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Relationship between anthropometric characteristics and strength in national team lower age categories of windsurfers

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Abstract

The aim of this study was to investigate the relationship between some selected anthropometric variables and strength performance of windsurfers. Twenty-seven windsurfers with an average age of 14.92±1.91, an average height of 168.66±10.56, an average weight of 56.21±8.83 % fat 15.43±6.98, a fat mass of 8.54±4.06 and a BMI of 19.65±1.79 actively competing in the Techno Plus and Techno 293 classes of the Turkish National Team participated in the study. Weight, height, arm-leg, and foot length were measured from anthropometric tests, while handgrip-leg-back strength and standing long jump tests were applied from strength tests. In the study, a significant relationship was observed between back strength and height (r=0.691) and back strength and right handgrip (r=0.644) in female surfers (p<0.005). It was found that there was a significant relationship between right handgrip (r=0.647), left handgrip (r=0.526), back strength (r=0.633), and leg strength (r=0.640) with the standing long jump test of male surfers (p<0,001). At the end of the study, it was determined that there was a relationship between some anthropometric values, which were thought to be effective in the performance of windsurfers, and strength performances. Paying attention to these characteristics in the selection of surfer-specific skills and training programs can be a factor for success.

Keywords: Antropometric, strength, windsurf

Milli takım alt yaş kategorilerinde yer alan rüzgâr sörfçülerinin antropometrik özellikleri ve kuvvet arasındaki ilişki

Öz

Bu çalışmanın amacı rüzgâr sörfçülerinin seçilmiş bazı antropometrik değişkenleri ile kuvvet performansları arasındaki ilişkiyi araştırmaktır. Çalışmaya yaş ortalaması 14,92±1,91, boy ortalaması 168,66±10,56, kilo ortalaması 56,21±8,83 % yağ oranı 15,43±6,98, yağ kütlesi 8,54±4,06 ve VKİ 19,65±1,79 olan ve Türk Milli Takımı'nın Techno Plus ve Techno 293 sınıflarında aktif olarak yarışan 27 rüzgâr sörfçüsü katılmıştır. Antropometrik testlerden kilo, boy, kol-bacak ve ayak uzunluğu ölçülürken, kuvvet testlerinden el-bacak-sırt kuvveti ve durarak uzun atlama testleri uygulandı. Çalışmada, kadın sörfçülerde sırt kuvveti ile boy uzunluğu (r=0,691) ve sırt kuvveti ile sağ el kavrama (r=0,644) arasında anlamlı bir ilişki gözlendi (p<0,005). Erkek sörfçülerin ayakta uzun atlama testi ile sağ el kavrama (r=0,647), sol el kavrama (r=0,526), sırt kuvveti (r=0,633) ve bacak kuvveti (r=0,640) arasında anlamlı bir ilişki olduğu tespit edilmiştir (p<0,001). Çalışma sonunda rüzgâr sörfçülerinin performansında etkili olduğu düşünülen bazı antropometrik değerler ile kuvvet performansları arasında ilişki olduğu tespit edildi. Sörfçülere özgü beceri ve antrenman programlarının seçiminde bu özelliklere dikkat edilmesi başarı için bir etken olabilir.

Anahtar Kelimeler: *Antropometrik, kuvvet, rüzgâr sörfü*

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INTRODUCTION

Windsurfing is a sports branch that consists of combining boards, sails, and various materials and is made by moving on the water by utilising the push and suction force of the wind. Although there are many different classes of this sport, the most important and common classes; Techno 293 and IQ Foil class (Yalçın, 2022). A person who is recreationally interested in windsurfing or a competition athlete should have good physical condition. This is because surfing involves a high level of conditioning and dynamic postural control in the face of challenging conditions or situations such as sudden changing waves and weather (Mendez-Villanueva & Bishop, 2005; Andrianopoulos & Vogiatzis, 2017).

