Offensive structuring in men's high-level volleyball: analysis of the attack zone

Estruturação ofensiva no voleibol masculino de alto nível: análise em função da zona do ataque

Gustavo De Conti Teixeira Costa[1]
Mariana Pereira Maia[1]
Juliano Capuzzo[1]
Breno Ferreira de Britto Evangelista[2]
Auro Barreiros Freire[3]
Fernanda Grazielle da Silva Azevedo Nora[1]
Mário Hebling Campos[1]
Herbert Ugrinowitsch[4]

Abstract – The aim of the present study was to analyze the association between variables of the game on the offensive structure from the zone in which attack is performed in high-level Men's volleyball. The sample was composed by 12 teams, with the analysis of 142 games, which totalized 19,545 reception, set and attack actions. Data analyses were run with descriptive statistic and the qui-quadratic test for searching association between the variables. The results showed association between tempo of attack and attack effect, type of attack and attack zone and attack zone and tempo of attack and attack effect. It was concluded that Brazilian teams underuse backcourt attacks, and the offensive structure accomplished through the faster game, which is mainly important on attacks carried out in positions 2, 3 and 4. Furthermore, the reception quality proved to be the precursor factor in the construction of attack. It was also observed that there was no 1st tempo of attacks from the backcourt, indicating that it is necessary to change the type of game, specifically with the increment of the speed of sets conducted by the backcourt.

Key words: Efficacy; Training; Volleyball.

Resumo – O objetivo do presente estudo foi o de analisar a associação entre as variáveis de jogo na estruturação ofensiva a partir da zona em que o ataque é executado no voleibol masculino de alto nível. A amostra foi composta por 12 equipes, com a análise de 142 jogos, totalizando 19.545 ações de recepção, levantamento e ataque. Os dados foram analisados através da estatística descritiva e ao teste do qui-quadrado para verificação da associação entre as variáveis. Os resultados mostraram associação entre o tempo de ataque e o efeito do ataque, entre o tipo de ataque e a zona do ataque e entre a zona do ataque e o tempo e efeito do ataque. Conclui-se que as equipes brasileiras subutilizam os ataques do fundo de quadra, sendo a estruturação ofensiva efetivada através do jogo mais rápido, o que é fundamental na conquista do ponto, principalmente nos ataques realizados das posições 2, 3 e 4. Além disso, a qualidade da recepção mostrou-se como fator precursor na construção do ataque. Observou-se ainda que não houve ataques de 1º tempo pelo fundo de quadra, indicando que é necessária a mudança do tipo de jogo, especificamente com o incremento de velocidade dos levantamentos para os ataques realizados pelo fundo de quadra.

Palavras-chave: Eficácia; Treinamento; Voleibol.

INTRODUCTION

The game analysis plays a vital role in the development of various collective sports in order to promote more efficient tactical strategies and improve the quality of training and the tactical organization of the team during the game[1]. In volleyball, specifically, studies on game analysis have shown that the attack is strongly associated with victory in the game[2,3], being responsible for obtaining most points. In addition, it is observed that the success in the set and the game is linked mainly to the attack effect and its correlation with other game procedures[1,4], especially reception and game speed. In this context, it is clear that the reception quality, one of the offensive structure foundations, influences the attack effect, and high-quality receptions are associated with winning the attack point, while low-quality receptions are associated with attack error[5]. By analyzing the attack speed, which began with the set, it appears that faster attacks (1st tempo and 2nd tempo) correlate with winning the attack point in relation to slower attacks (3rd tempo), which may be explained by the difficulty in defensive organization of the opponent's defense system[6,7].

