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Physical Performance Parameters of Korfball and Volleyball Athletes: A Cross-Sectional Study in Türkiye

Gamze AYDIN[1], Emine ATICI[1], Tülay ÇEVİK SALDIRAN[2]

[1] Istanbul Okan University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation
[2] Bitlis Eren University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation

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ABSTRACT

Objective: This study aimed to compare the physical performance parameters of korfball and volleyball athletes in a university**. Materials and Methods:** A total of 26 korfball (n=9) and volleyball (n=17) athletes voluntarily participated in this study. Body composition, aerobic and anaerobic capacity, muscle strength and endurance, static and dynamic balance, flexibility and hand grip strength were measured. **Results:** The average age of the athletes participating in this study was 22.2±2.2, 21.4±5.26 years (korfball, volleyball, respectively). There was no significant difference between the demographic features and body composition parameters of korfball and volleyball athletes ($p>0.05$). Skinfold thickness in four regions of volleyball athletes was significantly lower than korfball athletes ($p<0.05$). There was no significant difference in anaerobic and aerobic performance tests between groups. In addition, abdominal muscle strength of korfball athletes was significantly higher than volleyball athletes ($p=0.001$). The Flamingo balance test-right was lower and star excursion test-right was higher in korfball athletes than volleyball athletes ($p=0.032$, $p=0.033$, respectively). **Conclusion:** The korfball and volleyball athletes had similar performance parameters according to results of body composition, aerobic and anaerobic capacity, flexibility and hand grip strength except skinfold measurements, abdominal muscle strength and static and dynamic balance. This study supports the similarity of the physical and motoric values of these team players.

Key words: Volleyball, Exercise Test, Physical Functional Performance, Korfball.

Korfbol ve Voleybol Sporcularının Fiziksel Performans Parametreleri: Türkiye'de Kesitsel Bir Çalışma

ÖZ

Amaç: Bu çalışma, bir üniversitedeki korfbol ve voleybol sporcularının fiziksel performans parametrelerini karşılaştırmayı amaçladı. **Gereç ve Yöntemler:** Bu çalışmaya korfbol (n=9) ve voleybol (n=17) sporcularının oluşturduğu toplam 26 gönüllü sporcu katıldı. Vücut kompozisyonu, aerobik ve anaerobik kapasite, kas gücü ve dayanıklılığı, statik ve dinamik denge, esneklik ve el kavrama gücü değerlendirildi. **Bulgular:** Çalışmaya katılan sporcuların yaş ortalaması sırasıyla korfbol ve voleybol gruplarında 22.2±2.2 ve 21.4±5.26 yıldı. Korfbol ve voleybol sporcularının demografik özellikleri ve vücut kompozisyonu parametreleri arasında anlamlı bir fark bulunmadı ($p>0.05$). Voleybol sporcularının dört bölgede deri altı yağ kalınlığı, korfbol sporcularına göre anlamlı şekilde daha düşüktü ($p<0.05$). Gruplar arasında anaerobik ve aerobik performans testlerinde anlamlı bir fark görülmedi. Buun yanı sıra, korfbol sporcularının abdominal kas kuvveti ve enduransı, voleybol sporcularına göre anlamlı derecede daha yüksekti ($p=0.001$). Flamingo denge testi-sağ, korfbol sporcularında voleybol sporcularına göre daha düşük, star excursion test-sağ ise daha yüksekti ($p=0.032$, $p=0.033$, sırasıyla). **Sonuç:** Korfbol ve voleybol sporcuları, deri altı yağ kalınlığı, abdominal kas kuvveti ve endurasnı, statik ve dinamik denge dışında, vücut kompozisyonu, aerobik ve anaerobik kapasite, esneklik ve el kavrama gücü sonuçlarına göre benzer performans parametrelerine sahipti. Bu çalışma, bu takım sporcularının fiziksel ve motorik değerlerinin benzerliğini desteklemektedir.