In windsurfing, upper extremity strength is directly related to the performance of the sailor (Vogiatzis et al., 2002). In this branch, upper and lower body strength is required during various maneuvers, turns, jumps, and landings on the wave (Mendez-Villanueva & Bishop, 2005; Sheppard et al., 2013; Secomb et al., 2015; Parsonage et al. 2017). In addition, there is a sail-pumping movement in windsurfing depending on the weather conditions. The athlete rhythmically pulls and pushes the sail rhythmically like a wing, thus allowing the board to gain additional speed (Vogiatzis et al., 2006). This is especially necessary in low to moderate winds (Vogiatzis et al., 2002; Vogiatzis & Vito, 2014). During sail pumping, the arm, shoulder, and back muscles are more active than the leg muscles (Buchanan et al., 1996). Therefore, muscle strength and endurance of handgrip strength is a strong determinant in windsurfing (Trosclair et al., 2011). Furthmore, it has been reported that upper extremity strength in windsurfing may be related to handgrip sailor performance (Vogiatzis et al., 2000; Caraballo et al., 2021). In fact, this is because sailors also use the power of the finger and elbow flexors to control the direction and speed of the board (Guével et al., 2000; Castagna et al., 2008). Thus, the ability to have more explosive strength in the lower part of the body can give surfers an advantage by using the wind and wave they catch (Mendez-Villanueva & Bishop, 2005). To summarize, researchers have stated that strength and power abilities play a role in surfing performance (Tran et al., 2015).

When anthropometric related studies are examined in the literature in a study, it was found that Italian female basketball players had a low level of correlation between handgrip and height and BMI, but a positive correlation with arm length (Pizzigalli et al., 2016). In another study, it was reported that arm and leg length of male basketball players were significantly associated with strength tests (Singh & Ram, 2013). In another study conducted with weightlifters, a negative correlation was found between leg length and strength values (Aydos et al., 2012).

Zhao et al. (2018) reported a relationship between leg length and vertical jump in their study. In the study conducted by Çıplak et al. (2020), no relationship was found between standing long-jumping and arm and leg length. In addition to studies showing that there is a significant relationship between standing long jump and leg strength (Blackburn & Morrissy, 1998; Koch et al., 2003), there is a study showing that there is a significant inverse relationship between standing long jump and height and between standing long jump and weight (Çıplak et al., 2020) and leg strength (Blackburn and Morrissy, 1998; Koch et al., 2003).

When these factors are taken into consideration, the strength element comes to the forefront in windsurfing performance, and the results of this study are thought to contribute to the literature since there are not many such studies in windsurfing. The aim of this study was to investigate the relationship between some variables selected from the anthropometric characteristics of windsurfers and strength performance.

METHOD

Research group

A total of 27 windsurfing athletes, 17 male, and 10 female, actively competing in the Techno Plus and Techno 293 classes of the Turkish National Team participated in the study. As a condition for inclusion in the study, regular surf training at least 6 times a week was determined. In addition, participants were excluded from the study if they had any health problems that prevented participation in normal training and competition within 30 days.

Design and procedure

The study was conducted as a cross-sectional, descriptive research. Before starting the tests, the participants were informed about the study according to the Helsinki Declaration (Ethics Committee decision no: 2023/08). The tests were completed at the national team camp in Bodrum. Participants did not perform intense exercise, surf training or any excessive physical exertion in the 24 hours before the test. Firstly, the anthropometric test was applied to the participants. Afterward, they wore their own running shoes for the other tests and performed a standardised warm-up consisting of running at a speed of their choice and some dynamic exercises. After the warm-up, the participants completed the right-left handgrip, leg, and back strength, and standing long jump tests.

