Blocker's activity at men's european beach volleyball university championship
Actividad de los bloqueadores durante el Campeonato de Europa Universitario de vóley playa

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Abstract. In this paper, we present a study of blocker's activity at university beach volleyball players. A total of n=1166 blocking actions were analyzed from 24 European men's teams at the Ninth European Beach Volleyball Championship EUSA GAMES. Analysis of videos was carried out using the free software program LongoMatch v.0.27. Statistical significance of the comparison between systems was calculated using the Z test to compare proportions. Results showed that blockaders do not have a leading role in Direct Intervention (DI) of the ball (37%, p < 0.001). The blocking actions most occured were Line Blocking (LB) (46.9%), Net Exits (NE) (21.1%) and Diagonal Blocking (DB) (18.1%). When comparing periods of points (F1: 1 to 7, F2: 8 to 14, F3: 15 to 21), statistical differences (p < 0.001) where observed between periods F1 and F3 for the most used blocking actions: LB, NE and DB. Finally, similar efficiency values were observed for the most common blocking actions (29.3% for LB and 23.2% for DB). Higher efficiencies can be found in less common defensive actions, such as V Blocking (VB) (31.4%) and Fighting (F) (34.6%).
Keywords: beach volley, training, beach sports, university sport, block, blockers.

Resumen. En este artículo se presenta un estudio de la actividad del bloqueador en jugadores universitarios de voley playa. Fueron analizados un total de 1166 acciones de bloqueo de 24 equipos europeos masculinos durante el Noveno Campeonato Europeo de Voleibol de Playa EUSA GAMES. El análisis de los videos se llevó a cabo utilizando el programa de software libre LongoMatch v.0.27. La prueba estadística aplicada para la comparación de las proporciones fue la prueba Z. Los resultados mostraron que los bloqueadores no realizan una intervención directa (DI) de la pelota (37%, *p* < 0,001) como acción principal defensiva. Las acciones de bloqueo más utilizadas fueron Bloqueo en Línea (LB) (46,9%), Salidas de Red (NE) (21,1%) y Bloqueo Diagonal (DB) (18,1%). Cuando se comparan periodos de puntos (F1: 1 a 7, F2: 8 a 14, F3: 15 a 21), se observan diferencias estadísticas (p < 0,001) entre los períodos F1 y F3 para las acciones de bloqueo más utilizadas: LB, NE y DB. Finalmente, se observaron valores de eficiencia similares para las acciones de bloqueo más comunes (29,3% para LB y 23,2% para DB). Se pueden encontrar mayores eficacias en acciones defensivas menos comunes, como V Bloqueo (VB) (31,4%) y Lucha (F) (34,6%).
Palabras clave: voley playa, entrenamiento, deporte universitario, bloqueador, bloqueo, deporte de arena.

Introduction

The study of blocking in volleyball and beach volleyball has been of interest over the years for different researchers. This is a key technical element which, together with the serve effectiveness and errors in the attack, is directly related to the success of the game (Busca and Febrer, 2012; Jimenez Olmedo, Penichet Tomas, Saiz Colomina, Martinez Carbonell, and Jove Tossi, 2012; Marcelino et al., 2010; Peña et al., 2013). A hard and consistent blocking action hinders the attack of the opposing team (Castro et al., 2011), which indicates the motivation of studying its own characteristics and the degree of intervention in the game result.

The profile and characteristics of the blockers have been dealt in the literature. Different studies analyze the physical characteristics of the players according to their playing position, in senior teams (Jimenez-Olmedo, Pueo, Penichet-Tomás, Chinchilla-Mira, and Perez-Turpin, 2017; Palao et al., 2014) and in other categories like the junior one (Ciccarone et al., 2005). Two of these studies show that blockers have clear differences in body composition and somatotype while being in the field; they present a greater height and weight as well as higher values of maximum lower body strength (Ciccarone et al., 2008; Marques et al., 2009). In beach volleyball blockers show an increase in their weight and height, not found in defenders (Palao et al., 2008).

But not only the physical characteristics of the players are decisive for the selection of blockers, there are other factors that correlate the ability of successful volleyball players in general, and beach volleyball blockers in particular. Among them, we can find anxiety state (Milavic et al., 2013; Gonzalez Hernandez and Valadez Jimenez, 2016), decision making depending on the game´s time, the advantageous or disadvantageous situation in which players find themselves (Marcelino et al., 2011), the field factor (Campos et al., 2014), training methods (Sanchez-Sixto and Floria, 2017) and relation between training (Gonzalez-Fimbres, Griego, Cuevas-Castro and Hernandez, 2016; Murillo, Alvarez and Manomelles, 2016), and recovery (Reynoso-Sanchez et al., 2016).

