THE EFFECTS OF SKILL-BASED FACTORS ON THE RESULTS OF HIGH-LEVEL VOLLEYBALL GAMES

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Abstract: *Understanding the relationship of skill performance indicators to scores is helpful for athletes and coaches in gaining advantage through decision making and error control. The aim of this study was to determine the skill-based factors affecting the match results of the national teams participating in the CEV Tokyo Volleyball European Qualification 2020 competitions and to make predictions about the match result. A total of 30 national team's matches of the 8 women (15 matches, 56 sets) and 8 men (15 matches, 59 sets) were analyzed. Data were obtained from the websites in the Confédération Européenne de Volleyball (CEV). The analyzed variables are: match result, gender, service aces, service errors, block points, attack points, attack errors, blocked attack, percentage of attack points (PAP), attack efficiency, reception errors, percentage of reception errors (PRE), percentage of positive receptions (PPR), percentage of excellent receptions (PER), break points, opponent errors. The results showed that blocked attack, PPR and break points were effective on the match result (p<0.05), break points and PPR variables contributed to the probability of winning the teams by 0.318 and 0.101 respectively while the blocked attack variable contributed to the probability of defeat by 0.465.*

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ÜST DÜZEY VOLEYBOL MAÇLARINDA BECERİYE DAYALI FAKTÖRLERİN MAÇ SONUCUNA ETKİLERİ

Özet: *Beceri performansı göstergelerinin puanlarla ilişkisini anlamak, karar verme ve hata kontrolü yoluyla avantaj sağlamada sporcular ve antrenörler için yararlıdır. Bu çalışmanın amacı, CEV Tokyo Voleybol Avrupa Elemeleri 2020 müsabakalarına katılan milli takımların maç sonuçlarına etki eden beceriye dayalı faktörleri belirlemek ve maç sonucuna yönelik tahminde bulunmaktı. Sekiz kadın (15 maç, 56 set) ve sekiz erkek (15 maç, 59 set) milli takımın toplam 30 maçı analiz edildi. Veriler, Avrupa Voleybol Konfederasyonu (CEV) bünyesindeki web sitelerinden alındı. Analiz edilen değişkenler şunlardır; maç sonucu, cinsiyet, servis direk puanı, servis hatası, blok sayısı, atak sayısı, atak hatası, bloklanan atak, atak puanı yüzdesi (APY), atak verimliliği, karşılama hatası, karşılama hatası yüzdesi (KHY), olumlu karşılama yüzdesi (OKY), mükemmel karşılama yüzdesi (MKY), atılan servis sonrası ralliyi kazanma, rakip hatası. Sonuçlar bloklanan atak, OKY ve atılan servis sonrası ralliyi kazanmanın maç sonucu üzerinde etkili olduğunu (p<0,05), atılan servis sonrası ralliyi kazanmanın ve OKY değişkenlerinin takımların kazanma olasılığına sırasıyla 0,318 ve 0,101'lik katkı yaptığını, bloklanan atak değişkeninin ise mağlubiyet olasılığına 0,465'lik katkı yaptığını gösterdi.*

Anahtar kelimeler: *Voleybol, Lojistik Regresyon, Maç Sonucu, Tahmin*

In volleyball, a team sport, each error gives a point or an advantage to the other team, and the players have to be very coordinated because of the limit on the number of touches. This harmony among players also leads to the need to act together and implement the same strategy decisively. Mroczek et al. (2014) stated that players must perform various non-cyclical movements in constantly changing game situations, and that a volleyball player engages in various motor actions, such as moving with or without the ball, in a way that makes intense use of the nervous and muscular system. Practicing these different motor activities in harmony as a team is one of the keys to success. Bergeles (2009) states that a successful team is made up of people who have the same vision and agree on the objectives and principles.

In 1998, the Federation Internationale de Volleyball (FIVB) introduced a number of important rule changes related to the scoring system, service throwing and libero player. Moreover; this resulted in a shortening of the match length. For this reason, the behavior of a volleyball player during the game caused him to react quickly and consciously to changing situations on the field (Mroczek et al., 2014).

