



Physical fitness in windsurfing

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Abstract

Windsurfing is one of the recreative and competitive water sports. Especially in recent years, the performance values of surfers have gained importance due to its increasing popularity and becoming an Olympic sport. It is very important for windsurfers who are competitors to perform well especially in terms of strength and endurance parameters during the competition. In addition, other physical fitness components also play a key role in achieving a good performance and elite level. When the components that should be considered in the creation of training strategies for surfers in terms of physical fitness parameters are evaluated; knowing the physical fitness requirements for the sport and making a plan accordingly will contribute to the performance of the athletes. Considering this rationale, this study includes information about the physical fitness components required by windsurfing. In addition, performing the performance tests mentioned in the study before, during and after the competition season will help to have information about the performance status of windsurfers.

Keywords: Performance, physical fitness, windsurfing

Rüzgâr sörfünde fiziksel uygunluk

Öz

Rüzgâr sörfü, rekreatif ve rekabetçi su sporlarından biridir. Özellikle son yıllarda giderek yaygınlaşması ve olimpiik bir spor dalı haline gelmesi nedeniyle sörfçülerin performans değerleri de önem kazanmıştır. Yarışmacı statüsünde olan rüzgâr sörfçülerinin özellikle kuvvet, dayanıklılık parametreleri açısından iyi performans göstermeleri yarışma esnasında oldukça önemlidir. Bunun yanı sıra diğer fiziksel uygunluk bileşenleri de iyi bir performans ve elit düzeye sahip olabilmede kilit rol oynamaktadır. Fiziksel uygunluk parametreleri açısından sörfçüler için antrenman stratejilerinin oluşturulmasında göz önünde bulundurması gereken bileşenler değerlendirildiğinde; spor dalına yönelik fiziksel uygunluk gereksiniminin bilinmesi ve bu doğrultuda plan yapılması sporcuların performanslarına katkıda bulunacaktır. Bu gerekçe göz önünde bulundurularak bu çalışmada rüzgâr sörfünün gerektirdiği fiziksel uygunluk bileşenleri hakkında bilgilere yer verilmiştir. Bunun yanı sıra çalışmada belirtilen performans testlerinin yarışma sezonu öncesi, sırası ve sonrasında yapılması rüzgâr sörfçülerinin performans durumları hakkında bilgi sahibi olunmasına yardımcı olacaktır.

Anahtar Kelimeler: Performans, fiziksel uygunluk, rüzgâr sörfü

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INTRODUCTION

Although the surfing's precise ancestry is unknown, it is generally accepted that it began in Polynesia 800 years ago. Surfing has been practiced in many different ways over time. These are bodyboarding, windsurfing, stand-up paddling, wakesurfing, kite surfing, foilboards (Rice, 2021).

Windsurfing is a sport that combines surfing and sailing and is practiced on water. The principle is simple; windsurfers stand on the board with their feet shoulder-width apart and hold the sail with their hands to control the board and sail with the thrust of the wind (Andrianopoulos & Vogiatzis, 2017).

It is important for surfers to develop certain neuromuscular abilities such as agility, balance, muscle strength, flexibility, and reaction time in order to perform better (Alcantara et al., 2012). In other words, performance in surfing depends on the individual's skill, psychological and mental ability, and physical fitness as well as equipment and environmental conditions (Mendez-Villanueva & Bishop, 2005).

Physical fitness is the ability of cardiorespiratory fitness, strength, flexibility, and other motor competence elements to work in harmony (Miller et al., 1991). Physical fitness is divided into two as health-related and performance-related (Department of Health and Human Services, 2008; Corbin et al., 2000) while health-related physical fitness is defined as individuals' functioning performance in life and perceived well-being in physical, mental, and social areas of health (Hays & Reeve, 2010), performance-related physical fitness is the elements used in the realization of sports and motor skills (Corbin et al., 2000). Physical fitness elements related to health; Cardiorespiratory fitness, Muscular Strength, Muscular Endurance, Body Composition, Flexibility. Physical fitness elements related to performance; Balance, Coordination, Speed, Reaction Time, Agility.

Cardiorespiratory fitness

It alludes to the body's capacity to provide oxygen during physical exercise through the respiratory and circulatory systems. It is associated with the ability to perform moderate to high-intensity exercise for long periods of time (ACSM, 2010). Since windsurfers have to perform a variety of techniques and maneuvers that require good physical conditioning, physical conditioning can be challenging (Andrianopoulos & Vogiatzis, 2017). Aerobic capacity and fitness have been found to be directly related to the speed with which windsurfers react to wind changes, especially in the final stages of competition (Shephard, 1997).

