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The Relationship Between Frequency of Jumps and Negative Attack Technique of Elite Male Volleyball Players During Demo Competitions

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Abstract

The study was conducted to investigate the relationship between the frequency of jumps and negative attack performance by elite male volleyball players during a demo match. A total of 36 male elite volleyball players participated, who are part of the, 14 middle blockers (age: 28.2 ± 3.7 years, height: 202.2 ± 2.4 cm, weight: 91.1 ± 9.3 kg), 16 spikers (age: 25.5 ± 5.1 years, height: 196.1 ± 3.3 cm, weight: 88.3 ± 5.1 kg), and 6 opposite players (age: 27.5 ± 3.5 years, height: 200.3 ± 2.4 cm, weight: 98 ± 4.7 kg). The athletes were followed for 2 seasons. Vertical jump and negative attack performance data were collected. Vertical jump data were obtained by wearing a Vert belt and attack performances were obtained using Data Voley 4 professional software. Using the SPSS 25, it was determined that the data were not normally distributed and Spearman correlation analysis was performed. As a result, middle players and spikers, there are insignificant relationship between jump frequency and ineffective attack (r=,035; p>0,05; r=-,064; p>0,05) and blocked attack (r=,051; p>0,05; r=,006; p>0,05), while there was a significant relationship with attack error (r=,094; p<0,05; r=,164; p<0,05). There was a insignificant relationship between the number of jumps of the oppsite players and ineffective attack (r=-.003; p>0.05), blocked attack (r=.045; p>0.05) and attack error (r=.029; p>0.05). According to the data obtained, it was seen that the percentage of attack error will increase with the increase in the number of jumps of the middle players and spikers, while the negative attack variables were not affected by the increase in the number of jumps of the opposite players. In conclusion, it can be said that volleyball players' negative attack performances can be reduced by improving their jumping capacities according to their positions.

Anahtar kelimeler: *Vertical jump, negative attack, elite volleybol player*

Elit Erkek Voleybolcuların Demo Müsabakada Gerçekleştirdikleri Toplam Sıçrama Adedi ile Negatif Atak Tekniği İlişkisi

Özet

Çalışma elit erkek voleybolcuların demo müsabaka süresince gerçekleştirdikleri sıçrama adedi ile olumsuz atak performansları arasındaki ilişkiyi incelemek için yapılmıştır. Çalışmaya 14 orta oyuncu (yaş: 28.2 ± 3.7yıl, boy:

202.2 ± 2.4 cm, kilo: 91.1 ± 9.3 kg),16 smaçör (yaş: 25.5 ± 5.1yıl, boy: 196.1 ± 3.3cm, kilo: 88.3 ± 5.1kg) ve 6 pasör çaprazı (yaş: 27.5 ± 3.5 yıl, boy 200.3 ± 2.4cm, kilo: 98 ± 4.7kg) toplam 36 voleybolcu katılmıştır. Sporcular 2 sezon boyunca takip edilmiş ve rutin antrenman programları dahilindeki demo müsabakalarda dikey sıçrama sayıları ve olumsuz atak performansı verileri alınmıştır. Dikey sıçrama verileri Vert kemeriyle, atak performansları Data Voley 4 professionel yazılımıyla alınmıştır. Veriler SPSS 25 programında normallik analizi sonrası Spearman korelasyon ile analiz edilmiştir. Analiz sonucunda, orta oyuncular ve smaçörlerin, sıçrama sıklığı ile etkisiz atak ve bloklanan atak yüzdesi arasında anlamsız bir ilişki (r=,035; p>0,05; r=-,064; p>0,05; r=,051; p>0,05; r=,006; p>0,05), atak hata yüzdesinde ise pozitif yönde anlamlı bir ilişki (r=,094; p<0,05; r=,164; p<0,05) olduğu bulunmuştur. Pasör çaprazlarının sıçrama sayısı ile etkisiz atak, bloklanan atak ve atak hatası yüzdesi arasında anlamsız ilişki (r=-.003; p>0.05; r=.045; p>0.05; r=.029; p>0.05) görülmüştür. Elde edilen verilere göre orta oyuncuların ve smaçörlerin sıçrama adedinin artmasıyla atak hatası yüzdesinin artacağı, pasör çaprazlarının ise sıçrama adedinin artmasıyla olumsuz atak değişkenlerinin etkilenmediği görülmüştür. Sonuçta, voleybolcuların pozisyonlarına göre sıçrama kapasiteleri geliştirilerek olumsuz atak performanslarının azaltılabileceği söylenebilir.

