No prior action (Anpa)	KI to KVI
Type of attack (TpA)	Strong attack (TpSA) Directed attack (TpDA)	Tip (TpATip) Exploration of the block (TpAExpB)	KI to KVI
Effect of previous attacks (pAE/pTE)	No error (AaNOE) 1 previous same attacker error (1psAE) 2 previous errors of the same attacker (2psAE)	1 previous team error (1pTE) 2 previous team errors (2pTE) Loss of 3 consecutive points (Aa3PC)	KI to KVI
Distance of the attacker to the net (An)	Away from the net (AAn)	Close to the net (ACn)	KI to KVI
Attack Efficacy (AE)	#: Perfect (AE#) +: Positive (AE+) !: Exclamatory (AE!)	-: Negative (AE-) /: Poor (AE/) =: Error (AE=)	KI to KVI
Block opposition (BOp)	No Blockers (B0) Simple block (B1)	Double block (B2) Triple block (B3)	KI to KVI

held to respond to queries and resolve emerging issues. Matches were analyzed after being recorded in high definition (1080p) from the end of the court. The first inter-reliability test was part of an exploratory study of a play-off in the 2018/2019 Portuguese championship (Martins et al., 2021). Cohen's kappa values for all variables were above 0.75 (range: 0.774 to 0.997). Due to the extent of the tool and some redundancy among items, we applied a simplified version.

A second inter-observer reliability test was performed using two high-level women's matches (2018/2019 quarterfinals CEV Challenge Cup and 2018/2019 final of the Brazilian Women's Superliga, $n = 8$ sets), with a total of 134 plays. We performed the third test of reliability with 159 plays from two matches of the 2018/2019 final of the Brazilian Men's Superliga, totaling nine sets. In all tests of inter-observer reliability, the variables had kappa values greater than 0.75 (Fleiss et al., 2013). The inter-observer reliability for the present study was assessed using 10% of the total sample (26 plays; Tabachnick and Fidell, 2007). The calculated kappa values ranged from .989 to .999, which surpassed the recommended threshold of .75 typically presented in the literature (Fleiss et al., 2013).

Statistical Analysis

Data collection was performed using an instrument created in Microsoft Excel 2018, and analyzed using SPSS for Windows (version 26, IBM®, USA). This included a descriptive analysis to identify potential errors, followed by a cross-tabulation analysis. Next, SNA was used to analyze inter-player variability. In SNA, interaction networks analyze the degree of connection and specificity in the different phases of a game, thus helping to identify the most influential actions in the flow of the game (Wäsche et al., 2017). SNA captures networks of relationships, visually translated into nodes interconnected by edges (Borgatti, 2005). Although the most widely used measure in SNA is Degree Centrality (Gama et al., 2014; Mclean et al., 2018), Eigenvector Centrality (EC) has the advantage of also weighting direct connections based on their indirect connections (Bonacich, 2007). Moreover, while it is common for studies using MA to center SNA around the behaviors of individual players (Ribeiro et al., 2017), it is possible to apply the same tools to analyze relationships between game actions, sequences, and game complexes, which has a rich recent history in volleyball (Hurst et al., 2016; Laporta et al., 2018a, 2018b, 2019).

Gephi© 0.9.2 software was used to create directed networks and analyze the connections and their weights using EC. First, variables (game actions) were divided into each game complex sequentially based on the game events in volleyball, with each game action identified as a node. Next, using Gephi, direct and indirect connections between the nodes were calculated, and thus the weight of the variables and their influence in the game were calculated at critical moments. For example, attack zone appears concurrently with type of attack, so categories of the attack zone determine connection with the attack type. Though, attack zone is moved by setting conditions and followed by block opposition, thus it results in new direct connections to these two variables (Martins et al., 2022). The node sizes were manipulated, differing from a value of 100 and 300, to provide a good graphic difference. These values are an arbitrary and relative measure. The size of a node represents the degree of visual contrast between variables, while the edges between nodes correspond to the variable thickness to better reflect the values of EC (Bonacich, 2007). Thus, SNA can be applied to explain the complex dynamics of the game actions in critical moments within each game phase, and to highlight the decisive role of each node (Martins et al., 2021).