When sail pumping is practiced, the metabolic demands of windsurfers increase substantially (threefold) and oxygen consumption (VO_{2max}) can even reach 90%. However, depending on the wind force, the average heart rate (HR) can increase substantially, ranging from 160 to 180 beats/minute, due to the frequency of sail pumping. (Andrianopoulos & Vogiatzis, 2017). Figure 1 shows the different physiological responses of male and female athletes in oxygen uptake (VO_2), ventilation (VE), and heart rate during sail pumping and non-pumping (Vogiatzis et al., 2002).

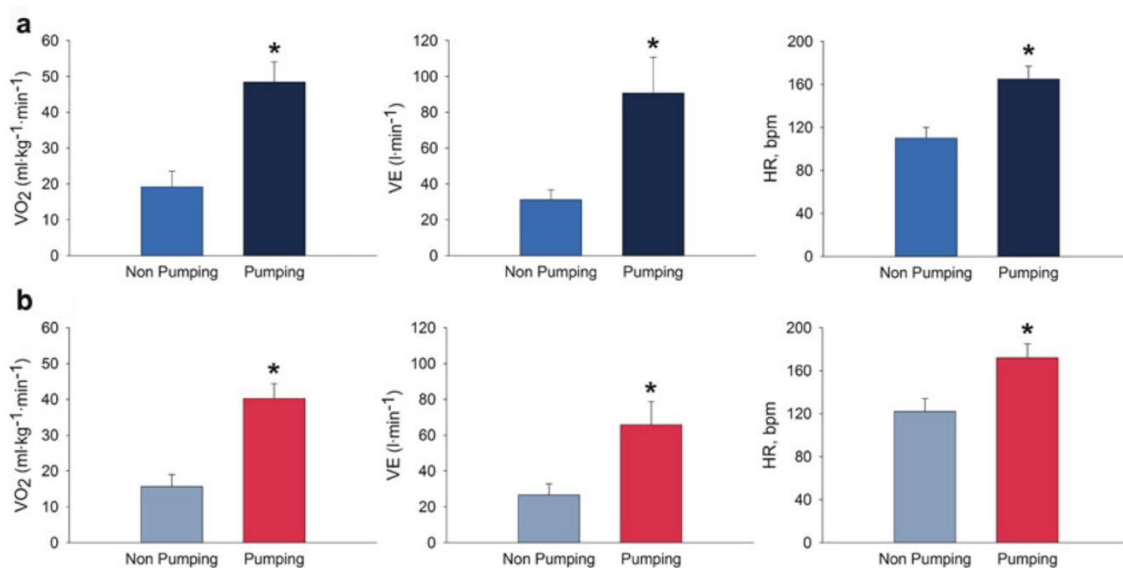


Figure 1. Physiological responses of male (a) and female athletes (b) (Vogiatzis et al., 2002; Andrianopoulos & Vogiatzis, 2017).

Downwind pumping, when pushing the sail rhythmically forwards on the board and then pulling the sail backwards, engages the lower body muscles more. In contrast, when sailing upwind, the sailor pulls the sail rhythmically, thus primarily engaging the upper body muscles. This is supported by the findings that downwind sailing causes a significantly greater increase in heart rate than upwind sailing (Vogiatzis et al., 2005; Vogiatzis & De Vito, 2015).

In studies, although a different board was used, aerobic demands were generally higher than 75% of VO_{2max} , and heart rate values were higher than 85% of HR_{max} . Furthermore, a study showed that aerobic demand values in windsurfing are close to those recorded during endurance events such as triathlon or rowing. Therefore, it can be stated that Olympic windsurfing is associated with high levels of aerobic demand. This suggests that athletes competing in international level competitions should take into account that energy consumption while sailing will have a significant impact on their performance (Castagna et al., 2007).

With the aid of tests, players and coaches can evaluate their athletic prowess and pinpoint their physical strengths and potential growth areas. Test results can also be used for goal setting (Haff & Triplett, 2015). Accordingly, a rowing ergometer, shuttle run, or step test can be used for aerobic endurance (Castagna et al., 2008; Michael & Robert, 2018). For anaerobic endurance, the wingate test can be applied (Gervasi et al., 2023).

Muscular strength

Force is the tension that occurs during muscle contraction or the effect that changes the location and movement of objects, etc. (Muratlı et al., 2011). There are different types and characteristics of force. Some of them can be said as maximal force, force continuity, and rate of force development. Maximal force is defined as the greatest force developed voluntarily through slow contraction of the muscular system, while force continuity is defined as the ability to resist fatigue in studies requiring continuous force (Muratlı et al., 2011). Rate of force development is defined as the rate of increase (development) in force or maximal force increase in minimal time and is also called "explosive force" (Haff & Triplett, 2015; Suchomel et al., 2016).

