Original Article

Reception and performance in high level male volleyball: A relational study

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ABSTRACT

The aim of this study was to know the association of the reception zone on the performance of the reception of the high-performance male volleyball teams, considering the impact of rotation. The sample consist of 4223 KI sequences, belonging to 29 men's matches of world national teams of the highest level played between 2012 and 2016. The 3 main variables were: the rotation of the team in reception; the reception area; and the reception performance. For data analysis, Pearson's Chi-square analysis has been used to determine the influence of rotation in the reception area, and ordinal regression models to determine the influence of the reception area and the interaction of rotation on the reception performance. The level of significance was set at $p = .05$. Results showed differences in the distribution of the serve depending on the team's rotation ($p < .001$; $V = 0.123$). Significant relationships and interactions were also found between the rotation of the equipment and the reception area, that allow us to understand the greater or lesser probability of achieving a better reception performance ($p < .001$). In conclusion, the reception area is associated with the rotation of the team, which seems to be related to tactical decisions during the serve of the rival team. Furthermore, the reception performance is different depending on the rotation of the equipment, the reception area, and the interaction between both variables.

Keywords: Sport performance; Side out; Rotation; Reception zone; Serve.

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INTRODUCTION

Volleyball is a sport characterized by having a sequential and cyclical structure (Carrero, Fernández-Echeverría, González-Silva, Conejero, & Moreno, 2017; João & Pires, 2015; Molina & Salas, 2009; Palao, Santos, & Ureña, 2004a; Stutzig, Zimmermann, Büsch, & Siebert, 2015), in a continuous transition between defence and attack (Beal, 1991), which generates different structured phases of play, also called complexes. This particular structure facilitates the study of the game. One of the most analysed aspects is the relationship between the performance of the complex with situations that present similar initial contexts, allowing to find predictive factors of the performance of the complex (Costa et al., 2018; Mesquita, Palao, Marcelino, & Afonso, 2013). Although we must understand that these predictive relationships in the complex systems that occur in sports, are focused towards increasing the probability of occurrence of events and not to linear relationships between stimulus and response (García-Manso, Martín-González, & Da Silva-Grigoletto, 2010).

The side-out or complex 1 (K1) corresponds to the phase of the team facing the serve, and is formed by the actions of reception, set and spike. The reception is the first action of the K1 and influences the attack options (Afonso, Esteves, Araújo, Thomas, & Mesquita, 2012; Costa, Afonso, Barbosa, Coutinho, & Mesquita, 2014; Costa et al., 2016; Papadimitriou, Pashali, Sermaki, Mellas, & Papas, 2004) and on the performance of a team's attack (Bergeles, Barzouka, & Nikolaidou, 2009; Costa et al., 2017; João, Mesquita, Sampaio, & Moutinho, 2006; Rodriguez-Ruiz et al., 2011), so it seems relevant to deepen its study.

One of the factors studied is the reception area. Traditionally, the division of the field into six spatial zones established by the regulation has been used (Hurst et al., 2016; Laporta et al., 2018; Maia & Mesquita, 2006; Rentero, João & Moreno, 2015), although it does not seem an adequate topographic division according to the functionality of the game and in order to draw relevant conclusions (Maia & Mesquita, 2006). Probably for this reason, different researchers have increased the number of zones or modified them with Ad-Hoc instruments, to assess the reception zone (Afonso et al., 2012; Afonso, Mesquita, Marcelino, & Da Silva, 2010; João & Pires, 2015; Lima, Mesquita, & Pereira, 2008; Marcelino, Afonso, Moraes, & Mesquita, 2014; Moreno, García de Alcaraz, Moreno, Molina, & Santos, 2007; Valhondo, Fernandez-Echeverria, Gonzalez-Silva, Claver, & Moreno, 2018). In any case, most of the previous investigations have detected areas where the highest incidence of service occurs, coinciding in pointing out the central backcourt area of the field as the area with the highest frequency of receptions (Callejón & Hernández, 2009; Ciuffarella et al., 2013; Lima et al., 2008; Moreno et al., 2007; Rentero et al., 2015). The choice of this area to send the serve seems to be mainly related to the risk reduction assumed by the servers, especially with very powerful serves (Afonso et al., 2012; Lima et al., 2008; Rentero et al., 2015).

