ORIGINAL ARTICLE

TRENDS in
Sport Sciences
2021; 28(**2**): 153-158
ISSN 2299-9590
DOI: 10.23829/TSS.2021.28.2-9

# Variations of technical actions among playing positions in male high level volleyball

RICARDO FRANCO LIMA[1], FRANCISCO CALEIRO[1], FILIPE MANUEL CLEMENTE[1,2]

**Abstract**

**Introduction. Volleyball is a team sport in which a mistake made by a player on one team gives a point to the opponent. This fact requires coaches to think of all volleyball skills as having the same level of importance. Aim of Study. The purpose of this study was to analyze and compare variations of the technical actions of players' in-game role in terms of total points, breaking points, and the point/error relationship during one professional season. Material and Methods. The study included 80 matches played by 14 teams participating in the male First Division Portuguese Championship during the 2017/2018 season. The study analyzed 295 sets with a total of 85,233 actions. Data was collected using the statistical programs Data Volley and Click & Scout after video recording the matches. Results. Considering breaking points, moderate decreases were found for middle blockers vs opposites, and small increases were found for outside hitters vs middle blockers. Also, small increases were found for outside hitters vs opposites. Considering the point/error relationship, small decreases were found for middle blockers vs opposites and for outside hitters vs opposites. Trivial differences were found between outside hitters and middle blockers. Conclusions. The main differences portrayed in the study show that to have success, during practice, coaches need to focus on improving players' efficiency in different game actions in the counter-attack phase.**

**KEYWORDS: match analysis, player role, elite players, notational analysis, performance.**

Received: 13 October 2020
Accepted: 27 January 2021

Corresponding author: ricardo.lima@esdl.ipvc.pt

[1] *Instituto Politécnico de Viana do Castelo, Escola Superior de Desporto e Lazer, Viana do Castelo, Portugal*
[2] *Instituto de Telecomunicações, Delegação da Covilhã, Covilhã, Portugal*

## Introduction

Volleyball is a team sport, in which an error made by a player on one team gives a point to the opponent. This fact requires coaches to think of all volleyball skills as having the same level of importance. In this sense, the literature has revealed that predictors of success in volleyball include skill efficacy (attack, serve, reception, set, block, and dig) [1, 2, 8]. Apart from game action efficacy, both scoring skills and non-scoring skills also predict a team's success or defeat in a volleyball game [19, 12]. Unsurprisingly, studies have shown that the main reasons for success in volleyball result from better technical and tactical performance of a team [4], as well as the efficacy of points in the Complex II phase (i.e. when the team is going to serve and has the opportunity to score the breaking point – regarding service actions, block points, and counter-attack efficacy), which improves a team's chance of winning [13]. Furthermore, in a study that tried to determine the technical elements that could lead to a prediction of winning or losing a match by taking into account the differences of the technical elements recorded among the teams that participated in the Japan 2006 World Volleyball Championship showed that the attack error and power jump serve aces led to the prediction of the match outcome, whereas attack after reception and

the first tempo attack emerged as the decisive factors for team success [21].

In the same way, studies on game actions in elite volleyball teams such as in Spain or in the European League [11, 17] and Portugal [13] have indicated that different players' in-game roles demand different actions from players. In this sense, literature has revealed that the opposite (i.e. the player who acts on the right side of the net) usually performs the most attack actions, but is not the most efficient player. Meanwhile, the middle blocker (i.e. the player who acts in the middle of the net) executes most blocks and has the fastest attack tempo, while the outside hitter (i.e. the player who acts on the left side of the net) is the most demanded in the reception action and is the most effective player regarding the attack action [14, 17, 29].

Additionally, a study that tried to determine the technical elements leading to a prediction of winning or losing a volleyball match during the CEV Men's Champion League in 2018 showed that volleyball coaches should focus more on the individual and team offensive techniques and tactics without neglecting defensive skills [22].