Although windsurfing has a predominantly aerobic metabolic profile, tactical and strategic choices made during racing also call for a combination of explosive and anaerobic strength. (Andrianopoulos & Vogiatzis, 2017). Olympic sailors' physical condition and muscle strength have emerged as crucial elements in performance optimization. (Bojsen-Møller et al., 2007).

The pumping motion necessary to improve the board's speed changes the high heart rate and lactic acid readings when the wind is not strong enough or when there are light breezes. According to Vogiatzis et al. (2002), sail pumping is regarded to be especially effective in winds up to 15 knots. The performance of maneuvers when riding a surfboard should take into account the amount of power a surfer can generate. (Axel, 2013). In this respect, the element of force and power is particularly important. Out of the water, windsurfers can practice on a paddle ergometer, which is a close exercise in which they can perform the pumping effort, as it engages both lower and upper body muscle activity (Castagna et al., 2008).

For upper extremity strength performance of windsurfers, 1 RM bench test or handgrip test can be used. In addition, vertical-horizontal jump tests or 1 RM squat test can be used for the lower extremities. (ACSM, 2010; Michael & Robert, 2018).

Muscular endurance

A muscle group's capacity to sustain a certain proportion of the maximum voluntary contraction for an extended length of time or to elicit repetitive contractions over time that are adequate to cause muscular fatigue (ACSM, 2010).

Windsurfing can encompass both leisure and competitive aspects of the sport (Vogiatzis et al., 2002). From a competitive point of view, windsurfers upper body strength as well as endurance is very important for them to perform well (Andrianopoulos & Vogiatzis, 2017). If we evaluate this situation in sail pumping, pumping is a challenging activity that requires a high level of physical fitness (Vogiatzis et al., 2002). And depending on the wind speed, its frequency can also vary, which greatly affects the strategy followed during the race (Andrianopoulos & Vogiatzis, 2017). The circumstances and environmental factors present in surfing locales, such as wave formation, wave size, weather, currents, rips, and frequency of waves, affect intensity and duration. Therefore, surfing athletes are required to have well-developed muscular endurance, and anaerobic power, especially in the upper torso (Farley et al., 2017).

Fatigue can occur during prolonged sail pumping and many repetitive movements and sufficient muscular endurance is required to overcome this (Jaszczur-Nowicki, 2005; Lo et al., 2013). In this case, there may be a risk of injury. Therefore, to prevent, treat and reduce the risk of recurrence of fatigue-related injuries, it is important to increase muscular endurance through training, thus helping the muscle to resist loads more efficiently (Günay et al., 2014). Due to the long-term adaptation of elite athletes in water and their training on land, their upper body muscular endurance skills have improved (Pan et al., 2022). Practical tests such as push-ups, planks, or wall squats can be preferred for muscular endurance (Michael & Robert, 2018; Topendsports, 2023).

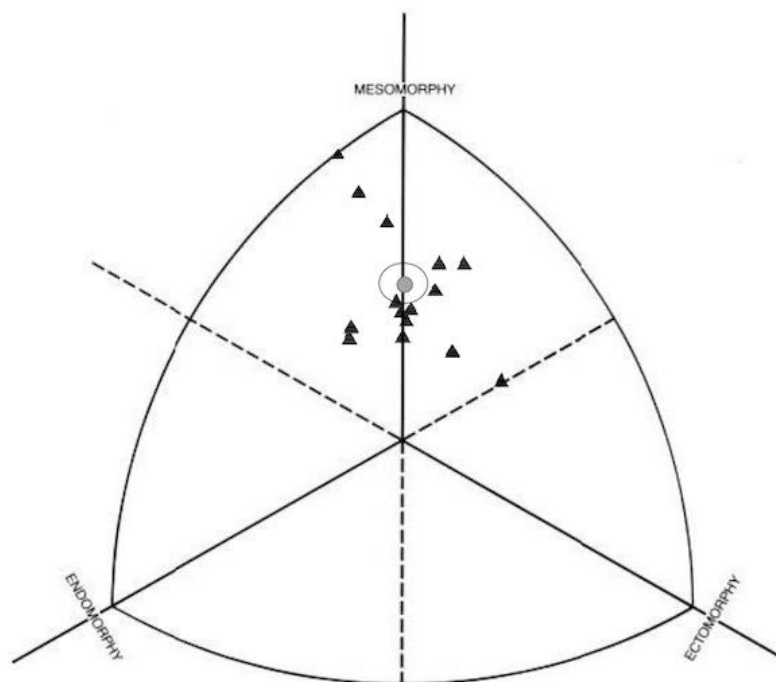
Body composition

It's crucial to measure body composition in a number of physiological and pathological situations. Clinical uses include everything from determining a child's level of obesity to identifying sarcopenia in older adults with chronic illnesses. In addition, it is often used to evaluate training programs and optimize athletes' nutrition (Fosbøl & Zerahn, 2015). There are different methods for assessing body composition. These methods include anthropometric measurements, body mass index (weight/height²), bioelectrical impedance analysis, hydrostatic weight measurement, dual-energy x-ray absorptiometry, air displacement plethysmography,