Although there are numerous studies that have considered the reception area as variable, only a few have related it to the reception performance. In high-level male volleyball, a relationship between the reception area and reception performance was found (Afonso et al., 2012; Lima et al., 2008; Valhondo et al., 2018). Although in two of the studies, the lateral corridors are grouped in the same area with the background area, not being able to discriminate them (Afonso et al., 2012; Valhondo et al., 2018). Furthermore, none of the reviewed investigations, incorporated teams' rotation as a contextual variable. In our study, we propose to add the rotation of the receiving team, to aid to understand the relationship between reception areas and performance.

The term rotation refers to the position that corresponds to the setter at the time of the service (Đurković, Marelić, & Rešetar, 2008; Silva, Sattler, Lacerda, & João, 2016; Zadražnik, Marelić, & Rešetar, 2009), according to the six positions of the players established by the volleyball regulations in section 7.4 (FIVB, 2016). Through the massive use of the 5: 1 functional system, which involves the use of a single setter (Paulo, Zaal, Fonseca, & Araújo, 2016), six different formal structures are generated during KI, in which the functions and players´ relationships are different, allowing comparison of teams based on rotations (Laios & Kountouris, 2010; Zadražnik et al., 2009). Comprehension of rotations as contextual situations that can affect performance has been proposed by different investigations, concluding that the analysis of the performance of each action or complex should be carried out individually based on each of the six rotations (Santos, 1992; Zadražnik et al., 2009). Other authors have grouped the rotations in which the setter is in front row or in back row, finding a relationship with performance in the different strategic complexes based on sex (Palao & Ahrabi-Fard, 2011; Palao, Santos, & Ureña, 2002), with the performance of the main actions of the game (Đurković et al., 2008; Đurković, Marelić, & Rešetar, 2009; Silva, Lacerda, & João, 2013), with its influence on the type of attack (Marcelino et al., 2014; Palao, Santos & Ureña, 2005) and with the block and its performance (Palao, Santos & Ureña, 2004b).

Understanding that the influence of receiving areas on performance is far to be extensive, and that we have not found any research that delves into receiving areas including interaction with team rotation, the present study aims to identify the association of the reception zone on the performance of the reception of the high performance male volleyball teams, considering the impact of rotation. As a secondary objective, the distribution of the reception areas according to the team's rotation is described.

We hypothesized that there is an association between the reception zone and the reception performance, and this association is mediated by the rotation.

METHODS

This study was conducted developing observational methodology, with a system of categories that met the requirements of mutual exclusivity and completeness (Anguera, 1991). This allowed the registration of all the observed cases. A specific observation scheme was made, with a nomothetic criterion and a multidimensional response level (Blanco, Losada, & Anguera, 2003).

Sample

The sample of the study consisted of 4223 actions of reception corresponding to 29 masculine world-high-performance matches. All these actions belong to the final phases of the Olympic Games (O.G.), the World Cup (W.C.) and the World League (W.L.), played between 2012 and 2016. A convenience, no-probabilistic sampling was used. Matches were selected according to the next criteria:

1. Be part of the final phases of one of the main international male competitions played in the Olympic Cycle 2012-2016: O.G. 2012, W.L. 2013, 2014, 2015 & 2016, World Championship 2014 (W.CH.), W.C. 2015.
2. That the complete match was available online.
3. That the image quality was equal to or greater than 720 p.
4. That the perspective of the field was predominantly lateral.

Variables

In the present study, three variables were analysed, each one defined by its corresponding system of categories:

Receiving team rotation (RT)

Establishing six zones according to the setter´s position in relation to the service.

Reception zone (RZ)

Given the disparity of the different zonal models from other studies, and not finding any that fully adapted to the requirements of this study, it was built. Following strategies were used to provide construction and content validity to this instrument (Castro & Mesquita, 2016). First, a literature review was carried out in order to identify different zonal reception instruments (Afonso et al., 2012, 2010; Callejón & Hernández, 2009; Carrero et al., 2017; Ciuffarella et al., 2013; García-Tormo, Redondo, Valladares, & Morante, 2006; Gil, Del Villar, Moreno, García-González, & Moreno, 2011; González-Silva, Moreno, Fernández-Echeverría, Claver, & Moreno, 2016; Hernández, Ureña, Molina, & Sánchez, 2013; Hurst et al., 2016; João & Pires, 2015; Laporta et al., 2018; Lima et al., 2008; Maia & Mesquita, 2006; Marcelino et al., 2014; Moreno et al., 2007; Paulo et al., 2016; Rentero et al., 2015; Stamm, Stamm, Vantsi, & Jairus, 2016; Stankovic, Ruiz-Llamas, Peric, & Quiroga-Escudero, 2018; Valhondo et al., 2018). The categories that best fit our vision of the problem, based on a structure of three online receivers that is most used by high-level men's teams (Ciuffarella et al., 2013), were those that divided the width of the field in 4 longitudinal reception corridors (Marcelino et al., 2014). But we consider relevant that the instrument allowed to discriminate the reception of short serves, which in many cases bounce or are received close to the back row line, but in the back part of the court, so the front reception areas were expanded in one meter up to four meters away from the net. Thus, the zonal model includes the following zones in Figure 1: RZ1, RZ2, RZ43, RZ32, RZ4, RZ5, RZ56 and RZ61.

