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## COMPARISON OF JUMPING PERFORMANCE WITH DIFFERENT METHODS OF VOLLEYBALL AND WRESTLING ATHLETES

### ABSTRACT

The aim of this study was to compare the jumping performance of female and male volleyball players and male wrestlers by static, counter, drop and repetitive jumping methods.

20 female and 20 male volleyball players which play in 2. league and 3. league and 20 national wrestlers voluntarily participated the study. All subjects were students in Physical Education and Sports Department. The mean ages were 21.15 years for female volleyball players, 20.80 years for male volleyball players and 20.60 years for wrestlers. All subjects performed static jump, counter jump, drop jump and repetitive jump. Values were measured by New Test Power Timer System 300 Series Instrument. Body Mass Indeks (BMI), flexibility and body fat percentage values was determined. The values among three groups were compared by Kruskal Vallis Test. For the pairwise comparison Mann Whitney-U test was used.

Flexibility values compared among athletes it has found that wrestlers were more flexible than male volleyball players. Height, BMI, body fat percentage were found significantly different among subjects, Drop, static, counter movement and repetitive jump height and power values were found significantly higher in male volleyball players than female volleyball players and wrestlers. Static and counter movement jump values were found significantly higher in wrestlers than female volleyball players.

A higher jumping value of male volleyball players than wrestlers is related sports branch. While better jumping performance of female volleyball players than wrestlers is expected, gender factor passed in front of this situation. As a conclusion, sports branch and gender factor have an important factor on jumping performance.

**Key Words:** Jumping Methods, Volleyball Players, Wrestlers

## VOLEYBOL VE GÜRE BRAN INDAK SPORCULARIN FARKLI YÖNTEMLER LE SIÇRAMA PERFORMANSLARININ KAR İLA TIRILMASI

### ÖZET

Bu çalışmanın amacı, bayan ve erkek voleybolcular ile güreççilerin statik, yaylanarak, dürek ve tekrarlı sıçrama performanslarını karşılaştırmaktır.

Bu çalışmaya Yar Doğu Beden Eğitimi ve Spor Yüksekokulunda okuyan 2.ve 3. Ligde mücadele eden 20 bayan voleybolcu, 20 erkek voleybolcu ile Milli 20 erkek güreççi gönüllü olarak katılmıştır. Bayan voleybolcuların yaş ortalaması 21.15 yıl, voleybolcu erkeklerin 20.80 yıl ve güreççilerin 20.60 yıldır. Bütün denekler statik sıçrama, yaylanarak sıçrama, dürek sıçrama ve tekrarlı sıçrama yapılmıştır. Sıçrama değerlerinin belirlenmesi, New Test Power Timer System 300 Series aleti kullanılarak yapılmıştır. Ayrıca çalışmaya katılan sporcuların, beden kitle indeksi (BKİ), esneklik ve vücut yağ yüzdesi de erleri ölçülmüştür. Üç grup arasında fark olup olmadığına bakmak amacıyla Kruskal Vallis testi, ikili karşılaştırmalarda Mann Whitney U testi kullanılmıştır.

Sporcuların karşılaştırıldığında güreççi erkeklerin voleybolcu erkelerden daha esnek oldukları görülmüştür. Boy, vücut ağırlığı, BKİ, vücut yağ yüzdesi arasında anlamlı derecede farklılık bulunmuştur. Voleybolcu erkeklerin Dürek, Statik, Yaylanarak ve Tekrarlı sıçrama yükseklikleri ve güçleri voleybolcu bayanlardan ve güreççilerden yüksek bulunmuştur. Güreççilerin ise statik ve yaylanarak sıçrama yükseklikleri ve güçleri bayan voleybolculardan daha yüksek bulunmuştur.

Erkek voleybolcuların sıçrama değerlerinin güreççilerden yüksek çıkması yapılan spor branşı ile ilgilidir. Voleybolcu bayanların sıçrama performansının güreççi erkeklerden daha iyi olması beklenirken cinsiyet faktörünün bu durumun önüne geçtiği görülmüştür. Sonuç olarak, yapılan spor branşının cinsiyetin sıçrama performansı üzerinde önemli etkisinin olduğu görülmüştür.

