

T.C.
YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF SPORTS PHYSIOTHERAPY

**EVALUATION OF THE RELATIONSHIP BETWEEN
CORE ENDURANCE LEVELS, BALANCE
PERFORMANCE, MUSCLE STRENGTH AND
FLEXIBILITY IN YOUNG ELITE SAILORS**

MASTER OF SCIENCES THESIS

BEYZA BAŞER ÖZTÜRK, PT

İstanbul-2022

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İstanbul-2022

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APPROVAL

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Bu çalışma jürimiz tarafından kapsam ve kalite yönünden Yüksek Lisans Tezi olarak kabul edilmiştir.

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Sağlık Bilimleri Enstitüsü Müdürü

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.



24/10/2022
Beyza Bařer Öztürk

BEYAN

Bu tezin kendi çalışmam olduğunu, planlanmasından yazımına kadar hiçbir aşamasında etik dışı davranışımın olmadığını, tezdeki bütün bilgileri akademik ve etik kurallar içinde elde ettiğimi, tez çalışmasıyla elde edilmeyen bütün bilgi ve yorumlara kaynak gösterdiğimi ve bu kaynakları kaynaklar listesine aldığımı, tez çalışması ve yazımı sırasında patent ve telif haklarını ihlal edici bir davranışımın olmadığını beyan ederim.

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LIST OF SYMBOLS AND ABBREVIATIONS

BMI	Body Mass Index
CM	Centimeter
HGS	Hand Grip Strenght
KG-F	Kilogram-Force
KG/M2	Kilogram Per Square Metre
L	Left
N	Number
R	Right
SD	Standart Deviation
SI	Symmetry Index
SLR	Straight Leg Raise
TYF	Türkiye Yelken Federasyonu

ABSTRACT

Öztürk Başer B. (2022). Evaluation of the Relationship Between Core Endurance Levels, Balance Performance, Muscle Strength, And Flexibility in Young Elite Sailors. Yeditepe University , Institute of Health Science, Department of Sports Physiotherapy, MSc thesis, İstanbul.

This study was conducted to evaluate the relationship between core endurance levels, balance performance, muscle strength and flexibility in young elite sailors aged between 8-20 (13.65 ± 2.56 years). The athletes were randomly selected from the Galatasaray sailing club and the athletes were divided into three groups according to their sailing class windsurfing, optimist and laser class respectively. A total of 26 boys and 14 girls from windsurfing (n=14), optimist (n=13) and laser (n=13) were participated in the study. Demographic features, body mass index, dominant side of the body of sailor's were recorded. For strength evaluation hand dynamometer were applied for the upper limb and vertical jump test, standing long jump test, single leg jump test were applied for the lower limb. For core endurance evaluation sit-up test, plank test and rotary stability tests were applied. For balance and flexibility evaluation Y balance test, straight leg raise test, shoulder flexibility test, sit and reach test, shoulder elevation test and total body rotation test were applied. When the three sailing classes were compared, a significant difference was found in the hand grip test results in terms of the mean values of both the right and left hands ($p < 0.001$). The highest mean value was found in the laser group. According to the results of the standing long jump test, it was seen that there was a significant difference between the groups ($p < 0.05$) and the highest mean value was also obtained in the laser group. There is a significant difference between the groups according to the results of the single leg jump test ($p < 0.05$) and the highest average is in the windsurf group. There was no statistically significant difference between the groups in terms of vertical jump, sit-up, plank, rotary stability, straight leg raise, shoulder flexibility, shoulder elevation, sit and reach and total body rotation test results ($p > 0.05$). According to the Y balance test results, there is a significant difference between the groups on both the right ($p < 0.05$) and left sides ($p < 0.05$), while the highest average values are in the optimist group. These results confirm that especially in strength and balance parameters each sailing class requires different physical properties and specific performance parameters.

Key words: Sailing sport, performance evaluation, core endurance, muscle strength, balance, flexibility

ÖZET

Öztürk Başer B. (2022). Genç Elit Yelkencilerde Gövde Kas Endüransı, Denge Performansı , Kas Kuvveti ve Esneklik Arasındaki İlişkilerin İncelenmesi . Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Spor Fizyoterapisi Bölümü , Yüksek Lisans Tezi , İstanbul.

Çalışmamız, 8-20 yaş aralığındaki (13.65 ± 2.56) genç elit yelkencilerde core dayanıklılık seviyeleri, denge performansı, kas kuvveti ve esneklik arasındaki ilişkiyi değerlendirmek amacıyla yapılmıştır. Sporcular Galatasaray yelken kulübünden rastgele seçilmiş ve rüzgar sörfü, optimist ve lazer yelken sınıfları olmak üzere üç gruba ayrılmıştır. Çalışmaya rüzgar sörfü (n=14), optimist (n=13) ve lazer (n=13) gruplarından toplam 26 erkek ve 14 kız sporcu katılmıştır. Yelkencilerin demografik özellikleri, vücut kitle indeksleri ve dominant tarafları kaydedilmiştir. Kuvvet değerlendirmesi için üst ekstremitede el dinamometresi, alt ekstremitede dikey sıçrama testi, durarak uzun atlama testi, tek bacak zıplama testleri uygulanmıştır. Core dayanıklılık değerlendirmesi için mekik testi, plank testi ve rotary stabilite testleri uygulanmıştır. Denge ve esneklik değerlendirmesi için Y denge testi, düz bacak kaldırma testi, omuz esneklik testi, otur - uzan testi, omuz elevasyon testi ve tüm vücut rotasyon testi uygulanmıştır. Yelken sınıfları gruplar arası karşılaştırıldığında, hem sağ hem de sol elin ortalama değerleri açısından el kavrama testi sonuçlarında anlamlı bir fark vardır ve en yüksek ortalama değer lazer grubundadır ($p<0.001$). Durarak uzun atlama testi sonuçlarında gruplar arasında anlamlı fark olduğu görülmüştür ve en yüksek ortalama değer lazer grubundadır ($p<0.001$). Tek bacak zıplama testi sonuçlarına göre anlamlı fark vardır ve en yüksek ortalama değer rüzgar sörfü grubundadır ($p<0.05$). Dikey sıçrama, mekik, rotary stabilite testi, düz bacak kaldırma testi , omuz esneklik testi, omuz kaldırma testi, otur- uzan testi ve gövde rotasyonu testi sonuçları açısından gruplar arasında istatistiksel olarak anlamlı fark yoktur ($p>0.05$) . Y dengesi testi sonuçlarına göre hem sağ hem de sol tarafta gruplar arasında anlamlı bir fark vardır ve en yüksek ortalama değer optimist grubundadır ($p<0.05$). Bu sonuçlar özellikle kuvvet ve denge parametrelerinde, her yelken sınıfının farklı fiziksel özelliklere sahip olduğunu ve spesifik performans parametrelerine ihtiyacı olduğunu göstermektedir .

Anahtar kelimeler: Yelken sporu, performans değerlendirme, gövde kas endüransı, kas kuvveti, denge, esneklik

1.INTRODUCTION

1.1. Purpose and Content

Sailing is a sport that requires tactical ability and strategy with different energy and movement requirements across the different boat classes (1). Muscle strength, muscle endurance, balance skills and flexibility are essential parameters in all sailing categories. This descriptive study aims to determine and compare the performance parameters such as muscle endurance, muscle strength, balance and flexibility of young sailing athletes in different sailing classes and genders.

1.2. General Information About Sailing Sport

Sailing is a sport that moves the boat using the power of the wind. The capacity of the sailor to maintain the boat's stability and combat outside pressures brought on by the boat and wind is crucial when sailing (1).

Numerous performance parameters such as the ability to understand weather conditions, tactical ability and strategy are important for sailing sport (2). In addition, the sailor's physical and physiological conditions, muscle strength, muscular endurance, aerobic and anaerobic energy capacity, balance skills and flexibility are important parameters in sailing and affect the sailor's overall performance (3).

Sailing is a combined sport that requires a high level of physical conditioning and many different performance parameters. Different sailing categories need another performance ability, different energy and movement requirements (2-4). Additionally, boat class determines the elements contributing to such competence (1,5).

The average sailor burns an average of 400 calories per hour in a race, especially in windy weather. Depending on the type of vessel, a race can be conducted at speeds ranging from 3 to 30 knots (6).

Sailing sports is a complex sport in which tactical, technical, psychological and physical properties contribute to sailor's successful performance outcomes (2, 7).

1.3 .Hypotheses

Ho: There is not a significant difference in muscle strength, core muscle endurance, balance performance and flexibility among windsurfing, optimist and laser sailing classes.

H1: There is a significant difference in muscle strength, core muscle endurance, balance performance and flexibility among windsurfing, optimist and laser sailing classes.

1.4.Sailing in Turkey

The sailing sport emerged in Turkey in 1850s and started with the races of yacht owners on the beaches of Büyükada, Moda and Yeşilköy. Sailing activities, which stopped due to the wars between 1914-1923, were updated again in 1923 with the establishment of the Water Sports Federation, which included the branches of Sailing, Rowing and Swimming.

In 1957, the sailing branch was separated from the Water Sports Federation and the Turkish Sailing Federation was officially established on May 25, 1957.



Figure 1.4.1.TYF Logo

However, Turkey's membership in the International Yacht Racing Association, which was established in 1907, took place in 1932.

The International Union, on the other hand, changed its name to International Sailing Federation (ISAF) in 1996, following the regulations of other sports organizations.

Rules and traditions regulating the sport of sailing are carried out by the International Sailing Federation in the world. In our country, it is carried out by the Turkish Sailing Federation within the Ministry of Youth and Sports, General Directorate of Sports.

The primary purpose of the Turkish Sailing Federation is to promote, develop and popularize the Sailing Sport. In this direction, the Sailing Federation, Provincial Representatives and Sailing Clubs open sailing schools, organize various athletes, National Team and training camps, organize training seminars for athletes and referees, and ensure that our country is represented in the best way in every subject on the international platform.

There are sailing boat classes registered by the Sailing Federation in our country. These are Laser, 470, Finn, RS:X in the Olympic category and Optimist, 420, Pirat, Techno293, Dragon, Yacht and Radio Control Yacht classes in the non-Olympic category. With the support of Mustafa Kemal Atatürk, the first Turkish sailing club was established on 8 April 1935 as a “Moda Sea Club” and became official.

National athlete Alican Kaynar came 8th in the sailing Finn class at the 2020 Tokyo Olympic Games (8).



Figure.1.4.2. Alican Kaynar

1.5.Galatasaray Sailing

The history of Galatasaray Sailing dates back to 1912. Galatasaray Sailing Club is one of the first sailing clubs to be established. In 1957, the Galatasaray sailing department moved from Bebek and moved to Galatasaray Island and then to Kalamış, which is its current location. In Galatasaray Sailing Club there are Optimist, Laser, Laser Radial, Laser M , Windsurfing , Windsurf Techno, IQ Foil, 420, 470 and Pirat teams.

A national sailor from Galatasaray Umut Eyriparmak came in 4th at the 2021 Laser Radial Men's World Championship held in Umman.



Figure 1.5.1.Umut Eyriparmak

Ecem Güzel, a national athlete from Galatasaray, who represented Turkey in the laser radial class in sailing at the 2020 Tokyo Olympic Games, ranked 20th among 44 athletes.

In the 2021 Laser Radial Women's World Championship, national athlete Ecem Güzel completed the organization in 32nd place with 248 net points after 11 races (9).