Nevertheless, it is necessary to understand not only the game actions of players individually, but also the effect of players' in-game roles on the point outcome and its relevance in the Complex II and Complex I phases (i.e. side-out transition – reception, set and attack action) [19]. In this sense, when evaluating skill performance a comparison between Complex I and Complex II in elite volleyball teams suggests that the reception, set and attack actions in Complex I should not be treated in the same way as the service, block, dig, and break-point actions in Complex II [7, 15, 26]. This is justified by the team's overall performance depending on the technical actions of Complex II (aces, block points and counter-attack efficacy) [13].

In this sense, the rationale of this study relies upon the fact that such comparative studies are scarce. Moreover, although the performance of the teams in European competitions has been improved through research, little is known about Portuguese volleyball specifically. Therefore, the purpose of this study is to analyze and compare variations in technical actions of players' in-game roles in terms of total points, breaking points (counter-attack – when the team tries to block or dig the ball) as well as the point/error relationship in the Portuguese Volleyball First Division league during the 2017/2018 season.

## Material and Methods

The study included the fourteen teams that participated (100% of the teams) in the male First Division Portuguese Championship during the classification phase of the 2017/2018 season (October to March). This study included 80 matches (with a total of 295 sets) and analyzed 131 athletes. We opted to select only the players who participated in the game and performed at least one technical action included in the match report.

The study followed the ethical recommendations of the Declaration of Helsinki for the study of humans.

In each game the players' in-game roles (positioning) were determined and classified by two independent observers with a coaching license (level I) and 5-year experience in volleyball. The in-game roles were classified as: (i) outside hitter (the player who hits and blocks on the front left side of the court); (ii) middle blocker (a player at the net in the middle of the court among two outside blockers); and (iii) opposite (a player on the right side in the front and back row). The players' in-game roles were defined as independent variables of the present study.

The data of game action (total points, points obtained in breaking points and the point/error) made by players were collected using the Data Volley and Click & Scout statistical programs after video recording the matches. The total points represented the total points obtained in the match, the breaking points represented the points obtained in the break-point phase; the relationship between winning points and errors was determined as point/error. It was defined as an error when the athlete misses a serve or an attack. The reception error was not included in the analysis, because it is not a terminal action.

The data were collected using the Data Volley and Click & Scout statistical programs after video recording matches with a SONY FDR-AX33 camera, which was positioned behind the volleyball court (Figure 1).

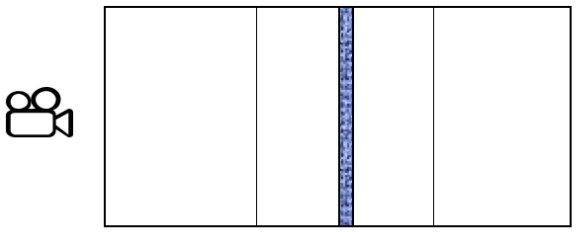

**Figure 1.** Video Cam SONY FDR-AX33 positioned behind the pitch

Data Volley is a statistical program that is used by top volleyball teams, because it can analyze game actions by player, skill, and rotation. It also provides the general statistics of teams and a video analysis program is integrated into the software [5]. The Click & Scout

statistical software is an important tool for analyzing the game actions of a team and its opponents [28]; it also provides feedback concerning matches [25].

Coleman [3] suggested that these software packages allow users to achieve intra-observer reliability values of 0.96-1.00 and inter-observer reliability values of 0.98-1.00. In our case, 5% of the full data set was used to test observers' intra- and inter-reliability. The test-retest was performed for the first games of the season, which took place over a 30-day interval during the beginning of the data collection period. The intra-class correlation test (ICC), two-way mixed and absolute agreement tests revealed good intra-reliability (ICC = 0.76) and inter-reliability values (ICC = 0.81). These values were consistent with those recorded in other studies [10, 25].

All the data were obtained from official match reports of the matches played in the male First Division Portuguese Championship between September 2017 and April 2018. These match reports included analyses of the following variables: total points (total points scored during the match), points obtained in the break-point phase and the relationship between winning points and errors (attack, service, and reception errors).

