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The performance comparison of middle blockers in female volleyball competitions of the Olympic games 2016 in spike and block techniques

Neda Mosleh
Senior Expert in Sports Physiology - Faculty of Physical Education and Sports Sciences, Gilan University - Rasht - Iran

Bahman Mirzaei
Professor, Sports Physiology Department, Faculty of Physical Education and Sports Sciences, Gilan University, Rasht, Iran

***Abstract*---**Objective: the present research aims to compare the performance of middle blockers in female volleyball competitions of the Olympic Games 2016 in spike and block techniques. Methodology: eight middle blockers were selected at the semi-finals and finals applying purposive sampling. The competition videos were analyzed using Edius software version 7, thirty frames per second. Spikes or blocks were categorized into three categories in rallies: positive, spike, or block which leads directly to points; neutral, spike, or block which does not lead to the rally termination after execution; and negative, spike, or block which leads to point loss. Spike efficiency and block average of each set were calculated by the method proposed by the Fédération Internationale de Volleyball (FIVB). Findings: Results revealed that except for the negative spikes and blocks (P=0.971), there was a significant difference between the positive spikes and blocks (P=0.001), neutral spikes and blocks (P=0.001), and their total number (P=0.001). In short, the mean spike efficiency and average block were respectively reported at 39.20% and 0.46 per set. Conclusion: it sounds like middle blockers are mostly employed in defensive tactics, but the efficiency of these players is better in the spike than in the block.

***Keywords*---** middle blocker, spike, block, volleyball, performance.

Introduction

Team sports are characterized by dynamic systems with relationships between teammates, opponents, and the environment over time, seeking to score a point and at the same time prevent the opponent from scoring (Valladares, García-Tormo, & João, 2016). Among team sports, volleyball is a popular Olympic team sport (Ozra Eftehari et al, 2017). Volleyball was invented in 1895 in America by William G. Morgan and presently it is considered one of the five major international sports (Site, FIVB Official Web, 2014). Volleyball comprises intense explosive movements and is characterized by short periods of intense work, and involves short rest periods. Understanding the potential competencies of each volleyball player is necessary for the team's success in major sports events, and therefore, players are employed in different positions in the same team (Eston & Reilly, 2001). Since the players are assigned to different playing positions according to their capabilities and body measurements during a specialized process; therefore, their performance depends on the complexity of specialized techniques, rules, game speed, and biological limitations (Milián-Sánchez et al, 2019). The positions of volleyball players include setter, opposite hitter, middle blocker, outside hitter, and libero (Milián-Sánchez et al, 2015).

Nowadays, great sports events are considered an opportunity for elite athletes to reveal their potential (Dolles & Soderman, 2008). Olympic games and world championships with the presence of the best athletes from all over the world represent the highest quality of these sports (Mirzaei, Faryabi, & Yousefabadi, 2021). The main goal of coaching in any sport is to create behavioral changes in athletes to improve their performance (Hughes, M, & Franks, 2004). The elite sports performance analysis should be used to objectify a movement in volleyball since studies in this court can bring more knowledge to determine the work rate (intensity) of an exercise (Hank et al., 2019). The knowledge of the conditions prevailing in the international games of top-level athletes is one of the factors affecting the excellent performance of players in competitions (Cojocaru & Cojocaru, 2018).

Therefore, several studies have been accomplished about the techniques, the relationship between techniques and team success, different match phases, and different positions of the players (Silva, Marcelino, Lacerda, & João, 2016). In general, the analysis and comparison of different techniques applied by players have attracted the attention of researchers in recent decades (Silva, Marcelino, Lacerda, & João, 2016). Although the volleyball match comprises the execution of several main techniques, a separate analysis of techniques has been introduced as a key factor in the players performance (Eom et al., 1992). Therefore, coaches attempt to ensure the athletes success in great sports events through better planning (Hank et al., 2019). However, despite the popularity of volleyball around the world, few high-quality scientific pieces of research carried out in this court (Site, FIVB Official Web, 2014). In 1989, through research on volleyball world championships, researchers reported two techniques of spike and block to be effective in the team's win (Eom & Han Joo, 1989).