Since blockers play a role in the development of the game, they have been the focus of training to improve their performance. New analytical methods have been developed to optimize the performance of athletes (Lin, 2014; Pascual, Alzamora, Martinez and Perez, 2015), with new techniques that improve the different technical and tactical aspects of the players (Schack et al., 2014). One of the most interesting aspects has been the preparation and technical-tactical improvement of the vertical jump for specific training purposes (Sheppard et al., 2011; Amasay, 2008).

But, these studies have been developed in volleyball and to a lesser extent in beach volleyball. In addition, no study has addressed the performance of athletes at university level. It is important to note that college athletics follow the same regulations as the senior competitions, so their study and analysis will help better understand the evolution of professional athletes who started their careers at lower levels, mainly at university level.

The aim of this study is to determine the intervention levels of the beach volleyball blocker at a university level, as well as an in-depth study of the types and effectiveness of blocks that are used in an international game competition.

Method

Sample

Data were collected from the videotaping of games celebrated from the 23rd to the 28th of July, 2013 in the Portuguese city of Oporto, during the Ninth European Beach Volleyball Championship EUSA GAMES. The competition hosted men's and women´s categories. In this study, 24 men's teams from 16 different nationalities of Europe were analyzed. Blockers actions were investigated, through an analysis of 1166 blocking actions.

Instruments and data collection

It was used a Sony DCR-cx 280 video camera with a focal length equivalent to 29.8-953.6 mm and a resolution of 1920x1080p / 50fps (Pueo, 2016). The camera was calibrated using four placeholders to create a framework containing an overlap of 30% above the limits of the field (Jimenez-Olmedo, Penichet-Tomas, Martinez Carbonell, Andreu Cabrera, and Perez-Turpin, 2014).

Blocking actions performed were analyzed by players in different games from the group stage to the final stages of the Championship. The analysis of the videos was carried out using the free software program LongoMatch v.0.27.

After transcoding the video, we were able to combine the characteristics of the files with the software requirements analysis of LongoMatch using the open source software Handbrake. The combination of frequencies obtained from the analyzed categories and subcategories was made with Google Drive Sheets.

Procedure

An experienced observer made the visualization and analysis of the video recordings. During the study, displays of a two intra-operator were performed to prove the reliability of the observation (Jimenez-Olmedo, Pueo, and Penichet-Tomás, 2016).

For each variable analyzed, to calculate the percentage error, the following mathematical expression was used (Hughes, 2004): $Erm=(Ó(mod[V_1-V_2])/V_{mean})*100$ where V_1 are the frequencies of the first visualization, V_2 the frequency of the second visualization, V_{mean} the average of the two frequencies visualization registered and mod is the module.

Reliability performed on the intra-observer analysis showed a margin of error lower than 5% (James et al., 2007), established within acceptable margins of error.

To carry out the analysis of the actions undertaken by the blockers, different categories of observation that would allow collecting the necessary frequencies to answer research questions were established.

First, the type of intervention during blocking defensive actions may lead to:

- Direct Intervention (ID): Defensive actions touching the ball.

- Indirect Intervention (II): Actions taken by the blocker without touching or trapping the ball.

Second, defensive actions have been categorized into six different types:

- Line Blocking (LB): Blockages to prevent the line attack.

- Diagonal Blocking (DB): Blockages to prevent the diagonal attack.

- V Blocking (VB): Blockages with wide opened arms to cover a large area and disturb opposing attack.

- Fighting (F): The ball is suspended over the net and both blockers try to control it at the same time.

- Net Exit (NE): The blocker analyzes opposing attack and leaves the net zone returning to a field position to construct and execute a fast break.

- No Blocking (NB): Actions out of the net line where, before an attack or a passing, the blocker does not go towards the net or stays out of it to continue and execute a fast break.

Finally, in order to establish relationships between the variables under analysis, it was decided to classify the effectiveness and frequencies obtained depending on the time when the action was carried out. To do this, the following periods were established:

- F1: Period of points 1 to 7
- F2: Period of points 8 to 14
- F3: Period of points 15 to 21

Statistical Analysis

The significance in the analysis of the effectiveness of the blocks was calculated by applying the Z test to compare proportions of frequency.