**Anahtar Kelimeler:** Sıçrama yöntemleri, Voleybol, Güreç

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## INTRODUCTION

Volleyball is a dynamic game, which bases on three won sets and in which; the play time is uncertain and quickness, strength, endurance, jumping come into prominence. Strength is also one of the most important parameters in executing the technical and tactical skills on a level desired in a volleyball game. Vertical jump is done frequently during games and practices by volleyballers. Players jump as vertical as they can during various defense and offence maneuvers (16). Jumping ability has a critical importance that will provide advantage in offence and defense (blocking) during a volleyball game (21). Jumping is a talent that includes a complex movement index and is connected to the power of the leg muscles, its explosive strength, flexibility of the muscles partaking in the jump and the jumping technique (10). It can be seen that combined motoric features such as quick strength and continuity in the strength during scrambles that are performed for transiting to offence in volleyball are in the foreground (17). While fundamental techniques such as blocking require a high-level jumping strength, movements like spike shot require arm strength. In order for players to keep up with the game tempo during match time, their endurance must be at a sufficient level in sports games due to game flow and play time, constant change in their movement and fast paced games (12). Static jump is executed for testing and evaluating the speed and explosive strength ability. Concentric muscle action is used in the test. Static jump was proven to have shown a strong correlation to the sprint performance, long jump and isokinetic leg extension test. Counter movement jump is used for testing the explosive speed and muscles coordination. Drop jump is used for evaluating the player's resistance to stretching blows and his/her ability of benefiting from the flexibility in his/her legs. As addition to that, explosive strength is investigated. In drop jump, players must be able to bear the high strike-force when contacting the ground and in the following

vertical jump, they must be able to convert the elastic energy accumulated in the elastic compounds in the legs (especially quadriceps). For this reason, the test is ideal for investigating the jumping skills and the legs coordination(24).

When looked at the literature, many studies regarding the jump height and power, which are very vital for volleyballers, aim to improve the jumping performance by using various practice methods. In the conducted studies, how much the jumping performance increased was investigated by using plyometric and ballistic resistance training method and with these performed training methods, an increase in the jumping performances of the players was confirmed. Also, traditional heavy endurance trainings performed by trainers was determined to hinder the jumping performance (11, 15). Wrestling is a sport that requires control and sports performance such as high-level endurance (aerobic, anaerobic, respiratory functions), strength, flexibility, velocity, quickness, balance, reaction and strategy (25).

The purpose of this study was to compare the static, counter movement, drop and repetitive jump performances of female and male volleyballers and wrestlers.

## MATERIAL and METHOD

20 female and 20 male volleyballers and 20 male national wrestlers, whom are being educated at Ya ar Do u Physical Education and Sports Highschool and play in the 2. and 3. League, attended to this study voluntarily.

**Body Mass Index (BMI):**  $BMI = \text{Weight/Height}^2$

Jump tests were done with the Powertimer PC 1.9.5 Version Newest device.

**Drop Jump:** Athletes dropped down with both feet from a stair at 30 cm height onto the mat on the ground with their arms akimbo and as soon as their feet touched the mat, they jumped as high as they can with a half squat. Athletes jumped three

times. Best score of each was used in the evaluation.

**Static Jump:** While athletes were standing on the mat on both feet with their knees at 90 ° squat stance and their arms akimbo, they jumped as high as they can. Athletes jumped three times. Best score of each was taken into evaluation.

**Counter Movement Jump:** Athletes were standing up at the starting position. Athletes crouched down rapidly and bend the knees 90 ° with their arms akimbo and then jumped as high as they can. Athletes jumped three times. Best score of each was taken into evaluation.

**Repetitive Jump Test:** Athletes stood on the mat with their arms akimbo and finished the test by jumping non-stop as high as they can for 30 seconds. New Test Power Timer device calculates the speed strength endurance capacity according to the formula written in the below.