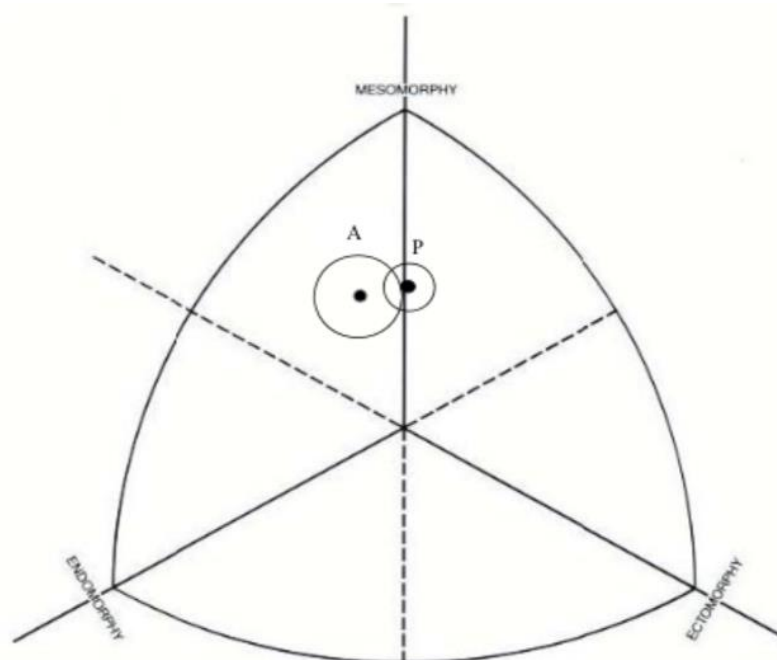
computed tomography (CT) and magnetic resonance imaging (MRI) analysis (ACSM, 2010; Fosbøl & Zerahn, 2015).

Somatotype analysis, which is evaluated within body composition, is the use of anthropometric measures to define the general physique in terms of body composition and shape. Body types are determined using the "Heath Carter Anthropometric Somatotype Method". In this method, height, weight, triceps skinfold, subscapular skinfold, supraspinale skinfold, calf skinfold, humerus biepicondylar diameter, femur biepicondylar diameter, biceps circumference, and calf circumference are measured (Heath-Carter, 1967). According to the data obtained from these data and formulation, 3 body types were determined. These are endomorph, mesomorph, and ectomorph. Endomorph refers to relative fatness. It is the evaluation of the degree of obesity on a continuum from the lowest to the highest recorded values. Mesomorph refers to relative musculoskeletal development. It is an assessment of musculoskeletal development on a continuum from the lowest to the highest grade recorded. It can be thought of as lean body mass. Ectomorph refers to the relative linearity of an individual physique. Its ratings assess the form and degree of longitudinal distribution of the first and second components (Heath-Carter, 1967).

Hadala et al. (2012) reported that anthropometric characteristics are significantly related to sailing performance. In a study, the anthropometric profile of professional windsurfers was 2.3 ± 0.4 endomorphy, 5 ± 0.8 mesomorphy, and 2.4 ± 0.6 ectomorphy. As seen in Graph 1, athletes are closer to meso-ectomorphy than ectomorphy. In addition, it was determined that the average muscle mass was 42.7% (35.5 ± 1.8 kg), fat mass was 10.7% (8.9 ± 1.8 kg), and bone mass was 16.9% (14.1 ± 1.5 kg) (Pérez-Turpin et al. 2009). Cortell-Tormo et al. (2010) showed that professional and amateur groups were predominantly mesomorphic (professionals 5 ± 0.8 and amateurs 4.9 ± 1.1), but professionals were more ectomorphic (2.4 ± 0.6) than endomorphic (2.3 ± 0.4), while amateurs were slightly more endomorphic (2.9 ± 0.9) than ectomorphic (2 ± 1.1) (Figure 2).



Graph 1. Example of somatotypes of windsurfers (Pérez-Turpin et al., 2009).



Graph 2. Distribution of somatotypes of windsurfers. Amateur (A), Professional (P) (Cortell-Tormo et al., 2010)

Body composition can be assessed by anthropometric measurements such as height, body weight, diameter, and circumference or by using bioelectrical impedance analysis devices (ACSM, 2010).