Figure 1.5.2. Ecem Güzel

1.6. Dinghy Sailing

Dinghy sailing is an olympic sport which is small boats used for sailing. Dinghies are small and steady therefore they are easy to rig and ideal for beginners (10, 11).

In dinghy sailing, there are many types of vessels. (single –double, monohull, multihull, with trapeze, without trapeze (12). In monohull-type vessels such as Laser, Optimist and 420 classes the stability of the vessel must be simultaneous with the sailor to perform the maneuver. If the time fluctuates, stabilizing the boat will take longer, which will have a detrimental impact on speed and the performance of the sailor (1).

In monohull-type boats, performance factors are significantly related to the sailor's ability to overcome external forces such as wind and boat swing. The wind's influence on the sails causes a lateral tilt known as heel, which is what gives monohull-type boats their characteristic shape (9,12).

The sailor uses a specific technique called “hiking bench” to overcome this lateral inclination. In order to maintain balance between the boat and the moment of the ensuing forces, a sailor uses this technique. He or she attaches his or her feet to the middle of the boat and leans overboard (13).

The hiking maneuver is the same in every boat. For the application of this technique, every boat has an adaptation called straps. This technique involves the sailor leaning back, partially or completely, over the side of the boat while standing horizontally and maintaining their feet fastened to the toe strap (1). The wind's effect on the sails causes the boat to heel, necessitating the use of the hiking bench technique. This increases resistance, which lowers boat speed (14, 15).

The muscles involved in hiking, including the quadriceps, hamstrings, and core muscles, contract isometrically. The sailor keeps their feet hooked beneath the toe strap in the middle of the boat to provide the necessary force and keep the boat straight in order to maintain stability and offset the effect of the wind on the sails (7, 15).

The hiking position is not maintained for longer than 20 seconds at a time before switching between three different positions: sitting up straight, vertical hiking, and hiking with the body leaned back (7, 16).

When sailing in light breezes, the boat's captain sits upright (from 0 to 7 knots). The sailor treks on the close-hauled course in an upright stance in crosswinds and on a run in heavy wind, as well as in medium winds (from 8 knots to 12 knots) (from 13 knots). Last but not least, the sailor walks rearward on a close-hauled course with strong gusts and switches from windward to leeward (17).

According to the angle between the hip and the trunk, there are three primary postures in the hiking bench maneuver.

1. The first position, known as sitting, involves angulating the hips between 90° and 120° .
2. The second position has an angular range of 120° to 150° and is vertical.
3. The expanded position, with an angulation between 150° and 180° , is the third position.



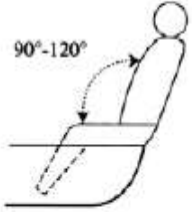
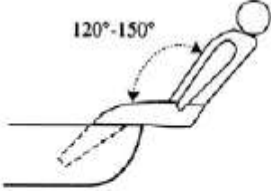
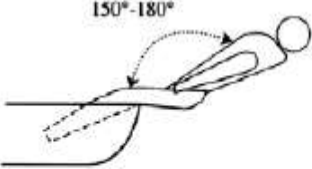
A	B	C
<p>1st Pos-siting</p>  <p>90°-120°</p>	<p>2nd Pos-upright hiking</p>  <p>120°-150°</p>	<p>3rd Pos-leaning backwards hiking</p>  <p>150°-180°</p>

Figure.1.6.1.The Hiking Bench Technique

The major objective of this maneuver is to maintain stability so that the boat may be propelled as quickly as possible using the wind's energy. At speeds more than eight knots, the sailor is able to complete this maneuver 94% of the time. The hiking bench move is not necessary in light winds.

The muscles most important for completing the technical technique of dinghy trekking are the quadriceps, abdominals (transverse, anterior rectus, major oblique, and minor oblique), and, to a lesser extent, the sternocleidomastoid, iliopsoas, and tibialis anterior (10,12,16).

Since there is no steady isometric activity during the hiking bench maneuver because the sailor makes slight adjustments to accommodate the frequent movements of the boat caused by the influence of the wind and waves, the muscular movement is known as "quasi-isometric" (11). Effective hiking reduces friction between boat and water, resulting in increased speed (18).

1.7. Types of Sailboats

There are olympic racing classes in sailing sport (**ISAF**)

1.7.1. Optimist Class

The Optimist is the smallest yacht used in competitive sailing. A single-handed sailing boat called an Optimist is made for kids and teens up to the age of 15. It was designed by Clark Mills in 1974. The boat has an average weight 35 kg and a length of 2.3 m (1, 14).

1.7.2. Laser Class

Bruce Kirby created the Laser class in 1970 with a focus on efficiency and effectiveness. The laser class is single-handed with a retractable keel dinghy in which the sailor is required to perform a series of actions to counter heeling forces from the sails in moderate to strong winds while maximizing the dinghy's sailing speed.

There is no age limit for competing athletes. Although the laser is fast, it is an unstable type of sailboat compared to other types of sailboats.

Laser is divided into 3 classes in terms of sail area. 7.06m² for Laser standard, 5.76m² for Laser Radial and 4.7m² for Laser 4.7. Since its introduction in 1971, the Laser dinghy has been one of the most widely used single-handed sailing dinghies in the world, having been produced in over 200,000 units (10,14).

In comparison to many other modern boats, the Laser is a very basic vessel with an unstayed mast and few sail form modifications. After the conventional Laser was changed to a men's event at the Olympics in 1996, a variation with a smaller rig (the Laser Radial) was adopted as a women's Olympic class in 2008 (16, 19).

1.7.2.1.Laser Standard

Performance Sailcraft Canada originally produced the popular one-design class of single-handed sailing dinghy known as the Laser Standard or ILCA 7. The laser is a straightforward, light, and quick boat to sail. It is cat rigged and has a single mainsail. The Laser Standard is the first dinghy in the Laser family of boats, which also includes the Laser Radial and Laser 4.7, all of which have the same hull but smaller rigs (1,4).

1.7.2.2.Laser Radial

A well-known one-design class of small sailing dinghy, the Laser Radial or ILCA 6, was first produced by Laser Performance. It is a singlehanded boat, which means that only one person may sail it. With a shorter mast and smaller sail area than the Laser Standard, the Laser Radial enables light sailors to sail in strong gusts. By World Sailing, the International Class is acknowledged (10).

1.7.2.3.Laser 4.7 (ILCA 4)

The Laser 4.7 is a single-design dinghy class in the Laser series, also referred to as the ILCA 4. All Lasers are constructed to the same standards. The Laser has a waterline that is 3.81 meters long and a length of 4.06 meters. Weight of the hull is 59 kg. Lasers have a single sail because they are cat-rigged (20).

The Laser's hull and top mast portion are shared by the 4.7, but its bottom mast section and sail are different. The sail's smaller size—4.7 square meters compared to 7 or 5.7 for the Laser Standard or Radial—and the fact that the bottom part of the mast is already bent significantly lower the rig's power.

The 4.7's smaller sail allows sailors weighing only 50 to 65 kg (110 to 145 lb) to sail it with ease, yet this boat can still be raced both under and over the recommended weights. (1,4,10).

1.7.3. Formula Kite

Formula World Sailing has selected kite as the kitesurfing discipline for the 2024 Summer Olympics. A foil kite and a board with a hydrofoil are included in the class. Competitors employ production equipment instead of the equipment being one design. The class is overseen by the International Kiteboarding Association (IKA). The course is open to both genders (21, 22).

1.7.4. Nacra 17

Sailing is done on the Nacra 17, a high-performance catamaran. Since its creation in 2012, it has been the center of multihull sailing at the Olympic Games. It was conceived in 2011 and put into production. For the 2020 Tokyo Olympics, the Nacra has been transformed into a sailing hydrofoil. The boat weighs 141 kg and hull length is 5.25 m (2).

1.7.5. 420 Class

420 class of boat is for two athletes and has a retractable keel dinghy designed by Christian Maury. In contrast to other boats, the 420 includes a Bermuda rig with an optional spinnaker and trapeze. The boat has an average weight 100 kg and hull length is 4.2 m. It can be set up to sail single-handedly or with a partner. The name alludes to the boat's 420-centimeter length (2,5).

1.7.6. 470 Class

The 470 is a monohull, centerboard-equipped, Bermuda-rigged, double-handed planing dinghy. Similarly 420 class, 470 class has also a retractable keel dinghy and two-athletes boat. It was designed by Andre Cornu in 1963.

The name of the boat is derived from its length of 470 centimeters (4.7 m) and weight of 120 kg. Since the 1976 Olympics, the 470 has been an Olympic class under the World Sailing International Class (5,17)

1.7.7.49er

A two-handed, high-performance sailing dinghy is the 49er and 49er FX. The two crew members do separate tasks, with the helm performing most of the steering and making many tactical decisions while the crew controls the majority of the sails. Each member of the crew is outfitted with a trapeze, and sailing is performed with the boat fully cantilevered over the water in order to maintain balance against the sails. Julian Bethwaite created the design for the 49er. Since the International Sailing Federation chose it to be the men's high-performance double-handed dinghy for the Sydney Summer Games of 2000, the boat has been an Olympic class (2,5).

1.7.8.RS:X (IQ Foil)

RS:X is a windsurfing class selected by the ISAF. Windsurfing is a one-athlete class designed by Jean Bouldoires and Robert Stroj in 2004. The average body weight is 15.5 kg and the hull length is 2.86m, the sail area varies between men, women and youth. RS:X will be replaced by the IQFoil class beginning with the 2024 Summer Olympics (5,17).

1.7.9.Techno 293

Techno 293 is a windsurfing, one-athlete class designed by Fabien Vollenweider in 2005. Body Length is 2.93m and body weight is 12.5kg. Techno 293 is primarily for the youth windsurfing class, mostly used as a preceding step to the Olympic class RS:X (2).

1.7.10. Pirate

The Pirate is a type of German sailing dinghy designed in 1934 by Carl Martens. The hull length is 5m and the weight of the boat is 170kg. The boat has a retractable keel dinghy and designed for two athletes.

1.7.11.Finn

A single-handed, cat-rigged sailboat called the Finn is an Olympic class in men's sailing. Finn is the largest single boat in its class. It was designed by Rickard Sarby in 1949. It weighs 107kg and its hull length is 4.5m.

1.7.12.Dragon

The Dragon is a one-design keelboat designed by Johan Anker in 1929. The boat has a fixed keel. The maximum capacity of the boat is 4. The hull length is 8.9 m and its weight is 1700 kg. The Dragon was an Olympic Class from 1948 until the 1972 Summer Olympics in Munich (13).

1.8.Sailing Anatomy

1.8.1.Active Muscle in Sailing Sport

Each sport has unique requirements and techniques and in each sport, different muscle groups are used more specifically for that sport. In sailing, there are three main muscle groups which always activated during sailing that is core, legs and arms. There are unique techniques used in sailing. Hiking maneuver is one of the most important technique in sailing. Hiking maneuvre involves several major muscle groups (18).

In sport sailing, sailors have to stand in certain positions for long periods of time therefore isometric endurance is key to efficient performance. It is essential to improve isometric muscle endurance, especially core and lower extremity muscles (16).

For performance optimization and maybe injury prevention in a number of sports where grasping and force application are crucial, such as baseball, climbing, golf, hockey, paddling, sailing, swimming, tennis, weightlifting, and wrestling, adequate hand grip strength is necessary (20).