Anahtar Kelimeler: Voleybol, Egzersiz Testi, Fiziksel Fonksiyonel Performans, Korfbol.

Sorumlu Yazar / Corresponding Author: Gamze AYDIN, Istanbul Okan University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye.
E-mail: gamze.tosun@okan.edu.tr

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INTRODUCTION

Korfball and volleyball are sports played both globally. Korfball, developed in the Netherlands, is a sport designed to score more points by throwing the ball into the opponent's basket (korf). Its primary aim is to create a game where men and women can play together without providing advantages or disadvantages to either gender. A korfball team consists of 4 male and 4 female players. Two males and two females are positioned in defense, while the other two males and two females play in offense. Each player is assigned a specific opponent to mark, requiring them to closely follow their counterpart. Korfball involves versatile movements, necessitating players to develop both offensive and defensive skills. The game includes short bursts of maximal or submaximal exertion (Summerfield & White, 1989).

Volleyball, a more advanced sport, is played with six players per team and involves skills such as passing, blocking, spiking, serving, diving, rolling, and defensive techniques. Both individual and team variations form a significant part of the game. These variations are shaped by mental, physical, and physiological functions, profoundly influencing performance. Volleyball is a popular sport among teams and athletes, combining technical and physical effort with aesthetic movements in a competitive setting. It contributes to the physical, emotional, mental, and social development of individuals (Olcucu et al., 2014).

As in many sports, anthropometric characteristics and physical performance capacities are among the most critical factors for success in volleyball, alongside technical and tactical skills. Although volleyball is primarily an aerobic sport in terms of energy production, neuromuscular performance and coordination also play significant roles. Additionally, volleyball is an interval-based sport where loading and resting phases are intertwined within short periods. It is a complex sport played on a 9-meter-long court, involving varying durations and intensities of movement, frequently requiring maximal force in actions such as running, rolling, and jumping. To recover the ball sent from the opposing court, players must execute sudden accelerations and skill-intensive movements flawlessly (Olcucu et al., 2014).

Both sports exhibit similar physical, physiological, and motor characteristics in addition to their technical requirements (Swann et al., 2015). As team sports classified as interval sports, korfball and volleyball utilize both aerobic and anaerobic energy systems. During training, it is challenging to isolate these systems entirely, although one may be more prominently utilized depending on the sport. Athletic performance can be defined as the total effort exerted to accomplish a specific athletic task. Evaluating sport-specific attributes such as strength, speed, endurance, flexibility, reaction time, and postural alignment is essential (Tsai et a., 2020). One of the factors influencing performance is the physical structure or physical characteristics of athletes, as these attributes directly impact physiological capacities. When an athlete's physical structure does not align with the demands of a specific sport, achieving the desired performance level becomes unlikely. Physical structure is an indicator of high performance and interacts with other performance metrics such as strength, power, flexibility, speed, endurance, and agility, collectively enhancing the athlete's overall performance (Tsai et al., 2020; Pereira et al., 2015).

As in many sports, fundamental attributes affecting the performance of korfball and volleyball players include body composition, strength, endurance, speed, and balance (Pereira et al., 2015). While numerous studies have examined performance parameters in volleyball players (Pereira et al., 2015; Bonato et al., 2022; Piatti et al., 2022), there is a lack of research evaluating the physical performance of korfball players in the literature. It is one of the few studies in this field that provides information about the physical and functional performance of korfball players. In this study, it is aimed to compare the physical performance parameters of volleyball and korfball athletes in a university.

MATERIALS AND METHODS

Study type

The single centered, cross-sectional study was performed through face-to-face interviews and assessments with Okan University Center of Sports from October-December 2024.

Study group

26 volleyball and korfball athletes between the ages of 17-25 were involved in this study. The inclusion criteria of participants were being a registered player for at least 2 years, playing in university volleyball or korfball team and training 2 hours a day and at least 2 days a week. Athletes having any systemic and/or neurological disease were not involved in this study. A power analysis was performed in the study with the G*POWER software.The effect size (f=1.332) for agility assessment, one of the performance parameters, was calculated based on Rathod L. (2018). It was determined that a total of 16 participants, with at least 8 athletes in each group, would be required to achieve an 80% statistical power level and a 5% significance level for the calculated effect size (Rathod, 2018).