Speed strength endurance capacity = 0-15 sec average jump height / counter movement jump height

**Skinfold Thicknesses:** were calculated with the Holtain Skinfold Kaliper device by using the Fat% = 5.783 + 0.153 (Triceps +

Subscapula + Abdominal + Suprailiac) formula.

**Flexibility Test:** Athletes sit on the ground barefoot with Standing Trunk Flexion Meter and leaned their soles to the test stand. Without bending the legs, two hands started to push the digital indicator placed on the stand towards forward. Waiting for a few seconds at the lastest extend they could reach, inditaced values were read. Subjects repeated this thrice. Best score of each was taken into evaluation.

### Statistical Analysis

The SPSS 19 package software was used in the statistical analyses of our study's data. Whether or not the data managed a normal distribution was scanned with the Kolmogorov-Smirnov test and then the data hadn't managed a normal distribution was confirmed. The values among three groups were compared by Kruskal Wallis Test. For the pairwise comparison Mann Whitney-U test was used. Because the comparison number was three, in each Bonferroni corrected Mann Whitney U tests, the level of significance taken into account was 0.05/3=0.0167

## RESULTS

**Table 1: Comparison of the Physical Characteristics of Athletes**

Variables	Sports Branches	Median	Min.-Max.	p
Age (year)	Male Volleyballers (1)	20.00	18.00- 26.00	0.419
	Male Wrestlers (2)	21.50	18.00-26.00	
	Female Volleyballers (3)	20.50	19.00-24.00	
Height (cm)	Male Volleyballers (1)	182.50	168.00-190.00	0.001**
	Male Wrestlers (2)	173.50	162.00-186.00	
	Female Volleyballers (3)	177.00	163.00-183.00	
Weight (kg)	Male Volleyballers (1)	74.50	67.00-86.00	0.000**
	Male Wrestlers (2)	70.00	60.00-110.0	
	Female Volleyballers (3)	60.00	51.00-75.00	
BMI	Male Volleyballers (1)	23.40	19.00-25.90	0.000**
	Male Wrestlers (2)	23.90	20.80-29.10	
	Female Volleyballers (3)	20.50	18.40-23.00	
Body Fat %	Male Volleyballers (1)	11.00	10.00-15.00	0.000**
	Male Wrestlers (2)	10.00	9.00-13.00	
	Female Volleyballers (3)	12.00	11.00-14.00	
Flexibility (cm)	Male Volleyballers (1)	16.05	5.90-24.50	0.047
	Male Wrestlers (2)	22.45	6.50-28.50	
	Female Volleyballers (3)	17.30	4.30-26.70	

\*\*p<0.0167

**Table 2: Comparison of Jump Height and Jump Power of Athletes**

Variables	Sports Branches	Median	Min.-Max.	p
Drop Jump Height (cm)	Male Volleyballers (1)	42.00	33.90-56.30	0.000**
	Male Wrestlers (2)	32.85	24.80-42.20	1>2,3**
	Female Volleyballers (3)	29.95	15.70-42.00	
Drop Jump Power (W)	Male Volleyballers (1)	42.00	2130.00-5957.00	0.000**
	Male Wrestlers (2)	32.85	1772.40-3639.60	1>2,3**
	Female Volleyballers (3)	29.95	976.00-5994.20	
Static Jump Height (cm)	Male Volleyballers (1)	43.25	33.80-52.00	0.000**
	Male Wrestlers (2)	34.60	29.30-41.80	1>2,3**
	Female Volleyballers (3)	25.55	16.30-36.80	2>3**
Static Jump Power (W)	Male Volleyballers (1)	4092.65	3139.20-4700.00	0.000**
	Male Wrestlers (2)	3355.35	2665.50-4707.30	1>2,3**
	Female Volleyballers (3)	2304.30	1654.30-3624.10	2>3**
Counter Movement Jump Height (cm)	Male Volleyballers (1)	47.65	32.60-74.20	0.000**
	Male Wrestlers (2)	36.00	29.60-46.40	1>2,3**
	Female Volleyballers (3)	25.50	16.30-29.90	2>3**
Counter Movement Jump Power (W)	Male Volleyballers (1)	4365.80	3006.60-6118.10	0.000**
	Male Wrestlers (2)	3509.05	316.10-4721.80	1>2,3**
	Female Volleyballers (3)	2304.30	1654.30-2800.00	2>3**