1.8.2. Lower Extremity and Sailing

Legs are a very large muscle group in your body and essential for mobility. Some of the major muscles in the legs are the hamstring, adductor muscles, quadriceps and calf muscles (gastrocnemius and soleus). Having strong legs is an important part of being a top athlete. Proper leg function also increases core stability and therefore this increases strength and stability throughout the body (18,23).

The hiking position is a most challenging position for sailors since it causes physical stress on the lower extremities, especially quadriceps (knee extensor) and psoas (hip flexor) muscle. In addition the rate of the physical load varies according to the wind velocity and intensity. Quadriceps muscle is one of the most important muscle for hiking bench position. During sailing, this muscle cannot perform an isometric contraction continuously since the sailor must adjust to the boat's constant motion (7).

According to studies, successful performance is closely related to the maximum quadriceps strength among Olympic sailors competing in the Laser class. It has been demonstrated that hand grip may be associated to sailor performance in the Tornado and Windsurfing classes when it comes to upper limb strength. To steer and accelerate their boats, sailors rely on the strength of their fingers and elbow flexors (14,24).

The impact on the boat's stability may be reduced if the sailor could perform the maneuvers in this kind of boat with more efficiency thanks to more hip joint flexibility. In particular, the lengthening of the hamstring muscles and hip joint flexibility are crucial performance elements in sport sailing.

However, in Windsurfing boats, a sailor's performance is closely correlated with the strength of their upper limbs. Greater hip joint flexibility provides an advantage for sailors to efficiently perform moves in dinghy boats (1,23, 25).

1.8.3.Upper Extremity and Sailing

Sailors steer and accelerate their boats by flexing their elbow and finger muscles (12). The performance of the sailor is directly correlated with their upper extremity muscle strength, particularly in the Windsurfing class.

Fingers and hand flexor strength is one of the determining parameters in the sailor's control of the boat. The boat is controlled by the sailor using the flexor muscles in his fingers and elbows, which changes the vessel's direction and speed (1).

1.8.4. The Core and Sailing

The core, also known as the "lumbopelvic-hip complex," is the center of the body's power. The diaphragm (superior), abdominal and oblique muscles (anterior), erector spina, quadratus lumborum and multifidus muscle (posterior), pelvic floor and hip girdle define the boundaries of the core in three dimensions (inferior). These muscle boundaries generate a natural corset-like stabilizing effect on the trunk and spine (20).

During functional motions, 29 muscle pairs contribute to support the spine, pelvis, and kinetic chain. The spine would become unstable if these muscles weren't functional (21,22). The appropriate weight distribution across the spine, pelvis, and kinetic chain depends on strong core muscles. Core muscles support the upper and lower extremities and safeguard the spine (20). Sailing is a difficult sport that calls for tremendous core stability, core strength, and core endurance since sailors use their body weight to maintain stability in small boats (6).

The abdominal muscles are crucial for force creation and stabilization of the body, as well as protecting the spine from trauma or excess stress. The core muscle is "power house" in the body due to the location of the body in center and supports both upper and lower extremity especially in during sports activities like sailing (23-26). Core strength, core endurance and core stability are all important for maintain spine stability and prevention of injury (27, 28).

Core stability indicates spine stability. The term "core strength" describes the muscular capacity to maintain spinal stability by contractile forces and intra-abdominal pressure, which actively regulate spinal stability by concomitant trunk muscle activation. The most significant factor in sailing is core endurance since it helps core muscles maintain an effective position for the trunk, showing how crucial core endurance is to spinal stability during prolonged effort.

The quadriceps, abdominals (transverse, anterior rectus, major oblique, and minor oblique), and, to a lesser extent, the sternocleidomastoid, iliopsoas, and anterior tibial muscles, are the most crucial muscles to complete the technical technique of dinghy hiking (29-33).

1.8.5.Strength Asymmetries and Sailing

The sailor's upper and lower extremity strength and symmetry are important for the monohull-type and the sailor's performance is highly related to keeping the boat stable. The muscles of the dominant limb may develop asymmetrically in unilateral sports like sailing. The asymmetry of the lower limbs may be influenced by the asymmetry of the upper limbs. The degree of asymmetry is determined by a few physical and genetic factors.

Strength asymmetries and imbalances can be affected by body movement of the joint during sailing and affect a sailor's performance adversely. For this reason, sailor asymmetry may need to be identified and evaluated in order to improve sports performance and prevent injuries. In the hiking bench position, sailors use both legs to avoid fatigue. However, sailors tend to use dominant legs likely, therefore, it produces asymmetrical force and strength asymmetries between both legs which causes chronic and compensated adaptations (14, 34).

1.9.Sailing Injuries

Numerous factors can lead to damage or disease in sailors. Acute injuries, overuse injuries, environmental injuries, and illnesses associated with sailing are the most frequent injuries suffered by sailors. Sun exposure, hypothermia, injuries sustained during submersion, and motion sickness are examples of environmental dangers. Acute injuries are frequently brought on by falls, direct impacts from different boat pieces, and tensioned lines. Finally, repetitive motions like "grinding" winches, piloting a boat, and hiking can result in overuse injuries.

Injury rates, mechanisms of injury and types of injury vary significantly according to the type of sailboat and type of sailing. The most frequent wounds are lacerations and contusions, mostly to the upper and lower extremities.

The most frequent ways that trauma occurs on a sailboat are falls and hits from various elements of the boat. The main causes of harm include strong winds, operator inexperience, and operator negligence.

Olympic-class sailors regularly experience back (29–45%) and knee (13–22%) overuse issues (35, 36).

Common sites of injury obtained by elite sailors include the low back (45%), knee, and shoulder (22%) (2,4,6). The prevalence of low back injuries are due to overuse, inadequate physical preparation, genetic predisposition, and poor hiking technique (high mechanical loading due to non-neutral posture (3).

Exercises that improve core stability are related to injury prevention and rehabilitation since the core musculature is linked to (musculoskeletal) damage (33, 37).

1.10. Sailing Asymmetry

Asymmetry in athletes can be found and evaluated using a functional examination. A functional evaluation can be carried out using the straight leg lift test (SLL) and the grip strength test. Asymmetry in an athlete's body is measured using the so-called symmetry index (1).

2. MATERIALS AND METHODS

This study was carried out with Galatasaray Sailing. The starting and finishing time of study is between December and January. The sailor's coach was contacted via e-mail and invited to participate in the study and necessary permissions were obtained. All sailors were informed about the study and informed consent was obtained.

The inclusion criterias are;

- 1) athletes who are professional sailing athletes,
- 2) not having any physical problems that may prevent the application of the tests,
- 3) being between the ages of 8-20
- 4) being an athlete in laser, optimist or windsurfing classes

The exclusion criterias are;

- 1) any musculoskeletal problem that prevents the athlete from performing the performance tests,
- 2) disability within the last 1 year

Performance tests were applied to determine and evaluate the strength, balance, endurance and flexibility parameters of sailors. Before testing each subject demographic information, height, weight, BMI and the dominant side of the leg and hand were recorded.

For strength measurements, for the upper limb; **Hand Dynamometry**, for the lower limb; **Vertical Jump Test(Sargent Jump)**, **Standing Long Jump Test (Broad Jump Test)** and **Single-Leg Side Hop Test** were used.

For core endurance muscle assessments, **Sit-Up test and Plank Test(Prone Bridge Test) and Rotary Stability Test** were applied.

For balance and flexibility measurements **Y Balance Test, Straight Leg Raise Test, Sit and Reach Test, Total Body Rotation Test, Shoulder Elevation Test and Shoulder Flexibility Test** were applied.

Optimist, Laser and Windsurfing classes were included in the study. Age distributions of classes are Optimist Class (8-15 years), Windsurfing Class (10-16 years) and Laser Class (13-20 years). The sample size of the study is consist 40 sailors between the ages of 8 and 20 who is an elite athletes in Galatasary Sailing. As a result of the power analysis made with the G Power program, considering the mean and standard deviations of the dominant side hand dynamometer in the reference research; it was calculated that a total of 36 individuals, 12 in each of the three research groups, should be included in the study with a significance level of 0.05, an effect size of 0.628, and a reliability level of 90%. At the end of the research, the data collected from 3 groups will be analyzed with the Kruskal Wallis H test in the SPSS program.

2.1. Strength and Power Measurements

2.1.1. Hand Dynamometry: The Jamar handgrip dynamometer was used to measure the maximum isometric hand-grip strength. The testing positions were uniform. On each hand, there were three trials. The right hand was used to begin the first three trials. Subjects were told to firmly squeeze the device for three seconds. 15 s separated each trial, and 3 min of rest were permitted when switching hands (38, 39).



Figurel 2.1.1.1. Hand grip strength measurement with JamarR hand dynamometer

2.1.2. Vertical Jump Test: The athlete stands side by side with it and extends the hand that is closest to the wall. While keeping the feet firmly planted on the ground, the point of the fingertips is marked or documented. This refers to the reach height while standing. Taking a step back from the wall, the athlete then leaps as high as they can, propelling their body forward with the aid of their arms and legs. Try to touch the wall as you jump to its highest point. The distance between the standing reach height and the leap height is used to calculate the score. Out of three attempts, the best one is recorded (40, 41).



Figure 2.1.2.1. Vertical Jump Test Measurement

2.1.3. Standing Long Jump Test (Broad Jump Test): Behind a line that has been painted on the ground, the athlete stands with their feet slightly apart. A bipedal takeoff and landing is used to achieve forward driving, which is performed by swinging the arms and bending the knees. The individual attempts to land on both feet without falling backward in order to jump as far as they can. Three attempts are allowed. The measurement is made from the take-off line to the closest contact point (back of the heels) on landing. The longest distance jump is recorded (40,42).

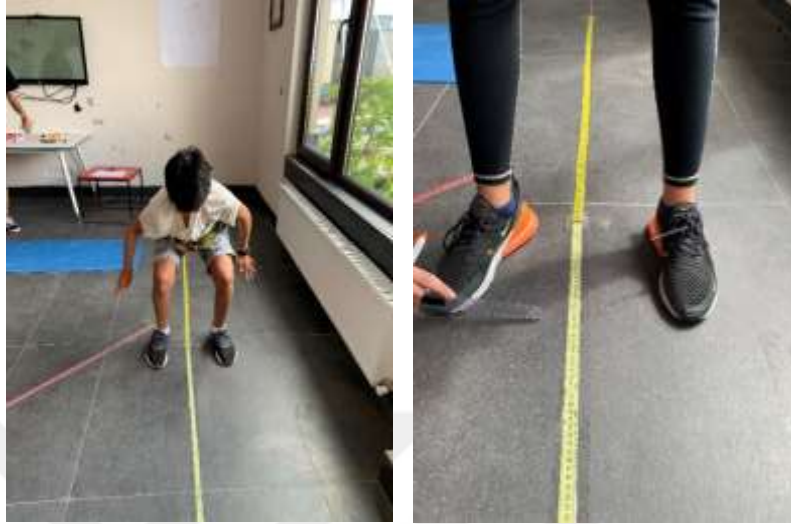


Figure.2.1.3.1. Standing Long Jump Test Measurement

2.1.4.Single Leg Side Jump Test: The athlete stands on the test leg during the single-leg side jump test and jumps with their hands behind them between two parallel tape strips that are 40 cm apart on the floor. Athletes are instructed to jump as much as possible over a 30 s period. The number of successful jumps performed is recorded (43).