In addition to the influence of game procedures, the attack itself shows different effects according to the technique option used, being more common in the game t powerful and technical attacks[2,3,8]. In this context, scoring is associated with powerful attack and its use is related to the situational constraints related to the opponent's defense organization[9]. Thus, situational factors that limit the performance of players, as well as their effectiveness in the game, emerge from the attack analysis. Thus, one should take into account the volleyball court position where attack is carried out[10] as well as the complexity of the action and its environmental restrictions[11]. In this bias, it is clear that in the attack zone, positions 2, 3 and 4, more fastballs are observed (1st tempo), while in the backcourt, positions 1, 6 and 5, there is a prevalence of 2nd and 3rd tempo balls[12,13].

While it is possible to suggest that there are differences in the game practiced according to the court zone in which the attack is performed, no study was found in literature addressing this issue in men's high-level volleyball. In this context, the aim of this study was to analyze the association between game variables in the offensive structuring from the area where the attack is performed, that is, understand the type of offensive game played from the attack zone and from the backcourt.

METHODOLOGICAL PROCEDURES

Sample

The study sample consisted of 12 Volleyball teams participating in the 2014/2015 Men's Superliga. In this sense, we used the observation of 142 games of the 151 games played in this Superliga and analyzed at least 22 games and a maximum of 26 games of each participating team, totaling 19,545 reception, set and attack actions. Erroneous receptions were excluded from the sample, since they did not allow the continuation of action and subsequent attack performance. It is noteworthy that Brazil

is consistently ranked among the top three men's volleyball teams in the world, and most of the players participate in the Brazilian Superliga.

Variables

Effect of reception: corresponds to the reception quality and its influence on the attack construction. To evaluate the reception quality, the instrument proposed by Eom and Schutz[4] was used. The following rating scale was used:

- Poor Reception (C): reception did not allow attack organization, showing the location of the attack distribution.
- Moderate Reception (B): reception allowed organized attack, though not all strikers were available for attack; more specifically, it reduced the possibilities of fast attacks.
- Excellent Reception (A): reception that allowed organized attack with all attackers available for attack.
-

Attack Tempo: is the time of the attack action regarding the temporal relationship between attacker, setter and ball. The categories that make up this dimension were adapted from Afonso et al.[14] and the following scale was used:

- 1st tempo of attack: attacker jumped during or immediately after the set, and only one step may occur after set;
- 2nd tempo of attack: attacker performed two or three steps after set;
- 3rd tempo of attack: attacker waits for the ball to reach the peak of the upward trajectory and only then the attack step began.

Attack Type: corresponds to the form and direction of the attack carried out by the attacker. To attack type analysis used an adaptation of Costa et al.[8]. The following categories were used: powerful attack to the diagonal, powerful attack to the parallel and drop.

Attack effect: will be evaluated by means of an adaptation of instruments proposed by Eom and Schutz[4] and Marcellin et al.[15]. Thus, the following categories were obtained:

- Attack error: attacker failed in the attack, since the ball was hit on the net, out of bounds or some violation of the regulation occurred.
- Attack block: the attack was blocked and resulted in a score for the opponent.
- Continuity: the attack action did not result in a terminal action and allowed new attack or counterattack.
- Attack point: the attack resulted in direct score, since the ball touched the opponent's court or was diverted by blocking off the court.
- Attack Zone: was evaluated from the position that started the attack. Thus, according to the sport's official rules published by the International Volleyball Federation, the following attack zones were obtained:
- Net: attacks carried out from positions 4, 3 and 2 of the volleyball court.
- Backcourt: attacks carried out from positions 1, 6 and 5 of the volleyball court.

Data collection procedure

All games were recorded with the camera positioned at approximately 7-9 meters behind the court bottom line and about three meters above ground level. A Sony camera with 1080p HD resolution and frequency rate of 60 Hz was used. Observers were volleyball statisticians with minimum experience of 5 years in this specific function and had a degree in physical education in order to ensure consistency of criteria and quality of data encoding. Moreover, they analyzed games via Data Volley 2014.