\*\*p<0.0167

**Table 3: Comparison of Repetitive Jump Test Values of Athletes**

Variables	Sports Branches	Median	Min.-Max.	p
Absolute Power (W)	Male Volleyballers (1)	4417.90	2307.30-15700	0.000**
	Male Wrestlers (2)	2902.90	21.50-9735.50	1>2,3**
	Female Volleyballers (3)	2676.60	1945.90-5313.49	
Average Power (W)	Male Volleyballers (1)	3774.95	1602.10-4536.50	0.000**
	Male Wrestlers (2)	2318.85	1678.20-3049.90	1>2,3**
	Female Volleyballers (3)	2370.95	1192.50-5795.70	
Fatigue Index (%)	Male Volleyballers (1)	95.85	75.90-117.90	
	Male Wrestlers (2)	98.50	72.20-114.50	1.092
	Female Volleyballers (3)	97.40	63.10-124.00	
Speed Strength Endurance Capacity	Male Volleyballers (1)	76.20	42.80-105.60	0.000**
	Male Wrestlers (2)	70.60	46.40-88.10	3>2,1**
	Female Volleyballers (3)	85.20	74.00-116.20	

\*\*p<0.0167

## DISCUSSION and CONCLUSION

This study was carried out for the purpose of comparing jumping performances, which were conducted with different methods, of male and female volleyballers and wrestlers and some of their physical characteristics. While there were no difference between the ages and flexibility values of athletes, a significant level difference at the degree of  $p<0.01$  among height, body weight, BMI, body fat percentage was found. It was observed that while fat percentage median values in

male volleyballers were 11.00, in wrestlers it was 10.00 and in female volleyballers it was 12.00. In the Fleck et al., (1985) studies, the body fat percentage was determined as 11.7 (7). The Duncan et al., (2006) stated the body fat percentage value of elite male volleyballers as 12.17 (5). The fat values of the volleyballers, who attended to this study, are close to those of that were found in the studies of the Fleck et al., (1985) and the Duncan et al., (2006). The body fat percentage values of wrestlers were found lower than those of

volleyballers. Studies in the literature showed that wrestlers have high body mass index and normal fat percentage (18). The Yoon (2002) study stated that wrestlers, who generally partake in national teams and whose kilograms change between 54 and 130, have low fat percentage (10%) (25). Among all the athletes that took place in the study, wrestlers have the best flexibility value. But no significant difference was found among the three groups. While the Fry et al., (1991) take the flexibility value of female volleyballers as  $19.5 \pm 4.3$  cm, the flexibility median value of female volleyballers in our study was 16.05 cm.

Regarding the values of jumping of the athletes, static jump heights of male, female volleyballers and wrestlers are respectively 43.25cm, 34.60cm and 26.30cm. And counter movement jump heights were 47.65cm, 36.00cm and 25.50cm. The Barnes et al., (2007) measured the values of jumping of 29 female volleyballers, whose age average is  $19.2 \pm 0.9$ , by counter movement jump. Values of jumping of I. League players were determined as  $36.4 \pm 2.5$ , II. League determined as  $31.8 \pm 4.6$  and III. League determined as  $30.2 \pm 7.2$  (2). The Ferries et al., (1995) determined the counter movement jump value as  $45.5 \pm 6.8$  in the study conducted upon 13 volleyballers (6). Values of jumping of females in our study were found lower than the values of other researchers. Reasons for this may be condition, genetic or ethnic differentials.