Figure.2.1.4.1.Single Leg Side Hop Test Measurement

2.2. Core Muscle Endurance Measurement

2.2.1. Sit-up Test: The test is initiated with the back vertical and in the up position. When the timing starts, lower your back until your shoulder blades are in contact with the ground, then raise yourself back up. The repetition lasts for a minute. A score is calculated based on how many correct shuttles are made overall every minute (40).



Figure 2.2.1.1. Sit-up Test Measurement

2.2.2. Plank Test (Prone Bridge Test): The plank test evaluates a person's ability to hold their body in place for a lengthy period of time using only certain muscle groups. The purpose of this test is to stay in an elevated position for as long as possible. Athletes begin the movement by pushing off the floor with their elbows, forearms, and toes. And they try to stay in this position as much as possible. Inability to keep the back straight or the hip drop is a completion criteria (40).



Figure 2.2.2.1.Plank Test Measurement

2.2.3.Rotary Stability Test: The rotary stability test measures the dynamic stability of the trunk in many planes while combining movements of the upper and lower extremities.

Athletes who can perform straight unilateral movements with their knees and elbows in line with the platform receive 3 points. Athletes who can perform straight diagonal movements with their knees and elbows in line with the platform receive 2 points. Athletes who cannot perform straight diagonal movements receive 1 point. Athletes who feel any pain during the test receive 0 point (40).

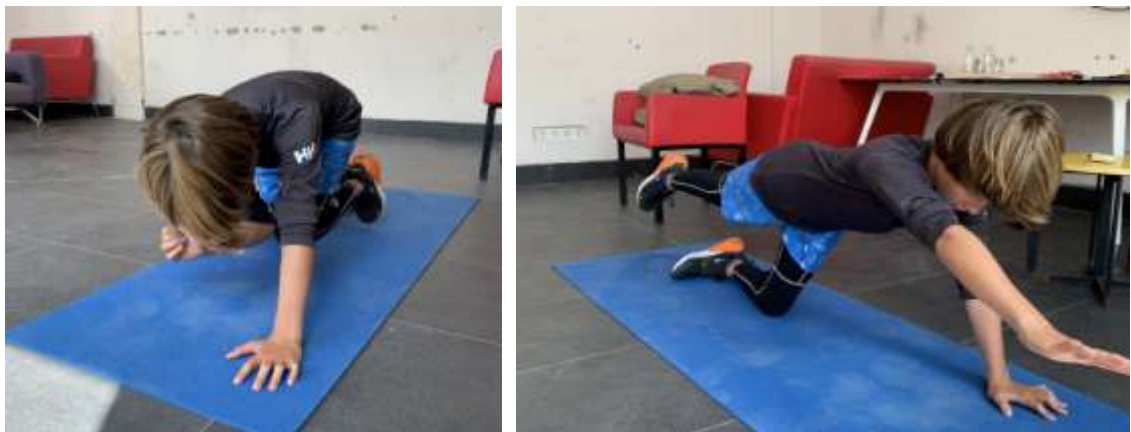


Figure 2.2.3.1.Rotary Stability Test Measuremen

2.3. Balance and Flexibility Measurement

2.3.1.Y Balance Test: The objective of this test is to maintain single-leg balance on one leg while extending the contralateral leg as far as possible in three directions. On each leg, the three movements are carried out in the anterior, posteromedial, and posterolateral orientations. Consequently, six tests must be carried out. Left anterior reach, right anterior reach, left posterior reach, right posterior reach, and left posterior reach. The score is obtained by dividing the total score achieved in the anterior, posterolateral and posteromedial regions by 3 x leg length and multiplying by 100 (44).



Figure 2.3.1.1.Y Balance Test Measurement

2.3.2. Straight Leg Raise Test: The athlete lies on the back with legs extended and hips in a neutral position. The goniometer is positioned on the femoral head once the leg has reached its maximum range of flexion, with one arm parallel to the ground and the other pointing in the malleolar direction of the fibula. Normality is considered at 75 and above in the examination of the angles, whereas grade I and grade II shortening were evaluated at 74 to 61 and 60 and lower, respectively (40).



Figure 2.3.2.1. Straight Leg Raise Test Measurement

2.3.3. Sit and Reach Test: The sit-and-reach test gauges the flexibility of both the hips and the low back. The athlete sits with the measuring stick between the legs and holds it straight with the knees 30 centimeters apart. Athletes then slowly extend their arms as far forward as they can while holding the measuring stick, holding this position for two seconds. The greatest length achieved during the movement is recorded (40).



Figure 2.3.3.1. Sit and Reach Test Measurement

2.3.4. Total Body Rotation Test: Before starting the test, a vertical line is marked on the wall. The athlete is asked to stand at arm's length from the wall. The athlete is asked to turn to the right side and extend his/her fist as far as possible along with the measuring stick and stay in this position for 2 seconds. The athlete is asked to repeat the movement for the other side. The measurements are noted and each score is recorded by taking the average of both sides (40).



Figure 2.3.4.1.Total Body Rotation Test Measurement

2.3.5.Shoulder Elevation Test: The athlete is asked to stand in a comfortable position while holding a long stick and the arm length is noted. The athlete is instructed to lie face down on a flat surface and lift the stick as high as he can. The test is repeated twice. The result is obtained by dividing the achieved score by the arm length and multiplying it by 100 (45).

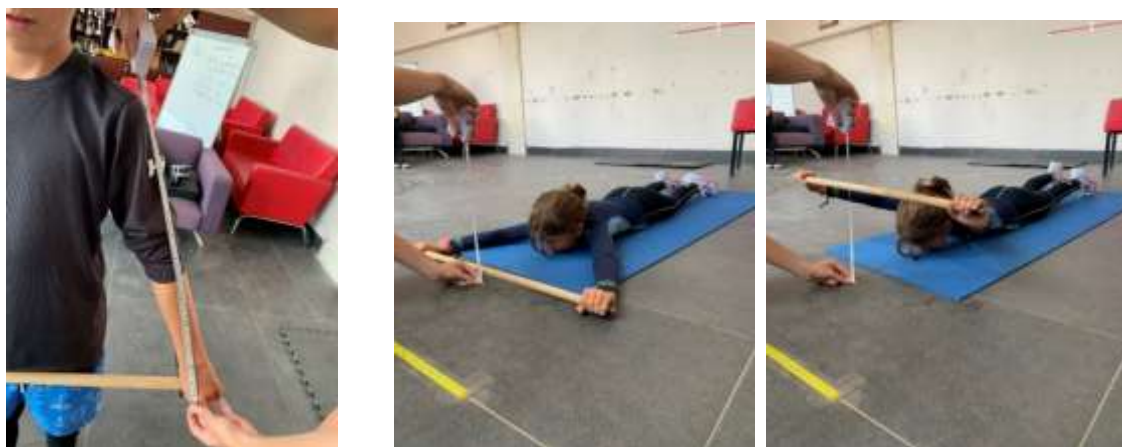


Figure 2.3.5.1.Arm Length and Shoulder Elevation Test Measurement

2.3.6. Shoulder Flexibility Test: This test is done while standing. Athletes are instructed to place one hand behind their heads, across their shoulders, and as far down the middle of their back as they can while keeping their fingers pointing down and their palms in contact with the body. The athlete is instructed to raise the fingers of the second arm, palm outward, as high as they can while attempting to contact or overlap the middle fingers of both hands. If the fingertips make contact, there is no point. If their fingertips do not contact, the space between them is noted (a "negative score"), and if they do, the measurement is noted (positive score) (46).



Figure 2.3.6.1. Shoulder Flexibility Test Measurement

2.3.7. Symmetry Index (SI): The asymmetry in strength and flexibility was quantified using the following formula.

$$SI = \frac{Xr - Xl}{\frac{1}{2}(Xr + Xl)} \times 100 \%$$

The values "Xr" and "Xl" in this formula stand for the right and left sides, respectively. The individual possesses complete symmetry in the examined joints, as shown by the SI value of zero. If SI is positive, then "Xr" is bigger than "Xl," and if SI is negative, then "Xr" is lower than "Xl." Asymmetry is taken into account when SI is more than 10% (47).

3.RESULTS

A total of 26 boys and 14 girls from laser, optimist and windsurfing sailing classes were included in our study, which examined the evaluation of the relationship between core endurance levels, balance performance, muscle strength and flexibility in young elite sailors.

The athletes were randomly selected from the Galatasary sailing club and the athletes were divided into three groups according to their sailing class.

The 1st group was determined as windsurfing, 2nd group optimist and 3rd group laser sailing classes. 14 athletes from the windsurfing class, 13 from the optimist class and 13 from the laser class were included in the study. The age range of windsurfing group is 10-17 years, optimist is 10-14 and laser is 13-19 respectively.

Demographic information such as age, height, body weight, body mass index, dominant side and sports history of the athletes was recorded before the study.

Table 3.1.Sailor’s Demographic Information

	Windsurfing (Mean ± SD) N=14	Optimist (Mean ± SD) N=13	Laser (Mean ± SD) N=13	Total (Mean ± SD) N=40
Age (year)	13,6±2.1	11.5±1.1	16±2.04	13.65±2.56
Height (cm)	160±10.6	149.8±8.0	169±6.6	159.9±11.7
Body weight (kg)	50.4±9.9	39.6±5.6	62.2±6.1	50.7±11.9
Body mass index (BMI) (kg/m2)	19.4±2.7	17.6±2.02	21.5±1.2	19.5±2.6

In our study 85% of the sailor were right- handed in all classes. And in our study 85,7% ,92,3% and 76,9% of the sailors were right-handed windsurfing,optimist and laser class respectively.