Results

We created an interaction network using Eigenvector Centrality (Figure 2 - 3) for each OH position. For each network, complexes were organized by color: KI (red), KII (green), KIII (purple), KIV (yellow), KV (grey), and KVI (orange). In total, there were 219 nodes (OH near = 109 and OH away = 110) and 1510 edges (OH near = 745 and OH away = 765) across both networks (Table 2).

We observed several major differences between OHNs and OHAs. First, when there were non-ideal setting conditions in KI, OHNs tended to prefer the strong attack while OHAs alternated between the strong attack and the tip. Second, when there was an action preceding the attack in side-out (KII), OHNs tended to use exploration of the block while OHAs were most likely to use the tip. Third, after consecutive errors in KI, OHNs sought to play to the opponent's error with a directed attack while OHAs sought the strong attack. Fourth, OHNs were able to attack in Z2 when playing near the setter while OHAs were not. The attacks of the OHNs were typically with a quick attack tempo in SCA and high ball attack in SCC, with most being a strong attack (alternating with tip and directed attacks). Fifth, regardless of the prior defense action, in KII OHNs were more likely to use the strong attack (with quick ball attack) and exploration of the block (with high ball attack), while OHAs typically only used the strong attack. Sixth, OHNs were mainly confronted with a double or triple block opposition in KII while OHAs were only confronted with a double block. Seventh, in KIII (despite low occurrence) OHNs were requested under non-ideal setting conditions while the OHAs were requested in both ideal and non-ideal conditions. Moreover, with SCC conditions in KIII OHNs only presented high attack tempos through the strong attack, while OHAs alternated between the tip and directed attack. Eighth, OHNs presented quick attack tempos (due to ideal setting conditions) in the attack coverage (KIV), while OHAs only presented high attack tempos. Finally, in KV, OHNs used quick ball attacks while OHAs used high ball attacks.

Several similarities in inter-player game patterns were also identified. First, both positional statuses (OHN and OHA) were generally requested in KI when there were ideal setting conditions. Also, in KI, with SCA and SCB most attacks were strong attacks with a quick attack tempo on Z4. Second, after a prior reception action, OHNs and OHAs both tended to use a strong attack. Third, in KII, both positional statuses were typically requested under non-ideal setting conditions, and both used high attack tempos. Fourth, under ideal setting conditions in KII,