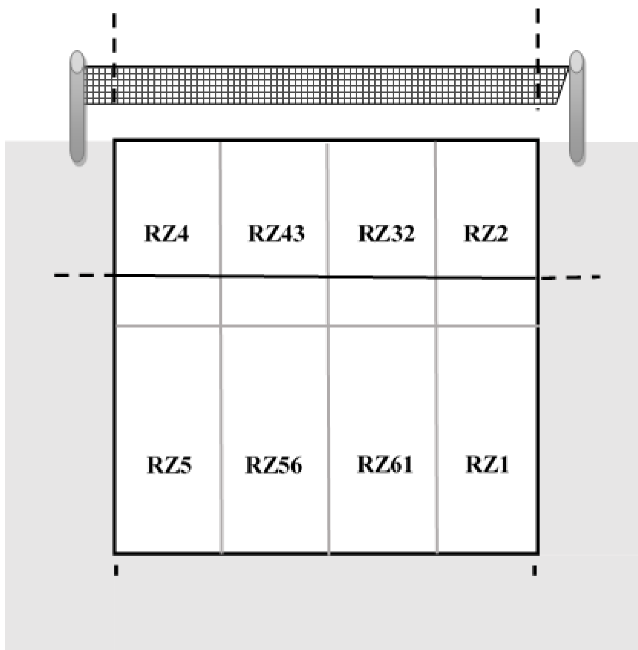

Figure 1. Reception zones.

Reception performance

Split up into 5 values:

- Reception error (RER): The serve achieves an ace or a reception error.
- Reception Bad (RBA): The reception quality does not allow to elaborate a sequence with setting and spike, returning a free ball.
- Reception Regular (RRE): The reception quality does not allow setting firsts times.
- Reception Good (RGO): The quality of the reception allows setting first times with risk.

- Reception Excellent (REX): The quality of the reception allows to play any type of setting in optimal conditions.

Approach and procedure

Actions were reviewed by a single observer, (with national top-level and international level II coach's certification, experience in performance evaluation and team management). A match was visualized joining criteria and establishing a manual of doubtful cases, that were incorporated into the categorization process. After completing the registration of matches, the observation of the first match was observed again in order to confirm intra-observer reliability. A second expert observer (with the same qualifications as first expert), was trained and analysed a match independently, ensuring the inter-observer arrangement. First attempts showed an almost perfect agreement in the intra-observer ($\kappa \geq .907$) and the inter-observer concordance ($\kappa \geq .867$).

LINCE sport observation and analysis software, was used to record the data (Gabin, Camerino, Anguera, & Castañer, 2012).

Data analysis

First, we analysed degree of intra- and inter-observer agreement through Cohen's Kappa test, assessing the reliability of data coding. The results were interpreted according to Landis and Koch (1977).

Frequencies and percentages were used to report the descriptive results of the sample.

To determine the relationship between the rotation and the reception zone, chi-square analysis was used. To report the magnitude of the relationship Cramer's V was used. To grasp the relationship, Haberman's corrected residues were used. These residues have been highlighted when they have exceeded the level of ± 1.96 as an absolute value and that implies their significative condition (Haberman, 1978).

To determine the influence of the reception zone on the performance of the reception, 3 ordinal regressions models were made. First model included bivariate estimations, second model multivariate adjusting model, and third model included the rotation´s interaction analysis. To evaluate the variance explained by the models, Nagelkerke pseudo r^2 was calculated.

Statistical processing was carried out with IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY (IBM Corp., 2012). The level of significance was set at $p = .05$ in all hypothesis contrasts.