Changes to the scoring system, where every mistake a team makes earns the opposing team a point, are inevitable to highlight some skills in terms of scoring. According to Silva et al. (2014a), while performing physical movements together with different skills (such as serving, blocking, attacking), the team that makes the least mistakes is more likely to be successful. Because of the possibility of directly scoring

points, spikes, blocks and services are regarded as scoring skills (Marcelino et al., 2010). Evaluating performance indicators in senior volleyball is important for coaches and players to understand the key factors that influence the outcome of the match. These indicators provide information on the amount of necessary training to develop skills that give a clear advantage through decision-making and error checking (Peña et al., 2013).

Computerized systems have provided the ability to use standardized assessment programs to generate and change information by eliminating a number of difficult processes or reducing the time required (Peña et al., 2013). Some studies have shown that information from match analysis affects the style and tactics of the game (Kraak et al., 2018; Martin et al., 2018). The Data Volley program, used by statisticians and researchers to perform multivariate analyses, is used by many national and professional teams all over the world. In addition, many volleyball studies (Marelić et al., 2004; Patsiaouras et al., 2010; Peña et al., 2013; Silva et al., 2014a) have been conducted using this software in the past.

Analyzing a match is crucial for the team's development, and the analysis can reveal the good parts of the performance. Furthermore; it can serve to strengthen them. It may also reveal negative aspects that need to be considered and corrected in training. The goal of this process is to enhance the team's game and counter the opponent's game. The aim of this study is to determine and predict the effects of skill-based factors that affect the match results of the national teams participating in the CEV Tokyo Volleyball European Qualification 2020 competitions. This information is likely to aid coaches and players in grasping the game's needs and streamlining the training processes.

Material and Method

Research Model

The document analysis method, one of the qualitative research approaches, was used in the research. The document analysis process was carried out by examining and evaluating computer-based and internet-enabled materials (Bowen, 2009). Document analysis consisted of the stages of reaching documents suitable for the purpose, checking the accessed documents, and analysing them using appropriate methods within a certain plan (Merriam & Tisdell, 2015).

The current research has been conducted within the framework of the "Guidelines for Scientific Research and Publication Ethics of Higher Education Institutions.

Research Universe and Sample Group

A total of 30 national team's matches of the 8 women (15 matches, 56 sets) and 8 men (15 matches, 59 sets) participating in CEV Tokyo Volleyball European Qualification 2020 were analyzed (Table 1).

Table 1: CEV Tokyo Volleyball European Qualification 2020 general information

	Male	**Female**
Teams (male=8, female=8)	(A) FR, RS, BG, NL (B) SI, DE, BE, CZ	(A) TR, DE, BE, HR (B) PL, NL, BG, AZ
Qualification 1st	FRANCE	TURKEY
Matchs (n=30)	15	15
Sets (n=115)	59	56
Date	05-10.01.2020	07-12.01.2020
Location	Berlin GERMANY	Apeldoorn NETHERLANDS

FR: France; RS: Serbia; BG: Bulgaria; NL: Netherlands; SI: Slovenia; DE: Germany; BE: Belgium; CZ: Czech Republic; TR: Turkey; HR: Croatia; PL: Poland; AZ:Azerbaijan

Data Collection Tools

After optaining permission to use data was obtained from the website "roadtotokyo.cev.eu" of Confédération Européenne de Volleyball (CEV) (accessed on 21.04.2021) and from match reports published on the website "https://www-old.cev.eu/Competition-Area/Statistics.aspx?ID=1208" (accessed 01.07.2021) (CEV, 2021a, 2021b). These data are provided by the Data Volley 4 (Data Volley System; Data Project) program widely used by country federations today. According to the program, variables are explained in detail in Table 2.