Data collection/processing method

Antropometric tests

1. Height: Measurements were made barefoot, with the head erect and in the frankfort plane, with the measuring table on the vertex of the head, following a deep inspiration, the distance between the vertex of the head and the sole of the foot was measured and recorded in cm with a Seca stadiometer.
2. Body weight: The athletes were dressed in standard sportswear (t-shirt and shorts) and measured and recorded in kg using a Tanita BC 418 electronic scale with an error margin of 100 g.
3. Body mass index (BMI): Body weight in kilograms divided by the square of the height in metres (kg/m2).
4. % Fat and fat mass: It was measured using Tanita BC 418 body analyzer.
5. Arm length: The shoulders are at the side; the arm is in flexion position and the forearm is parallel to the ground. The distance between the acromion and olecranon bones was measured. Holtain sliding caliper (Holtain, Crymych, United Kingdom) was used for arm length measurements (Bostancı et al., 2019).
6. Leg length: In leg measurement, the distance between the outermost point of the anterior superior iliac bone and the outer lateral malleolus of the foot was measured with the help of a tape measure while the participant was standing.
7. Foot length: In the foot measurement, the distance between the heel and the longest toe of the participant was measured by marking the distance between the heel and the longest toe of the participant on a white blank sheet placed under the foot while the participant was sitting and the knee was 90˚flexed.

Strength tests

1. Handgrip strength test: Before each measurement, the hand dynamometer (Jamar plus) was adjusted according to the athlete's hand. Then, the participants grasped with one hand in the anatomical position for hand grip strength with feet shoulder-width apart and arms at a 45-degree angle at the side and squeezed with all their strength by bringing the fingers closer to the palm of the hand. Right and left-hand strength assessments were performed separately. The measurement was repeated twice and the best result was recorded (Erdoğan et al., 2016).
2. Back strength test: Back strength was measured with a back dynamometer (Baseline). After the participants placed their feet on the dynamometer stand with their knees in a

stretched position, they pulled the dynamometer bar and grasped with their hands vertically upwards at the maximum rate while the arms were stretched, the back was straight and the trunk was slightly tilted forward. The pull was repeated twice and the best result was recorded (Aktaş, 2015).

3. Leg strength test: Leg strength was measured with a back-leg dynamometer (Baseline). For the measurement, the participants were asked to place their feet on the dynamometer stand with their knees bent forward. They were asked to pull the dynamometer bar upwards with maximal power using their legs with their hands in the position of arms stretched, back straight, trunk slightly tilted forward. The better of the measurements taken twice was recorded and 30 seconds was given for rest between repetitions (Tamer, 2000).
4. Standing long jump test: The athlete was asked to stand with the toes of both feet just behind a predetermined line. Without taking a step behind the line, the athlete was asked to crouch where he/she was and then jump forward with a maximum jump. Then, the distance between the last point where the heel of the foot made contact and the jump line was recorded. After two attempts, the best jump was recorded (Sevim, 2002; Karavelioğlu, 2008).

Data analysis

IBM SPSS Statistics 24 program was used for descriptive statistical analysis including frequency distribution, arithmetic mean, and standard deviation of the data of the athletes. Skewness - Kurtosis and Shapiro-Wilks test were used for the normality test. Since the data showed normal distribution, Pearson correlation coefficient was used in the correlation analysis of the variables. The statistical significance level was accepted as $p<0.05$.

FINDINGS

Statistical findings in line with the data obtained are shown below.

Table 1. Anthropometric data of windsurfers

Variables	Group	N	Minimum	Maximum	Mean±Ss
Age (year)	Woman	10	10.96	16.52	14.12±1.84
	Man	17	11.99	17.72	15.39±1.85
	Total	27	10.96	17.72	14.92±1.91
Height (cm)	Woman	10	138	169	160.60±8.61
	Man	17	153	185	173.41±8.66
	Total	27	138	185	168.66±10.56
Weight (kg)	Woman	10	34.90	68.60	51.89±9.18
	Man	17	39.60	69.90	58.75±7.80
	Total	27	34.90	69.90	56.21±8.83
Fat %	Woman	10	16.80	29.40	23.05±4.00
	Man	17	6	21.30	10.95±3.57
	Total	27	6	29.40	15.43±6.98
Fat mass	Woman	10	7.40	20.20	12.23±4.13
	Man	17	3.60	10,10	6.37±1.94
	Total	27	3.60	20,20	8.54±4.06
Bmı ($kg/m^{2)}$	Woman	10	17.80	24	19.97±2.05
	Man	17	16.90	24.20	19.46±1.65
	Total	27	16.90	24.20	19.65±1.79
Arm_length (cm)	Woman	10	42	55	49.52±3.74
	Man	17	46.50	58	53.37±3.08
	Total	27	42	58	51.94±3.78
Leg_length (cm)	Woman	10	75	96	87.02±7.00
	Man	17	79	105	93.53±6.15
	Total	27	75	105	91.12±7.11
Foot_length (cm)	Woman	10	22	26.40	24.39±1.32
	Man	17	24,10	28.50	26.38±1.19
	Total	27	22	28.50	25.64±1.56