Statistical procedures

Exploratory analysis used descriptive statistics, obtaining frequencies and respective percentages for each category of the variables under study. For the association between variables, the chi-square with Monte Carlo correction was used, whenever less than 20% of cells present value less than 5. Residual adjustments were calculated in order to identify which cells showed statistical significance in explaining the relationship between two variables, that is, when values were higher than 2. In data treatment, the SPSS software (Statistical Package for Social Sciences) version 20.0 for Windows was used, adopting significance level of 5% ($p = 0.05$).

To calculate the agreement among raters, 20% of the actions were re-analyzed, surpassing the 10% reference value[16]. The Cohen's Kappa values ranged from 0.90 to 1.00 for interobserver agreement, and from 0.94 to 1.00 for intraobserver agreement. In this sense, the agreement values are above the reference value, which is 0.75[17].

RESULTS

Table 1 shows that from the attack zone, there was association between attack tempo and attack effect ($x^2 = 402.418$, p <0.001, Phi = 0.16).

Table 2 shows that, from the reception quality analysis, there was an association between attack type and attack zone ($x^2 = 79.449$, p <0.001, Phi = 0.09).

Table 3 showed that, from the statistical analysis, there was association between attack zone and attack tempo and effect ($x^2 = 182.509$, p <0.001, Phi = 0.13).

Table 1. Relationship between attack tempo and attack effect according to attack zone

				Score	Continuity	Block	Error	Total
					Attack effect			Total
Net attack	Attack tempo	1st attack tempo	Occurred	4918	1323	1131	647	8019
			% Attack tempo	61.3%	16.5%	14.1%	8,1%	100,0%
			Adjusted residue	19.5*	-10.5*	-10.4*	-5,5*	
		2nd attack tempo	Occurred	2381	1046	873	484	4784
			% Attack tempo	49.8%	21.9%	18.2%	10,1%	100,0%
			Adjusted residue	-6.2*	4.1*	2.1*	2,2*	
		3rd attack tempo	Occurred	1573	924	857	419	3773
			% Attack tempo	41.7%	24.5%	22.7%	11,1%	100,0%
			Adjusted residue	-16.6*	8.1*	10.1*	4,2*	
	Total		Counting	8872	3293	2861	1550	16576
			% Attack tempo	53,5%	19.9%	17.3%	9.4%	100,0%
Backcourt attack	Attack tempo	2nd attack tempo	Occurred	1456	374	292	313	2435
			% Attack tempo	59.8%	15.4%	12.0%	12,9%	100,0%
			Adjusted residue	2.4*	-4.4*	-2.4*	3,8*	
		3rd attack tempo	Occurred	289	124	84	37	534
			% Attack tempo	54.1%	23.2%	15.7%	6,9%	100,0%
			Adjusted residue	-2.4*	4.4*	2.4*	-3,8*	
	Total		Counting	1745	498	376	350	2969
			% Attack tempo	58,8%	16.8%	12.7%	11.8%	100,0%
Total			Counting	10617	3791	3237	1900	19545
			% Attack tempo	54,3%	19,4%	16.6%	9.7%	100.0%

* Difference found for p≤0.05

Table 2. Relationship between reception effect and attack zone

			Net	Backcourt	Total
			Attack Zone		Total
Reception A	Powerful Attack in parallel	Occurred	2532	678	3210
		% Attack type	78.9%	21.1%	100,0%
		Adjusted residue	-8.8*	8.8*	
	Powerful attack in diagonal	Occurred	4782	799	5581
		% Attack type	85.7%	14.3%	100,0%
		Adjusted residue	6.5*	-6.5*	
	Drop	Occurred	745	106	851
		% Attack type	87.5%	12.5%	100,0%
		Adjusted residue	3.3*	-3.3*	
	Total	Occurred	8059	1583	9642
		% Attack type	83.6%	16.4%	100,0%
Reception B	Powerful Attack in parallel	Occurred	2465	316	2781
		% Attack type	88.6%	11.4%	100,0%
		Adjusted residue	.3	-.3	
	Powerful attack in diagonal	Occurred	3498	484	3982
		% Attack type	87.8%	12.2%	100,0%
		Adjusted residue	-1.9	1.9	
	Drop	Occurred	588	52	640
		% Attack type	91.9%	8.1%	100,0%
		Adjusted residue	2.8*	-2.8*	
	Total	Occurred	6551	852	7403
		% Attack type	88.5%	11.5%	100,0%