RESULTS

4223 reception actions were analysed. The distribution of the serves was different in the different reception zones ($X^2_5 = 49.421$; $p < .001$). The most frequent reception areas were the back row with 3966 actions. RZ56 was the area in which the most receptions were registered with 1284 (30.4%), followed by RZ61 with 1134 actions (26.9%), RZ5 with 818 (19.4%) and RZ1 with 730 (17.3%)). In the front reception areas, the registered actions were 257. The RZ43 was the front area in which the most receptions were registered with 91 (2.2%), followed by the RZ4 with 66 (1.6%), the RZ2 with 62 actions (1.5%) and by the RZ32 with 38 (0.9%).

A significant relation was found between the rotation and the reception zone ($X^2_{35} = 319.875$; $p < .001$; $V = 0.123$), with a weak level of association between variables (Table 1). An increase of reception was observed in RZ1 of the RT1; in RZ56 of the RT2; in RZ1, RZ32 and RZ43 of the RT3; in RZ5 and RZ56 of the RT4 and RT5; and in RZ1, RZ2 and RZ61 of the RT6. The number of receptions was lower in RZ4 and RZ56 of the RT1; in RZ1 and RZ2 of the RT2; in RZ5 and RZ56 of the RT3; in RZ1 and RZ32 of the RT4; in RZ1 and RZ2 of the RT5; and in RZ56 of the RT6.

Table 1. Distribution of the reception zone according to the rotation.

		RECEPTION ZONE								
		RZ1	**RZ2**	**RZ4**	**RZ5**	**RZ32**	**RZ43**	**RZ56**	**RZ61**	**Total**
RT1	Frequency	171	16	4	126	5	10	186	201	719
	% in RT	23.8%	2.2%	.6%	17.5%	.7%	1.4%	25.9%	28.0%	100,00%
	% in RZ	23.4%	25.8%	6.1%	15.4%	13.2%	11.0%	14.5%	17.7%	17.0%
	Residue	5.1	1.9	-2.4	-1.4	-.6	-1.5	-2.9	.7	
RT2	Frequency	59	1	13	120	6	17	255	165	636
	% in RT	9.3%	.2%	2.0%	18.9%	.9%	2.7%	40.1%	25.9%	100.0%
	% in RZ	8.1%	1.6%	19.7%	14.7%	15.8%	18.7%	19.9%	14.6%	15.1%
	Residue	-5.8	-3.0	1.1	-.3	.1	1.0	5.8	-.6	
RT3	Frequency	160	14	12	77	11	23	160	181	638
	% in RT	25.1%	2.2%	1.9%	12.1%	1.7%	3.6%	25.1%	28.4%	100.0%
	% in RZ	21.9%	22.6%	18.2%	9.4%	28.9%	25.3%	12.5%	16.0%	15.1%
	Residue	5.6	1.7	.7	-5.1	2.4	2.7	-3.2	.9	
RT4	Frequency	81	6	15	173	1	9	233	159	677
	% in RT	12.0%	.9%	2.2%	25.6%	.1%	1.3%	34.4%	23.5%	100.0%
	% in RZ	11.1%	9.7%	22.7%	21.1%	2.6%	9.9%	18.1%	14.0%	16.0%
	Residue	-4.0	-1.4	1.5	4.4	-2.3	-1.6	2.5	-2.2	
RT5	Frequency	62	2	9	182	4	21	275	179	734
	% in RT	8.4%	.3%	1.2%	24.8%	.5%	2.9%	37.5%	24.4%	100.0%
	% in RZ	8.5%	3.2%	13.6%	22.2%	10.5%	23.1%	21.4%	15.8%	17.4%
	Residue	-7.0	-3.0	-.8	4.1	-1.1	1.4	4.6	-1.7	
RT6	Frequency	197	23	13	140	11	11	175	249	819
	% in RT	24.1%	2.8%	1.6%	17.1%	1.3%	1.3%	21.4%	30.4%	100.0%
	% in RZ	27.0%	37.1%	19.7%	17.1%	28.9%	12.1%	13.6%	22.0%	19.4%
	Residue	5.7	3.6	.1	-1.8	1.5	-1.8	-6.3	2.6	
Total	Frequency	730	62	66	818	38	91	1284	1134	4223
	% in RT	17,30%	1.5%	1.6%	19.4%	.9%	2.2%	30.4%	26.9%	100.0%

In Table 2, three regression models are presented to study the relationship of the rotation and reception zone with reception performance.