Flexibility

For the body to conduct functional motions in daily life and during athletic competition, flexibility is a range of motion that gives the body an absolute range of motion at a joint or series of joints. (Axel, 2013). Decreased range of motion (ROM) of the shoulder and hip can lead to impaired kinematics of movement and consequent microtrauma and structural changes (MacWilliams, 1998; Dut et al., 2020). Reduced range of motion of the foot joint in dorsi flexion is also a risk factor for anterior cruciate ligament injury (Fong et al., 2011).

Having more flexibility in the hip joint can enable the sailor to perform maneuvers more efficiently and thus reduce the loss of balance on the board (Pulur, 2010). Surfing requires the athlete to rotate their torso, then shoulders, hips, knees, and ankles strongly to perform successful maneuvers. In this respect, surfing involves the risk of injury (Axel, 2013). Over the past ten years, competitive windsurfing has modified the physical demands, which has affected the injury profile. (Dyson, 2006).

According to recent studies, fractures, contusions, and injuries to ligaments are the most frequent injuries. 45% of new injuries are muscle/tendon strains, many of which are recurring.

(Dyson, 2006). It has been stated that these injuries or disabilities are mostly in the lower extremities (Szymiski et al., 2021). In this direction, injuries can be prevented or prevented by increasing flexibility performance (Sporis et al., 2011)

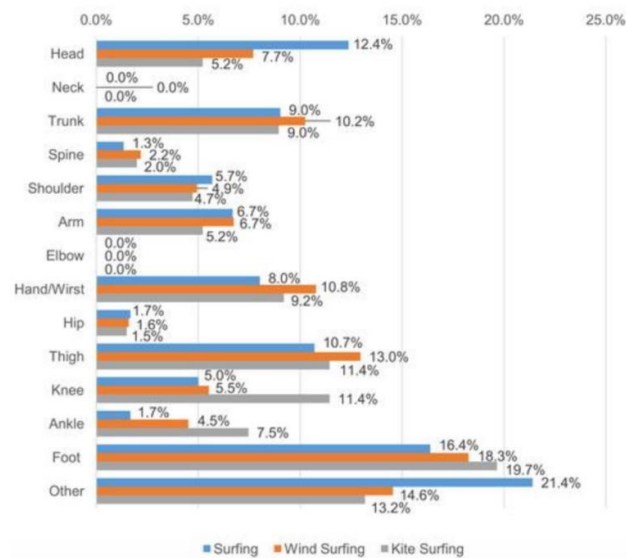


Figure 2. Distribution of injury type in surfing sports (surfing, windsurfing, kite surfing) (Szymiski et al., 2021).

When Figure 2 is examined, it is seen that the injuries in windsurfing are 7.7% head, 10.2% trunk, 2.2% spine, 4.9% shoulder, 6.7% arm, 10.8% hand/wrist, 1.6% hip, 13% thigh, 5.5% knee, 4.5% ankle, 18.3% foot and 14.6% others. In order to determine the shoulder flexibility of athletes for the upper extremity, it can be evaluated with the back scratch test (Topendsport, 2023). For the lower extremities, the sit reach test can be applied (ACSM, 2010).

Balance

According to Haff and Triplett (2015), balance is the capacity to maintain the body's center of gravity on the base of support. There are two types of balance: static and dynamic. Dynamic balance can be defined as the capacity to carry out an action while retaining or regaining a stable position, or as the capacity to maintain or restore equilibrium with little movement on an unstable surface, whereas static balance is the capacity to maintain a base of support with little movement (Winter et al., 1990; Kioumourtzoglou et al., 1997; Paillard & Noe, 2006).

Surfing is a dynamic sport and is practiced in a highly unstable and variable environment, making balance a vital attribute for surfers. In this respect, surfers have to fight the wave while trying to maintain balance, speed, and drive (Anthony et al., 2016). Body balance is a key element of a windsurfer's technique when moving through the water (El-Ashkar et al., 2023). Platzer et al. (2009) reported that windsurfers are able to balance their bodies in different planes.

A study on the effects of windsurfing exercise on male university students' static balance skills and ankle muscular strength was done by Shin et al. (2018). In their study, 11 male university students were examined for 6 weeks after practicing windsurfing exercise for 6 weeks, using a force platform, standing on one leg and ankle muscle strength and agility. During unipedal standing after windsurfing exercise, both ankle muscle strength and agility increased while the center of pressure area decreased, with muscle strength improving more than agility. Based on these findings, they stated that increased ankle muscle strength and agility with windsurfing exercise had a positive effect on static balance ability. BESS (balance error scoring system), that is, error scoring balance test, can be used to determine the static balance of athletes (Bell et al., 2011). Y balance test can be used for dynamic balance assessment (Plisky et al., 2009).

