ORIGINAL ARTICLE

Technical skills predictive of winning at CEV Volleyball Men's Champions League: identification and importance

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Abstract

Introduction. The purpose of the study was to determine the technical elements leading to a prediction of winning or losing a volleyball match during the European Volleyball Confederation (CEV) men's volleyball championships in 2018. Material and Methods. The sample consisted of all men teams' matches of the CEV Volleyball Champions League during 2018 season. The differences in technical elements between the teams were recorded. Seventy-six matches were evaluated using the official statistical logistic package of the European Confederation (CEV), as well as the SPSS 21 statistical package for additional analysis. Discriminant analysis was used to find which measured variables significantly contributed to the prediction of winning or losing a match, helped teams to progress successfully throughout the tournament, and led the best teams to the Final Four round. Results and Conclusions. Results showed that "serve total", "reception total", "attack excellent", and "block" led to the prediction of the match outcome (winning or losing a match), whereas "serve error", "reception excellent" emerged as the decisive factors for team's qualification, and finally "attack positive" was the only factor that could lead men's teams to participate in the CEV Final Four round.

KEYWORDS: volleyball, performance indicators, CEV Champions League, technical.

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Introduction

Over recent years, many research efforts attempted to discover all crucial technical elements that could lead to accurate predictions of winning or losing a volleyball game. The contribution of volleyball technical skills leading to successful results is greatly discussed among researchers and in the media [19, 20, 21, 23].

All volleyball coaches put systematic effort to improve volleyball skills of their team, identify skills and practices of the opponent team and develop a plan of winning points, sets, and matches [10]. Especially between two competing and equally successful high-level teams, such as those participating in the CEV Champions League, a positive outcome of a volleyball game is often based on learned action models and strategies to achieve winning goals.

The team making fewer mistakes is more likely to win the game. Among many different technical skills (service, block, attack, reception, setting, and defense), observed in a volleyball match, attacks, blocks, and service points are principally considered as scoring skills that significantly contribute to winning a match – due to their potential to create a direct (kill) point [14, 21]. On the other hand, defense procedures, group formation, and starting positions are considered as non-scoring skills [14] that are expected to contribute less to the outcome of the game.

Researchers [21] noted that "attack error", "jump services point", "quick ball error", and "jump serves" lead to the prediction of the match outcome whereas "attack after reception" and "quick ball attack" emerged as decisive factors for team qualification. Another study

pointed out that "service points", "reception errors", and "attacks blocked" appeared as important factors predicting winning or losing a match during the Beijing Olympic Games [19].

Patsiaouras et al. [20] pointed out statistically significant differences regarding to the "attack errors following bad receptions" skill between teams of the qualification round and teams qualified to the semi-final and final game of the Olympic Games 2008. The same dependence was also noted for the "attack after bad reception" prediction factor between the qualification round teams and the teams (Brazil vs USA) of the final [20].

Drikos [5] in his longitudinal study of success-defining factors, concluded that in elite male Greek volleyball championships the best predictors of success and final team ranking were "serve aces", "passing errors", "precise pass" and "attack following passing or defense". Furthermore, Drikos [6] also reported that "pass accuracy" during a match is necessary to provide at least two attack options, but it is not sufficient enough to determine successful attacks in all age categories of male volleyball. In another study, Marcelino et al. [13] found that "attack tempo" was negatively correlated with the quality of team's arrangements, suggesting that slower attack tempos give the attacker more time to prepare and to create momentum for performing the action.

According to Shephard et al. [22], the development of volleyball coaching and daily training practice is determined by the increased homogeneity of the characteristics of elite athletes. On the other hand, despite the richness of scientific information and relative researches in volleyball, there is an obvious and continuous need to update all relative knowledge about the effectiveness of technical skills due to changes in regulations and the development of novel trends and new strategies used during games. Such information could also help second-level teams to adjust their training schemes, such as spending more time for counter-attacks with medium and slow attack tempos, so as to reach the performance level of elite volleyball teams [23].

Top volleyball teams have significant similarities in both the average height of players and the technical performance of skills performed during the game [7, 22]. Thus, games among the top teams in the world are usually very balanced and understanding whether successful performance indicators relate to awarding points during a volleyball game is useful not only for athletes but also for coaches in all team sports [12, 14, 15, 17, 24].