The model 1 is a bivariate model, where the relationships between rotation and reception zone with reception performance can be explored. It was found a significant relation between RZ and performance reception ($X^2_7 = 34.657$; $p < .001$; $r^2 = .009$), being the superior performance in RZ43 comparing to RZ1, RZ5, RZ56 y RZ61, and in RZ61 comparing to RZ5. No significant relationship was found between RT and reception performance ($X^2_5 = 7.805$; $p = .167$; $r^2 = .002$).

The model 2 is a multivariate model, adjusting results of reception performance by rotation and reception zone. This model was significant ($X^2_{12} = 42.920$; $p < .001$, $r^2 = .011$), and slightly improves the variability explained. This model allowed detecting a higher performance in RT6 comparing to RT1, RT2 and RT5. It also confirmed the differences found in model 1 (better performance in RZ43 comparing to RZ1, RZ5, RZ56 y RZ61), but it also allowed to see higher performance in RZ1 comparing to RZ61 and in RZ5 and in RZ56 comparing to RZ5.

In Model 3 the interactions between RT and RZ in reception performance can be explored. This model was significant (X^2_{47} = 84.970; p = .001; r^2 = .021) and improves the variability explained by previous models, allowing to understand the existence of interaction between the RT and the ZR. It could be observed that the reception performance was higher in RT6*RZ61 comparing to RE3*RZ61. Furthermore, in RT6 the performance in RZ61 was higher than in RZ5 and RZ4, and the performance in RZ56 was higher than the performance in RZ4. In RT1 reception performance was higher in RZ61 compared to RZ56. In RT2, the performance in RZ4 was superior to that of the RZ61. In the RT3, the performance in the RZ4 was higher than on the RZ61. In the RT4, the performance in RZ4 was superior to RZ61´s and RZ56´s. Finally, in RT5, performance on RZ4 was superior compared to RZ61, and performance on RZ2 was lower than that obtained on RZ1, RZ2, RZ4, RZ5, RZ43, RZ56, and RZ61. But this last result in relation to RZ2 should be taken with caution, since in this rotation a very low number of actions were obtained in RZ2, which could alter the results. Based on this, the interactions of RZ2 in RT5 have not been taken into account in the discussion section.

Table 2. Distribution of the reception zone according to the rotation.

	n	MODEL 1		MODEL 2		MODEL 3	
		OR (IC95%)	**p**	**OR (IC95%)**	**p**	**OR (IC95%)**	**p**
RT1	718	-.15 (-.26; -.03)	.014	-.14 (-.26; -.03)	**.015**	-.06 (-.28; .15)	.559
RT2	635	-.11 (-.23; .01)	.068	-.13 (-.25; 0)	**.042**	-.22 (-.44; .01)	.060
RT3	637	-.09 (-.21; .03)	.145	-.11 (-.23; .01)	.078	-.24 (-.46; -.02)	**.031**
RT4	677	-.08 (-.19; .04)	.207	-.07 (-.19; .05)	.272	-.07 (-.3; .17)	.572
RT5	734	-.13 (-.25; -.01)	.027	-.13 (-.25; -.01)	**.030**	-.12 (-.35; .1)	.278
RT6	819	Ref.	.	Ref.	.	Ref.	.
RZ1	729	0 (-.1; .11)	.934	0 (-.11; .11)	.987	-.02 (-.24; .2)	.886
RZ2	62	.26 (-.05; .57)	.105	.25 (-.07; .56)	.121	-.04 (-.53; .46)	.890
RZ4	66	.05 (-.23; .34)	.711	.06 (-.23; .35)	.696	-.79 (-.39; -.18)	**.011**
RZ5	817	-.13 (-.23; -.03)	**.013**	-.13 (-.23; -.02)	**.015**	-.24 (-.47; 0)	**.049**
RZ32	38	.26 (-.13; .65)	.191	.26 (-.14; .65)	.202	.15 (-.58; .89)	.684
RZ43	91	.48 (.2; .75)	**.001**	.49 (.22; .76)	**.000**	.13 (-.6; .86)	.730
RZ56	1283	.08 (-.02; .17)	.108	.08 (-.01; .18)	.080	.23 (-.01; .46)	.059
RZ61	1134	Ref.	.	Ref.	.	Ref.	.
RT1*RZ1	171					-.11 (-.43; .21)	.515
RT1*RZ2	16					.62 (-.22; 1.46)	.151
RT1*RZ4	4					.91 (-.41; 2.24)	.176
RT1*RZ5	125					0 (-.35; .34)	.979
RT1*RZ32	5					-.29 (-1.53; .96)	.652
RT1*RZ43	10					.22 (-.86; 1.3)	.686
RT1*RZ56	186					-.35 (-.67; -.02)	**.038**
RT1*RZ61	201					Ref.	.
RT2*RZ1	58					.21 (-.2; .62)	.324
RT2*RZ2	1					.13 (-2.18; 2.44)	.914
RT2*RZ4	13					1.08 (.18; 1.98)	**.019**
RT2*RZ5	120					.13 (-.23; .48)	.482