Further, after studying the relationship between the set outcome and the dig and attack efficacy in male volleyball, Monteiro et al. suggested that Further research

should analyze the efficacy of block, set, and serve to obtain a deep knowledge of each action in the match, and to determine the most effective factor on the winning. Moreover, Dyba evaluated the needs of each specialized male volleyball position. He used information from different competitions to examine and compare the players performance in the match. Indeed, jumping techniques such as serve, spike, and block in volleyball are fundamental components for good performance in competition and lead to scoring (Lobietti, 2009). The two techniques of spike and block are the most effective skills in winning and losing the team because usually, these techniques lead to the transfer of the ball to the opposing team's court (Eom & Han Joo, 1989). Meanwhile, defensive performance is the most crucial parameter in differentiating winning and losing teams (Palao, Santos, & Ureña, 2004). Researchers have argued that middle blockers make more jumps during the game since they have to make fake jumps in addition to defending and hitting short passes (Polglaze & Dawson, 1992).

In this regard, Shepard et al. (2007) used Time- Motion Analysis to obtain detailed information about the players needs in international male volleyball tournaments. A section of this research investigated the evaluation of the activities (spike, block, set) carried out in the front areas of the court. The findings finally revealed that middle blockers played a greater defensive role than other players. The middle blocker volleyball position is of special importance in volleyball since the middle blockers create the best line of block and act effectively in both attack and block positions (Milián-Sánchez et al, 2019). These players play in the central part of the net and move in different directions regarding the opposing team's strategy (Milián-Sánchez, Morante Rábago, Hernández, Marzo, & Ureña, 2015; Millán-Sánchez, Morante Rábago, & Ureña Espa, 2019; Milián-Sánchez et al., 2015; Costa et al., 2016). One of the distinctive features of middle blockers is their speed and ability to predict different game conditions (Lenberg, 2006).

It is worth mentioning that the block tactics orientation should also be controlled by middle blockers (Lenberg, 2006). Marcelino et al. (2014) argued the position of the middle blocker as one of the basic variables for predicting the outcome of the opposing team's attacks, which indicates the significance of specific strategies applied by these players (Marcelino, Afonso, Cicero Moraes, & Mesquita, 2014). In this regard, the role of middle blockers in team attacks has been investigated from different perspectives in different studies (Milián-Sánchez al, 2019). Most of the accomplished studies focused on the role of middle blockers, morphology, body type, and reach (Ciccarone et al., 2008; Duncan, Woodcourt, & Al-Nakeeb, 2006; Y. González, Sedano, Fernández, & Díaz, 2014; Palao, Manzanares, & Valadés, 2014; Sterkowicz-Przybycień, Sterkowicz, & Żak, 2014). Furthermore, some studies have investigated the middle blockers physical efforts during training and matches (Milián-Sánchez et al, 2019). In these studies, variables such as the number and type of jumps, distance, scoring duration, heart rate, and blood lactate concentration were discussed (González et al., 2005). Other studies have addressed the importance of the role of these players, the relationship between different positions, and the team's success by analyzing the performance and observing the middle blockers actions during the match (Milián-Sánchez et al, 2019). In addition, in the case of sports biomechanics, the studies mainly address the middle blockers techniques when performing the major actions of spike and block (Janssen, Steele, Munro, & Brown, 2013).