Keywords: *Dikey sıçrama, olumsuz atak, elit voleybolcu*

Introduction

Volleyball is an timeless, high-paced, fast-paced sport that emphasizes motoric characteristics such as flexibility, strength, and jumping, involves short and sudden movements that require explosiveness, and is played with a net height of 243 cm for men and 224 cm for women (Borges et al. 2017; Patsiaouras Charionidis, Moustakidis & Kokaridas, 2009). There are five basic skills that determine the winning or losing of the competition in volleyball. Two of these skills are related to serving, while three are related to attacking (Drikos, Kountouris, Laios & Laios, 2009). Attack, which has a great impact on competition performance, is a parameter that includes complex technical skills associated with many environmental, physical, physiological and psychological factors (Rocha et al. 2020). Among these skills, vertical jumping is important for athletes for both attack, block and serve performance due to the characteristics of the branch. In the literature, vertical jump performance varies according to the gender, level and position of the athletes. While it is stated that male athletes show higher and more jump performance than female athletes and elite athletes show higher and more jump performance than amateur athletes, it is stated that there is no difference in female athletes according to position, but there is a difference in male athletes (Lidor & Ziv, 2010; Marques, Van den Tillaar, Gabbett, Reis & González-Badillo, 2009; Sattler, Hadžic, Dervišević & Markovic, 2015; Sheppard, Chapman, Gough, McGuigan & Newton, 2009).

Pawlik et al. (2020) analyzed data on jump flight distance (JFD), jump serve height (SJH), attack jump height (AJH), block jump height (BJH) and quantity of jump (JC) of 140 athletes participating in the 2014 Volleyball Men's World Championship. It was found that center players traveled shorter distances than the other players in JFD, while in BJH, receivers traveled shorter distances than opposite players. SJH showed statistically significant differences ($p<0.05$) between middle players, receivers and opposite players, while BJH showed statistically significant differences ($p<0.05$) between middle players and other players. The results of the study showed that leap height during serve and attack, leap flight distance traveled during attack, and number of block jumps were highly correlated, with the strongest relationship found between jumps that were largely associated with performing only a specific action, such as a leaping serve or an attacking jump.

Mori, Yamada, Umezaki, Kida & Nomura, (2020) recorded a total of 558 jump data, including 199 jumps by middle blockers (MB), 140 jumps by setters (S) and 219 jumps by outside hitters (OH) in a 5-set competition during a university men's volleyball match. 129 jumps were recorded in the 1st set, 107 in the 2nd set, 113 in the 3rd set, 115 in the 4th set and 94 in the 5th set. There was no difference between sets in the height of spike jump (SPJ), block jump (BJ) and service jump (SJ), while MB showed significantly higher performance than OH. In a 25-point set, the number of jumps was 12.7 - 16.3 times for OH, 18.5 - 23 times for MB and 23 - 32 times for S. In a 15-point set, it was 14.7 times for OH, 15.5 times for MB and 19 times for S.

Sattler et al. (2015) examined the vertical jump performance of 253 volleyball players (113 males and 140 females) from Slovenian 1st and 2nd league athletes. The height of squat jump (SJ), countermovement jump (CJ), block jump and attack jump were tested with the

Optojump system. As a result of the study, significant differences ($p<.05$) in VJ height were observed in SJ between 1st and 2nd league athletes. Position-dependent differences in VJ performance were observed between receivers and setters in male players ($p<0.05$), while no differences were observed in VJ performance in different playing positions in women ($p>.05$).