RT2*RZ32	6	-.48 (-1.63; .67)	.414
RT2*RZ43	17	.74 (-.26; 1.75)	.147
RT2*RZ56	255	-.04 (-.36; .29)	.830
RT2*RZ61	165	Ref.	.
RT3*RZ1	160	.14 (-.19; .47)	.397
RT3*RZ2	14	.29 (-.52; 1.1)	.478
RT3*RZ4	12	1.12 (.2; 2.04)	**.017**
RT3*RZ5	77	.38 (-.01; .77)	.053
RT3*RZ32	11	.66 (-.44; 1.77)	.240
RT3*RZ43	23	.48 (-.43; 1.39)	.303
RT3*RZ56	159	-.02 (-.36; .32)	.893
RT3*RZ61	181	Ref.	.
RT4*RZ1	81	-.08 (-.45; .3)	.692
RT4*RZ2	6	.75 (-.49; 1.99)	.238
RT4*RZ4	15	.96 (.09; 1.84)	**.031**
RT4*RZ5	173	.16 (-.19; .5)	.367
RT4*RZ32	1	12.66 (-967.32; 992.64)	.980
RT4*RZ43	9	.73 (-.49; 1.95)	.242
RT4*RZ56	233	-.25 (-.58; .09)	.146
RT4*RZ61	159	Ref.	.
RT5*RZ1	81	.01 (-.39; .4)	.969
RT5*RZ2	6	-2.55 (-4.17; -.94)	**.002**
RT5*RZ4	15	1.06 (.05; 2.07)	**.040**
RT5*RZ5	173	.07 (-.27; .4)	.692
RT5*RZ32	1	-.13 (-1.49; 1.23)	.850
RT5*RZ43	9	.13 (-.78; 1.04)	.778
RT5*RZ56	233	-.16 (-.48; .16)	.324
RT5*RZ61	159	Ref.	.
RT6*RZn		Ref.	.

OR, Odds Ratio; CI, Confidence Interval; p, p-value; RT: rotation team; RZ: reception zone; RZn: all receptions zones; Model 1: Bivariate model. Model 2: Multivariate model. Model 3: Interaction of RT and RZ.

DISCUSSION

Up to our knowledge, this is the first study to analyse the association of the reception zone on the performance of the reception of the high-performance male volleyball teams, considering the rotation impact on this relation.

First, the distribution of the reception areas of the ball was described according to the rotation of the team. It was observed that the reception area is associated with the rotation of the team. Despite the fact that, different authors consider important the study of contextualized game in each of the six rotations, considering them as different situations of the game, we have not found studies that analyse the relationship between reception zones and the rotation in which they develop . The fact that a relationship was found between both variables raises the existence of tactical or performance reasons related to the higher frequency of serving in each of the rotations to specific reception zones.

Higher and lower residues than expected, can be related to the position of the libero; taking as reference, the structure of three receivers as the most used in high-level men's teams (Ciuffarella et al., 2013; Paulo et al., 2016), in the rotations in which the libero received in the central part of the court, the reception frequency increased in the right reception corridor, especially in ZR1, decreasing in the left half of the court, especially in ZR56. On the other hand, when the libero received in the right part of the court, the reception frequency increased in the left half court and especially in ZR56, being reduced in the right corridor and especially in ZR1. Therefore, it seems that the servers are trying to avoid the intervention of the libero. But we strong believe that, a possible greater effectiveness of the libero´s reception (Callejón & Hernández, 2009) in relation to other players, is not the only factor that determines the sending serve´s zone, especially when there are contradictory results about the significant relationship -in high and medium level men's volleyball-, between the receiving player and the reception performance (Afonso et al., 2012; João et al., 2006; Ureña, Calvo, & Lozano, 2002; Valhondo et al., 2018). Therefore, other possible serve´s tactical objectives seem to influence, such as hindering the reception-attack transition (Marcelino et al., 2014), hampering the movements of the attackers, or occupying their jump or fall spaces with the receiving player.