			Attack Zone		Total
			Net	Backcourt	
Reception C	Powerful Attack in parallel	Occurred	698	171	869
		% Attack type	80.3%	19.7%	100,0%
		Adjusted residue	1.5	-1.5	
	Powerful attack in diagonal	Occurred	1086	315	1401
		% Attack type	77.5%	22.5%	100,0%
		Adjusted residue	-1.5	1.5	
	Drop	Occurred	182	48	230
		% Attack type	79.1%	20.9%	100,0%
		Adjusted residue	.2	-.2	
	Total	Occurred	1966	534	2500
		% Attack type	78.6%	21.4%	100,0%
Total		Occurred	16576	2969	19545
		% Attack type	84.8%	15.2%	100.0%

* Difference found at p≤0.05; A: excellent; B: moderate; C: poor.
Table 3. Relationship between offensive structures and attack zone.

				Attack zone		Total
				Net	Backcourt	
2nd attack tempo	Attack effect	Score	Occurred	2381	1456	3837
			% Attack effect	62.1%	37.9%	100.0%
			Adjusted residue	-8.1*	8.1*	
		Continuity	Occurred	1046	374	1420
			% Attack effect	73.7%	26.3%	100.0%
			Adjusted residue	6.6*	-6.6*	
		Block	Occurred	873	292	1165
			% Attack effect	74.9%	25.1%	100.0%
			Adjusted residue	6.8*	-6.8*	
		Error	Occurred	484	313	797
			% Attack effect	60.7%	39.3%	100.0%
			Adjusted residue	-3.5*	3.5*	
		Total	Occurred	4784	2435	7219
			% Attack effect	66.3%	33.7%	100.0%
3rd attack tempo	Attack effect	Score	Occurred	1573	289	1862
			% Attack effect	84.5%	15.5%	100.0%
			Adjusted residue	-5.4*	5.4*	
		Continuity	Occurred	924	124	1048
			% Attack effect	88.2%	11.8%	100.0%
			Adjusted residue	.6	-.6	
		Block	Occurred	857	84	941
			% Attack effect	91.1%	8.9%	100.0%
			Adjusted residue	3.7*	-3.7*	
		Error	Occurred	419	37	456
			% Attack effect	91.9%	8.1%	100.0%
			Adjusted residue	2.9*	-2.9*	
		Total	Occurred	3773	534	4307
			% Attack effect	87.6%	12.4%	100.0%
Total			Occurred	8557	2969	11526
			% Attack effect	74.2%	25.8%	100.0%

* Difference found at p≤0.05

DISCUSSION

The aim of this study was to analyze the association between game variables in the offensive structuring from the attack zone, identifying the offensive game played near the net or from the backcourt. Analysis has shown that in the net attack, the attack score was associated with game played with higher speed, 1st tempo, while slower game, i.e., 2nd and 3rd attack tempo, was associated with game continuity or attack error. Dissimilarly, it was observed that in the offensive structuring from the backcourt, the attack point was associated with the 2nd attack tempo while game continuity was associated with the 3rd attack tempo. These results are consistent with studies on this subject that demonstrated the association of faster game with attack point, while slower game, for allowing a better defensive structuring of the opposing team, is associated with game continuity or attack error[1,18,19]. In this context, the game speed in the offensive structuring tends to temporally limit the opposing team, providing opportunities for the presence of flaws in the defensive system, allowing a successful attack.