The height and reach of attack and block jumps and the height of squat jump (SJ), countermovement jump (CMJ) and arm swing with CMJ (CMJA) were evaluated in 13 male professional athletes in 8 matches. It has been stated that attack movements are directly related to the vertical jump performance of athletes (Berriel et al. 2021).

As a result of the literature review, it can be said that vertical jumping skill is an important parameter in the attacking performance of volleyball players. In the studies on vertical jump and attack performance, vertical jump height distance values were generally used (Pocek et al. 2021; Ramirez-Campillo et al. 2020). It is also known that vertical jump is directly related to anaerobic power and performance (Savoie, Kenefick, Ely, Cheuvront & Goulet, 2015). This information can also be supported for volleyball as the anaerobic power factor is more prominent than aerobic power in volleyball (Bagheri, Rashidlamir & Attarzadeh Hosseini, 2018; Gacesa, Barak & Grujic, 2009). As the number of jumps increases, physical and physiological fatigue may also increase, which may negatively affect attack performance. In this context, the study was designed to examine the relationship between the frequency of jumps performed by elite male volleyball players in the competition and negative statistical variables related to attack technique.

Method

A total of 36 male elite professionel volleyball players participated in this study, who are part of the, including 14 middle blockers (age: 28.2 ± 3.7 years, height: 202.2 ± 2.4 cm, body weight: 91.1 ± 9.3 kg), 16 spikers (age: 25.5 ± 5.1 years, height: 196.1 ± 3.3 cm, body weight: 88.3 ± 5.1 kg), and 6 opposite players (age: 27.5 ± 3.5 years, height: 200.3 ± 2.4 cm, body weight: 98 ± 4.7 kg). Athletes were followed in 30 demo competitions during 2 seasons and the frequency of jump oppsite players 17,816, middle players 44,848, spikers 44,589 (Figure 1).

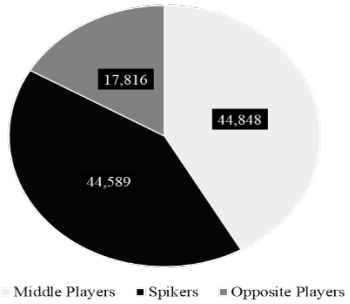

Figure 1: Distribution of Total Number of Jumps of 30 Match

Jumping Measurements

The athletes were fitted with Vert belts at the end of the warm-up period of the demo competitions and vertical jump data were recorded with the Vert Team System (version 2.0, Mayfonk Inc., Fort Lauderdale, FL, USA) during the competition. The device records jumps above 15 cm (Mahmoud, Othman, Abdelrasoul, Stergiou & Katz, 2015).

Technical Analysis

Technical analysis of the competitions was performed with Data Voley 4 professional (version 4.02.32 ginius spor, Italy), a volleyball-specific analysis program. The negative statistical data of attacking technical performance such as (-) negative attack, (/) blocked attack and (=) attack error percentages were evaluated (Silva, Sattler, Lacerda & João, 2016).

Data Analysis

The normality of the data obtained in the study was tested with the Kolmogorov-Smirnov test and it was determined that the data did not show a normal distribution. In the literature, skewness kurtosis values are also used in normality assumption applications. The value range of -1.5 +1.5 suggested by Tabachnick, Fidell & Ullman (2013) for kurtosis skewness values was taken into consideration and it was seen that the data were not within this range. Accordingly, the relationship between the average number of jumps by position and negative attack parameters was analyzed using Spearman correlation analysis. The coefficients obtained from the results were evaluated according to Schober, Boer & Schwarte, (2018) (.00-.10: insignificant, .10-.39: weak, .40-.69: moderate, .70-.89: strong, .90-1: very strong).

Ethics of Research

The necessary approval was obtained from Erzincan Binali Yıldırım University Human Research Health and Sports Sciences Ethics Committee. We acknowledge that the principles recommended in the Declaration of Helsinki for human and animal studies have been followed.