Procedures

All assessments were made by blinded researchers under the same standard environment conditions. The age, gender, exercise habits, smoking and alcohol consumption of the athletes were questioned. Anthropometric measurements and performance parameters (aerobic, anaerobic, periodical performance, balance, flexibility, hand grip strength) were evaluated.

Anthropometric measurements

Anthropometric measurements and body composition of the athletes were measured using the TANITA Bioempedance Body Composition Analyzer and the fat ratio was measured using the 'Holtain Skinfold Calipper' brand skinfold. Skinfold measurements were made from biceps, triceps, suprailiac and subscapular by using J-P (Jackson-Pollock) method (Jagim et al., 2023). Height measurements were taken using a stadiometer with an accuracy of 0.01 cm. Body mass index (BMI) was determined by calculating the ratio of body weight (kg) to squared height (m^2) (Nuttall, 2015).

Performance evaluations

Aerobic test

The aerobic test was performed using the 12-minute Cooper test. Participants were instructed to run within a designated area for 12 minutes, aiming to cover the greatest possible distance. The stopwatch was started as soon as the individual began running, and the distance covered at the end of the 12 minutes was recorded. Maximal oxygen consumption ($maxVO_2$) was then calculated using the formula: $maxVO_2$=(distance covered (m)-504.9)/44.73 (Saritas et al., 2011).

Anaerobic tests

Horizontal jump test: The distance that the athletes jumped on two legs with the feet adjacent and without falling back was noted (Kotsifaki et al., 2021).

Vertical jump test: The test is designed to measure explosive power in the vertical direction. For the test, the athlete was instructed to stand with feet shoulder-width apart, evenly distributing their weight, and jump as high as possible. The starting point and the peak reached were identified and recorded. This vertical distance between these two marks was recorded as the final score. After test, the score calculation of the athletes was calculated with the formula of Power (watts) = 21.67 x body weight (kg) x vertical displacement (m) x 0.5 (Sales et al., 2018).

Slalom test: Slalom Test was employed to assess the multi directional speed, and agility of the participants. 6 obstacles were placed at 2 m intervals for the test. The athlete was instructed to run at peak speed following a slalom pattern, navigating obstacles in both forward and reverse directions from the starting point. The timer was started when the foot first crossed the starting line, and the time was recorded when the athlete crossed the same line again. The normative values of the test were based on (Alricsson et al., 2001).

20 m sprint test: Speed assessment was evaluated by 20-Meter Sprint test (Comfort et al., 2012). The athletes were instructed to complete the marked distance in the shortest time possible. The best time was noted after the evaluation was repeated twice.

Periodical performance tests

Sits Up: Abdominal muscle strength was evaluated by instructing the athletes to lie on a mat with their knees bent, feet resting flat on the ground, and arms folded across their chest.The knees were flexed at approximately 90° and the hips at 45°, the athletes were asked to raise themselves to the 90° position and then return to the same position. The number of sit-ups made in 30 seconds was noted (Reiman & Manske, 2009).

Push up: The athletes were instructed to assume a prone position with their hands placed shoulder-width apart and the weight of their lower limbs supported on their toes to evaluate the muscular strength and endurance of the upper limbs. They were then asked to extend their arms while keeping their head, shoulders, back, hips, knees, and feet aligned in a straight line. The total number of push-ups completed within 1 minute was recorded (Reiman & Manske, 2009).

Closed Kinetic Chain Upper Extremity Test (CKCUET): The athletes were asked to take a push up position to measure the strength, anaerobic power, and closed kineic chain stability of the upper limb. They were asked to put their hands on the floor, right next to the 2 lines drawn with an interval of 0.9 m. They were asked to move their hands from one line to the next in the shortest time possible. The total number of line touches in 15 seconds was noted (Reiman & Manske, 2009).

