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

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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 efetuada 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. In volleyball, specifically, studies on game analysis have shown that the attack is strongly associated with victory in the game, 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, 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. 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.

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 powerful and technical attacks. 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. 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 as well as the complexity of the action and its environmental restrictions. 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.

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

Continue…
### Table 2. Relationship between reception effect and attack zone

<table>
<thead>
<tr>
<th>Attack Zone</th>
<th>Total</th>
<th>Net</th>
<th>Backcourt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occurred</td>
<td>8562</td>
<td>2532</td>
<td>678</td>
</tr>
<tr>
<td>% Attack type</td>
<td>88.6%</td>
<td>78.9%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>-8.8*</td>
<td>-8.8*</td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>2177</td>
<td>574</td>
<td>1603</td>
</tr>
<tr>
<td>% Attack type</td>
<td>87.5%</td>
<td>87.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>3.3*</td>
<td>-3.3*</td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>1088</td>
<td>588</td>
<td>500</td>
</tr>
<tr>
<td>% Attack type</td>
<td>91.9%</td>
<td>91.9%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>-2.8*</td>
<td>2.8*</td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>8127</td>
<td>3917</td>
<td>4210</td>
</tr>
<tr>
<td>% Attack type</td>
<td>92.4%</td>
<td>92.4%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>1.9</td>
<td>-1.9</td>
<td></td>
</tr>
<tr>
<td>Percent occurrence</td>
<td>100%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

* Difference found for p≤0.05
## Table 3. Relationship between offensive structures and attack zone.

<table>
<thead>
<tr>
<th>Attack Zone</th>
<th>Net</th>
<th>Backcourt</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Powerful Attack in parallel</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>698</td>
<td>171</td>
<td>869</td>
</tr>
<tr>
<td>% Attack type</td>
<td>80.3%</td>
<td>19.7%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>1.5</td>
<td>-1.5</td>
<td></td>
</tr>
<tr>
<td><strong>Powerful attack in diagonal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>1086</td>
<td>315</td>
<td>1401</td>
</tr>
<tr>
<td>% Attack type</td>
<td>77.5%</td>
<td>22.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>-1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td><strong>Drop</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>182</td>
<td>48</td>
<td>230</td>
</tr>
<tr>
<td>% Attack type</td>
<td>79.1%</td>
<td>20.9%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Adjusted residue</td>
<td>.2</td>
<td>-.2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occurred</td>
<td>1966</td>
<td>534</td>
<td>2500</td>
</tr>
<tr>
<td>% Attack type</td>
<td>78.6%</td>
<td>21.4%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

* Difference found at p≤0.05; A: excellent; B: moderate; C: poor.

## 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 error1,18,19. 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 sets3,8,20 and these are associated mainly with position 310,21 due to the proximity of the setter with the attacker22. When considering the attack type and reception quality, studies have shown that high-performance volleyball requires powerful attack to score8,9,18, and high-quality reception23.

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 error19,21,24. Considering that studies on game analysis, in most cases, do not differentiate the attack location and knowing that most attacks occur from the attack zone23, 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**