Results

Table 1

Spearman Correlation Analysis Results for the Relationship Between Frequency of Jumps and Negative Attack Parameters of Middle Players

Negative attack		**Frequency of jump**
(-) %: Ineffective attack	r	,035
	p	,425
	n	517
(/) %: Blocked attack	r	,051
	p	,249
	n	517
(=) %: Attack error	r	,094*
	p	**,033**
	n	517

In Table 1, it is determined that there is a positive insignificant relationship between the frequency of jumps of the middle players and the percentage of ineffective attacks (r=,035; p>0,05), and a positive insignificant relationship with the percentage of blocked attacks (r=,051; p>0,05), but this relationship is not statistically significant. Finally, it was found that there was a positive insignificant relationship with attack error percentage (r=,094; p<0.05) and this relationship was statistically significant.

Table 2

Spearman Correlation Analysis Results for the Relationship Between Frequency of Jump and Negative Attack Parameters of Spikers

Negative attack		**Frequency of jump**
(-) %: Ineffective attack	r	-,064
	p	,110
	n	620
(/) %: Blocked attack	r	,006
	p	,885
	n	620
(=) %: Attack error	r	,164**
	p	**,000**
	n	620

In Table 2, although there is a negative insignificant correlation between the frequency of jumps of spikers and ineffective attack percentage (r=-,064; p>0,05) and a positive insignificant correlation with blocked attack (r=,006; p>0,05), this relationship is not statistically significant. Finally, it was found that there was a weak positive relationship with the percentage of attack error (r=.164; p<0.05) and this relationship was statistically significant.

Table 3

Spearman Correlation Analysis Results for the Relationship Between Total Number of Jumps and Negative Attack Parameters of Opposite Players

Negative attack		**Frequency of jump**
(-) %: Ineffective attack	r	-,003
	p	,964
	n	245
(/) %: Blocked attack	r	,045
	p	,484
	n	245
(=) %: Attack error	r	,029
	p	,646
	n	245

Table 3 shows that there is a negative insignificant correlation between the frequency of jumps of opposite players and the percentage of ineffective attacks (r=-.003; p>0.05), a positive insignificant correlation with the percentage of blocked attacks (r=.045; p>0.05) and finally a positive insignificant correlation with the percentage of attack errors (r=.029; p>0.05).

Discussion and Conclusion

This study was conducted to investigate the relationship between the frequency of jumps performed by elite male volleyball players in a demo match and negative statistical variables of attacking technique. A total of 36 elite professionel volleyball players including 14 middle players, 16 spikers and 6 opposite players, participated. The athletes were followed for 2 seasons and the vertical jump numbers and negative attack performance data were obtained in 30 demo competitions within the routine training program during the season. As a result of the data obtained, it was seen that the percentage of attack errors would increase with the increase in the frequency of jumps of the middle players and spikers, while the negative attack variables were not affected by the increase in the frequency of jumps of the opposite players.

Pawlik & Mrozcek, (2023) examined the relationship between jump height and performance of 39 male and 24 female elite volleyball players during competition. In men, a decrease in jump height was observed in the sets after the first set and this had a negative effect on match performance. The opposite was observed in women. It was stated that training practices to maintain and improve jump height during the competition for men would contribute positively to match performance.

In the studies, it was reported that the number of jumps varied according to the positions of male players, the number of jumps in a set was 13.3 times for outside hitter, 20.7 times for middle blocker and 31.7 times for setter, with the setter having the highest number of jumps (Lima, Palao & Clemente, 2019). In another study, it was found that there was no statistical difference between the jumping skill levels of elite female volleyball players according to their playing positions, and according to the average of the general jumping score (JUMPscore), volleyball players in the receiver position had the highest score with 66.58 ± 9.18 points, and volleyball players in the setter position had the lowest score with 54.52 ± 10.34 points (Dopsaj, Ćopić, Nešić & Sikimić, 2012).