Table 2: The description of variables

Variables	Description
Match result	Won and lost
Gender	Man and woman
Service aces	Number of direct points won from the service
Service errors	Number of service errors
Block points	Number of direct blocks resulting in points
Attack points	Number of direct points won from attack
Attack errors	Number of errors made on attack
Blocked attack	Number of blocked attacks
Percentage of attack points (PAP)	(Attack Points / Team Total Attack) x 100
Attack efficiency	[Attack Points – (Attack Errors + Blocked Attack) / Team Total Attack] x 100
Reception errors	Number of errors in service reception
Percentage of reception errors (PRE)	(Reception Errors / Team Total Reception) x 100
Percentage of possitive receptions (PPR)	(Positive Receptions / Team Total Reception) x 100
Percentage of excellent receptions (PEP)	(Excellent Receptions / Team Total Reception) x 100
Break points	Points won by the team after serving
Opponent errors	The opponent's errors (The points gained from the errors)

Data Analysis

In the study, data and match reports from websites were checked by logging into the Microsoft Office Excel 2016 programme to avoid a possible error. All statistical analyzes were performed using the SPSS 25 software package (version 25.0 for Windows; SPSS, Inc., Chicago, IL, USA). In the analysis, the significance level was accepted as $p<0.05$. Before the analysis, gender (female-male) and match result (won-lost) variables were arranged categorically, and all other variables were arranged numerically.

In match reports, regression analysis assumptions were fulfilled to determine which of the variables that contributed to the teams' match results should be selected. Therefore, when the regression analysis is examined, the Durbin-Watson (DW=2.654) value between 1-3 indicates that there is no autocorrelation.

After multicollinearity diagnosis, because the tolerance values are less than 0.1 and the VIF values are greater than 10 (Denis, 2021; Malek et al., 2018), attack points, PAP, attack efficiency, reception errors, and PRE variables were excluded from the model (Table 3). The rest of the variables were included in the model. The remaining variables were included in the model.

Table 3: Tolerance and VIF values of variables or multicollinearity diagnosis

Variables	Tolerance	VIF
Gender	.215	4.660
Service aces	.457	2.187
Service errors	.316	3.164
Block points	.370	2.704
Attack points	.059[a]	17.003[b]
Attack errors	.132	7.565
Blocked attack	.121	8.240
PAP	.048[a]	20.844[b]
Attack efficiency	.021[a]	47.832[b]
Reception errors	.027[a]	36.912[b]
PRE	.031[a]	32.274[b]
PPR	.312	3.205
PER	.318	3.145
Break points	.178	5.633
Opponent errors	.554	1.804

a<0.1, b>10; a, b variables removed from the model

In our study, "Binary Logistic Regression (BLR)" analysis, one of the regression analyzes, was used. BLR was conducted to evaluate the effects of independent variables on the outcome of the match (dependent variable).

Since the dependent variable (match result) has two categories (win-lost), the BLR model was created using the "Backward: Wald" method. This model was evaluated with Cox&Snell and Nagelkerke R2 values,

and the significance of the model was tested with the Hosmer and Lemeshow Test.

The probability values of independent variables were calculated with the following formula (Denis, 2021; George & Mallery, 2020).

$$Z = \beta_0 + \beta_1 {*} X_1 + \beta_2 {*} X_2 + \beta_3 {*} X_3 \ldots \ldots \beta n {*} Xn$$

$$p = 1 / (1 + e^{-Z}) = e^{Z} / (1 + e^{Z})$$

The constant "e" is a real number and its value is approximately 2.71828.

Results

The chi-square value was found to be significant in the initial estimation of the logistic regression (χ^2=32.865, p<0.01, p=0.000287). When the independent variables were examined, it was seen that the variables of gender, service errors, attack point and opponent errors (p=1.000, p=0.302, p=0.937 and p=0.338) did not significantly contribute to the predictive power of the model (p>0.05). Since the analysis will be continued as a result of the significant chi-square value, the non-significant gender, service errors, attack point and opponent errors variables were removed from the model and the logistic regression was carried out again. The Chi-square value (χ^2=29.559, p<0.01, p=0.000048) and independent variables obtained as a result of logistic regression were found to be significant (p<0.05) and the analysis was continued.