All jump heights and jump strengths of male volleyballers were found higher in a significant level than wrestlers and female volleyballers at a value of  $p < 0.0167$ . Plyometric training is used commonly in sport branches like volleyball, basketball for improving the jump abilities (3). In this study, a value of jumping of male volleyballers turning out to be higher than those of wrestlers is related to the executed sport branch. While jumping exercises take a great place in the trainings of volleyballers, this situation

doesn't go the same with that of wrestlers. When the anaerobic performance was measured by vertical jump test of wrestlers in the Ta et al., (2008) study, it was determined that wrestlers had a low anaerobic power (23). In a study where the Sheppard et al., (2008) compared the highest spike and counter movement jump values of 7 good volleyballers with the 7 bad volleyballers, differences in the counter movement jump values were determined as significant. And the most important finding in their study was determined as the difference in the drop jump between the good and bad athletes. In this study that Sheppard and his friends conducted, good athletes doing a more systematic jumping exercise points to the importance of the training on the jumping performance. Alongside with the context of the training, structural differences can be linked to the reasons of wrestlers having lower values of jumping than the male volleyballers (19).

Static jump height, static jump power, counter movement jump height and counter movement jump power of wrestlers came out to be different from the female volleyballers at a value of  $p < 0.0167$  (Table 2). Whilst expecting a better performance from female volleyballers in jumping than male volleyballers, it was seen that gender factor prevented this expectation from becoming reality.

In a study, male national volleyballers were determined to have better spike and block jump performances than the players in university. Absolute values of jumping of national players were found higher. Because no difference was found in the standing reach among the groups, the reason for this difference was thought to be the better jump abilities of national players (22). In the Forthomme et al., (2005) study, it was stated that the male players in Belgium 1. League can jump better than the ones in the 2. League (8). While counter movement jump value of 1. League players were  $56.5 \pm 4.6$ , the same value of 2. League players were given as

51.2±2.3 and identically, values of jumping of American national team players were determined to be higher than the university players (7). In the study carried out with 17 players, Hakkinen et al., (1993) determined the static and counter movement jump values of two teams playing in the Finland League like this. While static jumps of the first team were determined as 28.5 ±1.1 and counter movement jump value was determined as 31.1± 1.3; static jumps of the second team were determined as 29.6± 2.5 and counter movement jump value was determined as 31.3 ±4.6, also athletes weren't allowed to wave their arms during the jump tests (11). The Marques et al., (2008) found a 2.8% improvement in the counter movement jump values of elite volleyballers playing in the Portuguese 1. League (14). Ballistic type exercises such as counter movement and loaded counter movement jump can improve the jumping performance of elite athletes with careful planning in their trainings.

In the studies that the Sheppard et al., (2008) conducted upon male national volleyballers, it was concluded that athletes can improve the repetitive jump performance through training (20). When examined the repetitive jumping values of athletes, absolute power and average power values of male volleyballers were found to be higher than male wrestlers and female volleyballers ( $p<0.0167$ ). Volleyballers having a better jumping

performance than wrestlers may be resulting from repetitive jumping exercises.

In our research, along with not finding a significant difference among the fatigue index values, also the fatigue index percentage of wrestlers is higher. Amongst the reasons for this, it can be counted that wrestlers don't give as much place as volleyballers to jumping exercises in their trainings. To make the fatigue index value more apparent, making the test time longer can be advised.

When the comparison table was investigated; drop, static and counter movement jump heights and powers were significantly different among three group athletes at the degree of  $p<0.0167$ . In the study that the Kollias et al., (2004) conducted upon 138 elite athletes, it was found that the counter movement jump and drop jump values of volleyballers are significantly higher than the ones of basketball, football and handball players (13). In another study, it was stated that a higher drop jump performance was shown by volleyballers than the other athletes (4).

As a conclusion, a value of jumping of male volleyballers turning out to be higher than those of wrestlers is related to the executed sport branch. Whilst expecting a better performance from female volleyballers in jumping than male wrestlers, it was seen that gender factor prevented this expectation.

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