The results are presented in the form of means and standard deviations. The data were tested for the normality and homogeneity of variance before the inferential statistical tests. After the assumptions of normality and homogeneity ($p > 0.05$) were compared using the Kolmogorov–Smirnov and the Levene tests, respectively, one-way ANOVA was executed to analyze the variations in actions of players' in-game roles. Additionally, the Tukey post-hoc test was used for pairwise comparisons. These statistical procedures were executed in the SPSS software (version 24.0, IBM, Chicago, USA) for $p < 0.05$. For the pairwise comparisons the standardized differences of effect size (ES) with 95% confidence interval (CI) were also calculated [25]. The following scale was used to interpret the magnitude of differences [25]: [0.0; 0.2] trivial; [0.2; 0.6] small; [0.6-1.2] moderate; [1.2] large. The computation of statistical procedures was performed in a specific spreadsheet of Hopkins et al. [9].

## Results

Descriptive statistics can be found in Figure 2. Opposites scored more 5.89 and 3.66 total points than middle

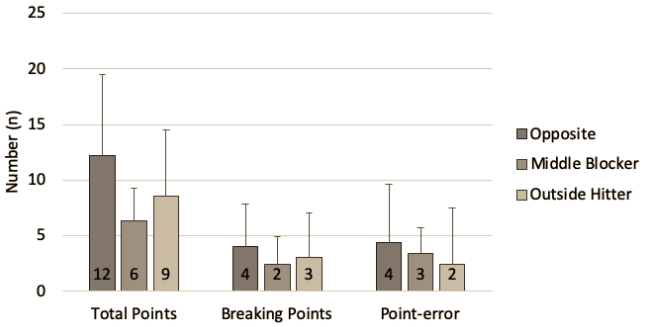


**Figure 2.** Descriptive statistics (M ± SD) of the total points, breaking points and point/error relationships made by match between in-game role (average per player)

**Table 1.** Total points, breaking points and point-error relationships made by match between in-game roles

| | % difference [95%CI] | Pairwise p-value | ES [95%CI] and magnitude |
|---|---|---|---|
| *Total Points* | | | |
| outside hitter vs middle blocker | 31.4 [20.3; 43.5] | <0.001 | 0.39 [0.27; 0.52] small ES |
| outside hitter vs opposite | −30.6 [−37.5; −22.9] | <0.001 | −0.52 [−0.67; −0.37] small ES |
| middle blocker vs opposite | −47.1 [−52.4; −41.3] | <0.001 | −0.91 [−1.05; −0.76] moderate ES |
| *Breaking Points* | | | |
| outside hitter vs middle blocker | 26.8 [16.2; 38.3] | <0.001 | 0.36 [0.23; 0.49] small ES |
| outside hitter vs opposite | 14.6 [1.6; 29.3] | <0.001 | 0.20 [0.02; 0.38] small ES |
| middle blocker vs opposite | −33.9 [−40.5; −26.5] | <0.001 | −0.61 [−0.77; −0.46] moderate ES |
| *Point/Error* | | | |
| outside hitter vs middle blocker | 4.0 [−7.1; 16.4] | 0.021 | 0.05 [−0.10; 0.21] trivial ES |
| outside hitter vs opposite | −21.5 [−31.7; −9.8] | <0.001 | −0.31 [−0.48; −0.13] small ES |
| middle blocker vs opposite | −24.5 [−33.8; −14.0] | 0.064 | −0.36 [−0.52; −0.19] small ES |

Note: 95%CI – confidence interval of 95%; ES – effect size (standardized effect size of Cohen)

blockers and outside hitters, respectively. Moreover, opposites executed more 1.58 and 0.9 breaking points than middle blockers and outside hitters, respectively. Finally, middle blockers and outside hitters scored 0.98 and 1.94 point/error units fewer than the opposite.