Frequencies obtained in the reception zones are consistent with those obtained in other investigations with high-level male teams. In these investigations, a very low incidence was found on the front reception zones (Callejón & Hernández, 2009; Lima et al., 2008), with most of the serves sent to the centre-back zone (Callejón & Hernández, 2009; Lima et al., 2008; Rentero et al., 2015), and a slight but higher frequency in the left reception corridor (ZR5) in relation to the right corridor, both at the highest international level (Callejón & Hernández, 2009; Rentero et al., 2015), as in top-level domestic male competitions (Ciuffarella et al., 2013; Moreno et al., 2007). Even though, one study obtained the opposite result (Lima et al., 2008).

When analysing the reception zone and reception performance, we found a statistically significant relationship between both. This relation matches with that found in research carried out at the international male high level, with data from the 2007 World Cup (Afonso et al., 2012), and the 2011 men's European Championship (Valhondo et al., 2018). In this last study, authors concluded that the reception area was a predictor of reception performance. However, another study with Portuguese international players did not find any relation between both studies, but the sample was only 4 players and they were not analysed in a competition context (Paulo et al., 2016).

In relation to the front reception zones, the results of the bivariate analysis of Model 1 and the ordinal multivariate regression of Model 2, showed that receiving in ZR43 causes better reception performances than in any of the defending areas. As a possible explanation, the ZR43 is an area in the central part of the court and very close to the setting zone. In this regard, some authors have raised the possibility that greater distances between the reception area and the setting zone, have a negative influence on reception performance (Afonso et al., 2012). This idea would be consistent with the decrease in reception performance, which some authors have found with serves directed to the back of the court or the lateral corridors (Afonso et al., 2012; Moreno et al., 2007; Valhondo et al., 2018). Whereas, this fact could be attributed to the execution of movements of the receivers and not only to distance (Ureña et al., 2002). However, the performance of the other front reception zones close to the setting zone (ZR32 and ZR2), was not superior to that of other zones. In both cases, the fact of sharing space with the optimal setting zone in which the setter generally waits for reception, could hinder the reception and complicate the achievement of a superior performance to that of more distant zones. Therefore, the use of the short serve on the front reception areas in male volleyball seems to be a resource used by the teams with a tactical or surprising purpose (Maia & Mesquita, 2006) and not a serve´s regular scope.

In terms of the back row reception zones, when receiving in ZR56 and ZR61, higher performances were obtained than when doing so in ZR5. These results partially match with the idea that the lateral corridors acquire lower reception performance than the central zones (Afonso et al., 2012; João & Pires, 2015; Lima et al., 2008; Moreno et al., 2007; Valhondo et al., 2018). In this case there was only a statistically significant difference with the left side of the reception (ZR5), but not with the right one (ZR1).

The centre-back reception zones receive most of the serves, despite obtaining better reception performance than lateral back areas and especially ZR5. It seems that serving to centred zone allows not only to reduce serve´s error, but also to serve to the interference space between the receivers (Valhondo et al., 2018), and, in accordance with the trend pointed out by João and Pires (2015), try to nullify the ability of the outside hitter in back row to participate in combinations with pipe settings or back row by Zone 6. It should not be surprising, this tactical choice of the serving team at high male level, given the high entrenchment and performance of this attack (Costa et al., 2018; Millán-Sánchez, Morante, & Ureña, 2017; Silva et al., 2016). Nevertheless the success of this type of attack is conditioned by the good quality of the previous reception (Costa et al., 2018; Silva et al., 2013), which allows the combination of attack by Zone 3.

In relation to the rotations, the results obtained in this study showed a progressive decrease in the frequencies of actions recorded from RT6 to RT2 of the receiving team. This reduction is compatible with the approach of greater use of RT1 and RT6 as initial training, understanding that the same number of complete rotations does not usually occur in each set. Palao and Ahrabi-Fard (2011), found a tendency to start the sets in women's university competitions in the USA in RT1. And in studies on the male Greek A1 League, they found that RT1 was the most used initial formation in K2, while RT2 was the most used in K1 followed by RT6. They interpreted this trend based on their record of greater effectiveness of the teams in K2 in RT1 (Laios & Kountouris, 2010), since they did not find statistically significant differences in the performance of K1 according to rotation (Laios y Kountouris, 2011).