Coordination

Coordination has two components. These are general and specific coordination. General coordination is the ability of the whole body to adjust and regulate movements simultaneously

while performing a movement. That is, each movement involves all or most of the muscles, nervous system, and joints. For this overall coordination, the regularity of movement from several other limbs is needed so that the movements performed are harmonious and effective so that the learned movement skills can be mastered. General coordination is an important element in motor performance and indicates the level of ability a person has. Therefore, general coordination is also the basis for the development of specific coordination. Specific coordination is the ability to coordinate the movements of several limbs simultaneously (Tantri et al., 2019). Because general coordination is the ability to perform a variety of motor abilities regardless of sport specialization, performing sport-specific tasks repeatedly during training eventually results in sport-specific coordination (Bompa, 1999).

Windsurfing is a wave and wind sport that requires skill, coordination and muscle activity (Labadie, 1984). In the use of coordination specific to this branch, it is necessary to adjust the eyes, hands, feet and posture position and to do it in a combination. Surfing involves gross and fine motor skills, basic skills and transition skills. In this respect, the surfer must be able to learn and repeat these motor skills to be successful (Patterson, 2000). Alternate Hand Wall Toss Test can be used for coordination assessment (Topendsports, 2023).

Speed

It is a skill-related component of physical fitness related to the ability to perform a movement in a short period of time (Corbin et al., 2000). The words speed and velocity are concepts that are often confused in the literature. In the international literature, speed is referred to as speed and velocity as velocity. When we examine these concepts, speed is a scalar quantity, that is, it defines only how fast an object moves and the rate at which an object covers a distance. Velocity, on the other hand, describes both how fast an object is traveling and its direction. In short, speed is a velocity with a direction (Haff & Triplett, 2015).

In this respect, which term should we use in windsurfing? Since this branch is done according to the wind direction, it may be more accurate to use the concept of velocity. This concept also appears in Cardoso de Brito's (2022) publication on board designs to reach more speed.

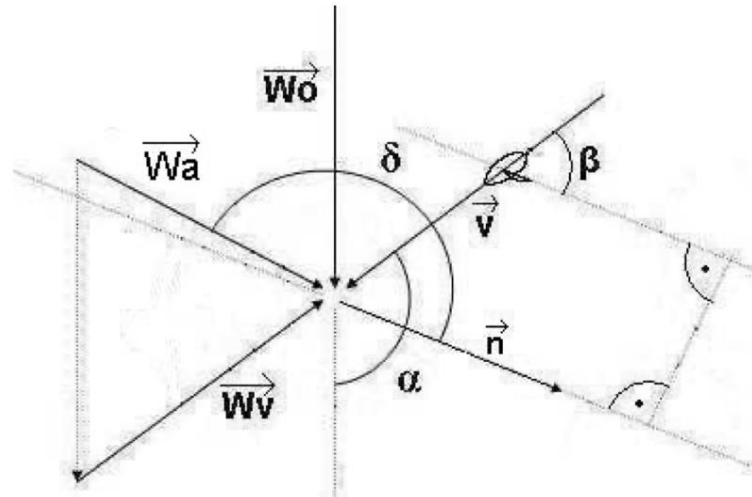


Figure 3. Surfer's motion with local coordinate system (Kunoth et al., 2007).

When Figure 3 is analyzed, the surfer moves downwind in the direction of $v \rightarrow$ with angle α from the wind and holds the sail from the board with angle β . The vector $n \rightarrow$ is the position of the sail. Thus, α is the angle between W_o and $-v \rightarrow$ while β is the angle between $-v \rightarrow$ and $n \rightarrow$. All angles refer to the local coordinate system (Kunoth et al., 2007). From this point of view, since the windsurfer's direction of travel and angles are known, the concept of velocity can be mentioned.

When the waves are not too big, the common objective of many windsurfers is to reach a given speed for a specific sliding condition on the ocean surface. This is dependent on the size of the sail, board, and fin (Kunoth et al., 2007). During a race, speed varies depending on external factors. What are these external factors? For example, wind, wave, board, equipment and air resistance of the surfer.

In terms of individual performance, the speed of the limb movements required in sudden maneuvers will positively affect performance. In this respect, technical and tactical performance in windsurfing competition is determined by the average or high speed as well as the distance traveled and the number of maneuvers performed along the course (Caraballo et al., 2022).

For the speed evaluation of the athletes, 30 meters, 60 meters or 100 meters tests can be done from the field tests (Topendsports, 2023). However, since wind intensity is the most important external factor in speed evaluation in this branch, this situation should not be ignored.

It is necessary to determine in advance whether the evaluation is a speed made with a board or an action performed by running individually.

Reaction time

Reaction time is the time between the occurrence of a sensory, visual, or tactile stimulus and the first response and can be improved with well-designed repetitive studies (Turkeri et al., 2019). It also plays a key role in success in many sports branches and is a factor that can affect the outcome (Göral et al., 2012; Turkeri et al., 2019).