Balance tests

The Flamingo Balance Test: This test was conducted to evaluate static balance. The athletes were asked to maintain their balance for 1 minute on a wooden balance beam that measured 50 cm in length, 4 cm in height, and 3 cm in width. The number of falls per 60 seconds was noted as a score (Gokdemir et al., 2012).

Star Excursion Balance Test (SEBT: It was utilized to evaluate dynamic balance. Star shape with a 45° angle in 8 directions was drawn by placing tape measure on the floor. The athletes were asked to reach in predetermined directions, and the distance they reached was noted in cm. The test was performed bilaterally for the dominant and non-dominant foot (Gokdemir et al., 2012).

Flexibility

The athlete was asked to sit and touch the soles of the feet against the 26 cm marked flexometer (sit and reach box). The athlete was asked to reach slowly with both hands as far as he/she could and should stay in this position for about 2 seconds. Two attempts were made and the best result was noted (Ayala et al.,).

Hand Grip Strength

It was assessed by a JAMAR hand dynamometer. The dominant hand was measured only. Two attempts were made and the better force value was noted in kilograms (Tonak et al., 2021).

Statistical analysis

Statistical analysis was performed by the Statistical Package for Social Sciences version 22.0 (IBM) software. Descriptive features statistics were reported as mean, standard deviation, frequency, and percentages. The Shapiro-Wilk test was employed to

assess normality. To compare the parameters, the Chi-square test and Mann-Whitney U test were used. A significance level of 0.05 was set.

Ethical considerations

The study was approved by Scientific, Social, and Non-Interventional Health Sciences Research Ethics Committee of Okan University (09.10.2024-No:11). Athletes provided their informed consent to take part in the research, which was conducted in compliance with the principles of the Helsinki Declaration.

RESULTS

A total of thirty athletes were initially evaluated, but four athletes were excluded from the study because they did not fulfill the inclusion criteria. As a result, 26 athletes participated in the evaluations, including 9 korfball and 17 volleyball athletes, all of whom volunteered for the study.

The comparison of the demographic variables and physical fitness features of the athletes were shown in Table 1. No significant differences were found between the groups regarding demographic characteristics (age, gender, BMI, regularly exercise habits, smoking and alcohol consumption parameters) ($p>0.05$).

Despite the fact that there was no difference in body fat percentages between the groups, a significant difference was found between the results of the 4-site skinfold measurements. The biceps, triceps, subscapular and suprailiac measurements of the volleyball athletes were lower than korfball athletes. Volleyball and korfball athletes' waist/hip ratio were 0.79±0.07 and 0.75±0.05, in the same order, and this difference was not statistically significant ($p>0.05$).

Table 1. Demographic variables and body composition parameters of korfball and volleyball athletes.

	Korfball athletes (n=9)	Volleyball athletes (n=17)	
Demographic variables	Mean±SD	Mean±SD	p^a
Age (years)	22.2±2.2	21.4±5.26	0.687
			p^b
Female sex (n/%)	4(44.4%)	11(64.7%)	0.321
Regulary exercise habits (n/%)	6(66.7%)	8(47.05%)	0,341
Cigarette consumption (n/%)	5(55.6%)	5(29.4%)	0.192
Alcohol consumption (n/%)	8(88.9%)	9(52.9%)	0.065
Previous injuries story (n/%)	5(55.9%)	8(47.1%)	0.682
Physical fitness parameters			p^a
Weight (kg)	67.07 ±9.54	65.24±12.3	0.704
Height (cm)	174.44±7.82	175.29±8.94	0.817
BMI (kg/m^2)	22.01±2.57	21.22±3.81	0.584
Waist circumference (WC) (cm)	77.8±10.03	74±10.45	0.362
Hip circumference (HC) (cm)	97.6±4.3	97.3±7.8	0.915
Lean body mass (kg)	58.92±10.39	56.06±10.91	0.523
Body fat percentage (%)	12.32±7.77	13.41±8.95	0.762
4-sites skinfold measurements			p^a
Biceps	6.44±3.74	2.71±0.62	**0.001**
Triceps	8.84±3.93	3.52±1.33	**0.001**
Subscapular	11.36±5.58	6.38±3.63	**0.011**
Suprailiac	9.07±2.82	5.43±2.88	**0.001**

BMI:Body Mass Index, n: number of participants, SD: standard deviation, p^a Independent-samples t-test, p^b: Chi-square test.