The analysis of the association between attack type and attack zone showed that the net attack was more requested than the backcourt attack. When considering the reception quality, it was observed that in reception A, the net attack was associated with powerful attack on the diagonal and drop and backcourt attack in parallel. In addition, it was observed that after reception B, net attack was associated with drop. These results are in agreement with the trend shown by studies on the higher request of net attacks, since teams search for offensive structuring with faster sets[3,8,20] and these are associated mainly with position 3[10,21] due to the proximity of the setter with the attacker[22]. When considering the attack type and reception quality, studies have shown that high-performance volleyball requires powerful attack to score[8,9,18], and high-quality reception[23].

The relationship between attack effect and attack zone showed that after the 2nd attack tempo, the attack point and attack error were associated with backcourt attack, while game continuity and attack block were associated with net attack. When considering the 3rd attack tempo, it was observed that attack point was associated with backcourt attack, while attack block and attack error were associated with net attack. Although there are no studies on this topic, studies on game analysis in volleyball have shown that faster game culminates in score, specifically the 1st attack tempo, while game with intermediate or slow speed, 2nd and 3rd tempo respectively, is associated with game continuity or the attack error[19,21,24]. Considering that studies on game analysis, in most cases, do not differentiate the attack location and knowing that most attacks occur from the attack zone[23], it could be inferred that the trend shown above corroborates the results found in this study, especially with the effects of the net attack. However, it is clear that backcourt attacks are associated with the attack point, regardless of game speed, suggesting that this type of set is unexpected for being little frequently used. In this context, as practical implication, it is suggested that high-level male volleyball teams seek greater use of backcourt attacks in order to increase the number of attackers in relation to the number of blockers. Thus, during the offensive organization, the team will have four

attackers, making the defensive structuring difficult due to the greater offensive complexity. Furthermore, it is suggested that training focusing on offensive behavior improve the setter's game reading for appropriate decision making in the offensive scenario.

This study analyzed only the attack complex, namely, the offensive organization from reception, not considering aspects related to the defense system such as blocking, which is a study limitation. In addition, analyses have shown general characteristics, not allowing stratifying the offensive organization from the team's competitive level in the analyzed competition.

CONCLUSION

The analysis of the 2014/2015 Men's Superliga showed that the offensive structure through the faster game is of utmost importance for scoring, especially in net attacks, i.e., positions 2, 3 and 4. In addition, the reception quality is shown as a key factor in attack construction.

In this sense, although studies have shown the request of frontcourt attackers (positions 2, 3 and 4) in high-quality reception, the analysis of the results allows inferring that, in the Brazilian volleyball, there is underutilization of backcourt attacks. It appears that these attacks are used as a resource to overcome situational constraints and not as part of the previously established offensive strategy. Thus, it is necessary to investigate the reason for this type of attack action distribution, since the reduced use of backcourt attacks limits the offensive structuring, making the game more predictable. Furthermore, it was observed that there was no 1st tempo attack tempo by the backcourt, indicating that it is necessary to change the type of game played, specifically with the increase in the speed of sets from the backcourt.

REFERENCES

1. Marcelino R, Mesquita I, Sampaio J. Efficacy of the volleyball game actions related to the quality of opposition. Open Sports Sci J 2010;3:34–5.
2. Costa G, Mesquita I, Grego PJ, Ferreira N, Moraes JC. Relação entre o tempo, o tipo e o efeito do ataque no Voleibol masculino juvenil de alto nível competitivo. Rev Bras Cineantropom Desempenho Hum 2010;12(6):401-34.
3. Costa G, Mesquita I, Grego PJ, Ferreira N, Moraes JC. Relação saque, recepção e ataque no voleibol juvenil masculino. Motriz: Rev Educ Fís 2010;17(1):11-8.
4. Eom HJ, Schutz RW. Statistical analysis of volleyball team performance. Res Q Exerc Sport 1992;63(1):11-8.
5. Peña J, Rodríguez-Guerra J, Serra N. Which skills and factors better predict winning and losing in high-level men's volleyball? J Strength Cond Res 2013;27(9):2487-93.
6. Katsikadelli A.A comparative study of the attack serve in high-level Volleyball Tournaments. J Hum Mov Stud 1996;30(6):259-67.
7. Rocha CM, Barbanti VJ. Uma análise dos fatores que influenciam o ataque no voleibol masculino de alto nível. Rev Bras Educ Fís Esporte 2004; 18(4):303-14.
8. Costa GC, Ferreira NN, Junqueira G, Afonso J, Mesquita I. Determinantsofattack-tactics in Youth male elite volleyball. Int J Perform Anal Sport 2011;11(1):96-104.
9. Castro J, Mesquita I. Estudo das implicações do espaço ofensivo nas características do ataque no Voleibol masculino de elite. Rev Port Cien Desp 2008;8(1):114-25.