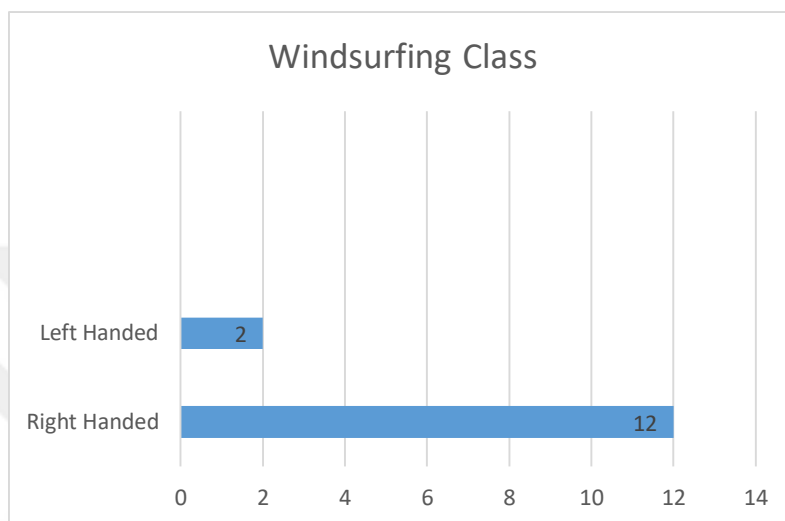


Figure 3.1. Windsurfing Class Dominant Hand Distribution

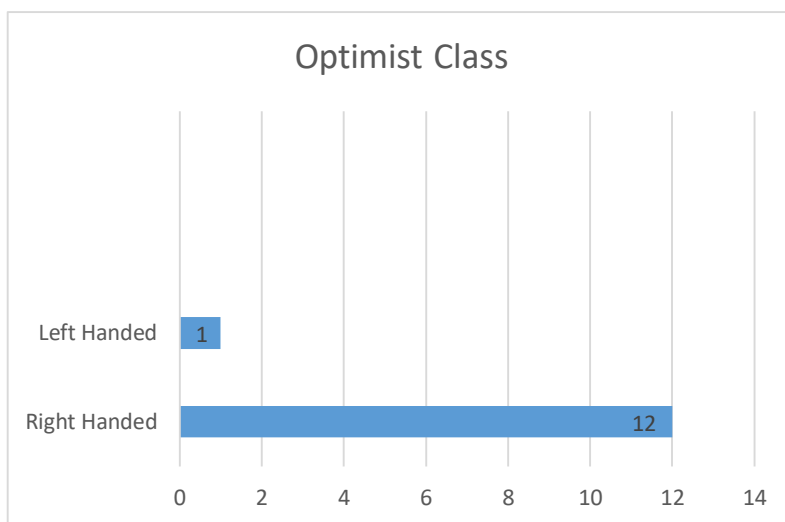


Figure 3.2. Optimist Class Dominant Hand Distribution

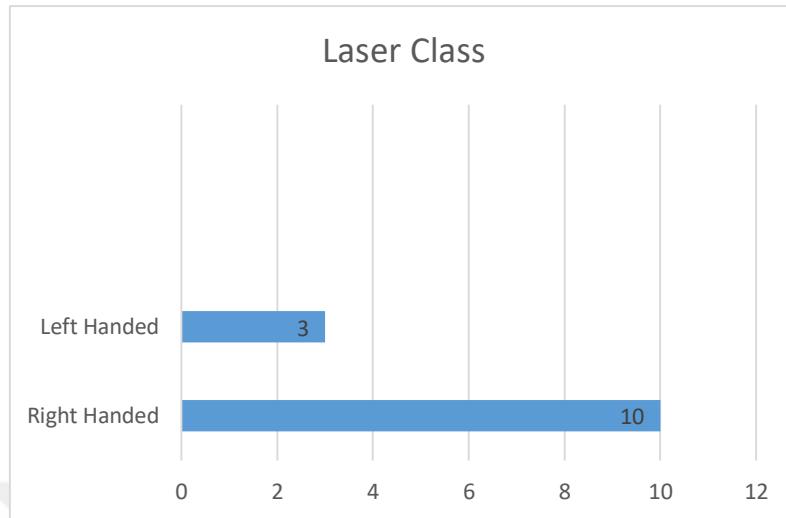


Figure 3.3. Laser Class Dominant Hand Distribution

In our study in the total sample 12,5% had grade I shortening in the right leg while 7,5% had grade I shortening in the left leg. In Optimist class we observed that 100% of sailors had normal flexibility in the both legs. Windsurfing class has 7,2% grade I shortening in the right leg while there is no shortening in the left leg. Laser class has 30,8% and 23,1% grade I shortening right and left legs respectively (Figure 3.4).

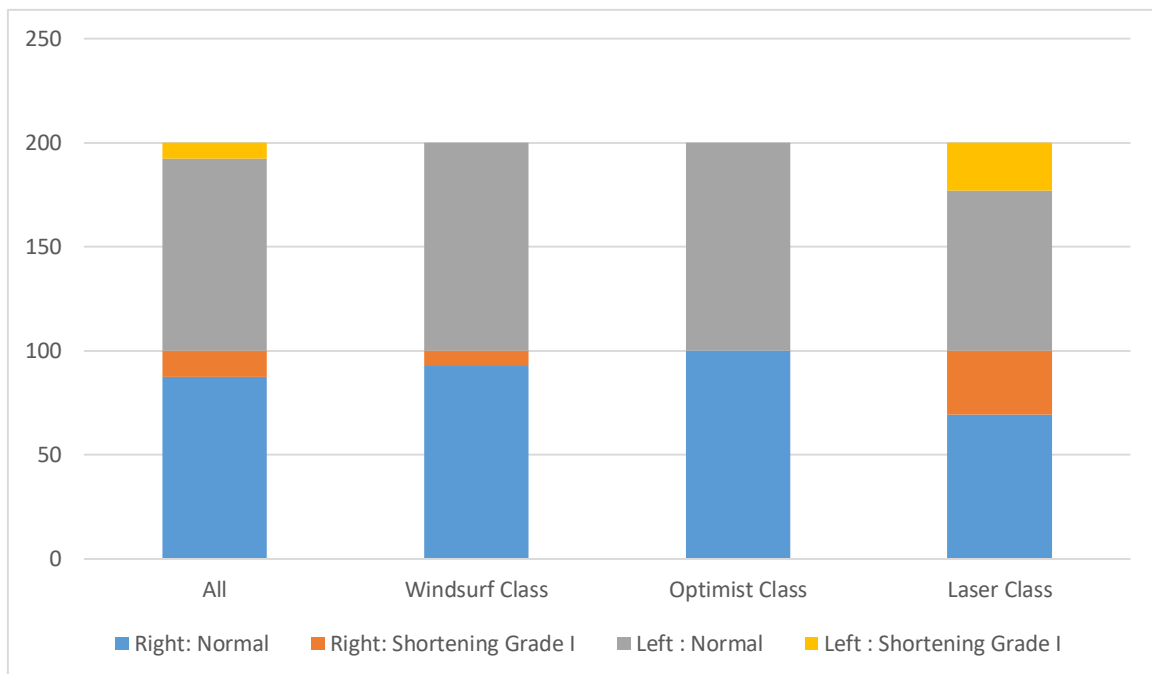


Figure 3.4. Percentage of sailors presenting normal flexibility or grade I shortening

In the statistical analysis of the study, the measurements between groups were made with the Kruskal Wallis test, and the analysis according to gender was made with the Mann-Whitney U test.

As a result of the Kruskal Wallis Analysis according to sailing class;

When the three sailing classes were compared in the Kruskal Wallis analysis, a significant difference was found in the Jamar hand grip test results in terms of the mean values of both the right and left hands ($p < 0.001$). The highest mean value was found in the laser group (Table 3.2).

According to the results of the Standing long jump test, it was seen that there was a significant difference between the groups ($p < 0.05$) and the highest mean value was also obtained in the laser group

There is a significant difference between the groups according to the results of the single leg jump test ($p < 0.05$) and the highest average is in the windsurf group. (Table 3.2).

There was no statistically significant difference between the groups in terms of vertical jump, sit-up, plank, rotary stability test ($p > 0.05$) (Table 3.3).

In addition there was no significant difference between the groups in terms of straight leg raise, shoulder flexibility, shoulder elevation , sit and reach and total body rotation test results ($p > 0.05$) (Table 3.4).

According to the Y balance test results, there is a significant difference between the groups on both the right ($p < 0.05$) and left sides ($p < 0.05$), while the highest average values are in the optimist group (Table 3.4).

Table.3.2.Strength performance tests comparisons between sailing classes

	Windsurfing (Mean \pm SD) N=14	Optimist (Mean \pm SD) N=13	Laser (Mean \pm SD) N=13	P
Hand Dynamometer -R (kg-f)	61.07 \pm 20.58	41.53 \pm 8.98	86.15 \pm 23.99	0.000**
Hand Dynamometer – L (kg-f)	61.42 \pm 19.84	40.76 \pm 9.09	83.07 \pm 20.26	0.000**
Vertical Jump Test (cm)	37.82 \pm 13.74	29.23 \pm 7.63	39.11 \pm 10.85	0.068
Standing Long Jump Test (cm)	177.39 \pm 37.31	158.38 \pm 17.48	193.15 \pm 23.33	0.003*
Single Leg Jump Test (n)	32.14 \pm 11.27	22.07 \pm 7.04	24.23 \pm 9.04	0.041*

(R: Right ; L:Left ; *=p<0.05 **=p<0.001)

Table.3.3.Endurance tests performance comparison between sailing classes.

	Windsurf (Mean \pm SD) N=14	Optimist (Mean \pm SD) N=13	Laser (Mean \pm SD) N=13	P
Sit Up Test (n)	18.42 \pm 2.34	17.30 \pm 1.97	20 \pm 4.50	0.239
Plank Test (s)	162.71 \pm 89.01	149.69 \pm 81.63	143.69 \pm 76.20	0.915
Rotary Stability Test –R (score)	3.0 \pm 0	2.92 \pm 0.27	2.92 \pm 0.27	0.575
Rotary Stability Test –L (score)	2.71 \pm 0.46	2.92 \pm 0.27	2.61 \pm 0.50	0.188

(R: Right ; L:Left ; *=p<0.05 **=p<0.001)

Table.3.4.Balance and flexibility performance test comparison between classes

	Windsurfing (Mean ±SD) N=14	Optimist (Mean ±SD) N=13	Laser (Mean ±SD) N=13	P
Y balance Test –R	122.44 ± 8.50	126.83 ± 12.48	113.20 ± 9.08	0.006*
Y balance Test –L	116.82 ± 9.05	124.03 ± 11.87	105.63 ± 8.37	0.000**
Straight Leg Raise Test –R	88.28 ± 9.35	92.69 ± 7.83	81.73 ± 12.24	0.114
Straight Leg Raise Test –L	87.32 ± 8.12	91.42 ± 9.36	84.11 ± 14.37	0.286
Shoulder Flexibility Test- R	7.35 ± 5.47	4 ± 7.38	1.34 ± 11.44	0.402
Shoulder Flexibility Test-L	2.67 ± 7.37	-0.19 ± 7.98	-.269 ± 10.36	0.612
Sit and Reach Test	7.42 ± 9.92	6.76 ± 8.25	10 ± 14.49	0.938
Shoulder Elevation Test (cm)	19.42 ± 8.18	18.69 ± 6.18	17.15 ± 6.69	0.752
Total Body Rotatiton Test-R	59.47 ± 18.08	49.20 ± 15.62	43.40 ± 14.66	0.052
Total Body Rotatiton Test-L	52.19 ± 22.92	44.67 ± 15.96	43.62 ± 14.08	0.587

(R: Right ; L:Left ; *=p<0.05 **=p<0.001)

As a result of Kruskal Wallis analysis, Table 4.8 shows that the Laser class had a greater percentage of asymmetries in both hand dynamometer and straight leg raise test (Table 3.5).

Table 3.5. Mean \pm SD of the SI (Symmetry Index) variables analyzed in the groups of Windsurfing, Optimist and Laser.

	Windsurf (Mean \pm SD) N=14	Optimist (Mean \pm SD) N=13	Laser (Mean \pm SD) N=13	P
Hand Dynamometer SI (%)	3,35 \pm 6,4	3,72 \pm 7,7	5,97 \pm 8,3	0,497
Straight Leg Raise Test SI (%)	2,75 \pm 2,2	2,83 \pm 2,8	3,62 \pm 4,08	0,953

(SI: Symmetry Index ; *=p<0.05 **=p<0.001)

As a result of Mann Whitney U analysis, it was observed that the group of boys had a greater percentage of asymmetries in hand dynamometer and straight leg raise test (Table 3.6).

Table 3.6. Mean \pm SD of the SI (Symmetry Index) variables analyzed in the groups of Girls and Boys

	Girl (Mean \pm SD) N=14	Boy (Mean \pm SD) N=26	p
Hand Dynamometer SI (%)	3,61 \pm 6,71	4,71 \pm 7,85	0,670
Straight Leg Raise Test SI (%)	2,78 \pm 4,06	3,21 \pm 2,45	0,231

(SI: Symmetry Index ; *=p<0.05 **=p<0.001)

Regarding SI hand dynamometer values laser class has greater asymmetry percentage (46%). Optimist and windsurf class has similar asymmetry percentage (26% versus 28%).