Reaction time responds to environmental information provided by the eyes, ears, and limbs and is common in many sports, but for surfing a more complex type of response is demanded by the control system. Therefore a surfer must constantly use his visual dynamic intelligence (Patterson, 2000).

In a study, it was stated that the surfers who ranked higher at the end of the competition had faster reaction times than the first group of surfers who were eliminated (Lowdon & Pateman, 1980). In this direction, it is understood that reaction skills are at a higher level in elite athletes. Lighted reaction devices can be used in the development and evaluation of reaction skills (Wilke et al., 2020).

Agility

Agility is the ability to move the body between two points and change direction as easily, quickly, and in a controlled manner as possible with the partnership of balance, speed, strength, and neuromuscular coordination (Turner, 2011). The term agility also includes the concept of change of direction. Change of direction is defined as the ability to adapt to ever-changing game scenarios with fast and effective changes of direction. In the ability to change direction, it is sometimes done by slowing down and changing direction using a different mode and then accelerating again, while in agility, perceptual and cognitive ability is used along with the ability to change direction (Haff & Triplett, 2015).

In a study, it was found that as balance performance increased, agility performance also increased. Athletes with good dynamic balancing skills exhibit less postural oscillation and better stabilization. According to a statement, this circumstance will help reactive agility tasks that necessitate constant direction adjustment perform better (Kocahan et al., 2022). In terms of windsurfing, the surfer should acquire the capacity to change the direction of movement rapidly without loss of balance (Patterson, 2000). Hexagon or Illinois test can be used to evaluate the agility of athletes. (Michael & Robert, 2018; Topendsports, 2023).

CONCLUSION

Windsurfing is one of the recreative and competitive water sports. Especially in recent years, the performance values of surfers have gained importance due to its increasing popularity and becoming an Olympic sport. It is very important for windsurfers who are competitors to perform well especially in terms of strength and endurance parameters during the competition. In addition, other physical fitness components also play a key role in achieving a good performance and elite level. When the components that should be considered in the creation of training strategies for surfers in terms of physical fitness parameters are evaluated; knowing the physical fitness requirements for the sport and making a plan accordingly will contribute to the performance of the athletes. Considering this rationale, this study includes information about the physical fitness components required by windsurfing. In addition, performing the performance tests mentioned in the study before, during and after the competition season will help to have information about the performance status of windsurfers.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Rüzgâr sörfü, sörf ve yelken bileşenlerini birleştiren ve su üstünde yapılan bir spor dalıdır. Prensibi basittir; rüzgâr sörfçülerinin ayakları omuz genişliğinde açık olacak şekilde board üzerinde durur ve boardu kontrol etmek için elleriyle yelkeni tutar ve rüzgârın itiş gücü ile seyir yapar (Andrianopoulos & Vogiatzis, 2017). Sörfte performans bireyin becerisine, psikolojik ve zihinsel yeteneğine, fiziksel uygunluğuna, ekipmana ve çevresel koşullara bağlıdır (Mendez-Villanueva & Bishop, 2005). Fiziksel uygunluk sağlıkla ilgili ve performansla ilgili olmak üzere ikiye ayrılır (Corbin ve ark., 2000; Department of Health and Human Services, 2008); sağlıkla ilgili fiziksel uygunluk bireylerin yaşamdaki işlevsel performansı ve sağlığın fiziksel, zihinsel ve sosyal alanlarında algılanan iyilik hali olarak tanımlanırken (Hays & Reeve, 2010), performansla ilgili fiziksel uygunluk spor ve motor becerilerin gerçekleştirilmesinde kullanılan unsurlardır (Corbin ve ark., 2000). Kardiyovasküler fitness, kassal kuvvet, kassal dayanıklılık, beden kompozisyonu, esneklik sağlığa ilişkin unsurlar olarak adlandırılırken, Denge, koordinasyon, sürat, reaksiyon zamanı, çeviklik ise performansa ilişkin unsurlar olarak değerlendirilmektedir. Bu başlıklar altında incelendiğinde aerobik kapasite ve kondisyonun, rüzgâr sörfçülerinin özellikle yarışmanın son aşamalarında rüzgâr değişikliklerine tepki verme hızıyla doğrudan ilişkili olduğu bulunmuştur (Shephard, 1997). Bunun yanında rüzgâr sörfü ağırlıklı olarak aerobik bir metabolik profile sahip olsa da yarış sırasında yapılan taktiksel ve stratejik seçimler patlayıcı ve anaerobik gücün bir kombinasyonunu da gerektirir. (Andrianopoulos & Vogiatzis, 2017). Rüzgâr sörfü, sporun hem eğlence hem de rekabetçi yönlerini kapsayabilir (Vogiatzis ve ark., 2002). Yarışmacı statüsünde olan rüzgâr sörfçülerinin üst vücut kuvvetinin yanı sıra dayanıklılık açısından da iyi performans göstermeleri çok önemlidir (Andrianopoulos & Vogiatzis, 2017). Hadala ve arkadaşları