Results

The first analysis on the intervention of the blocker establishes a significant difference ($p<0.001$) between Direct Intervention (DI) and Indirect Intervention (II). The results indicate that the blocker does not have a leading role in the Direct Intervention of the ball (DI) as to touch the ball occurs only in 37% of cases. In the remaining actions, (63%), his task focuses on defenses without direct contact with the ball.

As for the most used blocking actions, it is observed that 46.9% of the blockades carried out the attack on the line. The second action most carried out by the blockers was net exits with 21.1% of total actions, followed by blocking attacks seeking diagonal movement with 18.1%. To a lesser extent, 6.4% non-blocking (NB) defensive actions were registered. In addition, actions which recorded the lowest frequencies correspond to the actions of fighting (F) net with 4.5% and finally V blocks (VB) with 3%.

The comparison between actions allows establishing the possible statistical differences between them. The results indicate differences between all actions, except among the diagonal blocks (DB) with no blocks (NB) ($p=0.569$), as well as actions V block (VB) and fights (F) in the net ($p=0.06$).

It is also important to analyze the evolution of the use of technical aspects throughout the set; therefore, the frequency of technical actions is presented in Table 1.

Table 1:
Blocker frequency of actions performed by set area

	Frequency (%)	Frequency (%)	Frequency (%)
LB	39.12*	38.39	22.29*
DB	28.86*	36.97	24.17*
VB	51.43*	31.43	17.14*
F	40.38*	38.46	21.15*
NE	41.06*	35.37	23.58*
NB	44.00*	22.67*	33.33

Note: LB: Line Blocking; DB: Diagonal Blocking; VB: V Blocking; F:Fighting; NE: Net Exit; NB: No Blocking; *=p<0.05

Table 2:
Effectiveness of the different analyzed actions

	F1	F2	F3
LB	24.80%	32.90%	30.90%
DB	19.50%	24.40%	27.50%
VB	33.30%	27.30%	33.30%
F	38.10%	35,00%	27.30%
NE	23.80%	39.10%	34.50%
NB	30.30%	23.50%	64,00%

LB: Line Blocking; DB: Diagonal Blocking; VB: V Blocking; F: Fighting; NE: Net Exit; NB: No Blocking

An evolution is observed in the technical actions used by the blockers in his defensive tasks. The results indicate a decrease in the frequency of all actions during period 3 (F3) in relation to period 1 (F1) and period 2 (F2).

On the one hand, the analysis of the evolution of the actions presents differences between period 1 (F1) and period 3 (F3) for line blocking (LB) actions ($p<0.001$), whereas it does not present differences between period 1 (F1) and period 2 (F2) ($p=0.803$). In the same way, as for the diagonal blocking (DB) and net exits (NE), statistical differences between periods are repeated. It is necessary to emphasize this fact, as these three actions are the most used ones, so the difference in periods 1 (F1) and 2 (F2) with respect to period 3 (F3) could refute the idea of fatigue due to the decreased number of actions as the set develops. Regarding the actions of fight (F), the only difference is established between period 1 (F1) and period 3 (F3) ($p=0.033$), as occurs in V blocking (VB) ($p=0.002$). By contrast, non-blocking actions (NB) recorded differences between period 1 (F1) and period 2 (F2) ($p=0.005$).

Besides, one of the most important aspects is the effectiveness of each action. The most used blocking types present similar values of efficiency: 29.3% for line blocking (LB) and 23.2% for diagonal blocking (DB). In case of the least used defensive actions, such as V blocking (VB) (31.40%) and fighting (F) (34.60%), activities are higher. Among them, the most effective one is given in actions where blocking tactics (40%) are not used, followed by actions of net exits (NE) (31.7%). This result does not indicate that the defensive actions where there is no blockage are more effective and therefore a couple should play without using them, but these non-blocking actions did not present a threat to the continuation of the game (distant attacks, passes ball free, intentional or not), so the construction of a counter facilitates the subsequent completion of the point by the defending team.

The development of the game causes that different indexes of efficiency could exist for the same action along the disputed sets. Therefore, the effectivities differentiated by bands set is presented in Table 2.