Regarding SI straight leg raise values either laser class has greater asymmetry percentage. Optimist and windsurf class has similar asymmetry percentage (31% versus 30%) (Figure 3.10).

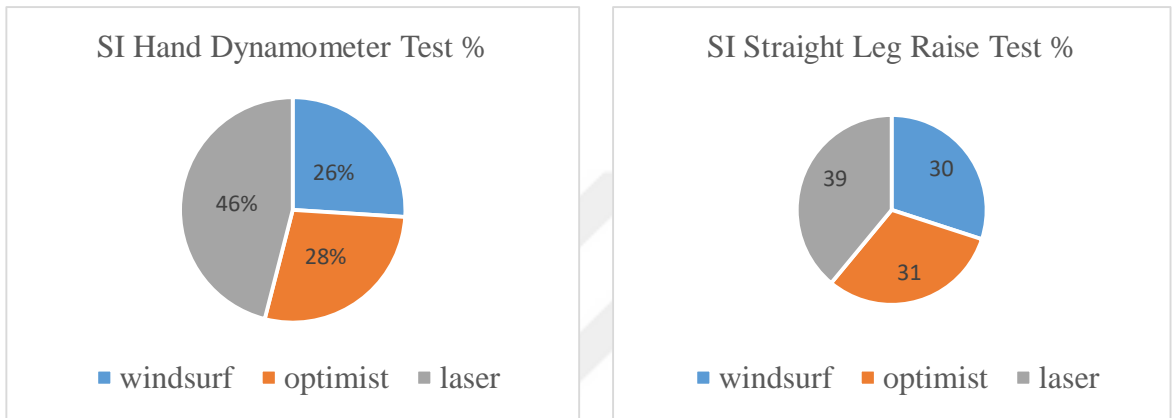


Figure 3.5 Percentages of sailors presenting asymmetry according to the SI values.

According to Figure 3.11. boys have a greater asymmetry percentage than girls both hand dynamometer and straight leg raise test.

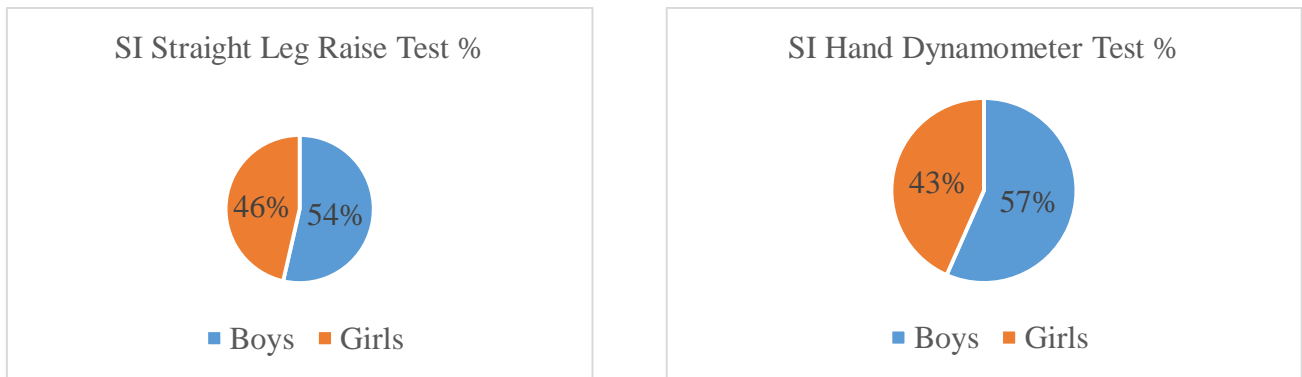


Figure 3.6. Percentages of sailors presenting asymmetry according to the SI values.

In Mann Whitney U analysis according to gender, a significant difference was found in favor of men in Jamar hand dynamometer right hand, vertical jump test, single leg jump test, standing long jump test and sit up test. ($p < 0.05$)

There is no significant difference was found in other performance-determining variables. ($p>0.05$) (Table3.7).

Table 3.7. Performance test comparison between gender

(R: Right ; L:Left ; *= $p<0.05$ **= $p<0.001$)

	Male (Mean \pm SD)	Female (Mean \pm SD)	P
Jamar Right Hand (kg)	70.38 \pm 27.05	48.92 \pm 17.34	0.013*
Jamar Left Hand (kg)	68.07 \pm 25.3	50.00 \pm 16.87	0.051
Vertical Jump Test (cm)	39.09 \pm 11.59	28.67 \pm 8.68	0.007*
Standing Long Jump Test (cm)	187.71 \pm 29.7	155.21 \pm 18.63	0.001*
Single Leg Jump Test (n)	28.84 \pm 10.63	21.57 \pm 7.26	0.025*
Sit Up Test (n)	19.57 \pm 3.37	16.71 \pm 1.99	0.003*
Plank Test (s)	164.73 \pm 85.21	129.21 \pm 69.19	0.155
Rotary Stability Test –R (score)	2.96 \pm 0.19	2.92 \pm 0.26	0.652
Rotary Stability Test –L (score)	2.80 \pm 0.4	2.64 \pm 0.49	0.257
Y balance –R	121.32 \pm 10.56	120.01 \pm 13.17	0.799
Y balance –L	114.75 \pm 11.99	116.96 \pm 13.01	0.660
SL Raise Test –R	86.69 \pm 9.63	89.25 \pm 12.67	0.424
SL Raise Test –L	86.15 \pm 8.67	90.32 \pm 14.4	0.362
Shoulder Flexibility Test- R	4.00 \pm 9.01	4.89 \pm 7.95	0.865
Shoulder Flexibility Test-L	0.28 \pm 9.03	1.71 \pm 7.6	0.765
Sit and Reach Test	5.84 \pm 9.04	12.14 \pm 13.25	0.144
Shoulder Elevation Test (cm)	18.96 \pm 7.75	17.50 \pm 5.4	0.723
Total Body Rotatiton Test-R	47.84 \pm 17.80	56.60 \pm 15.02	0.106
Total Body Rotatiton Test-L	44.43 \pm 19.85	51.65 \pm 13.97	0.126

In Mann Whitney U analysis according to the comparison of group 1 (windsurfing class) and group 2 (optimist class), there is a significant difference was found in the Jamar hand grip test in favor of Windsurfing class ($p < 0.05$).

In addition single leg jump test was found higher in the windsurfing class in comparison to the optimist class. ($p < 0.05$) (Table 3.8)

Table 3.8. Performance test comparison between Windsurfing and Optimist Class

	Windsurfing (n=14)		Optimist (n=13)		P
	Mean	SD	Mean	SD	
Hand Dynamometer -R (kg-f)	61.07	20.58	41.53	8.98	0.007*
Hand Dynamometer- L Hand (kg-f)	61.42	19.84	40.76	9.09	0.002*
Single leg jump Test (n)	32.14	11.27	22.07	7.04	0.018*

(R: Right ; L:Left ; *= $p < 0.05$ **= $p < 0.001$)

In Mann Whitney U analysis according to thr comparison of group 2 (optimist class) and group 3 (laser class), there is a significant difference in Jamar hand grip test for both right and left hand. ($p < 0.001$)

There is a significant difference in the vertical jump test and standing long jump test in favor of group 3(laser class) comparison to group 2 (optimist class). ($p < 0.05$)

The highest score of the Y balance test both the right and left lower limbs was obtained from group 2 (optimist class) in comparison to group 3 (laser class). ($p < 0.05$) (Table 3.9).

Table 3.9. Performance test comparison between Optimist and Laser Class

	Optimist (n=13)		Laser (n=13)		P
	Mean	SD	Mean	SD	
Hand Dynamometer -R (kg-f)	41.53	8.98	86.15	23.99	0.000**
Hand Dynamometer- L Hand (kg-f)	40.76	9.09	83.07	20.26	0.000**
Vertical Jump Test (cm)	29.23	7.63	39.11	10.85	0.021*
Standing long jump test (cm)	158.38	17.48	193.15	23.33	0.000**
Y balance Test-R	126.83	12.48	113.20	9.08	0.006*
Y balance Test-	124.03	11.87	105.63	8.37	0.001*

(R: Right ; L:Left ; *= $p<0.05$ **= $p<0.001$)

In Mann Whitney U analysis according to the comparison of group 1 (windsurfing class) and group 3(laser class), there is a significant difference obtained from Jamar hand grip test both right and left hand in favor of the Laser class.($p<0.05$)

Windsurfing class showed higher score of the Y balance test both the right and left lower limbs.($p<0.05$)

In total body rotation assessment windsurfing class showed a higher score in comparison to laser class on the right side. ($p<0.05$)

On the left side of the trunk rotation, there is no significant difference between windsurfing and laser class. ($p>0.05$) (Table 3.10)

Table 3.10 Performance test comparison between Windsurfing and Laser Class

	Windsurfing (n=14)		Laser (n=13)		P
	Mean	SD	Mean	SD	
Hand Dynamometer -R (kg-f)	61.07	20.58	86.15	23.99	0.006*
Hand Dynamometer- L Hand (kg-f)	61.42	19.84	83.07	20.26	0.007*
Y Balance Test-R	122.44	8.50	113.20	9.08	0.012*
Y balance Test-L	116.82	9.05	105.63	8.37	0.004*
Total Body Rotatiton Test-R	59.47	18.08	43.40	14.66	0.021*
Total Body Rotatiton Test-L	52.19	22.92	43.62	14.08	0.343

(R: Right ; L:Left ; *=p<0.05 **=p<0.001)

4. DISCUSSION AND CONCLUSION

As a result of our study, our hypotheses were confirmed. As we stated in our first hypothesis there is no significant difference was found in some performance parameters between sailing classes. There were no significant differences between the groups in performance tests such as plank and sit-up tests that determine static and dynamic core endurance. In addition, there were no significant differences between the groups in the rotary stability test, which determines dynamic core endurance and balance. In flexibility parameters such as straight leg raise test, sit and reach test, shoulder flexibility test, shoulder elevation test and total body rotation test there were also no significant differences between the groups.

As we stated in our second hypothesis there is a significant difference was found especially in strength and balance parameters between sailing classes. There are differences between groups, especially in the Jamar hand grip test. The highest values are in laser, windsurfing and optimist class respectively. We think that the mean age between the groups may also be effective in this result. In vertical jump test, standing long jump test and single leg jump test there is also a significant difference between classes. The laser class has highest value in vertical and standing long jump tests followed by Windsurfing and Optimist class. And in the single leg jump test highest values in the windsurfing class, laser class and optimist class respectively. Moreover, Y balance test is a distinctive test between groups and the highest value were observed optimist, windsurfing and laser respectively.

As for gender comparison, all strength evaluation tests. Boys have higher values than girls and there is a significant difference. In addition in the sit-up test which demonstrate dynamic core endurance boys also have greater values than girls. There is no significant difference between genders in other performance tests.

In a study conducted in 2021 by Caraballo Isabel et al., 68 young elite Spanish sailors aged 9–19 years were divided into four groups: Windsurfing, Optimist, Laser and 420 classes. The single-leg vertical countermovement jump (VCJ), single-leg horizontal countermovement leap, and hand dynamometry tests were used to evaluate the strength of the upper and lower limbs. The sailors in the laser class exhibited greater levels of upper and lower limb strength in our study as well (Table 3.2). As in our investigation, the Jamar hand dynamometer was used to test hand grip strength. Unlike our study, the tests to determine lower extremity strength were performed single leg both vertical and horizontal directions. This shows that similar grip strength and lower limb strength results in our study agree with the literature on this issue.