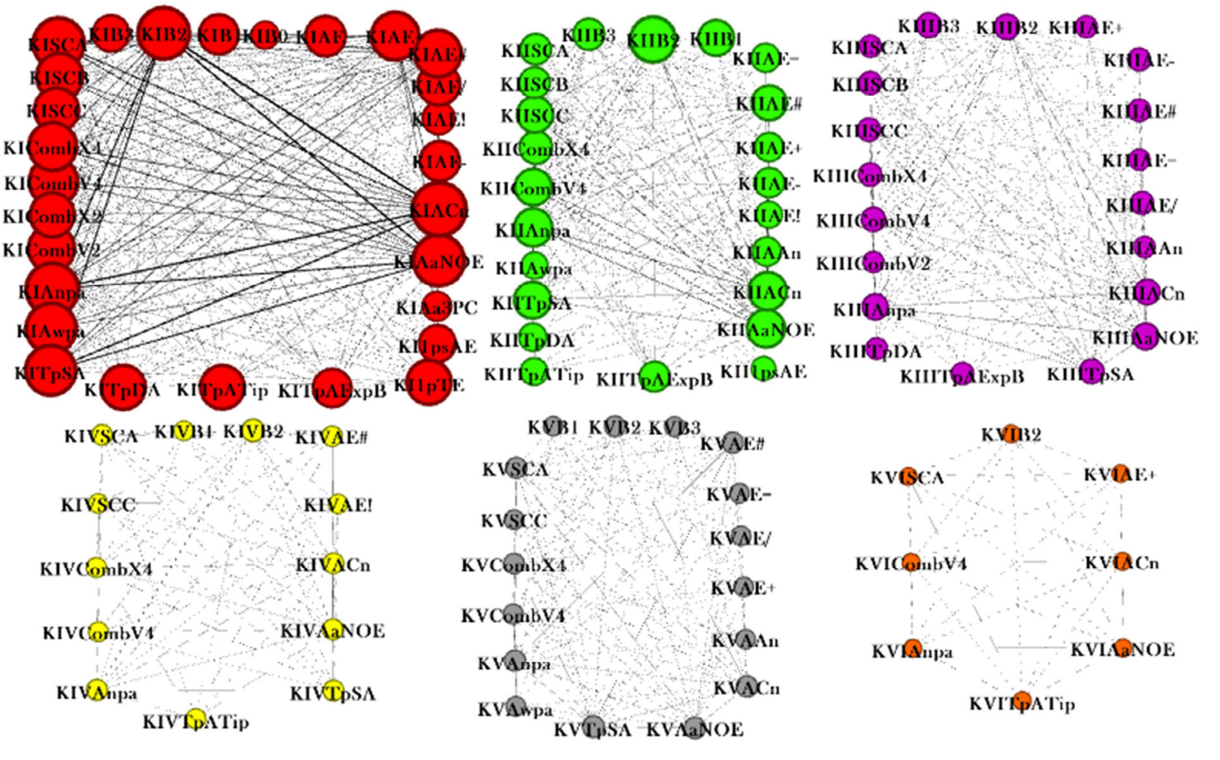

Figure. 2. Outside Hitter Near, with Eigenvector Centrality.
Terminology: On each node, the codes are represented by the name of the complex, followed by the variable and its category. The codes for the different variables are: FNC – function of the attacker; SC – setting conditions; Comb – attack zone/combinations; pa – action preceding the attack; TpA – type of attack; pAE/pTE – effect of previous attacks; An – distance of the attacker to the net; AE – attack efficacy; and BOp – block opposition.

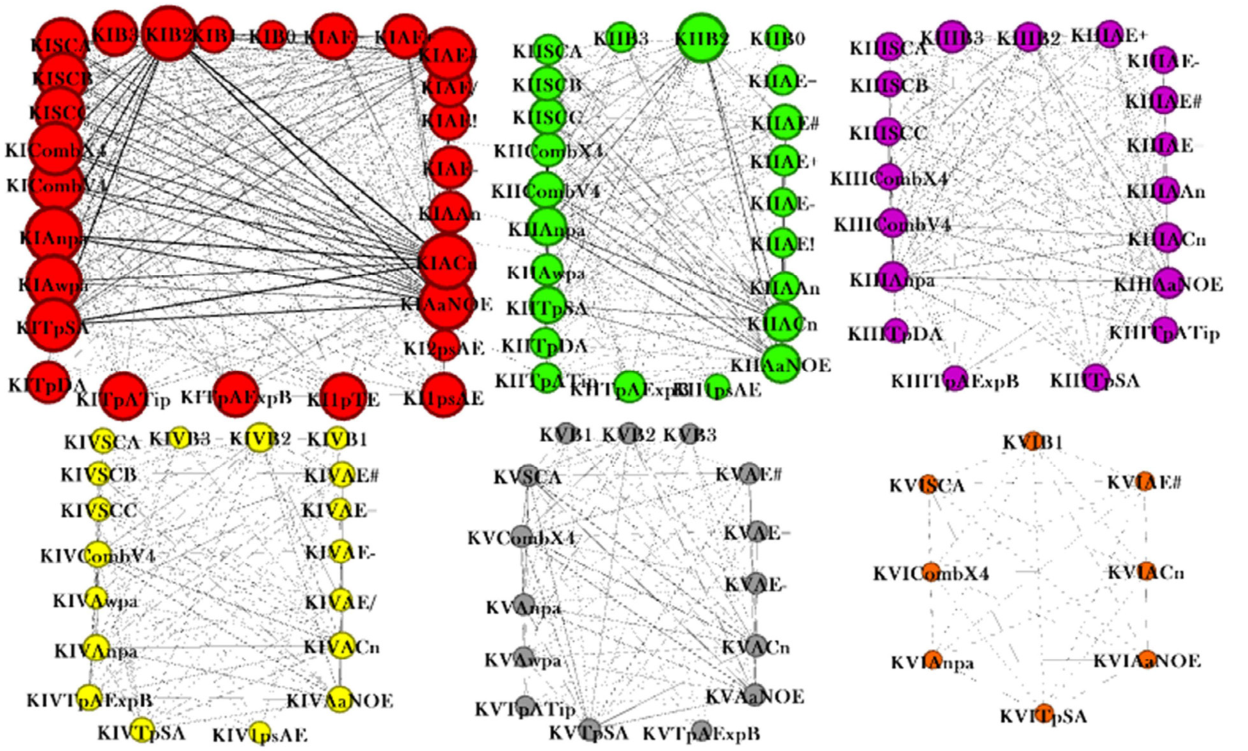

Figure. 3. Outside Hitter Away, with Eigenvector Centrality.
Terminology: Please consult the legend of Figure 2.