One-way ANOVA revealed significant differences among in-game roles in the variables of breaking points ($F_{(2;918)} = 27.680$; $p = 0.001$), point/error ($F_{(2;918)} = 10.512$; $p = 0.001$) and total points ($F_{(2;918)} = 77.190$; $p = 0.001$). Pairwise comparisons of the total points, breaking points and point/error by in-game roles can be found in Table 1.

**Discussion**

This paper aimed to analyze and compare variations in different technical actions of players' in-game roles in terms of total points, breaking points as well as the point/error relationship in the Portuguese Volleyball First Division league during the 2017/18 season. The findings provide insights that could elucidate the current trends seen in the elite of volleyball teams. The main results demonstrated that considering total points moderate decreases were found for middle blockers vs opposites, while small decreases were found for outside hitters vs opposites, and finally small increases were found for outside hitters vs middle blockers. Therefore, game action position roles can be analyzed during matches in the Portuguese league and other national and international leagues in the same way.

Similar results were found in other studies that analyzed variations in the technical actions and their efficacy as well as probabilistic relationships predicting outcomes relating to attack players in elite-level men's volleyball [2,14]. Regarding previous studies, the opposite is the player most solicited in attack actions and who has the greatest and the most efficacy attack contribution followed by the outside hitter and finally by the middle blocker [11]. In this way, knowing such patterns will enhance the rate of success for the defending teams, while the attacking teams should try to create strategies of using each set of game constraints in a different manner. Consequently, this result might be considered sensible; thus, while the opposite player must have solid resources to attack under difficult situations [1], the outside hitter is a double-task player (receiving and attacking), so he needs to focus on more than one action [16]. In turn, the middle blockers require a strong reception quality to attack, this player is not solicited often when a team does not have high quality receptions [15].

During the breaking point phase as the total point variable result, the opposite player is the most requested player when compared with the middle blockers and outside hitters. The results could be justified by the breaking-point phase when often the team with ball possession plays with only two options to finish the rally. As a result, despite the unfavorable conditions the outside hitters manage to execute power attacks in the majority situations and score a high frequency of attack points [1]. Likewise, a study that compared the total attacks, points in the defense phase and attack efficiency players' in-game roles in Portuguese men's volleyball teams revealed that the opposite player is the one that scores more total attacks and total points in a game than any other player [13].

Regarding the point/error ratio variable, small decreases were found for middle blockers vs opposites and outside hitters vs opposites. Also, small differences were found for outside hitters vs middle blockers.

In the same line of thought, a study that tried to identify the performance indicators during the Complex II phase found that the best predictors of team success are related to the sequences of defending, setting and counter-attacking [24]. Consequently, in counter-attacks (after defense) the setter rarely has a perfect ball, so the first-priority player to hit the ball is the opposite, while the second-priority player to hit the ball is the outside hitter [1].

Although as previously mentioned, this study did not predict wins or losses; instead, it revealed the importance of counter-attack actions from different players' in-game roles. Some studies have showed that the relationships between digs, sets and counter-attacks predict match outcomes [18, 23, 27]. Furthermore, same studies have revealed that attack efficacy and service actions could also predict best performance in Complex II, so teams which improve their actions during this phase tend to increase their probability of scoring a point and consequently win the match. Regarding Complex I, several studies that tried to identify play structure variables between top-level teams and second-level teams in international men's volleyball, revealing that there are no differences between these types of teams regarding side-out actions [6, 13, 20]. Such results show a general trend and indicate the importance of coaches having their teams spend more time practicing Complex II actions regardless of the team level.

This study has some limitations. Only one national league was analyzed and possibly inferences should be carefully generalized. In addition to the comparison between players' in-game roles, it would be interesting to analyze the influence of game actions on the final result of the match. Further research is needed to compare

technical actions and different game phases (Complex I and II) between players' in-game roles in different leagues.