Similar to this research, in our study, the average age, height and weight of the optimist group were lower than the laser and windsurfing group. These values are not surprising since the individuals in the laser group are close to senior elite sailing, considering their age, anthropometric characteristics and technical development.

In our study 85% of the sailor were right handed in all classes while other study 88.2 % of entire sample were right handed. In addition, 85.7%, 92.3%, and 76.9% of the sailors in the windsurfing, optimist, and laser classes, respectively, were right-handed, but in another study, the percentages were 93.3%, 89.7%, and 77.8% for the upper limbs.

In our study, the SI value of the hand dynamometer was found to be higher in boys than in girls (Table 3.6) In addition, while the hand dynamometer was highest in the SI laser group (Table 3.5) , it was highest in the windsurfing class in the current study. This may be due to the diversity of racial and developmental factors (14).

In a 2015 study by Callewaert Margot et al., 47 male youth sailors aged (10-18 years) participated. The sample was divided into two groups optimist and laser classes. Similar to our study sit-up test, standing long jump test, side jump test, hand grip test and sit and reach test were performed. The laser class had higher scores in all above performance tests while in our study laser class had higher scores in the hand grip, standing long jump and sit and reach tests than other sailing classes (Table 3.2) (48).

When this is evaluated together with other research findings, it can be said that individuals in the laser group have reached these high values in performance tests both with their anthropometric characteristics and because of the different and high-intensity training styles in this group.

In 2020, Caraballo Isabel et al conducted in a study including three sailing classes Windsurfing, Optimist and Laser class same as ours. 33 sailors were included in the study and the hand grip test and straight leg lift test were conducted. The levels of strength and flexibility between male and female sailors did not differ significantly. However, in our study, there is a differences in the level of hand grip strength which is boys are greater values than girls.

In this study, optimist, windsurfing and laser were ranked from highest to lowest in terms of SI % values for the straight leg lift test, while in our study they were ranked as laser, optimist and windsurfing.

In terms of hand dynamometer, while the SI % order was windsurfing, laser and optimist, in our study it was found as laser, optimist and windsurfing. As a result, it is seen that the SI values were higher in the laser group in our study (Table 3.5).

In terms of gender, the SI % for the hand dynamometer variable was found to be higher in women than in men, and the SI % of straight leg lift was found to be slightly higher in boys than in girls. In our study, the SI % for both hand dynamometer and straight leg lift tests is higher in favor of boys (Table 3.6).

The factors that may cause this situation can be listed as genetic and developmental status and differences in the training method.

12,5% of the entire sample in our study had grade I shortening in the right leg, compared to 7,5% in the left. In Figure 4.4. Only 9% of sailors overall showed grade I shortening in the right leg and 12% in the left, according to the results of another study's SLL test for the right and left legs.

We found that every sailer in our study's Optimist class had normal flexibility in both legs. In the windsurfing class, the right leg has a grade I shortening of 7.2%, but the left leg has no shortening. Laser class has 30,8% and 23,1% grade I shortening the right and left legs respectively (Figure 4.4).

In contrast to Caraballo's study, where 100% of the sailors in the windsurfing class had normal flexibility in both legs, the laser class had 28,6% of right-leg grade I shortening and 14,3% of left-leg grade I shortening, and the optimist class had 12,5% right, 12,6% of right-leg grade I shortening.

In our survey, right-handed sailors made up 85% of all classes of sailors. Right-handed sailors made up 85,7%, 92,3%, and 76,9% of the windsurfers, optimists, and laser class sailors, respectively. In Caraballo's study, 70% of the sailors were right-handed, and in the classes of Windsurfing, Optimist, and Laser, respectively, 60%, 79%, and 47% of the sailors were right-handed (1).

In another study by Caraballo, 29 Spanish male (16-23 years old) laser class athletes were included in the study. Anthropometric data such as height, weight, leg length, sitting height were collected. While the average age of the athletes in this study was 17, the average height was 172 cm, and the bmi was 22.3, in our study the average age was 16, height 169 cm, bmi 21.5, and the values were close to each other (Table 3.1) With the performance tests applied in the research, it was concluded that these features are quite advantageous for the hiking maneuver. As a result, it was concluded in Caraballo's research that age, body composition and anthropometric characteristics directly affect sailing performance (10). The fact that the laser group had similar characteristics and was the most successful group in terms of performance in our study supports these results.

In a study conducted by Pan in 2022, of 167 sailing athletes (93 men, 74 women), 38 men and 27 women are in the laser group. Other groups included in the research are sailing groups, which are different from our research. Anthropometric data, anaerobic capacities, strength tests and aerobic tests were applied to the individuals included in this study. Similar to our study, vertical jump and sit and reach tests were performed. The results of these tests are close to the results of the laser group in our study and are higher (40). In addition, in this study, the vertical jump and sit and reach test results of the laser group were higher than the other groups, as in our study.

A study done in Turkey in 2020 began with the participation of 23 sailors who competed at the national and international levels and were between the ages of 15 and 17. However, the research did not specify a sail class. Functional movement screening, handgrip strength tests, vertical jump tests, sit-and-reach flexibility tests, one repetition maximum bench press tests, one repetition maximum squat tests, and back strength dynamometer tests were used three times in pre-season, mid-season, and post-season. This is similar to our research.

Mid-season values are Hand grip (right) 39.15+8.85, Hand grip (left) 39.00+7.87, Vertical jump 45.74+9.11. In our study, the handgrip was found to be 59.65 cm on the right and 59 cm on the left. The vertical jump is 33.88 cm. While the mean age in this study was 16.35, it was 13.65 in our study. This difference explains the difference between performance test results. The fact that the cases were not divided into sailing classes in the present study is an important limitation. We have brought together individuals from different sailing groups to reveal the differences between the groups (49).

In a study conducted in Singapore in 2006, 55 laser sailors (37 males, 18 females, mean age of 20 years) were included in the study. The average height of the athletes included in the study is 165 cm. Similar to our study, the vertical jump test was applied to these athletes to measure lower extremity strength. When analyzed according to gender, it was found to be 24 cm in women and 34 cm in men (50). The results of the vertical jump test in sailing athletes aged 13.65 and with an average height of 160 cm, included in our study, were found to be 28 cm for women and 39 cm for men. This shows that although athletes with lower age and height averages were included in our study, higher lower extremity strength values were obtained from Singapore sailing athletes.

A study on professional sailors in 2020 revealed how decisive the strength and performance test results are in this sport. In the research, sailors were divided into two groups successful and unsuccessful. It has been concluded that the performance test results of successful sailors are also high (38). We applied handgrip strength and other performance tests in our research. We also analyzed the results by sailing classes and gender.

In a study conducted in Brazil in 2020, 22 sailors with at least 3 years of experience from different countries were included. The average age is 18.8. Participants were divided into two groups those with low back pain and those without. Similar to our research, the passive straight leg raise test was used for flexibility. In the group without low back pain, it was found to be 61.6 degrees on the right side and 61.8 degrees on the left side. In our research, the straight leg lift test is 87.9 degrees on the right side and 88.2 degrees on the left side. This shows that the individuals participating in our study are more flexible. In addition, the fact that the population of the current study consists of sailors from different countries may be an indication that, unlike in our study, a homogeneous group did not occur (51).

When the literature was examined, there are few studies on different sailing classes. In this context, our research is meaningful for our country and makes an important contribution to the international literature.

As a result of the performance tests we conducted on professional sailing athletes within the scope of our research, various differences were found in the strength, endurance, flexibility and balance parameters of sailing athletes according to gender and sailing class.

Each sailing class has its own physical, anthropometric and performance characteristics. These characteristics are shaped according to age, gender, sport-specific training and the needs of the sport.

Our results show that; the performance tests applied reveal the current profile of the athletes and will guide the preparation of exercise programs for the needs.

The absence of a control group in our study can be considered as a limitation, but the normative values of the athletes can be reached from the literature.

Increasing research in the field of physiotherapy for sailing will be beneficial in terms of determining performance parameters in sailing athletes. We aim to include exercise practices and follow-ups for these athletes in our future research.

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DEMOGRAPHIC INFORMATION FORM

Tarih :/..../....

*İletişim Numarası:.....

*1)Adı-Soyadı :

*2) Yaş :

*3) Cinsiyet :

Kadın

Erkek

*4) Yelken Sınıfı :

*5) Boy (cm) :

*6) Kilo (kg) :

*7) BMI

*8) Dominant Taraf :

Sağ

Sol

*9) Profesyonel spor geçmişi:.....

*10) Geçirilmiş herhangi bir sakatlık/hastalık var mı ? Var ise açıklayınız.

Var.....

Yok

*11) Düzenli ilaç kullanımı var mı ? Var ise açıklayınız.

Var.....

Yok

INFORMED CONSENT FORM

(18 yaş altı katılımcılar için)

(Fizyoterapistin açıklaması)

Sayın katılımcı,

Sizi Genç Elit Yelkencilerde Gövde Kas Endüransı, Denge Performansı, Kas Kuvveti Ve Esneklik Arasındaki İlişkinin Değerlendirilmesi başlıklı bir araştırmaya davet ediyoruz .Çalışmaya katılımınız tamamen gönüllülük esasına dayalıdır. Bu araştırmaya katılıp katılmama kararını vermeden önce, araştırmanın neden ve nasıl yapılacağını bilmeniz önem taşımaktadır. Aşağıdaki bilgileri dikkatlice okumak için zaman ayırınız. İsterseniz bu bilgileri aileniz ve/veya yakınlarınız ile tartışınız.Eğer anlayamadığınız ve sizin için açık olmayan şeyler varsa, ya da daha fazla bilgi isterseniz bize sorunuz.

Yelken sporunda sporcu performansı kas kuvveti, kas dayanıklılığı, denge performansı ve esneklik gibi bir çok performans parametresine bağlıdır ve sporcuların fiziksel performanslarını etkileyen faktörler bir bütün olarak görülmeli ve değerlendirilmelidir. Bu çalışmanın amacı yelken sporcularında performansı etkileyen faktörlerin değerlendirilmesidir. Çalışmamıza katılımınız araştırmanın başarısı için oldukça önemlidir.Çalışma üç yelken sınıfında yapılacaktır. Bu yelken sınıfları Laser, Optimist, Windsurfing sınıflarıdır. Çalışmamıza tahmini her sınıftan 12 kişi olmak üzere 36 gönüllü sporcu katılması hedeflenmektedir. Ocak-Şubat ayları arasında (2 ay) çalışmanın tamamlanması öngörülmektedir. Çalışmamıza katılacak olan gönüllüler rastgele 3 farklı yelken grubu (Laser, Optimist, Windsurfing) içerisinde seçilecektir.

Eğer çalışmaya katılmayı kabul ederseniz Fizyoterapist Beyza BAŞER ÖZTÜRK tarafından size birtakım değerlendirmeler yapılacak ve bulgular kaydedilecektir. Yapılacak değerlendirmeler kuvvet, denge, dayanıklılık ve esneklik gibi parametreleri değerlendiren fonksiyonel performans testlerini içermektedir.