OHNs and OHAs both tended to search for quick tempos and a strong attack. Fifth, both positional statuses mostly used the directed attack and exploration of the block in KII. Also, in KII, OHNs and OHAs both tended to attack close to the net and with little prior action. Sixth, neither OHNs nor OHAs were requested to a great extent in KIII. Seventh, in KIV the strong attack was predominant for both positions, and both displayed high efficacy in this attack despite the opposition of the block (double and triple). Eighth, both positional statuses showed a preference for the strong attack, and were efficient at it, in freeball and downball. Finally, most attacks by OHNs and OHAs across complexes faced a double block opposition.

Discussion

Research on inter-player variability has focused on differences between positional statuses, and most have been on football (Clemente et al., 2020; Gonçalves et al., 2014; Moura et al., 2015). Inter-player variability associated with the same player role is an important topic deserving further consideration. This study aimed to analyze inter-player variability within the same positional status (outside hitter near vs. outside hitter away), in high-level men's volleyball, during critical game moments. We created two networks, through eigenvector centrality. These presented differences and similarities in the way the game is approached between OHNs and OHAs at critical moments.

We identified key differences as a function of positional status. In KI, under non-ideal setting conditions, OHNs were more likely to use the strong attack while the OHAs alternated between the strong attack and the tip, following the investigation of Martins et al. (2022). As advocated by Laporta et al. (2019), this is probably because OHNs are usually the more powerful outside hitters. During side-out, OHNs were able to attack through exploration of the block after having performed a previous action, while OHAs typically used the tip. This finding is based on the ideia that the OHA has greater control and security over other players (Lima et al., 2019). In KII, the strong attack (with quick tempos) and exploration of the bock (with slow tempos) were central for OHNs, while OHAs only used the strong attack. Further, after consecutive OH errors in KI, OHNs typically presented a game in the opponent's error (as defended by Mesquita et al., 2013) via the directed attack, as shown by Lima et al. (2019). In contrast, OHAs sought the strong attack. In KIV, we found that OHNs presented quick attack tempos, due to ideal setting conditions, while OHAs presented only high attack tempos, probably to achieve greater safety in the game and to play on the opponent's error (Laporta et al., 2018a).

The study revealed similarities between OHAs and OHNs. Firstly, both positional statuses were requested in KI under ideal setting conditions, with quick attack tempos on Z4, and mostly using the strong attack (Laporta et al., 2019). When a double action preceded the attack (e.g., re-

Table 2.
Outside hitter near and outside hitter away Eigenvector Centrality values for Complex:

Complex	Variables	Eigenvector Centrality values	
		Outside Hitter Near	Outside Hitter Away
KI	Setting conditions (SC)	SCA (0.874); SCB (0.777); SCC (0.694)	SCA (0.853); SCB (0.767); SCC (0.738)
	Attack Zone/Combination (Cmb)	CombX4 (0.775); CombV4 (0.881); CombV2 (0.622); CombX2 (0.660)	CombX4 (0.909); CombV4 (0.892)
	Action preceding the attack (pa)	Anpa (0.957); Awpa (0.942)	Anpa (0.918); Awpa (0.794)
	Type of attack (TpA)	TpSA (0.911); TpDA (0.618); TpATip (0.646); TpAExpB (0.613)	TpSA (0.866); TpDA (0.655); TpATip (0.698); TpAExpB (0.429)
	Effect of previous attacks	AaNOE (0.921); 1psAE (0.615); 1pTE (0.616); 2pTE (0.254); Aa3PC (0.442)	AaNOE (0.877); 1psAE (0.568); 1pTE (0.619); 2pTE (0.378)
	Distance of the attacker to the net (An)	ACn (0.994); AAn (0.456)	ACn (0.932); AAn (0.526)
	Attack efficacy (AE)	AE# (0.802); AE+ (0.778); AE/ (0.750); AE- (0.703); AE! (0.428); AE= (0.561)	AE# (0.741); AE+ (0.748); AE/ (0.673); AE- (0.664); AE! (0.478); AE= (0.625)
	Block opposition (BOp)	B0 (0.262); B1 (0.629); B2 (0.894); B3 (0.629)	B1 (0.612); B2 (0.949); B3 (0.486)
KII	Setting conditions (SC)	SCA (0.444); SCB (0.573); SCC (0.713)	SCA (0.434); SCB (0.533); SCC (0.544)
	Attack Zone/Combination (Cmb)	CombX4 (0.521); CombV4 (0.709); CombV2 (0.358)	CombX4 (0.497); CombV4 (0.641)
	Action preceding the attack (pa)	Anpa (0.725); Awpa (0.317)	Anpa (0.723)
	Type of attack (TpA)	TpSA (0.655); TpDA (0.515); TpATip (0.406); TpAExpB (0.438)	TpSA (0.589); TpDA (0.447); TpATip (0.434); TpAExpB (0.395)
	Effect of previous attacks	AaNOE (0.723); 1psAE (0.359)	AaNOE (0.694); 1psAE (0.261); 1pTE (0.265)
	Distance of the attacker to the net (An)	ACn (0.677); AAn (0.456)	ACn (0.643); AAn (0.458)
	Attack efficacy (AE)	AE# (0.634); AE+ (0.556); AE/ (0.440); AE- (0.399); AE! (0.154)	AE# (0.587); AE+ (0.480); AE/ (0.329); AE- (0.412); AE! (0.259); AE= (0.244)
	Block opposition (BOp)	B0 (0.482); B1 (0.468); B2 (0.99); B3 (0.390)	B1 (0.047); B2 (0.99); B3 (0.249)
KIII	Setting conditions (SC)	SCA (0.254); SCB (0.193); SCC (0.270)	SCA (0.164); SCB (0.176); SCC (0.224)
	Attack Zone/Combination (Cmb)	CombX4 (0.190); CombX2 (0.155); CombV4 (0.258); CombV2 (0.201)	CombX4 (0.187); CombV4 (0.245)
	Action preceding the attack (pa)	Anpa (0.356)	Anpa (0.284)
	Type of attack (TpA)	TpSA (0.304); TpDA (0.223); TpATip (0.210); TpAExpB (0.162)	TpSA (0.212); TpDA (0.181); TpATip (0.183)
	Effect of previous attacks	AaNOE (0.378); 1psAE (0.135)	AaNOE (0.301)
	Distance of the attacker to the net (An)	ACn (0.344); AAn (0.188)	ACn (0.267); AAn (0.112)
	Attack efficacy (AE)	AE# (0.257); AE+ (0.149); AE/ (0.185); AE- (0.223); AE! (0.154); AE= (0.089)	AE# (0.179); AE+ (0.125); AE/ (0.180); AE- (0.189)
	Block opposition (BOp)	B0 (0.114); B1 (0.131); B2 (0.336); B3 (0.285)	B0 (0.125); B1 (0.158); B2 (0.247); B3 (0.223)
KIV	Setting conditions (SC)	SCA (0.157); SCB (0.194); SCC (0.131)	SCA (0.196); SCB (0.414); SCC (0.182)
	Attack Zone/Combination (Cmb)	CombX4 (0.219); CombX2 (0.100); CombV2 (0.138)	CombX4 (0.196); CombV4 (0.289)
	Action preceding the attack (pa)	Anpa (0.259)	Anpa (0.280); Awpa (0.162)
	Type of attack (TpA)	TpSA (0.208); TpDA (0.131); TpATip (0.165); TpAExpB (0.146)	TpSA (0.226); TpDA (0.160); TpAExpB (0.136)
	Effect of previous attacks	AaNOE (0.252)	AaNOE (0.289)
	Distance of the attacker to the net (An)	ACn (0.245); AAn (0.101)	ACn (0.289)
	Attack efficacy (AE)	AE# (0.230); AE+ (0.131); AE/ (0.096); AE- (0.101)	AE# (0.196); AE+ (0.189); AE/ (0.139); AE- (0.143); AE! (0.133)
	Block opposition (BOp)	B1 (0.100); B2 (0.366)	B2 (0.414); B3 (0.168)
KV	Setting conditions (SC)	SCA (0.062)	SCA (0.047); SCB (0.047); SCC (0.043);
	Attack Zone/Combination (Cmb)	CombX4 (0.052); CombX2 (0.037)	CombX4 (0.060); CombV4 (0.043)
	Action preceding the attack (pa)	Anpa (0.052); Awpa (0.037)	Anpa (0.081)
	Type of attack (TpA)	TpSA (0.051); TpATip (0.038); TpAExpB (0.040)	TpSA (0.060); TpDA (0.043)
	Effect of previous attacks	AaNOE (0.062)	AaNOE (0.081)
	Distance of the attacker to the net (An)	ACn (0.062)	ACn (0.081)
	Attack efficacy (AE)	AE# (0.052); AE/ (0.037)	AE# (0.047); AE/ (0.047); AE- (0.043)
	Block opposition (BOp)	B1 (0.038); B2 (0.055)	B1 (0.047); B2 (0.047); B3 (0.043)
KVI	Setting conditions (SC)	SCA (0.018)	SCA (0.022)
	Attack Zone/Combination (Cmb)	CombX4 (0.018)	CombX4 (0.022)
	Action preceding the attack (pa)	Anpa (0.018)	Anpa (0.022)
	Type of attack (TpA)	TpSA (0.018)	TpATip (0.022)
	Effect of previous attacks	AaNOE (0.018)	AaNOE (0.022)
	Distance of the attacker to the net (An)	ACn (0.018)	ACn (0.022)
	Attack efficacy (AE)	AE# (0.018)	AE! (0.022)
	Block opposition (BOp)	B0 (0.018)	B2 (0.022)