The model obtained by the Backward: Wald method of independent variables is showed in Table 4. Cox and Snell R², Nagelkerke R² and Hosmer-Lemeshow tests were performed to assess the "goodness of fit" of logistic regression. The values obtained are 0.484 for the Cox and Snell R² test and 0.646 for the Nagelkerke R² test (maximum value 1). In other words, with the established model, 48.4% of the match result can be explained according to the Cox and Snell R² result and 64.6% of the match result can be explained according to the Nagelkerke R² result. The Hosmer-Lemeshow test result (χ^2=10.556; p=0.228) shows that the model is fit. As the final classification obtained from the established logistic regression model, a correct

classification value of 81.7% was reached in total. Initially, this estimate was 50%.

Table 4: The result of logistic regression analysis

Variables	β	p	O.R.	95% Confidence interval	
				Lower	Upper
Blocked attack	-.465	.002*	.628	.472	.837
PPR	.101	.016*	1.107	.019	1.201
Break points	.318	<.001**	1.374	.164	1.621
Constant	-8.642	.003*	0.000		

*p<0.05, **p<0.001; O.R.: Odds ratio; PPR: Percentage of possitive receptions*

According to Table 4, an increase in the blocked attack value reduces the probability of winning (OR=0.628; p=0.002). When PPR increases one unit, the probability of winning increases 1.107 times (p=0.016). When break points increase one unit, the probability of winning increases 1.374 times (p<0.001). According to these data, using the constant (-8.642) and model coefficients in the table, one can predict the result (winner/loser) of a match in the qualifiers thanks to the following formula:

$$Z = \beta_0 + \beta_1 {*} X_1 + \beta_2 {*} X_2 - \beta_3 {*} X_3$$

Z=−8.642+0.318*(Break Points)+0.101*(PPR)−0.465*(Blocked Attack)

Model Application

We may predict the result of the first match between Turkey and Germany women's national volleyball teams (Turkey: 1 - Germany: 3) with real data and using a formula.

The number of blocked attacks of the Turkish team is 9, PPR 63% and the number of break points is 15. Accordingly, if we make an example calculation;

- Firstly, we must find the Z value:

Z= −8.642+0.318*9+0.101*63−0.465*15= -1.997

- We must substitute the Z value we found in the formula:

p= $e^{Z}/(1+e^{Z}) = e^{-1.997}/(1+e^{-1.997}) = 0.136/(1+0.184) = 0.120$

This result (0.120) shows Turkey's possibility of winning the match against Germany. For Germany,

this result is calculated as 0.815. If the obtained value is >0.5, it is classified as a winner, and the obtained value is <0.5, it is classified as a loser.

A total of 60 predictions were made for each match (separately for the two teams) (30 predictions for 15 women's matches, 30 predictions for 15 men's matches). According to the predictions, 4 errors (4/30, 13.3%) in women's matches, 7 errors (7/30, 23.3%) in men's matches and a total of 11 errors (11/60, 18.3%) were achieved with the final classification value of the logistic regression model, being 81.7%. The classification obtained as a result of the model, 5 teams that actually lost the match were classified as winners as a result of guessing, and 6 teams that actually won the match were classified as losers as a result of guessing. There may be other factors affecting the outcome of the match, reasons such as the fact that the parameters contained in the model do not show distinctiveness in some results or may make a reverse classification may be the reasons for misclassification.

Discussion and Conclusion

It was not included in the model because there were no gender differences in the matches we analyzed. However, there are some studies (Ciemiński, 2018; Costa et al., 2012; Palao et al., 2009) revealing the differences between the genders. Palao et al. (2009) showed that service was more effective in women and service reception in men, but there was no difference in attack effectiveness in both genders. Contrary to Palao et al. (2009); in his study, Cieminski (2018) revealed that women's teams are more efficient in serving and blocking, while men's teams are more efficient in putting the ball into the play and attack. In the same study, it was also reported that there was no difference between genders in the service. Costa et al. (2012) showed in their study that there was a gender difference in service type, attack tempo and attack type. In another study on player positions (Bergeles et al., 2009), it was shown that there was no difference between the genders. As can be seen, there are differences between the findings in terms of the same variables. There are differences between the genders

physically (Sattler et al., 2015) and mentally (Pashabadi et al., 2011), but it can be said that the developing training science has brought the quality of men's and women's volleyball closer to each other.