(2012) antropometrik özelliklerin yelken performansı ile önemli ölçüde ilişkili olduğunu bildirmiştir. Esneklik açısından değerlendirildiğinde ise kalça eklemine daha fazla esnekliğe sahip olmak, yelkencinin manevraları daha verimli bir şekilde gerçekleştirmesini sağlayabilir ve böylece board üzerindeki denge kaybını azaltabilir (Pulur, 2010). Sörf dinamik bir spordur ve zemin açısından değişken bir ortamda yapılır, bu da dengeyi sörfçüler için hayati bir özellik haline getirir. Bu bağlamda, sörfçüler dengelerini, hızlarını ve sürüşlerini korumaya çalışırken bir yandan da dalgayla mücadele etmek zorundadırlar (Anthony ve ark., 2016). Bu spor dalına özgü koordinasyon kullanımında gözlerin, ellerin, ayakların ve duruş pozisyonunun ayarlanması ve bunun bir kombinasyon halinde yapılması gerekmektedir. Bireysel performans açısından, ani manevralarda gereken uzuv hareketlerinin hızı performansı olumlu yönde etkileyecektir. Reaksiyon zamanı gözler, kulaklar ve uzuvlar tarafından sağlanan çevresel bilgilere yanıt verir ve birçok sporda yaygındır, ancak sörf için kontrol sistemi tarafından daha karmaşık bir yanıt türü talep edilir. Bu nedenle bir sörfçü sürekli olarak görsel dinamik zekasını kullanmalıdır (Patterson, 2000).

SONUÇ

Rüzgâr sörfü, rekreatif ve rekabetçi su sporlarından biridir. Özellikle son yıllarda giderek yaygınlaşması ve olimpiik bir spor dalı haline gelmesi nedeniyle sörfçülerin performans değerleri de önem kazanmıştır. Yarışmacı statüsünde olan rüzgâr sörfçülerinin özellikle kuvvet, dayanıklılık parametreleri açısından iyi performans göstermeleri yarışma esnasında oldukça önemlidir. Bunun yanı sıra diğer fiziksel uygulamalar bileşenleri de iyi bir performans ve elit düzeye sahip olabilmede kilit rol oynamaktadır. Fiziksel uygunluk parametreleri açısından sörfçüler için antrenman stratejilerinin oluşturulmasında göz önünde bulundurulması gereken bileşenler değerlendirildiğinde; spor dalına yönelik fiziksel uygunluk gereksiniminin bilinmesi ve bu doğrultuda plan yapılması sporcuların performanslarına katkıda bulunacaktır. Bu gerekçe göz önünde bulundurularak bu çalışmada rüzgâr sörfünün gerektirdiği fiziksel uygunluk bileşenleri hakkında bilgilere yer verilmiştir. Bunun yanı sıra çalışmada belirtilen performans testlerinin yarışma sezonu öncesi, sırası ve sonrasında yapılması rüzgâr sörfçülerinin performans durumları hakkında bilgi sahibi olunmasına yardımcı olacaktır.

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KATKI ORANI CONTRIBUTION RATE	AÇIKLAMA EXPLANATION	KATKIDA BULUNANLAR CONTRIBUTORS
Fikir ve Kavramsal Örgü <i>Idea or Notion</i>	Araştırma hipotezini veya fikrini oluşturmak <i>Form the research hypothesis or idea</i>	Meriç ÖDEMİŞ
Tasarım <i>Design</i>	Yöntem ve araştırma desenini tasarlamak <i>To design the method and research design.</i>	Meriç ÖDEMİŞ
Literatür Tarama <i>Literature Review</i>	Çalışma için gerekli literatürü taramak <i>Review the literature required for the study</i>	Meriç ÖDEMİŞ
Veri Toplama ve İşleme <i>Data Collecting and Processing</i>	Verileri toplamak, düzenlemek ve raporlaştırmak <i>Collecting, organizing and reporting data</i>	Meriç ÖDEMİŞ
Tartışma ve Yorum <i>Discussion and Commentary</i>	Elde edilen bulguların değerlendirilmesi <i>Evaluation of the obtained finding</i>	Meriç ÖDEMİŞ
Destek ve Teşekkür Beyanı/ Statement of Support and Acknowledgment		
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Etik Kurul Beyanı/ Statement of Ethics Committee		
Bu araştırma nitel yöntemle (geleneksel derleme) yapıldığı için Etik Kurul gereksinimi bulunmamaktadır. <i>Since this research was conducted with a qualitative method (traditional review), there is no need for an Ethics Committee.</i>		



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