Note that effectiveness evolves differently throughout the set. In

the most performed actions, actions blocker activity on the net, such as blocking the line (LB) and blocking the diagonal (DB), increase in their effectiveness is observed. This increase may be due to a better reading of the game done by the blocker on the opposing team, which takes the defense to better protect the net using a working lock. Improving effectiveness of in line blocking (LB) by 6.1% and by 8% in the diagonal blocking (DB) may be due to this factor.

Discussion

The importance of the blockade and its influence in volleyball is widely known. There are several studies that prove or not (Silva et al., 2014) this success when it comes to blockades. Nevertheless, as far as Beach Volleyball University is concerned, only 37% of attacks had a direct intervention (DI) by the blocker, far from 56.5% of direct intervention (DI) observed in professional beach volleyball players (Koch and Tilp, 2009). This difference may be due to several factors. Among them is the limitation of technical skills that influence the blocking (Smith et al., 1992), the number of steps performed before the jump (Lobietti and Merni, 2006), jump height (Sterkowicz-Przybycien et al., 2014) and the analysis that the blocker does of the attacker. All these circumstances help more or less the direct intervention performed by the blocker. Despite all this, it should be noted that, in the specific case of the college beach volleyball players, shares where further direct interventions (DI) occurred were in the line blocks (LB), the diagonal (DB) and net exit (NE). These interventions may be the result of a greater insistence by blockers to carry out these actions. However, in the case of direct interventions (ID) of the diagonal blocks (DB), it should be noted that, the coverage area is lower in this type of attack. In addition, attacks on the diagonal are accompanied by a rolling, which prevents the blocker from carrying out modifications or adjustments to the blocking action to stop the attack (Ficklin et al., 2014).

Regarding the evolution of blocking actions, the most used actions are the line blocks (LB), followed by the diagonal blocks (DB) and finally net exits (NE). This is based on a simplification of the actions of the blocker and a better understanding with the defender, as the blocking actions and exits on the line facilitate the work of the defender or the delayed player. Thus, they did not changed positions within the field because these require more communication between players for game points (Künzell et al., 2014).

Nevertheless, even so it must be taken into account the evolution of the actions throughout the set. A study about the intervention of the number of blocking actions indicates that professional players of beach volleyball decrease the number of blocking actions along the sets (Palao et al., 2014), which would correspond to the decrease in number of shares, in this case by period of the game. This may be justified because of the intensity and the demand required by players. In addition to the conditions of the increased load, other factors must be taken into account, such as game: strategy, preferences, limitations or potential of the player, as well as environmental conditions or the movements of the adversaries, and the condition of directly performing a type of locks or others (Schläppi-Lienhard and Hossner, 2015).

Despite the existing differences between the uses of some technical actions instead of others, the results show greater effectiveness in unstructured attack actions like fighting (F), no locks (NL) and net exits (NE), as opposed to the structured attack actions like line blocks (LB) or diagonal (D) attacks. It is important to emphasize that the fighting (F) occurs when the ball is divided and not during an attack, as a non-blocking action. Typically, these actions are the result of a poor attack-opposing player resulting in a pass ball, allowing the player to work on a proper attack. The same situation would be given in net exits (NE), which would explain a more effective blockage. Therefore, although there are large differences between frequencies, these are not that great as far as effectiveness is concerned.

Conclusions

This study has presented a detailed analysis of blocker's activity in university beach volleyball players. The natural position of blocker in beach volleyball should be the net and, therefore, this player works mostly near the net (72.5%). As a consequence, it is important to develop specific job training for blockers, although we must also bear in mind that blockers develop an important defensive assignment outside the net, which should be taken into account when training. In addition, the fact that only in 36.71% of actions performed the blocker touches the ball (DI), we can conclude that his defensive role is mostly indirect (II).

On the other hand, the most used blocking actions are Line Blocking (LB), Diagonal Blocking (DB) and Net Exit (NE), despite not being the most effective blocking actions when it comes to getting more points. This type of defensive actions blocker is the basic structure of the first line of defense. In addition, blocker can easily signal the defender and the type of block to perform, which help to build structure defensive systems during the match. Also, this type of blocking actions is a complement to defender actions, which should cover those areas not covered by the blocker on the net.

Finally, there is no clear tendency in the effectiveness of the blocker throughout period of points, except for the diagonal blocks (DB), which undergoes a positive effectiveness per period. There are several reasons for this behavior: shares anticipation by the blocker, different types of attacks, accumulation of fatigue or different environmental conditions, among others. These factors would be responsible for the irregular effectiveness pattern along the set and the match, which can be either positive or negative, depending on the evolution of the game.