The points taken from the service are very important for the teams psychologically as well as the contribution of points. Although the effect on the match result was not significant in our study, some studies emphasize the importance of the score from the service (Marelić et al., 2004; Zetou et al., 2006; Zetou et al., 2007) and it is shown among the variables that determine the match result (Silva et al., 2013, 2014b; Valladares et al., 2016). Although our findings show that the serve does not provide a significant advantage in high-level volleyball, according to Raiola et al. (2016), the use of the serve should not be avoided as a tactical choice, as a match is played between two high-level teams.

Twenty-nine matches in 2008 Beijing Olympic Games were analyzed by Patsiaouras et al. (2010) in order to evaluate the importance of technical skills (service, service reception, attack and block) that lead to the success of national teams, and as a result, it was shown that service points and receiving errors are skills that can affect the game outcome. In addition to this, blocked attacks also emerged as an important factor determining the winning or losing of the match. In another study analyzed 125 matches played in the regular season of the 2010-11 Spanish Men's Major League Volleyball Championship ("Superliga"), the number of receiving errors and blocked balls were shown as determinants of volleyball match results (Peña et al., 2013). In our study, it appeared that the attacks that remained on the block contributed to the defeat of teams. In fact, it can be said that hitting the block for the attacking teams and gaining direct points from the block for the defending teams express the same situation. While these skills increase the probability of one team winning or losing, or otherwise is true for the other team. Many studies have shown that attack plays an important role in the victory of teams (Bozhkova, 2013; Drikos et al., 2019; Marcelino et al., 2010; Silva et al., 2013, 2014b). The study (Bozhkova, 2013) analyzed the game efficiency

of the top four players from the world's top four teams showed that attack continues to be the skill that earns the most points in the game among the top volleyball players. Actually, mistakes made in block and serve are more than points earned from this skill (Bozhkova, 2013). From this point of view, it is normal for blocked attacks to have a negative impact on teams. In a situation in which high-level volleyball teams are more organized, careful and successful in holding space to defend their opponent's attacks, being able to evade the block while attacking can be seen as an important advantage.

In the studies (Patsiaouras et al., 2010; Peña et al., 2013; Silva et al., 2014a) it has been shown that service reception errors affect the outcome of the game. In our study, PPR, which can be evaluated as sub-skills of service satisfaction, was found to be a significant factor, while PER was not significant. Silva et al. (2014a) indirectly emphasizes that the success in PPR and PER also depends to some extent on the risk taken in the opponent's service. Also, Valladares et al. (2016) associated PER with winning the match in their study on Senior Female Volleyball World Championship 2014. Our findings are supported by a study on the team levels in the 2016-2017 season, which involved 12 teams from the Chinese Women's Volleyball Association League playing 100 matches and 377 sets (Yu et al., 2018). According to the study, while middle-level teams showed that service reception errors were an important variable for winning sets against low-level teams, PER did not show a significant difference between set results. Although it is a set result, the findings are parallel to ours. PPR and PER are not skills that directly generate scores, but they are skills that are required from players by teams to generate scores. By assisting the setter, PER increases the attacking possibilities of the team and enables it to attack more organized (JoãTo et al., 2010).

Winning the rally served by the team is a factor that contributes to the victory (Drikos et al., 2021; Peña et al., 2013). Break points actually includes many skills of your team such as service aces, block points, attack points and opponent errors (Peña et al., 2013). However, some of these variables (attack points and opponent errors) were not included in our model. However, other variables (service ace and block points) included did not have a significant effect on the match result by themselves. The break points that represent these skills in our model are the ones that enhance the probability of winning the match. This variable depends on the opponent's service reception, defense and offensive performance. According to Peña et al. (2013), making few mistakes in receiving and attacking will have a negative effect on the points won by the opponent. As a result, it is necessary to approach the break points factor as a set of skills.

As a result of our study, it was seen that blocked attacks and break points were variables being effective on the match result. We can use our results to evaluate how different skills matter in a game irrespective of gender. Avoiding a block is as important as making a block, too. For this reason, coaches can concentrate on different tactical approaches so that spikers can escape from the block. A good service reception is the first step of the tactic to be applied. Therefore, quality and stability in PPR is an important part of gaining numbers on attack. For this, attention, concentration and ball tracking should be included in the training sessions. Break points are a set of skills, as they are based on different skills. In training, it may be a good strategy to reconsider the amount of practice to enhance the quality of these skills, extend the working time, and improve the physical parameters required by the skills.