In general, nowadays, there are rarely significant differences between teams participating in top-level sports competitions (González et al, 2005). However, differences have been observed in different positions of team sports players (González et al, 2005). In other words, investigating the different positions of players is required to better understand the teams needs since the statistical information of each player is as important as the percentage information of top-level players. Moreover, the coaches and players also need this information to direct the team development (Milián-Sánchez et al, 2019). Although it is believed that male and female volleyball rallies are similar, no considerable research has been conducted on female volleyball (Lidor & Ziv, 2010). Further, the performance of female volleyball players separately sorted by their specialized positions needs further research. Therefore, the present research aims to compare the performance of middle blockers in female volleyball competitions to the spike and block techniques.

Research Methodology

This study is a cross-sectional survey conducted to obtain practical findings in the court of volleyball. The present research was carried out on volleyball games that had already been played, so it is also considered as Ex-Post Facto research. The statistical population included middle blockers of the female volleyball teams participating in the Olympic Games 2016. 12 teams participated in this tournament. Each team included four middle blockers. According to the rules of the Fédération Internationale de Volleyball (FIVB), only 2 players played in this position. Therefore, the statistical population of this research included 24 middle blockers who participated in the competitions. Since the purposive sampling method was applied in this research, 8 middle blockers playing in the semi-finals and finals were selected as the sample. The semi-final and final stage games consisted of 16 sets. The total data obtained from 32 sets were recorded and analyzed since the performance of the middle blockers of each team was analyzed separately in the case of each game.

The videos of the semi-final and finals were downloaded from www.youtube.com and were analyzed using Edius version 7 software, shooting a rate of 30 frames per second. After reviewing the competition's videos, the spike and block techniques of the middle blockers in each rally were classified into three categories: positive, spike or block which leads directly to points; neutral, spike or block which does not lead to the rally termination after execution; and negative, spike or block which leads to point loss. Then, a score of 0.25 was considered for each positive block to calculate and compare the efficiency of the spike and block average per set regarding the analysis form of the Olympic Games 2016. Further, the spike efficiency was calculated using the following relation:

$$\text{Spike Efficiency} = \frac{\text{number of positive spikes}}{\text{total number of spike}} \times 100$$

Finally, to interpret the research data, descriptive statistics indicators including mean and standard deviation were used. Further, independent t-tests and Mann-

Whitney U tests were used in case of inferential statistics. All statistical operations were performed using SPSS software at a significance level of P≥0.05.

Research findings

Descriptive data related to the analysis of videos of 16 sets, and the spike efficiency and block average were presented in Tables 1 and 4, respectively. To compare the performance of middle blockers in two spike and block techniques, two statistical techniques of independent t-test and Mann- Whitney U were used regarding the data distribution. The results were presented in Tables 2 and 3. According to Table 2, there observed a significant difference in the total number of spikes and blocks (P=0.001) as well as the number of neutral spikes and blocks (P=0.001). Therefore, the total number of blocks and neutral blocks is greater than the total number of spikes and neutral spikes. According to Table 3, there is a significant difference between positive spikes and positive blocks (P=0.001), in such a way that the number of positive spikes is more than the number of positive blocks. However, there observed no significant difference between negative spikes and negative blocks (P=0.971).

Table 1
Number of spike and block techniques

Techniques	Positive	Negative	Neutral	Total
Spike	108	23	92	223
Block	59	25	830	914

Table 2
Results of Independent t-test

Techniques	F	t	Degree of freedom	P
Total number of spikes and blocks	37.78	-13.56	62	*0.001
Neutral spikes and blocks	45.24	-13.09	62	*0.001
				*P≤0.05

Table 3
Results of the Mann- Whitney U test

Techniques	Mann- Whitney U	Z	P
Positive spikes and blocks	216.5	-4.07	*0.001
Negative spikes and blocks	509.5	-0.37	0.971
			*P≤0.05