References

Amasay, T. (2008). Static block jump techniques in volleyball: upright versus squat starting positions. *Journal of Strength and Conditioning Research*, *22*(4), 1242–8.

Busca, B. and Febrer, J. (2012). Temporal fight between the middle blocker and the setter in high level volleyball. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, *12*(46), 313–327.

Campos, F. A. D., Stanganélli, L. C. R., Campos, L. C. B., Pasquarelli, B. N. and Gómez, M. A. (2014). Performance indicators analysis at Brazilian and Italian women's volleyball leagues according to game location, game outcome, and set number. *Perceptual and Motor Skills*, *118*(2), 347–61.

Castro, J., Souza, A. and Mesquita, I. (2011). Attack efficacy in volleyball: elite male teams. *Perceptual and Motor Skills*, *113*(2), 395–408.

Ciccarone, G., Croisier, J. L., Fontani, G., Martelli, G., Albert, A., Zhang, L. and Cloes, M. (2008). Comparison between player specialization, anthropometric characteristics and jumping ability in top-level volleyball players. *Medicina Dello Sport*, *61*(1), 29–43.

Ciccarone, G., Fontani, G., Albert, A., Zhang, L. and Cloes, M. (2005). Analysis of anthropometrics characteristics and jumping ability in junior top level volleyball athletes. *Medicina Dello Sport*, *58*(1), 1–15.

Ficklin, T., Lund, R. and Schipper, M. (2014). A Comparison of jump height, takeoff velocities, and blocking coverage in the swing and traditional volleyball blocking techniques. *Journal of Sports Science and Medicine*, *13*(1), 78–83.

González Fimbres, R. A., Griego Amaya, H., Cuevas Castro, C. S., and Hernández Cruz, G. (2016). Influence of training load volume and intensity on heart rate recovery. *Retos: Nuevas Tendencias En Educación Física, Deporte Y Recreación*, (30), 180–183.

González Hernández, J., and Valadez Jiménez, A. (2016). Personality and psychological response in athletes. Temporal and adaptive representation of the person-sport process. *Retos. Nuevas Tendencias En Educacion Física, Deporte y Recreación*, (30), 211–

215.

Hughes, M. (2004). Notational analysis – A mathematical perspective. *International Journal of Performance Analysis in Sport*, *4*(2), 97–139.

James, N., Taylor, J. and Stanley, S. (2007). Reliability procedures for categorical data in Performance Analysis. *International Journal of Performance Analysis in Sport*, *7*(1), 1–11.

Jimenez-Olmedo, J. M., Penichet-Tomas, A., Martinez Carbonell, J. A., Andreu Cabrera, E., and Perez-Turpin, J. A. (2014). Análisis del saque en jugadoras femeninas profesionales de vóley playa Analysis of professional female players serve in beach volleyball. *Retos. Nuevas Tendencias en Educación Fisica, Deporte y Recreación*, (25), 76–79.

Jimenez-Olmedo, J. M., Pueo, B., and Penichet-Tomás, A. (2016). Defensive systems during the Men ' s European University Beach Volleyball Championship. *Journal of Physical Education and Sport*, *16*(3), 945–950.

Jimenez-Olmedo, J. M., Pueo, B., Penichet-Tomás, A., Chinchilla-Mira, J. J., and Perez-Turpin, J. A. (2017). Physiological work areas in professional beach volleyball: A case study. *Retos. Nuevas Tendencias en Educación Fisica, Deporte y Recreación*, (31), 94–97.

Jimenez Olmedo, J. M., Penichet Tomas, A., Saiz Colomina, S., Martinez Carbonell, J. A., and Jove Tossi, M. A. (2012). Serve analysis of professional players in beach volleyball. *Journal of Human Sport and Exercise*, *7*(3).

Koch, C. and Tilp, M. (2009). Beach volleyball: Techniques and tactics. A comparison of male and female playing characteristics. *Kinesiology*, *41*(1), 52–59.

Künzell, S., Schweikart, F., Köhn, D. and Schläppi-Lienhard, O. (2014). Effectiveness of the call in beach volleyball attacking play. *Journal of Human Kinetics*, *44*(1), 183–91.

Lin, K. (2014). Applying Game Theory to Volleyball Strategy. *International Journal of Performance Analysis in Sport*, *14*(3), 761–774.