ception), OHNs and OHAs were both more likely to use a strong attack, confirming the study of Lima et al. (2019). Neither positional status was requested much in KII after a previous action. Both OHA and OHN were mostly requested in ideal setting conditions and with high attack tempos, possibly to develop better security and gameplay through the error of the opponent's team (Afonso et al., 2017). In all complexes, most attacks of the OHNs and OHAs faced a double block, consistent with what has been described by Stamm et al. (2016). Lastly, in KV and KVI both positional statuses were, as expected, submitting low difficulties in setting condition, performing in ideal setting conditions, and via quick attack tempos. Past research highlights the need for coaches to develop non-ideal setting conditions (Hurst et al., 2016; Laporta et al., 2018a). We argue that it is important to accurately characterize each stage of the game in the training process, creating exercises with increased pressure in the task (for example, in exercises with non-ideal setting conditions or with error management in attack) and at the moment (for example, with the use of conditioning with the marker) to improve the ecology of the game. Moreover, these results strengthen the idea that training, even in the base training of the young athlete, coaches should consider the individual characteristics for building a dynamic game model, rather than trying to force a generic performance model (Martins et al., 2022; Vargas et al., 2018).

Conclusions

With this investigation, we conclude that this type of analysis is essential for two reasons: (i) it highlights both the similarities and differences between players with the same positional status; and (ii) it shows more similarities than differences between male outside hitters with different sub-functions. Our findings have implications for coaches, for example, understanding the main differences between variations within the same positional statuses allows coaches to better assign players to sub-functions. With this knowledge, coaches will better decide which players are the most appropriate to use in a safety-related positional status (e.g., OHA), as well as to better prepare players for game constraints (Laporta et al., 2018b; Martins et al., 2021). Our results provide an important contribution to the performance analysis literature, indicating that there is relevant inter-player variability within the same positional status in game scenarios of high pressure. As limitations of our study, we highlight: (i) an inter-player analysis with comparison between the different teams simultaneously, to compare different game models between each country and game philosophy; (ii) missing, a comparative analysis based on the ideal and non-ideal setting conditions of all players (outside-hitter, middle-blocker and opposite); (iii) and/or an increase in sample extension for the group phase as well. As future, this theme can follow an analysis of the inter-position variability, using full games (without limitation of critical moment) or else analyze intra-team variability comparing men and women.

Declaration of interest

None

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