García-de-Alcaraz, Ramírez-Campillo, Rivera-Rodríguez & Romero-Moraleda, (2020) recorded the external jump load over a season in a high-level volleyball team, analyzing the differences between player positions at different seasonal stages of elite volleyball players in the positions of 4 outside-hitters, 2 opposite, 3 middle blockers and 2 setters who participated in 174 training sessions over 32 weeks. Middle blockers showed the highest jump load and setters the lowest performance regardless of the season stage. Outside-hitter and setter players showed similar jump loads. Various training sessions during different periods of the season, such as competition or preparation, have a great influence on the distribution of the jump load. The specific differences in each of the analyzed variables suggest that position-specific jump training loads are required. Lobietti, Coleman, Pizzichillo & Merni, (2010) analyzed 12 top-level matches in the Italian professional volleyball league. As a result of the analysis, an average of 96 jumps per set were performed in competition, while in training this load increases more. Since the jumping and landing techniques of the athletes vary according to their positions and the increase in jumping load may cause knee injuries and injuries and negatively affect performance, it is stated that jumping loads should be applied in a controlled manner in training or competitions. Bahr & Bahr, (2014) examined differences in jump frequency during training and matches in young elite volleyball players (26 boys, 18 girls). 1 week of volleyball training

(9 training sessions for boys and 10 training sessions for girls, 14.1 h and 17.8 h, respectively) and 10 matches (5.9 h (16 sets) for boys and 7.7 h (21 sets) for girls) were analyzed. As a result of the analysis, a total of 11943 jumps were recorded, 4138 in competitions and 7805 in training. Participation in training and frequency of jumps differed significantly between players. The total number of jumps in training ranged between 50-666 jumps/week for boys and 11-251 jumps/week for girls. This corresponds to an average of 35.7 jumps/hour for boys and 13.7 jumps/hour for girls ($p=0.002$). The total number of jumps in the matches ranged between 1-339 for boys and 0-379 for girls, which corresponded to an average of 62.2 jumps/h for boys and 41.9 jumps/h for girls ($p<0.039$). In conclusion, there were significant gender differences in jump frequency data and total jump volume may be a more important risk factor than total training volume for competitive performance and knee injuries.

de Leeuw, van Baar, Knobbe & van der Zwaard, (2022), in their study with 17 male national volleyball players, applied volleyball-specific strength and jump loading training to the athletes. In addition, 31 competitions they participated in for 24 weeks were analyzed. It was stated that heavy strength training for the lower extremities had a positive effect on attack performance, while heavy strength training for the upper extremities, low jump height and high number of jumps had a negative effect on attack performance. It was recommended to reduce the intensity of upper extremity strength and jump loading training during the competition period.

Berriel et al. (2021) examined the relationship between the height and reach of attack and block jumps and the height of squat jump (SJ), countermovement jump (CMJ), and CMJ and arm swing (CMJA) in 8 matches of 13 male professional athletes competing in the Brazilian Volleyball Super League, attack jump height and attack efficiency ($r=0.57$; $p=,05$), block jump height SJ height and attack jump height CMJ height were found to be highly correlated ($r=0,82$; $p<,01$; $r=0,86$; $p<,01$). It was stated that attack movements were directly related to the vertical jump performance of the athletes.

Wnorowski, Aschenbrenner, Skrobecki & Stech, (2013) A total of 378 data were recorded from the technical tactical skills of 5 Polish volleyball players (the attacker, the setter, the middle blocker and two receivers) during the competition. There was a significant and positive correlation between the reach values obtained and the results obtained in individual sets. The attacker was closest to the maximum reach value, while the setter had the lowest values. During the competition, the players made the highest jump in the first set and their performance decreased in the following sets.

As a result of the study, it was seen that the percentage of attack errors would increase with the increase in frequency of jumps of the middle players and spikers, while the negative attack variables were not affected by the increase in frequency of jumps of the opposite. As a result, it can be said that volleyball players' negative attack performances can be reduced by improving their jumping capacities according to their positions. While there is a consensus in most of the studies that jump height or depth has a positive effect on attacking performance, it is thought that more studies should be conducted on the subject in order to comment on the number of jumps.

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