It remains crucial to understand the importance and contribution of technical skills to win a game, since other studies [1, 2] provided evidence that in top-level teams skill errors occur more often than technical errors due to a higher level of risk. Consequently, more research studies are needed to further identify performance factors that distinguish to teams in winning or losing a game. Especially teams competing in highly challenging championships such as the CEV Champions League could use all relative information to improve their final ranking.

Aim of Study

The purpose of the study was to determine the technical skills leading to a reliable prediction of winning or losing a volleyball match, and successful progress to the Final Four in the CEV men's volleyball championships (2018).

Material and Methods

The sample consisted of all men teams' matches of the CEV Volleyball Champions League during 2018 season, with seventy-six matches evaluated. The majority (N = 43) of matches' results ended with a 3-0 score for the winning team, whereas the rest of the matches (N = 18) finished either after 4 sets (3-1 score) or after 5 sets, with a 3-2 score (N = 15).

Statistical analysis included the use of the official statistical logistic package Data Volley 4 Professional [4] of the European Volleyball Confederation [3]. Reliability of the study was achieved through an agreement between the two observers assigned by the World Championships' Committee and the leader of this research – qualified and experienced volleyball coach. Inter-rater reliability was Cohens k = 0.97 [4, 18], as data was derived from direct observation of four randomly selected games and later from video recordings from www.laola1.tv. Inter-observer reliability of at least 80% was considered as acceptable [11]. Additional statistical analysis of the results was done using the SPSS 21 statistical package.

The specific logistic program (Data Volley 4) records quantitative data only, that is, it records all technical elements that are involved during a volleyball match and groups these elements into four basic factors that were evaluated and used for statistical analysis in this study along with all the mistakes and points obtained during matches. These factors were: a) service (total services, service point-ace and service error-point for the opponent), b) service reception (total receptions, reception errors – point for the opponent, positive receptions, and excellent receptions), c) attack following service reception (total attacks, failed attacks

following service reception – point for the opponent, attack blocked and point for the opponent, positive attacks, excellent attacks – point for the team), and d) block (point after successful block).

Statistical Analysis
The SPSS 21.0 Statistical Package was used to present the descriptive methods of data analysis. Discriminant analysis was used to locate which measured variables significantly contributed to the prediction of winning or losing a match during CEV Men's Champions League in 2018. The stepwise method was used for discriminant analysis between a) winning or losing a match, b) qualified or non-qualified teams and, c) Final Four participant or Final Four non-participant team, as dependent variables. The calculation of effect size η^2 of all obtained factors, using the stepwise discriminant analysis, follows the suggestion of Ellis [25].

Results
Given that the aim of the study was to examine the contribution of volleyball technical elements as performance indicators leading to the match result, discriminant analysis was implemented, with categories for each technical element which entered into the analysis separately, as independent variables (Means ± ± SD, Table 1).

The stepwise method of entering the variable to the model was used, whereas estimation of the correct participation was based on the "leave-on-out" classification method, proposed by Zetou et al. [24]. Effect size η^2 was used to explain the ratio of the variance of the dependent variable associated with one or more predictors of the game outcome. The "alpha" level was set to 0.05.
Regarding winning or losing a match, as a grouping variable, the discriminant analysis revealed one significant function from the 4 categories of technical elements "service total", "reception total", "attack excellent", and "block". In particular, Wilks' $\Lambda = 0.333$, x^2 (4, N = 149) = 159.24, $p \leq 0.001$ indicated that group means differ from each other. Box's M statistical analysis was not significant, showing that the assumption of multivariate normality was not violated (Box's M = = 3.38, $F_{(10, 124305)} = 2.62$, p = 0.100).
The four variables that entered into the final model ("serve total", "reception total", "attack excellent", and "block") were able to classify correctly 92.6% of the original groups' case (Table 2).
The final model including four significant functions with "attack excellent" ($\eta^2 = 0.444$), "serve total" ($\eta^2 = 0.724$), "block" ($\eta^2 = 0.286$) and "reception total" ($\eta^2 = 0.560$) in this particular order (from stronger to weaker predictor) led to the prediction of winning or losing a match (Table 2). None of the other categories

Table 1. Overall results (Mean and SD) of prediction factors for winning in CEV Men's Champions League in 2018