## Conclusions

Our findings indicate that the opposite is the player who scores the most points. The opposite has greater point/error values than the outside hitter and middle blocker. Meanwhile, outside hitters scored slightly more breaking points than opposites and middle blockers. The patterns found in this study could guide coaches in planning their practice-design strategies. Coach strategies can be improved by adjusting the block position to the opposite opponent player instead of the middle blocker or the outside hitter during the break-point phase. Moreover, coaches need to focus their practices on improving the efficacy of the attack in the counter-attack and transition phases for both outside hitter and opposite players.

## Conflict of Interests

The authors state no conflict of interest.

## Acknowledgments

This study made part of one curricular unit of Sports and Leisure Degree at Escola Superior de Desporto e Lazer, Instituto Politécnico de Viana do Castelo, Portugal.

## References

1. Castro J, Souza A, Mesquita I. Attack efficacy in volleyball: elite male teams. Percept Mot Skills. 2011;113(32): 395-408. https://doi.org/10.2466/05.25.PMS.113.5.395-408.
2. Cohen J. Statistical power analysis for the behavioral sciences. 2nd ed. New York: Routledge; 1988.
3. Coleman J. The volleyball coaching bible. In: Shondell D, Reynaud C, editors. Scouting opponents and evaluating team performance. Champaign: Human Kinetics; 2002. pp. 321-346.
4. Conti G, Costa G, Maia M, Martins L, Campus M, Milisteted M, et al. Association between effect of reception and game procedures in high-level Brazilian volleyball: the case of the women's "Superliga" champion team. Rev Bras Cineantropom Hum. 2017;19(6):663-675. http://dx.doi.org/10.5007/1980-0037.2017v19n6p663.
5. Data Project. The statistics and analysis software used by the best teams worldwide. 2014. Retrieved from: http://www.dataproject.com/US/en/Volleyball.
6. Drikos S, Kountouris P, Laios A, Laios Y. Correlates of team performance in volleyball.Int J Perform Anal Sport. 2009;9(2):149-156.http://doi.org/10.1080/24748668.2009.11868472.
7. Eom HJ, Schutz RW. Statistical analyses of volleyball team performance. Res Q Exerc Sport. 1992;63(1):11--18. http://doi.org/10.1080/02701367.1992.10607551.
8. Gil Arias A, Claver Rabaz F, Fernández-Echeverría C, Moreno-Dominguez A, Moreno-Arroyo M. Análisis comparativo del saque en voleibol entre los campeonatos de España 2005-2010 (Comparative analysis of the serve in volleyball between the Spanish Championships 2005--2010). Revista Internacional De Medicina y Ciencias De La Actividad Física Y Del Deporte. 2016;16(63):439--456. https://doi.org/10.15366/rimcafd2016.63.003.
9. Hopkins W, Marshall S, Batterham A, Hanin J. Progressive statistics for studies in sports medicine and exercise science. Med Sci Sport Exerc. 2009;41(1):3-13. http://doi.org/10.1249/MSS.0b013e31818cb278.
10. Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016;15(2):155-163. http://doi.org/10.1016/j.jcm.2016.02.012.
11. Lima R, Palao JM, Moreira M, Clemente FM. Variations of technical actions and efficacy of national teams' volleyball attackers according to their sex and playing positions. Int J Perform Anal Sport. 2019;19(4):491-502. https://doi.org/10.1080/24748668.2019.1625658.
12. Lima RF, Palao JM, Clemente FM. Jump performance during official matches in elite volleyball players: a case study. J Hum Kinet. 2019;67(1):259-269. https://doi.org/10.2478/hukin-2018-0080.
13. Lima R, Silva AF, Clemente FM. Temporal effects of final action on the performance of the Portuguese men's volleyball teams. Biomed Hum Kinet. 2019;11(1):121--130. https://doi.org/10.2478/bhk-2019-0017.
14. Marcelino R, Afonso J, Moraes JC, Mesquita I. Determinants of attack players in hight-level men's volleyball. Kinesiology. 2014;46(2):234-241.
15. Marcelino R, Mesquita I, Afonso J. The weight of terminal actions in Volleyball. Contributions of the spike, serve and block for the teams' rankings in the World League 2005. Int J Perform Anal Sport. 2008;8(2):1-7. https://doi.org/10.1080/24748668.2008.11868430.
16. Marcelino R, Mesquita I, Sampaio J, Moraes J. Estudo dos indicadores de rendimento em voleibol em função do resultado do set (Study of performance indicators in male volleyball according to the set results). *Revista Brasileira* de *Educação Física e Esporte*. 2010;24(1):69-78. http://dx.doi.org/10.1590/S1807-55092010000100007.
17. Millán-Sánchez A, Morante Rábago JC, Ureña Espa A. Differences in the success of the attack between outside and opposite hitters in high level men's volleyball. J Hum Sport Exerc. 2017;12(2): 251–257. https://doi.org/ 10.14198/jhse.2017.122.01.