When analysing the performance by means of a multivariate ordinal regression with an adjusted model that includes the variable reception zone (Model 2), we found a superior performance estimate for RT6, in relation to RT1, RT2 and RT5. It is possible that this difference is related to the game model used and the location of the outside hitter with the best performance in reception, near or far from the setter (Silva et al., 2016). But since this study doesn't focus on game models, no tactical reason can be found to justify the increased performance on RT6.

Hereunder, we will try to interpret and explain for each rotation, the reception performance estimates, obtained in the reception areas, although the variability explained by the model is low.

In RT1 there was a higher frequency of sending the serve to RZ1, probably trying to hinder the reception-attack transition of the front outside hitter that attacks by zone 2, outside its usual zone 4. Under this greater incidence of the serve in RZ1 and less in RZ56, there is a logical option for the libero to move his spatial position closer to RZ1, assuming greater responsibility on the right side of the court. This would allow to decrease the spatial responsibility of the front outside hitter, but it would generate more space in RZ56 which could lead to lower performance.

The serve aimed at RZ4 could have clear tactical targets in some of the rotations in which obtained a lower performance than ZR61, not seeking an effect on reception performance, but to make it difficult for one or both spikers to join the attack and facilitate the defensive organization of the serving team. The best reception performance of the ZR4 occurs in 3 of the four rotations when the setter is a forward and only has two front attackers, which could support the tactical objective of making the reception-attack transition of the outside hitter in front row difficult, by reducing his attacking approach and temporary availability. In addition, on RT2, RT4 and RT5, the centre-back starts from Zone 4, closed to the court´s left line. A serve with a tactical objective towards RZ4 can make it difficult for the centre to move into the attack, especially if he is going to attack a tense and separate set in zone 3-4 and hinder the reception (spatially or visually) if it coincides with the centre movement or impair the join to attack of the outside hitter in front row after receiving close to the net.

However, in RT6 this trend is reversed, with better reception performance in RZ61 than in RZ4 and RZ5, and better performance in RZ56 than in RZ4. It is possible that in this rotation, without the objective of hindering the central movements drawing from Zone 2, and with three forward attack options for the setter, the serves made to this zone change the tactical objective into a more offensive aim, hindering the action of reception.

As practical applications of this study, we consider that the game models and the training methodology should prepare the teams to respond against the serves´ qualities (power, direction, trajectory, aimed zones) in different competitive situations related to rotation and the reception zone. Although they must have enough variability to adapt to the less frequent serves, not entailing a problem in performance. We consider it necessary for the tactical analysts of the teams to locate the most vulnerable areas of the team's reception systems, estimating that in this study there is data from some teams that can hide the trends in others.

As a future line of work, we propose the study of the interaction of the rotation of the receiving team, and the receiving zone on the performance of the attack and K1. We also consider interesting, the study of reception performance based on the formal and functional structures applied to the game model.

Some concerns must be considered when interpreting the results of this work. This is the first study that analyses the influence that rotation of the receiver team with the reception zone, has on high performance volleyball male teams. Other strength is the homogeneity and the highest competitive level belonging during an Olympic cycle. As limitations of this study, some actions analysed have low representation, which reduces the precision of some estimations. Furthermore, a convenience sampling had to be used, due to the restriction of access permissions to some matches.

CONCLUSIONS

In general, we can conclude that the reception performance varies depending on the reception zone, the rotation of the receiving team, and the interaction between those both. In addition, the rotation of the receiving team interferes in the choice of the destination of the service and therefore in the receiving zone.

Despite considering that, the present study contains data from some teams that can hide the trends of others, the repetition of the formal game models used by the high-performance male´s teams, provokes trends in reception performance, depending on rotations and receiving zones of the receiving team. Despite the fact that an individualized study of each rival, including the variables analysed in this study is recommended, having the aim of serving towards RZ5 as well as avoiding the RZ43, seem clear slogans at the high level given the performance found in both reception areas.

AUTHOR CONTRIBUTIONS

Conceived of the investigation idea: López, E.; Díez-Vega, I., & Molina, J.J. Conceived and planned the observation: López, E., & Molina, J.J. Performed the observation: López, E. Interpretation of the results: Díez-Vega, I. Wrote the manuscript: López, E.; Díez-Vega, I., & Molina, J.J. All authors discussed the results and contributed to the final manuscript.

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