Table 1 shows that the mean age of the participants was 14.90±1.89 years, mean height was 168.07±10.83 cm, mean weight was 55.77±8.97 kg, body mass index was 19.62±1.76, fat percentage was 10.95±3.57, fat mass was 8.54±4.06, mean leg length was 90.93±7.05 cm, mean arm length was 51.88±3.73 cm and mean foot length was 25.64±1.53 cm.

Table 2. Strength test values of windsurfers

Variables	Group	N	Minimum	Maximum	Mean±Ss
Rh (kg)	Woman	10	19.50	33.50	27.70±5.57
	Man	17	25	54.50	38.82±8.11
	Total	27	19.50	54.50	34.70±9.01
Lh (kg)	Woman	10	18.50	34.50	26.75±5.98
	Man	17	25	58	37.82±8.68
	Total	27	18.50	58	33.72±9.40
Bs (kg)	Woman	10	60	110	91±13.70
	Man	17	42	180	127.17±35.53
	Total	27	42	180	113.77±34.04
Lgs (kg)	Woman	10	60	120	95±17.79
	Man	17	40	410	147.05±77.19
	Total	27	40	410	127.77±66.58
Slj (cm)	Woman	10	119	166	150.70±15.00
	Man	17	135	245	183.29±26.94
	Total	27	119	245	171.22±27.97

Rh: right hand grip Lh: lef hand grip Bs: back strength Lgs: leg strength Slj: standing_long jump

When Table 2 is examined, the mean of the right-hand handgrip is 34.19±9.24 kg, the mean of the left handgrip is 33.21±9.61 kg, the mean of leg strength is 116.07±36.14 kg, the mean of back strength is 112.21±34.42 kg, and the mean of standing long jump test result is 169.39±29.11 cm.

Table 3. The relationship between the data of female windsurfers and selected variables

		Height	Weight	Arm_length	Leg_length	Foot_length	Rh	Lf	Bs	Lgs	Slj
Height	r	1									
Weight	r	0.837**	1								
Arm_length	r	0.742*	0.476	1							
Leg_length	r	0.712*	0.509	0.681*	1						
Foot_length	r	0.812**	0.705*	0.575	0.663*	1					
Rh	r	0.581	0.754*	0.203	0.430	0.306	1				
Lh	r	0.515	0.706*	0.126	0.494	0.260	0.966**	1			
Bs	r	0.691*	0.553	0.251	0.493	0.336	0.644*	0.627	1		
Lgs	r	0.558	0.387	0.275	0.283	0.035	0.638*	0.598	0.843**	1	
Slj	r	0.099	-0.067	-0.148	0.337	-0.163	0.382	0.510	0.222	0.263	1

$p<0.05$* $p<0.01$**

When Table 3 was analyzed, a significant positive direction correlation relationship was observed between back strength and height (r=0.691) and right handgrip (r=0.644) of female athletes ($p<0.005$). While there was a significant positive direction relationship between leg strength and right handgrip (r=0.638) ($p<0.005$), there was a very significant positive direction relationship between back strength (r=0.843) ($p<0.001$).