Prediction factors (technical elements)	Win the game M ± SD	Lost the game M ± SD	Qualification rounds M ± SD	Pool M ± SD	Play-offs M ± SD	Participation in F4 M ± SD	Non-participation in F4 M ± SD
Service total	87.17 ± 16.4	74.95 ± 19.72	75.83 ± 16.84	83.26 ± 20.11	84.71 ± 18.5	79.51 ± 18.55	89.83 ± 20.08
Service error	14.81 ± 5.26	13.95 ± 4.56	12.56 ± 4.44	14.92 ± 5.04	16.29 ± 4.52	13.88 ± 4.79	17.13 ± 4.84
Servive point	6.31 ± 2.89	3.77 ± 2.24	4.96 ± 2.99	5.25 ± 3.04	4.58 ± 1.99	4.73 ± 2.71	6.78 ± 3.18
Reception total	61.36 ± 17.5	71.31 ± 13.81	62.48 ± 15.93	68.04 ± 16.64	68.38 ± 16.5	67.08 ± 16.05	62.04 ± 18.59
Reception error	3.96 ± 2.37	6.47 ± 2.99	5.17 ± 3.22	5.30 ± 3.05	5.00 ± 2.19	5.34 ± 3.09	4.48 ± 2.09
Reception positive	51.65 ± 10.0	46.51 ± 9.79	50.96 ± 11.29	49.48 ± 9.61	44.17 ± 8.48	49.17 ± 10.55	48.70 ± 8.28
Reception excellence	28.03 ± 10.48	23.11 ± 8.92	27.79 ± 10.59	25.77 ± 9.96	20.58 ± 7.22	25.38 ± 10.53	26.70 ± 6.57
Attack total	89.95 ± 23.7	92.61 ± 22.47	86.98 ± 23.63	93.04 ± 22.43	94.17 ± 23.7	91.76 ± 22.62	88.57 ± 25.73
Attack error	6.59 ± 3.11	9.04 ± 3.35	8.50 ± 3.71	7.53 ± 3.21	7.29 ± 3.54	8.20 ± 3.40	5.65 ± 2.90
Attack block	6.35 ± 3.86	9.20 ± 2.98	7.31 ± 3.87	8.01 ± 3.72	7.88 ± 3.52	8.02 ± 3.72	6.39 ± 3.49
Attack excellence	47.76 ± 10.6	40.32 ± 12.02	40.27 ± 11.21	45.56 ± 11.80	46.88 ± 12.0	43.13 ± 11.59	49.17 ± 12.34
Attack positive	54.12 ± 6.97	43.70 ± 6.21	47.46 ± 8.82	49.55 ± 8.51	50.00 ± 7.03	47.53 ± 7.65	56.70 ± 8.26
Block	9.23 ± 3.11	6.32 ± 3.79	7.23 ± 3.91	8.10 ± 3.72	7.88 ± 3.52	7.48 ± 3.84	9.48 ± 2.71

Table 2. Results of discriminant analysis of variables related to win or lose a match in CEV Men's Champions League in 2018

Predictor variable	Standardized discriminant function coefficient	Chi-square	Wilks's Lambda	F(1.147)	p
Serve total	0.798	106.374	0.351	71.955	<0.001
Total Receptions	−1.99	82.248	0.826	59.348	<0.001
Excellent Attacks	1.014	65.072	0.371	67.267	<0.001
Block	0.420	42.897	0.359	68.419	<0.001

Table 3. Results of discriminant analysis of variables related to match outcome in CEV Men's Champions League in 2018 (basic rounds and play-offs)

Predictor variable	Standardized discriminant function coefficient	Chi-square	Wilks's Lambda	F(1.146)	p
Excellent Receptions	0.731	1.143	0.866	5.41	<0.001
Service error	0.616	27.554	0.925	5.91	0.003

Table 4. Results of discriminant analysis of variables related to participation in Final Four or not participating in Final Four in CEV Men's Champions League in 2018

Predictor variable	Standardized discriminant function coefficient	Chi-square	Wilks's Lambda	F(1.147)	p
Positive Attacks	0.95	24.884	0.85	24.88	<0.001

significantly discriminated match outcome (p > 0.10) thus, they were excluded from the proposed model.

Discriminant analysis, with the qualification of the team as grouping variables, using the 4 categories of the technical elements revealed only one significant function, Wilks' $\Lambda = 0.87$, x^2 (2, N = 149) = 20.96, p < 0.001. Box's M statistical analysis was not significant, showing that the assumption of multivariate normality was not violated (Box's M = 6.54, $F_{(6,48613)} = 1.063$, p = 0.380).