It was noted that there was no difference in the results of the anaerobic and aerobic performance tests among the groups, but the number of repetitions sit ups that took in 30 seconds of korfball athletes was significantly higher than the volleyball athletes in the periodical performance tests (Table 2).

During the flamingo balance test on the right foot of the korfball athletes, the number of falls at 60 seconds were less than the volleyball athletes (p:0.032). In addition, korfball athletes reached longer distances in the star excursion balance test on the right foot than volleyball athletes (p: 0.033) (Table 2).

Table 2. Comparison of physical performance tests of korfball and volleyball athletes.

Physical Performance Tests	Korfball athletes (n=9)	Volleyball athletes (n=17)		
	Mean±SD	Mean±SD	z	p
Aerobic test				
12 minute run test (VO^2 max)	29.96±5.84	29.76±5.89	0.081	0.932
Anaerobic tests				
Horizontal jump test (cm)	186.77±30.69	188.65±41.07	-0.120	0.907
Vertical jump test	220.94±35.15	215.78±43.92	0.304	0.762
Slalom test (sn)	15.26±1.29	15.24±1.59	0.035	0.976
20m sprint test (sn)	3.84±0.51	3.65±0.41	1.024	0.314
Flexibility test				
Sit and reach test (cm)	24.22±9.08	31.14±11.07	-1.607	0.121
Periodical performance tests				
Sits up (n)	24.33±3.50	16.11±3.07	6.178	**0.001**
Push up (n)	25.11±12.25	22.88±7.75	0.570	0.579
Ckcuet (n)	17.87±3.64	19.82±3.04	-1.403	0.176
Handgrip Strength Test				
Right	25.88±8.62	30.11±11.48	-0.966	0.345
Left	26.59±10.98	27.52±8.22	-0.246	0.801
Static and dynamic balance tests				
Flamingo balance test-R	3.11±2.66	6.94±4.73	-2.232	**0.032**
Flamingo balance test-L	4.66±2.91	6.88±4.63	-1.298	0.204
Star excursion test-A	79.33±8.48	75.64±6.62	1.225	0.238
Star excursion test-R	107.33±13.69	95.52±12.70	2.196	**0.033**
Star excursion test-L	105.55±13.19	97.29±11.68	1.641	0.112

n: number of repetation, SD: standard deviation, R:right, L:left, A:anterior, p: Mann Whitney U test.

DISCUSSION

This study examined the anthropometric measurements, body composition and performance parameters of korfball and volleyball athletes. Analyses showed no differences were found between the athletes in regards to the demographic characteristic (age, sex, weight, height, BMI, regularly exercise habits, smoking and alcohol consumption parameters). Although there was no significant difference between the body fat percentages, lean body mass of the groups, there were significant differences between the 4-sites skinfold measurements. The biceps, triceps, subscapular and suprailiac measurements of the volleyball athletes were lower than korfball athletes. Also, analyses showed significant differences among korfball and volleyball athletes for number of repetition of sits up test, number of falling in flamingo balance test and star excursion balance test. However, no statistically significant differences were found among groups for flexibility, anaerobic and aerobic tests, handgrip strength test, and periodical performance tests except sits up test. The number of repetition sit ups that took 30 seconds of the korfball athletes was significantly higher than the volleyball athletes. During the flamingo balance test on the right foot, the number of falls at 60 seconds of korfball athletes were less than the volleyball athletes. The korfball athletes reached longer distances in the star balance test on the right foot than volleyball athletes.