Table 4. The relationship between the data of male windsurfers and selected variables

		Height	Weight	Arm_length	Leg_length	Foot_length	Rh	Lf	Bs	Lgs	Slj
Height	r	1									
Weight	r	0.798**	1								
Arm_length	r	0.730**	0.639**	1							
Leg_length	r	0.763**	0.555*	0.806**	1						
Foot_length	r	0.440	0.461	0.657**	0.723**	1					
Rh	r	0.682**	0.873**	0.569*	0.311	0.353	1				
Lh	r	0.557*	0.812**	0.444	0.148	0.248	0.936**	1			
Bs	r	0.413	0.513*	0.181	0.100	0.216	0.566*	0.530*	1		
Lgs	r	0.441	0.606**	0.337	0.260	0.244	0.577*	0.449	0.609**	1	
Slj	r	0.338	0.405	0.184	0.015	0.041	0.647**	0.526*	0.633**	0.269	1

$p<0.05$* $p<0.01$**

When Table 4 was analysed, it was found that back strength of male athletes had positive direction a significant relationship ($p<0.005$) with right handgrip ($r=0.566$) and left handgrip ($r=.530$), leg strength had positive direction a significant relationship ($p<0.005$) with weight ($r=.606$) and right handgrip ($r=0.577$), and positive direction a very significant relationship ($p<0.001$) with back strength ($r=0.609$). In addition, it was found that there was positive direction a very significant relationship between the standing long jump test and right handgrip ($r=0.647$), left handgrip ($r=0.526$), back strength ($r=0.633$) ($p<0.001$).

DISCUSSION AND CONCLUSION

The aim of this study was to investigate the relationship between some selected variables and strength in windsurfers. When the studies in the literature are examined, it is reported that there are strong relationships between physical variables and surfing performance. (Silva & Clement, 2017). Some of these variables; weight, height, thigh length and BMI were reported to be effective on the performance of sailors (Pezelj, 2019; Caraballo et al., 2019; Sánchez-Oliver et al., 2023).

In our study, a significant relationship was observed between back strength and height and right handgrip in female windsurfers ($p<0.005$). While there was a significant relationship between leg strength and right handgrip ($p<0.005$), there was a very significant relationship between back strength ($p<0.001$). In a study, a relationship was found between back strength, height, and leg strength of young elite wrestlers (Aydos et al., 2009). In a study conducted on healthy female individuals aged 18-42 years, a relationship was found between hand grip strength and back strength (Wang et al., 2005). Milliken et al. (2008) reported a significant relationship between hand grip tests and explosive strength of the lower part of the body in children. In another study, a positive relationship was found between back strength and leg strength values (Akyüz et al., 2013).

In our study, it was found that back strength of male windsurfers had a significant relationship between right handgrip and left handgrip ($p<0.005$), leg strength had a significant relationship with weight, right handgrip ($p<0.005$), and a very significant relationship with back strength ($p<0.001$). In addition, it was found that there was a very significant relationship between the standing long jump test and right handgrip, left handgrip, back strength, and leg strength ($p<0.001$). In a study, no relationship was found between hand grip and back strength of adolescent cricketers (Singla et al., 2018). In a study conducted with college university students, it was reported that there was a strong relationship between handgrip strength and leg strength (Trosclair et al., 2011). Likewise, in another study conducted with college athletes, a relationship was found between leg strength and weight (Peterson et al., 2006). Jiménez-Pavón et al. (2012), in a study on adolescents, reported a highly significant correlation between standing long jump and hand grip. In a study involving young baseball players, it was reported that there was a significant relationship between standing long jump and back strength (Nakata et al., 2013). In another study, it was found that there was a relationship between standing long jump and leg strength (Peterson et al., 2006). Milliken et al. (2008) found a relationship between

standing long jump test and height, but not between leg strength in their study. When the studies are analyzed, it can be stated that the different results are due to sport-specific requirements.

At the end of the study, it was determined that there was a relationship between some anthropometric values, which were thought to be effective in the performance of windsurfers, and strength performances.

Recommendations

-It can be stated that it is important to conduct physical fitness tests in talent selection.

- The necessity of strength training comes to the fore in order to have physical competence in sail pumping in low winds or controlling the board and sail in strong winds. Therefore, it is useful to perform explosive strength, ballistic, and plyometric exercises specific to the branch.