18. Mroczek D, Januszkiewicz A, Kawczynski A, Borysiuk Z, Chmura J. Analysis of male volleyball players motor activities during a top level match. J Strength Cond Res. 2014;28(8):2297-2305. http://doi.org/10.1519/JSC.0000000000000425.
19. Oliveira AOGF, Vaz LMT, Pastore JC, João PV. Discriminate scoring skills and non-scoring skills according to results in the Brazilian men's volleyball SuperLeague. Montenegrin J Sport Sci Med. 2018;7(1): 73-79. http://doi.org/10.26773/mjssm.180310.
20. Palao JM, Santos JA, Ureña A. Effect of team level on skill performance in volleyball. Int J Perform Anal Sport. 2017;4(2):50-60. https://doi.org/10.1080/24748668.2004.11868304.
21. Patsiaouras A, Charitonidis K, Moustakidis A, Kokaridas D. Comparison of technical skills effectiveness of men's National Volleyball teams. Int J of Perform Anal Sport. 2009;9(1):1-7. https://doi.org/10.1080/24748668.2009.11868460.
22. Patsiaouras A, Kokaridas D. Technical skills predictive of winning at CEV Volleyball Men's Champions League: identification and importance. Trends Sport Sci. 2019;2(1):71-76. https://doi.org/10.1080/24748668.2009.11868460.
23. Peña J, Casals M. Game-related performance factors in four European men's professional volleyball championships. J Hum Kinet. 2016;53(1):223-230. https://doi.org/10.1515/hukin-2016-0025.
24. Peña J, Rodriguez-Guerra J, Busca B, Serra N. Which skills and factors better predict winning and losing in high-level men's volleyball? J Strength Cond Res. 2013;27(9):2487-2493. http://doi.org/10.1519/JSC.0b013e31827f4dbe.
25. Silva M, Lacerda D, Vicente JP. Match analysis of discrimination skills according to the setter attack zone position in high level volleyball. Int J Perform Anal Sport. 2013;13(2):367-379. https://doi.org/10.1080/24748668.2013.11868661.
26. Silva M, Marcelino R, Lacerda D, João PV. Match analysis in volleyball: a systematic review. J Sport Sci Med. 2016;5(1):35-46.
27. Stutzig N, Zimmermann B, Büsch D, Siebert T. Analysis of game variables to predict scoring and performance levels in elite men' volleyball. Int J Perform Anal Sport. 2017;15(3):816-829. https://doi.org/10.1080/24748668.2015.11868833.
28. Szabo D. Modalities of using the information provided by the statistical program Click and Scout for improving the outside hitters service efficiency in volleyball game. EpSBS. 2015:341-347.
29. Wnorowski K, Aschenbrenner P, Skrobecki J, Skrobecki J, Stech M. An assessment of a volleyball player's loads in a match on the basis of the number and height of jumps measured in real-time conditions. Balt J Heal Phys Act. 2013;5:199-206. http://doi.org/10.2478/BJHA-2013-0019.