Table 4
spike efficiency and block average per set

Techniques	Mean	Standard deviation
Spike efficiency per set	%39.20	23.76

Block average per set	0.46	0.29

Discussion and Conclusion

Today, attack speed is considered a crucial factor in disrupting the block of the opposing team in modern volleyball. In other words, faster attacks reduce the cohesion of the opposing team's defensive line (Afonso, Mesquita, Marcelino, & Coutinho, 2008). Polglaze and Dawson (1992) argued that middle blockers are players who hit short passes at high speed in addition to defending. In other words, further research is required to examine and analyzes the main techniques including spike and block or middle blockers performance so that the team's performance is improved in modern volleyball. No considerable research has been conducted in this court, especially female volleyball. For instance, the analysis of female volleyball competitions in the 2015 European Games revealed that spike, block and serve techniques lead to more points, respectively (Silva, Marcelino, Lacerda, & João, 2016).

It should be noticed that these results were generally reported for all players in different positions and they were consistent with the results of the present research conducted on middle blockers. The results of this study showed that 48.43% of the middle blockers spikes in each set of female volleyball competitions in the 2016 Olympics led to points and only 10.31% of the spikes led to point loss. In research conducted on the middle blockers of male volleyball tournaments, the researchers reported that spikes attract public attention however block is necessary for the team's winning (Rabaz, Castuera, Arias, DOMÍGUEZ, & Arroyo, 2013). According to the results of other research, the block was considered the basis of the performance of the male volleyball teams in the 1988 Olympic Games, but there observed a weak correlation between the team's performance and the block in the 1992 Olympics due to the increase in spike capacity (Palao, Santos, & Ureña, 2004). In this regard, the other important finding of the present study was that only 6.45% of blocks of middle blockers led to scoring points and 2.73% of blocks resulted in point loss. Further, in 2005, researchers also concluded that block efficiency decreased in male volleyball tournaments. However, 8 to 11 percent of blocks resulted in scoring points (Afonso et al., 2008).

Afonso et al. (2005) argued that blocking the opposing team's spike is only one of the goals of the block technique. Therefore, even if the block technique just results in speed loss, it can still be effective. These findings corresponded to the results of the present study conducted on middle blockers in female volleyball tournaments, in such a way that not only the total number of blocks was more than the total number of spikes per set, but also the number of neutral blocks was significantly higher than neutral spikes (P=0.001). Indeed, 90.8% of blocks and 41.25% of spikes were neutral. It should be noted that according to the Fédération Internationale de Volleyball (FIVB) definition of the spike (a powerful strike for attack and point) and block (an action to block the ball), a neutral block is more valuable than a neutral spike since the neutral spike not only does not lead to scoring points but also paves the way for the opposing team, except in cases where the spike results in imperfect block of the opposing team and the ball return to the attacking team's court. In such conditions, the implemented

technique will not be efficient. While the neutral block can result in three states: In the first state, the ball returns to the rally after hitting the middle blocker's hands in the opposing court. In the second state, the ball enters the court with less intensity after hitting the middle blocker's hands, and the rally continues in the same team's court; in the third state, the ball enters the receiving team's court without any touch with the middle blocker's hands, and if the ball receivers in the backcourt act well, the rally will continue. In the first and second states, the neutral block will block the ball. Further, in the third state, even if the neutral block does not block the ball, it would be too difficult for the opposing team to attack, which in turn can be another advantage of the neutral block.

In general, according to the findings of the present research, the total number of blocks of middle blockers is about 4.09 times higher than the total number of their spikes. Therefore, these players are mostly employed in defensive tactics. Of course, whereas volleyball is a team game, the backcourt players incomplete reception or the employment of a greater number of opposite hitters and outside hitters is one of the possible cases that lead to the reduction of the total number of middle blockers blocks. This requires further research. Regarding this matter that the number of the middle blockers positive spikes are significantly higher than their positive block, therefore, while they use more defensive tactics, their attack (spike) performance would be better. The significant difference in the number of spikes and neutral blocks can also be interpreted in such a way that these players play a significant role in creating difficult conditions for the opposing team's attackers. In short, regarding the definitions of the two techniques of spike and block, the middle blockers act better in spike than in block.

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