-In new studies to be conducted, it can be ensured that the number of participants in the sample is homogeneous in terms of gender.

-It is important to observe the development of the athlete by performing performance tests before, during and at the end of the season.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Rüzgâr sörfü; tahta, yelken ve çeşitli malzemelerin bir araya getirilmesiyle oluşan, rüzgârın itme ve çekme kuvvetinden yararlanarak su üzerinde hareket etmek suretiyle yapılan bir spor dalıdır. Bu sporun birçok farklı sınıfı olmakla birlikte en önemli ve yaygın sınıfları; Techno 293 ve IQ Foil sınıfıdır (Yalçın, 2022). Rüzgâr sörfü ile rekreasyonel olarak ilgilenen veya yarışma sporcusu olan bir kişinin iyi bir fiziksel kondisyona sahip olması gerekir. Çünkü sörf, ani değişen dalgalar ve hava durumu gibi zorlu koşullar veya durumlar karşısında yüksek düzeyde kondisyon ve dinamik postüral kontrol gerektirir (Mendez-Villanueva & Bishop, 2005; Andrianopoulos & Vogiatzis, 2017).

Rüzgâr sörfünde üst ekstremite kuvveti, yelkencinin performansı ile doğrudan ilişkilidir (Vogiatzis ve ark., 2002). Bu branşta çeşitli manevralar, dönüşler, atlayışlar ve dalgaya inişler sırasında üst ve alt vücut kuvveti gerekmektedir (Mendez-Villanueva & Bishop, 2005; Sheppard ve ark., 2013; Secomb ve ark., 2015; Parsonage ve ark., 2017). Ayrıca rüzgâr sörfünde hava koşullarına bağlı olarak yelken pompalama hareketi vardır. Sporcu yelkeni bir kanat gibi ritmik olarak çeker ve iter, böylece tahtanın ek hız kazanmasını sağlar (Vogiatzis et al., 2006). Bu özellikle düşük ve orta şiddetteki rüzgarlarda gereklidir (Vogiatzis ve ark., 2002; Vogiatzis & Vito, 2014). Yelken pompalama sırasında kol, omuz ve sırt kasları bacak kaslarından daha aktiftir (Buchanan ve ark., 1996). Bu nedenle, el kavrama kuvvetinin kas gücü ve dayanıklılığı rüzgar sörfünde güçlü bir belirleyicidir (Trosclair ve ark., 2011). Ayrıca, rüzgar sörfünde üst ekstremite kuvvetinin el kavrama yelkenci performansıyla ilişkili

olabileceği bildirilmiştir (Vogiatzis ve ark., 2000; Caraballo ve ark., 2021). Aslında bunun nedeni, yelkencilerin tahtanın yönünü ve hızını kontrol etmek için parmak ve dirsek fleksörlerinin gücünü de kullanmasıdır (Guével ve ark., 2000; Castagna ve ark., 2008). Dolayısıyla, vücudun alt kısmında daha fazla patlayıcı güce sahip olma yeteneği, sörfçülere yakaladıkları rüzgâr ve dalgayı kullanarak avantaj sağlayabilir (Mendez-Villanueva & Bishop, 2005). Özetlemek gerekirse, araştırmacılar kuvvet ve güç yeteneklerinin sörf performansında rol oynadığını belirtmişlerdir (Tran ve ark., 2015).