10. Costa G, Ceccato, JS, Evangelista, BFB, Freire AB, Oliveira, AS, Milistetd M, Rodrigues HA, Ugrinowitsch H.Tactic determinants of game practiced by middle attacker in men's volleyball. Rev Bras Cineantropom Desempenho Hum 2016;18(3):371-9.

11. Raab M. Decision Making in Sports: Influence of complexity on implicit and explicit learning. Int J Sport Exerc Psychol 2003;1(4):310-37.

12. Maia N, Mesquita I. Estudo das zonas e eficácia da recepção em função do jogador recebedor no voleibol sênior feminino. Rev Bras Educ Fís Esporte 2006; 20(4):257-70.

13. Palao JM, Santos JA, Ureña A. Effect of the manner of spike execution on spike performance in volleyball. Int J Perform Anal Sport 2007; 7(2):126-38.

14. Afonso J, Mesquita I, Marcelino R, Silva J. Analysis of the setter's tactical action in high-performance women's volleyball. Kinesiology 2010; 42(1):82-9.

15. Marcelino R, Mesquita I, Sampaio J. Effects of quality of opposition and match status on technical and tactical performances in elite volleyball. J Sports Sci 2011; 29(7): 733-41.

16. Tabachnick B, Fidell L. Using multivariate statistics. (6th ed.). Boston: Allyn & Bacon; 2013.

17. Fleiss J. L., Levin B., Paik M. C. Statistical methods for rates and proportions. 3rd ed. New York: Wiley-Interscience; 2003.

18. Castro J, Souza A, Mesquita I. Attack efficacy in volleyball: Elite male teams. Percept Mot Skills 2011;113(2):395-408.

19. Costa GCT, Afonso J, Barbosa RV, Coutinho P, Mesquita I. Predictors of attack efficacy and attack type in high-level brazilian women's volleyball. Kinesiology 2014;46(2):242-8.

20. Garcia-De-Alcaraz A, Ortega E, Palao JM. Effect of age group on male volleyball players technical-tactical performance profile for the spike. Int J Perform Anal Sport 2015;15(2):668-86.

21. Laporta L, Nikolaidis P, Thomas L, Afonso J. Attack coverage in high-level men's volleyball: organization on the edge of chaos? J Hum Kinet 2015;47(3):249-57.

22. Panfil R, Superlak E.The relationships between the effectiveness of team play and the sporting level of a team. Hum Mov 2012;13(2):152-60.

23. Millán-Sanchez A, Rábago JCM, Hernández MA, Marzo PF, Ureña A. Participation in \terminal actions according to the role of the player and his location on the court in top-level men's volleyball. Int J Perform Anal Sport 2015; 15(2):608-19.

24. Stutzig N, Zimmermann B, Busch D, Siebert T. Analysis of game variables to predict scoring and performance levels in elite men's volleyball. Int J Perform Anal Sport 2015;15(3):816-29.

CORRESPONDING AUTHOR

Gustavo De Conti Teixeira Costa
Universidade Federal de Goiás
Avenida Esperança s/n, Campus Samambaia
Faculdade de Educação Física e Dança
Goiânia, GO. Brasil
CEP: 74690-900
E-mail: conti02@hotmail.com