Volleyball is a team sport that involves high-velocity and high-impact movements, such as jumping, hopping, and cutting. Korfball requires efforts from sprinting, sudden changes in direction, running,

jumping, shooting, and passing, interspersed with rest periods of about 20 to 30 seconds. Therefore, the anthropometric profile, particularly body composition, is a key factor in the physical performance of both korfball and volleyball athletes. In a previous study, male korfball athletes were found to be of similar height to volleyball athletes, but shorter than basketball players. However, they were lighter than both basketball and volleyball athletes (Godinho, Fragoso and Vieira, 1996). Additionally, Godinho et al. demonstrated that volleyball and basketball athletes had less limb fat compared to korfball athletes (Godinho, Fragoso and Vieira, 1996). Data analysis revealed that male korfball athletes had body fat levels similar to those of basketball athletes (9.0% to 10.6%) and lower relative fat compared to volleyball athletes. Female korfball athletes exhibited less relative fat and more lean body mass than athletes from other sports, including volleyball (25.3%) and basketball (20.8%) (Godinho, Fragoso and Vieira, 1996). In another study, the body height of volleyball players was higher than that of korfball players, while the body fat content and absolute body fat of volleyball players were lower compared to korfball players. However, no significant difference was observed in lean body mass and total body weight between the two groups (Chamoli and Alaspure, 2023). In a study, female volleyball players were found the tallest and the lowest values of body fat among the volleyball, handball, basketball athletes (Malousaris et al., 2008). In previous studies, it has been reported that volleyball players are taller, leaner, and have a lower body fat percentage (Mala et al., 2015; Bayios et al., 2006). These studies also found that female volleyball players are taller and heavier compared to female korfball players. In the same studies, female handball players were observed to be shorter, but heavier and more muscular. The fact that female volleyball players are leaner and have less body fat than korfball players may be attributed to the number of training sessions and diets followed by the athletes. In handball, players defend one-on-one, while in korfball, both men and women play together equally, but players can only defend against opponents of the same sex from the opposing team. The greater muscularity observed in handball players may be due to the strength training required for defense. On the other hand, korfball is a sport based on skill rather than strength. In korfball, skill-based training plays a more prominent role in training programs than strength training, which may explain why female athletes tend to be leaner. In contrast to previous studies, there were no significant differences between both groups in the weight, height, BMI, the body fat percentages, lean body mass in present study. However, in line with the studies, the 4-sites skinfold measurements of the volleyball athletes were lower than korfball athletes.

Previous studies have shown that VO2max in passers (42.25±9.45 ml/kg min-1) was higher than in liberos (39.88±6.65 ml/kg min-1) and spikers (39.38±7.71 ml/kg min-1) for aerobic capacity in volleyball athletes (Gabbett and Georgieff, 2007). Some studies have reported VO2max values of 45.2 ml/kg min-1 or higher in elite volleyball athletes, while other studies have found values of 44.2 and 41 ml/kg min-1 or more (Kalinski, Norkowski, Kerner and Tkaczuk, 2002). On the other hand, in this study Vo2max values are lower in both korfball and volleyball athletes (29.96±5.84 ml/kg min-1, 29.76±5.89 ml/kg min-1, respectively), in addition no significant differences were found between groups.