YÖNTEM

Çalışmaya Türk Milli Takımı'nın Techno Plus ve Techno 293 sınıflarında aktif olarak yarışan 17 erkek ve 10 kadın olmak üzere toplam 27 rüzgar sörfü sporcusu katılmıştır. Çalışmaya dahil edilme koşulu olarak, haftada en az 6 kez düzenli sörf antrenmanı yapmak belirlendi. Ayrıca katılımcılar, 30 gün içerisinde normal antrenman ve müsabakalara katılımı engelleyen herhangi bir sağlık sorunu yaşamaları halinde çalışma dışında bırakıldı. Testlere başlamadan önce katılımcılar Helsinki Deklarasyonu'na göre çalışma hakkında bilgilendirilmiştir (Etik Kurul kararı no: 2023/08). Testler Bodrum'daki milli takım kampında tamamlanmıştır. Katılımcılar testten önceki 24 saat içinde yoğun egzersiz, sörf antrenmanı veya herhangi bir aşırı fiziksel efor sarf etmemişlerdir. Katılımcılara ilk olarak antropometrik test uygulanmıştır. Daha sonra, diğer testler için kendi koşu ayakkabılarını giymişler ve kendi seçtikleri bir hızda koşma ve bazı dinamik egzersizlerden oluşan standart bir ısınma gerçekleştirmişlerdir. Isınmanın ardından katılımcılar sağ-sol el kavrama, bacak ve sırt kuvveti ile ayakta uzun atlama testlerini tamamladılar.

BULGULAR

Araştırmaya katılan katılımcılar incelendiğinde kadın sporcuların sırt kuvveti ile boy uzunluğu ($r=0,691$) ve sağ el kavrama ($r=0,644$) arasında pozitif yönde anlamlı bir ilişki olduğu görülmektedir ($p<0,005$). Bacak kuvveti ile sağ el kavrama ($r=0,638$) arasında pozitif yönde anlamlı bir ilişki bulunurken ($p<0,005$), sırt kuvveti ($r=0,843$) arasında çok anlamlı bir ilişki bulunmuştur ($p<0,001$). Erkek sporcuların ise sırt kuvveti ile sağ el kavrama ($r=0,566$) ve sol el kavrama ($r=0,530$) arasında pozitif yönde anlamlı bir ilişki ($p<0,005$), bacak kuvveti ile ağırlık ($r=,606$) ve sağ el kavrama ($r=,577$) arasında pozitif yönde anlamlı bir ilişki ($p<0,005$), sırt kuvveti ($r=0,609$) arasında ise çok anlamlı bir ilişki ($p<0,001$) olduğu tespit edilmiştir. Ayrıca, ayakta uzun atlama testi ile sağ el kavrama ($r=0,647$), sol el kavrama ($r=0,526$) ve sırt kuvveti ($r=0,633$) arasında pozitif yönde çok anlamlı bir ilişki olduğu bulunmuştur ($p<0,001$).

TARTIŞMA VE SONUÇ

Bu çalışmanın amacı, rüzgâr sörfçülerinde seçilen bazı değişkenler ile kuvvet arasındaki ilişkiyi araştırmaktır. Literatürdeki çalışmalar incelendiğinde, fiziksel değişkenler ile sörf performansı arasında güçlü ilişkiler olduğu bildirilmektedir. (Silva & Clement, 2017). Çalışmamızda kadın ve erkek rüzgâr sörfçülerinde bazı antropometrik özellikleri ile kuvvet arasında pozitif yönde anlamlı bir ilişki

bulunmuştur. Yapılan bir çalışmalar incelendiğinde genç elit güreşçilerin sırt kuvveti, boy uzunluğu ve bacak kuvveti arasında ilişki bulunmuştur (Aydos ve ark., 2009). 18-42 yaş arası sağlıklı kadın bireyler üzerinde yapılan bir çalışmada ise el kavrama kuvveti ile sırt kuvveti arasında ilişki bulunmuştur (Wang ve ark., 2005). Başka bir çalışmada, ergen kriketçilerin el kavrama ve sırt kuvveti arasında bir ilişki bulunamamıştır (Singla ve ark., 2018). Üniversite öğrencileriyle yapılan bir çalışmada, el kavrama kuvveti ile bacak kuvveti arasında güçlü bir ilişki olduğu bildirilmiştir (Trosclair ve ark., 2011). Benzer şekilde, üniversiteli sporcularla yapılan bir başka çalışmada da bacak kuvveti ile ağırlık arasında bir ilişki bulunmuştur (Peterson ve ark., 2006).

Çalışma sonunda rüzgâr sörfçülerinin performansında etkili olduğu düşünülen bazı antropometrik değerler ile kuvvet performansları arasında bir ilişki olduğu tespit edildi.

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