Lobietti, R. and Merni, F. (2006). Blocking footwork techniques used by male and female volleyball players are different. *Journal of Human Movement Studies*, *51*(5), 307–320.

Marcelino, R., Mesquita, I. and Sampaio, J. (2011). Effects of quality of opposition and match status on technical and tactical performances in elite volleyball. *Journal of Sports Sciences*, *29*(7), 733–41.

Marcelino, R., Mesquita, I., Sampaio, J. and Moraes, J. C. (2010). Estudo dos indicadores de rendimento em voleibol em função do resultado do set. *Revista Brasileira de Educação Física e Esporte*, *24*(1), 69–78.

Marques, M. C., van den Tillaar, R., Gabbett, T. J., Reis, V. M. and González-Badillo, J.J. (2009). Physical fitness qualities of professional volleyball players: determination of positional differences. *Journal of Strength and Conditioning Research*, *23*(4), 1106–11.

Milavic, B., Jurko, D. and Grgantov, Z. (2013). Relations of Competitive State Anxiety and Efficacy of Young Volleyball Players. *Collegium Antropologicum*, *37*(2), 83–92.

Murillo Lorente, V., Alvarez Medina, J., and Manomelles Marqueta, P. (2016). Control of training loads through perceived exertion. Prediction of heart rate. *Retos. Nuevas Tendencias en Educacion Física, Deporte y Recreación*, *30*, 82–86.

Palao, J. M., Gutierrez, D. and Frideres, J. E. (2008). Height, weight, Body Mass Index, and age in beach volleyball players in relation to level and position. *Journal of Sports Medicine and Physical Fitness*, *48*(4), 466–471.

Palao, J. M., Manzanares, P. and Valadés, D. (2014). Anthropometric, physical, and age differences by the player position and the performance level in volleyball. *Journal of Human Kinetics*, *44*(1), 223–36.

Palao, J. M., Valadés, D., Manzanares, P. and Ortega, E. (2014). Physical actions and work-rest time in men's beach volleyball. *Motriz: Revista de Educação Física*, *20*(3), 257–261.

Pascual, N., Alzamora, E. N., Martínez Carbonell, J. A., & Pérez Turpin, J. A. (2015). Analysis of different teaching methods in young soccer players. *Retos. Nuevas Tendencias en Educacion Física, Deporte y Recreación*, (28), 94–97.

Peña, J., Rodríguez-Guerra, J., Buscà, B. and Serra, N. (2013). Which skills and factors better predict winning and losing in high-level men's volleyball?. *Journal of Strength and Conditioning Research*, *27*(9), 2487–93.

Pueo, B. (2016). High speed cameras for motion analysis in sport science. *Journal of Human Sport and Exercise*, 11(1), 53-73.

Sánchez-Sixto, A., & Floría, P. (2017). Effects of combined plyometric and resistance training in biomechanical variables of the vertical jump in basketball players. *Retos. Nuevas Tendencias En Educacion Física, Deporte y Recreación*, (31), 114–117.

Schack, T., Essig, K., Frank, C. and Koester, D. (2014). Mental representation and motor imagery training. *Frontiers in Human Neuroscience*, *8*, 328.

Schläppi-Lienhard, O. and Hossner, E.-J. (2015). Decision making in beach volleyball defense: Crucial factors derived from interviews with top-level experts. *Psychology of Sport and Exercise*, *16*, 60–73.

Sheppard, J. M., Dingley, A. A., Janssen, I., Spratford, W., Chapman, D. W. and Newton, R. U. (2011). The effect of assisted jumping on vertical jump height in high-performance volleyball players. *Journal of Science and Medicine in Sport*, *14*(1), 85–9.

Silva, M., Lacerda, D. and João, P. V. (2014). Game-Related Volleyball Skills that Influence Victory. *Journal of Human Kinetics*, *41*, 173–9.

Smith, D. J., Roberts, D. and Watson, B. (1992). Physical, physiological and performance differences between Canadian national team and universiade volleyball players. *Journal of Sports Sciences*, *10*(2), 131–8.

Sterkowicz-Przybycien, K., Sterkowicz, S. and Zak, S. (2014). Sport skill level and gender with relation to age, physical development and special fitness of the participants of Olympic volleyball tournament Beijing 2008. *Collegium Antropologicum*, *38*(2), 511–516.