In the present study, anaerobic tests include the horizontal and vertical jump tests, slalom test, and 20 m sprint test. Vertical and horizontal jumps are performed frequently by volleyball and korfball athletes during practices and games. In various defensive and offensive maneuvers, athletes are required to jump either vertically or horizontally as high as or as far as they are capable of doing. In this study, findings showed that there were no statistically significant differences among volleyball and korfball athletes for anaerobic tests included in horizontal and vertical jumps. Erzeybek et al. compared the anaerobic power and motor skills of korfball and basketball players and they reported that korfball players had higher vertical jump scores compared to basketball players. In addition, Erzeybek et al. reported that basketball players had higher hand grip strength and leg isokinetic strength compared to korfball players (Erzeybek, Yuksel, Kaya and Onen, 2022). Kalinski et al. (2002) compared anaerobic performance using the Wingate anaerobic test across team sports, including basketball, volleyball, handball, rugby, and soccer, and found that athletes in basketball, volleyball, and handball exhibited higher relative and peak anaerobic power than those in other team sports (Kalinski, Norkowski, Kerner and Tkaczuk, 2002). Since there are very few studies on korfball athletes, it is difficult to compare and interpret performance parameters. At the same time, korfball is similar to both basketball and handball team games. Due to the limited number of studies evaluating the performance parameters of korfball players, we can consider that korfball, as a team sport, involves similar maneuvers to basketball and handball and make inferences accordingly. The previous study that consists of 20 male korfball athletes and 20 male netball (similar with basketball) athletes investigated agility between groups. The illinois agility test was used to conduct agility test for both groups. It was found that netball athletes have good agility compared to korfball athletes. The mean of netball athletes in the shuttle run is 14.31 second compared to korfball athletes' mean of 15.57 second (Kaur, 2015). On the other hand, Malousaris et al. showed that hitters and liberos were significantly faster and had better agility than setters and middle

blockers in volleyball athletes (Malousaris et al., 2008). Kasabalis et al., reported that measurements of vertical jump and Wingate scores indicated higher values for volleyball athletes than nonathletes in different ages (adults, junior, youth) (Kasabalis, Douda and Tokmakidis, 2005).

In a study, which was conducted with 50 subjects-25 from basketball and 25 from korfball team sports-the explosive power of the legs and flexibility were investigated. Basketball athletes demonstrated higher strength compared to korfball athletes, whereas korfball athletes exhibited better flexibility in the sit and reach test than basketball athletes (Rameshkannan and Chittibabu, 2014). In current study, no statistically significant differences were found among volleyball and korfball athletes for flexibility.

The result of this study showed there was significant difference in abdominal strength endurance between korfball and volleyball athletes. The number of repetition sit ups test of korfball athletes were significantly higher than the volleyball athletes (24.33±3.5, 16.11±3.07, respectively). Rameshkannan et al. compared the maximum number of sit-ups completed in one minute between handball and volleyball athletes and reported no difference in abdominal strength endurance between these athletes. (Rameshkannan and Chittibabu, 2014). In another study, abdominal strength and endurance of handball players was higher than volleyball players (Lanning et al., 2006). Therefore, no statistically significant differences were found among groups for push up and CKCUET tests in current study.

In present study, during the flamingo balance test on the right foot, the number of falls at 60 seconds of korfball athletes were less than the volleyball athletes. The korfball athletes reached longer distances than volleyball athletes in the star balance test on the right foot. Similar results were noted in a previous study, in the postural control assessment with the star excursion balance test, the anterior reach distance was significantly lower than the other side measures for volleyball athletes playing various positions (Elahe, Narges, Mahdieh and Somayeh, 2013). On contrast, Lanning et al. found that the dynamic balance values of female volleyball athletes were higher than the values of female football athletes (Lanning et al., 2006).

Study Limitations and Strengths

This study is strong in terms of the objective tests conducted for evaluating performance parameters and its contribution as a reference to the literature on korfball players. However, the small number of korfball players in the sample size is considered a limitation.

CONCLUSION

The korfball and volleyball athletes had similar performance parameters according to results of body composition, aerobic and anaerobic capacity, muscle strength and endurance, flexibility and hand grip strength except skinfold measurements, abdominal muscle strength and static and dynamic balance. This study supports the similarity of the physical and motoric values of these team players. In addition, the structural and functional characteristics of athletes are crucial for success in korfball, as in other sports. This study compared the similarities between volleyball and korfball players. It is one of the few studies in this field that provides information about the physical and functional performance of korfball players.

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Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: GA, EA; **Material, methods and data collection:** GA, EA, TCS; **Data analysis and comments:** GA; **Writing and corrections:** GA, EA.

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Ethical Approval

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