Two variables entered into the final model "serve error", and "reception excellent", both able to classify correctly 56.3% of the original groups' case (Table 3). Predicting match outcome (rounds, pool, play-off teams) from the final model resulted in two significant functions "serve error" ($\eta^2 = 0.189$), and "reception excellent" ($\eta^2 = 0.783$) (Table 3). None of the other categories significantly discriminated the match outcome (p > 0.10) thus, they were excluded from the model proposed.

Finally, a discriminant analysis concerning the qualification of a team in Final Four, or not, as a grouping variables, with 4 technical elements categories included, revealed only one significant function, Wilks' $\Lambda = 0.85$ x^2 (1, N = 147) = 24.88, p < 0.001. Box's M statistical analysis was not significant, showing that the assumption of multivariate normality was not violated (Box's M = 0.23, $F_{(1,12405)} = 0.23$, p = 0.640).

One variable "positive attacks" entered into the final model, able to classify correctly 86.7% of the original case of groups (Table 4). Prediction of match outcome (participating or not in the Final Four round) from the final model resulted in one significant function of "positive attacks" ($\eta^2 = 0.169$, Table 4). None of the other categories significantly discriminated match outcome (p > 0.100) thus, they were excluded from the proposed model (Table 4).

Discussion

The purpose of the study was to examine all technical elements that emerge as reliable prediction factors of a match result during the CEV Men's Champions League in 2018. Discriminant analysis of the results revealed four decisive factors as performance indicators of winning or losing a match, that is, "total services", "total reception", "excellent attacks", and "block". In agreement with Palao et al. [16], block points served as a predicting factor of the final results probably due to coaches' continuous instructions to build solid blocks.

Results show that along with attacking skills of services and excellent attacks, defensive skills such as total receptions and blocks are also important. It reveals that paying the necessary attention to the proper technical execution of attacking efforts [24] is still a dominant factor, but not the only one. Although results showed that

attacking skills were still stronger outcome predictors, the appearance of defensive skills, as predictors in the final model, show that in modern volleyball, as the situation continually shifts from offense to defense, the supreme execution of technical elements lead to victory. Furthermore, results revealed "service errors" and "excellent receptions" as factors providing a prediction of teams' qualification, both representing the best predictors to win, and lead participant teams to the next round. Interestingly, "positive attacks" emerged as a decisive performance indicator helping a team to participate in the Final Four of CEV Men's Champions League.

It seems that volleyball coaches realized the weakness of reception, as a technical element to deal with jump services. Consequently, they paid great attention to this particular technical element by adapting the tactical defense of their teams and adjusted training of the libero player. For this reason, positive attacks that follow service reception emerged as the decisive factor that could predict participation in the Final Four of CEV Men's Champions League. These results are in line with the study of Gustavo De Conti Teixeira Costa et al. [8, 9], who stated that attack, as a predictive factor of winning the game, performed by the position 1 attacker showed greater chance to score after an excellent or moderate reception. The rest of examined technical elements, due to no significant results, are not recognized as factors predicting a match outcome.

The strong feature of this study was that all the significant technical elements that could lead to a positive result were taken into account. Nevertheless, Gustavo De Conti Teixeira Costa et al. [9] included few technical elements, like: distinction between counter attack or between attack location and attack tempo, which were not included in this study. This may be assumed as a limitation of this study.

Future research should consider using even larger number of technical elements in research design in order to ascertain the magnitude of their prediction influence on match outcomes during major volleyball tournaments, like CEV men's volleyball championships.

Conclusions and Practical Implications

The results of this study showed that volleyball coaches should focus more on the individual and team offensive techniques and tactics without however, overlooking defensive skills. Such skills are especially related to middle blockers, as the points gained by block represent a significant performance indicator to win a match along with the attack that follows a good or excellent reception of the ball. It appears that adopting an offensive approach

possibly helps teams to take the situation into their hands instead of trying to deteriorate the opponent's performance only through solid defense. Thus, the attention should probably shift to the development of offensive tactics and techniques (that each time adapt to the weaknesses of the opposite team), bearing in mind the importance of defensive skills, since positive attack following effective defense was a good predictor for a team to participate in the Final Four of CEV Men's Champions League in 2018.

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