Since the analyzed competitions were played in the same place, there was no question of playing in the inner court or the outer field for the teams. However, it is thought that the advantage of playing inner court may affect the match results. For this reason, it can be examined as a factor by considering this situation in the analyzes of different studies.

References

Bergeles, N., Barzouka, K., & Nikolaidou, M. E. (2009). Performance of male and female setters and attackers on Olympic-level volleyball teams. *International Journal of Performance Analysis in Sport*, *9*(1), 141-148. https://doi.org/10.1080/24748668.2009.11868470

Bozhkova, A. (2013). Playing efficiency of the best volleyball players in the world. *Research in Kinesiology*, *41*(1), 92-95.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40. https://doi.org/10.3316/QRJ0902027

CEV. (2021a). Retrieved April 21, 2021, from *https://roadtotokyo.cev.eu/en/women/matches/*

CEV. (2021b). Retrieved July 1, 2021, from *https://www-old.cev.eu/Competition-Area/Statistics.aspx?ID=1208*

Ciemiński, K. (2018). The efficiency of executing technical actions in volleyball and the teams' gender and sports level. *Trends in Sport Sciences*, *3*(25), 159-165. https://doi.org/10.23829/TSS.2018.25.3-6

Costa, G., Afonso, J., Brant, E., & Mesquita, I. (2012). Differences in game patterns between male and female youth volleyball. *Kinesiology*, *44*(1).

Denis, D. J. (2021). *Applied univariate, bivariate, and multivariate statistics: understanding statistics for social and natural scientists, with applications in SPSS and R* (2 ed.). John Wiley & Sons.

Drikos, S., Barzouka, K., Nikolaidou, M.-E., & Sotiropoulos, K. (2021). Game variables that predict success and performance level in elite men's volleyball. *International Journal of Performance Analysis in Sport*, 1-13. https://doi.org/10.1080/24748668.2021.1945879

Drikos, S., Sotiropoulos, K., Papadopoulou, S. D., & Barzouka, K. (2019). Multivariate analysis of the success factors in high-level male volleyball: a longitudinal study. *Trends in Sport Sciences*, *26*(4), 177-185. https://doi.org/10.23829/TSS.2019.26.4-6

George, D., & Mallery, P. (2020). *IBM SPSS statistics 26 step by step: a simple guide and reference* (6 ed.). Routledge.

JoãTo, P. V., Leite, N., Mesquita, I., & Sampaio, J. (2010). Sex differences in discriminative power of volleyball game-related statistics. *Perceptual and motor skills*, *111*(3), 893-900. https://doi.org/10.2466/05.11.25.PMS.111.6.893-900

Kraak, W., Magwa, Z., & Terblanche, E. (2018). Analysis of South African semi-elite rugby head coaches' engagement with performance analysis. *International Journal of Performance Analysis in Sport*, *18*(2), 350-366. https://doi.org/10.1080/24748668.2018.1477026

Malek, M. H., Coburn, J. W., & Marelich, W. D. (2018). *Advanced statistics for kinesiology and exercise science: a practical guide to ANOVA and regression analyses*. Routledge.

Marcelino, R., Mesquita, I., Sampaio, J., & Moraes, J. C. (2010). Study of performance indicators in male volleyball according to the set results (Estudo dos indicadores de rendimento em voleibol em função do resultado do set). *Rev. bras. educ. fís. esporte*, *24*(1), 69-78.

Marelić, N., Rešetar, T., & Janković, V. (2004). Discriminant analysis of the sets won and the sets lost by one team in A1 Italian volleyball league-A case study. *Kinesiology*, *36*(1), 75-82.

Martin, D., Swanton, A., Bradley, J., & McGrath, D. (2018). The use, integration and perceived value of performance analysis to professional and amateur Irish coaches. *International Journal of Sports Science & Coaching*, *13*(4), 520-532. https://doi.org/10.1177/1747954117753806

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

Mroczek, D., Januszkiewicz, A., KawczyNski, A. S., Borysiuk, Z., & Chmura, J. (2014). Analysis of male volleyball players' motor activities during a top level match. *The Journal of Strength & Conditioning Research*, *28*(8), 2297-2305. https://doi.org/10.1519/JSC.0000000000000425

Palao, J., Manzanares, P., & Ortega, E. (2009). Techniques used and efficacy of volleyball skills in relation to gender. *International Journal of Performance Analysis in Sport*, *9*(2), 281-293. https://doi.org/10.1080/24748668.2009.11868484

Pashabadi, A., Shahbazi, M., Hoseini, S. M., Mokaberian, M., Kashanai, V., & Heidari, A. (2011). The Comparison of mental skills in elite and sub-elite male and female volleyball players. *Procedia-Social and Behavioral Sciences*, *30*, 1538-1540. https://doi.org/10.1016/j.sbspro.2011.10.298

Patsiaouras, A., Moustakidis, A., Charitonidis, K., & Kokaridas, D. (2010). Volleyball technical skills as winning and qualification factors during the Olympic Games 2008. *International Journal of Performance Analysis in Sport*, *10*(2), 115-120. https://doi.org/10.1080/24748668.2010.11868507

Peña, J., Rodríguez-Guerra, J., & Serra, N. (2013). Which skills and factors better predict winning and losing in high-level men's volleyball? *The Journal of Strength & Conditioning Research*, *27*(9), 2487-2493. https://doi.org/10.1519/JSC.0b013e31827f4dbe

Raiola, G., Altavilla, G., De Luca, C., & Di Tore, P. A. (2016). Analysis on some aspects of the service in volleyball. *Sport Science*, *9*(1), 74-77.

Sattler, T., Hadžic, V., Derviševic, E., & Markovic, G. (2015). Vertical jump performance of professional male and female volleyball players: Effects of playing position and competition level. *The Journal of Strength & Conditioning*

Research, 29(6), 1486-1493.
https://doi.org/10.1519/JSC.0000000000000781

Silva, M., Lacerda, D., & João, P. V. (2013). Match analysis of discrimination skills according to the setter attack zone position in high level volleyball. *International Journal of Performance Analysis in Sport*, *13*(2), 452-460. https://doi.org/10.1080/24748668.2013.11868661

Silva, M., Lacerda, D., & João, P. V. (2014a). Game-related volleyball skills that influence victory. *Journal of Human Kinetics*, *41/2014*, 173-179. https://doi.org/10.2478/hukin-2014-0045

Silva, M., Lacerda, D., & João, P. V. (2014b). Match analysis of discrimination skills according to the setter defence zone position in high level volleyball. *International Journal of Performance Analysis in Sport*, *14*(2), 463-472. https://doi.org/10.1080/24748668.2014.11868735

Valladares, N., García-Tormo, J. V., & João, P. V. (2016). Analysis of variables affecting performance in senior female volleyball World Championship 2014. *International Journal of Performance Analysis in Sport*, *16*(1), 401-410. https://doi.org/10.1080/24748668.2016.11868895

Yu, Y., García-De-Alcaraz, A., Wang, L., & Liu, T. (2018). Analysis of winning determinant performance indicators according to teams level in Chinese women's volleyball. *International Journal of Performance Analysis in Sport*, *18*(5), 750-763. https://doi.org/10.1080/24748668.2018.1517289

Zetou, E., Moustakidis, A., Tsigilis, N., & Komninakidou, A. (2007). Does effectiveness of skill in Complex I predict win in men's Olympic volleyball games? *Journal of Quantitative Analysis in Sports*, *3*(4), Article 3. https://doi.org/10.2202/1559-0410.1076

Zetou, E., Tsigilis, N., Moustakidis, A., & Komninakidou, A. (2006). Playing characteristics of men's olympic volleyball teams in complex II. *International Journal of Performance Analysis in Sport*, *6*(1), 172-177. https://doi.org/10.1080/24748668.2006.11868365