Çalışmamızda değerlendirmeler sırasında oluşabilecek herhangi bir risk bulunmamaktadır. Bu çalışmaya katılmanız için sizden herhangi bir ücret istenmeyecektir. Çalışmaya katıldığınız için size ek bir ödeme de yapılmayacaktır. Bilgileriniz gizli tutulacak, ancak çalışmanın kalitesini denetleyen görevliler, etik kurullar ya da resmi makamlarca gereği halinde incelenebilecektir. Bu çalışmaya katılmayı reddedebilirsiniz. Bu araştırmaya katılmak tamamen isteğe bağlıdır. Çalışma ile ilgili herhangi bir sorunuz olduğunda Fizyoterapist Beyza BAŞER ÖZTÜRK ile iletişim kurabilirsiniz.

(Katılımcının/ Sporcunun Beyanı)

Fizyoterapist Beyza BAŞER ÖZTÜRK tarafından Galatasaray Yelken Kulübünde fizyoterapi ve rehabilitasyon ile ilgili bir araştırma yapılacağı belirtilerek bu araştırma ile ilgili yukarıdaki bilgiler bana aktarıldı. Bu bilgilerden sonra bu araştırmaya “katılımcı” olarak davet edildim.

Eğer bu araştırmaya katılırsam araştırmacı ile aramda kalması gereken bana ait bilgilerin gizliliğine bu araştırma sırasında da büyük özen ve saygı ile yaklaşılacağına inanıyorum. Araştırma sonuçlarının eğitim ve bilimsel amaçlarla kullanımını sırasında kişisel bilgilerimin korunacağı konusunda bana yeterli güven verildi. **Bu çalışma sonuçlarının kullanılmasını kısıtlamamayı,yayın,rapor ve benzeri bilimsel dokümanlarda kullanılmasını kabul ediyorum.**Projenin yürütülmesi sırasında herhangi bir sebep göstermeden araştırmadan çekilebilirim. (Ancak araştırmacıları zor durumda bırakmamak için araştırmadan çekileceğimi önceden bildirmemim uygun olacağını bilincindeyim.) Araştırma için yapılacak harcamalarla ilgili herhangi bir parasal sorumluluk altına girmiyorum. Bana da bir ödeme yapılmayacaktır.**İster doğrudan, ister dolaylı olsun araştırma uygulamasından kaynaklanan nedenlerle meydana gelebilecek herhangi bir sağlık sorunumun ortaya çıkması halinde, her türlü tıbbi müdahalenin sağlanacağı konusunda gerekli güvence verildi.**

Araştırma sırasında herhangi bir saatte Fizyoterapist Beyza BAŞER ÖZTÜRK ‘e 0530 047 79 87 (cep) no’lu telefondan ulaşabileceğimi biliyorum. Araştırmaya katılmayı onaylamak zorunda değilim. **Söz konusu araştırmaya, hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı kabul ediyorum.**Bana yapılan tüm açıklamaları ayrıntılarıyla anlamış bulunmaktayım.İmzalı bu form kağıdının bir kopyası bana verilecektir.

Katılımcının yasal vasisinin Adı Soyadı :

İmza / Tarih :

Telefon Numarası /Adresi :

Katılımcı ile görüşen fizyoterapist Adı soyadı, unvanı: Fizyoterapist Beyza BAŞER
ÖZTÜRK

Sorumlu Araştırmacı Adı soyadı, unvanı : Dr.Öğr.Üys. Ayça AKLAR

Tanıklık Eden Kişi Adı soyadı, unvanı:

İmza /Tarih :

Telefon Numarası /Adresi:

INFORMED CONSENT FORM

(18 yaş üstü katılımcılar için)

(Fizyoterapistin açıklaması)

Sayın katılımcı,

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Katılımcının Adı Soyadı :

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Katılımcı ile görüşen fizyoterapist Adı soyadı, unvanı: Fizyoterapist Beyza BAŞER
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Tanıklık Eden Kişi Adı soyadı, unvanı:

İmza /Tarih :

Telefon Numarası /Adresi:

STRENGTH MEASUREMENT

Hand Dynamometry (kg)	Right Hand	Left Hand

Vertical Jump Test(cm)	Highest Point of Jump (cm)		
	<u>1. Trial</u>	<u>2.Trial</u>	<u>3.Trial</u>

Standing Long Jump Test (cm)	Longest Distance of Jump (cm)		
	<u>1. Trial</u>	<u>2.Trial</u>	<u>3.Trial</u>

Single Leg Jump Test(n)	Number of Jumps

CORE MUSCLE ENDURANCE MEASUREMENTS

Sit Up Test (n)	Number of shuttles

Plank Test (Prone Bridge Test) (s)	Time

Rotary Stability Test (right)	Pain 0	Fail Diagonal 1	Diagonal 2	Unilateral 3
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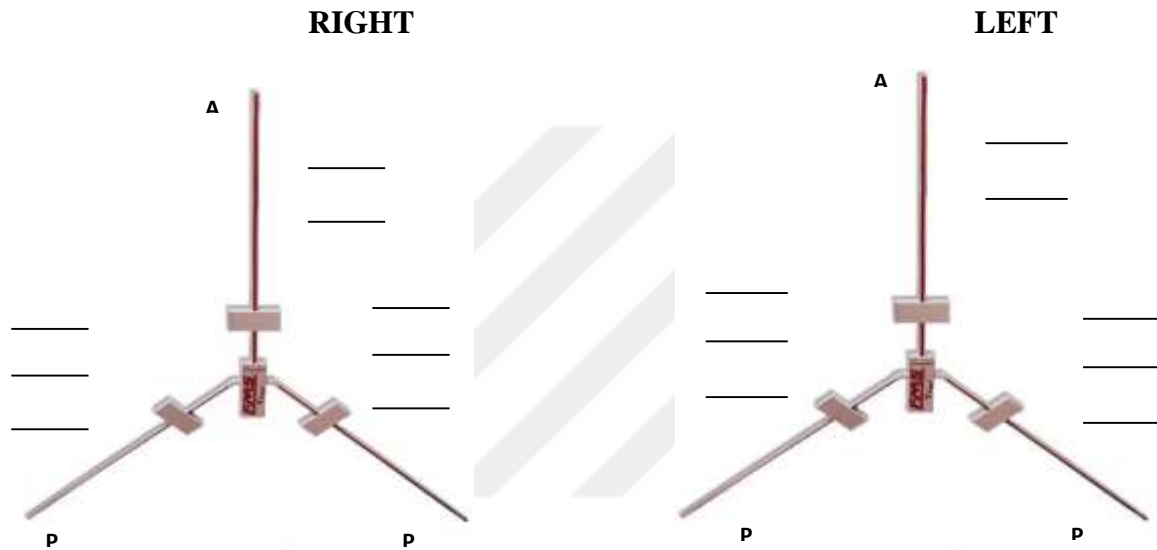
Rotary Stability Test (left)	Pain 0	Fail Diagonal 1	Diagonal 2	Unilateral 3
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BALANCE AND FLEXIBILITY MEASUREMENTS

Y-Balance Test – Score Sheet

Right limb length in centimeters: _____

(Measure from right ASIS to right medial malleolus in supine after performing bilateral bridge)



	Right	Left	Difference
Anterior (A)			
Posteromedial (PM)			
Posterolateral (PL)			

(Anterior + Posteromedial + Posterolateral)

_____ X 100

3 x Right Limb Length

Sit and Reach Test(cm):	1.	2.	3.
Shoulder Elevation Test(cm):	1.	2.	3.

Shoulder Flexibility Test (cm)	Right	Left
1		
2		
3		

Total Body Rotation Test (cm)	Right	Left
1		
2		
3		

Straight Leg Raise Test (cm)	Right	Left
1		
2		
3		



KARAR FORMU

14.03.2022

ETİK KURUL BİLGİLERİ	Etik Kurulun Adı	Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu
	Açık Adres	Yeditepe Üniversitesi Kayışdağı Kampüsü, Tıp-Mühendislik Binası, Sağlık Bilimleri Enstitüsü, İnönü Mah. Kayışdağı Cad. 326A, 26 Ağustos Yerleşimi 34755 Ataşehir, İstanbul
	İnternet Sayfası	http://goetik.yeditepe.edu.tr/
	Telefon	0216 578 00 00
	E-posta	goetik@yeditepe.edu.tr

DEĞERLENDİRİLEN BELGELER	Islak imzalı başvuru dosyası, CD'si ve elektronik başvuru	<input checked="" type="checkbox"/>
	Araştırma başlığı ve araştırmacıların isimleri	<input checked="" type="checkbox"/>
	Başvuru dilekçesi	<input checked="" type="checkbox"/>
	Başvuru Formu- Araştırmanın;	<input checked="" type="checkbox"/>
	• Niteliği	<input checked="" type="checkbox"/>
	• Önemi ve özgün değeri	<input checked="" type="checkbox"/>
	• Amaç ve hedefleri	<input checked="" type="checkbox"/>
	• Yöntemi	<input checked="" type="checkbox"/>
	• Yönetimi	<input checked="" type="checkbox"/>
	• Yaygın etkisi	<input checked="" type="checkbox"/>
	• Araştırma bütçesi (Mevcutsa)	<input checked="" type="checkbox"/>
	• Süresi ve uygunluğu (Zaman cetveli)	<input checked="" type="checkbox"/>
	• Kaynakları	<input checked="" type="checkbox"/>
	Bilgilendirilmiş Gönüllü Olur Formu (yapılan araştırmaya özel olarak hazırlanmış)	<input checked="" type="checkbox"/>
	Taahhütname-1 Araştırmanın yapılacağı kurumdan izin alma sorumluluğunun araştırmacılara ait olduğuna dair taahhüt	<input checked="" type="checkbox"/>
	Taahhütname-2 Dünya Tıp Birliği Helsinki Bildirgesinin son versiyonunun ve Sağlık Bakanlığı'nın ilgili tüm kılavuzlarının okunmasına dair taahhüt	<input checked="" type="checkbox"/>
	Taahhütname-3 Daha önce yapılmış etik kurul başvuruları mevcut olup olmadığına dair taahhüt	<input checked="" type="checkbox"/>
Taahhütname-4 Araştırma sırasında araştırma bütçesinde yer almayan ve gönüllünün kendisine veya Sosyal Güvenlik Kurumuna ek yük getirecek hiçbir işlem uygulanmayacağına dair taahhüt	<input checked="" type="checkbox"/>	
Taahhütname-5 COVID-19 hastalarında tedavi yaklaşımları ve bilimsel araştırmalar genelgesi okunmasına dair taahhüt	<input checked="" type="checkbox"/>	
Taahhütname-6 Milli Eğitim Bakanlığı Araştırma Uygulama İzinleri konulu yazının okunmasına dair taahhüt	<input checked="" type="checkbox"/>	
Araştırmacıların her birisine ait özgeçmiş formu	<input checked="" type="checkbox"/>	
Ek belgeler (Varsa kullanılan ölçek izinleri vb.)	<input checked="" type="checkbox"/>	

KARAR BİLGİLERİ	Başvuru Numarası	202112131
	Toplantı Tarihi	14.01.2022
	Toplantı Yeri	Çevirim içi (Google Meet)
	Karar No	9



BAŞVURU NUMARASI: 202112131

14.03.2022

KARAR

<input checked="" type="checkbox"/> KABUL	<input type="checkbox"/> RET <input type="checkbox"/> KAPSAM DIŞI (GİRİŞİMSEL) <input type="checkbox"/> BİLİMSEL VE/VEYA ETİK KURALLARA AYKIRI <input type="checkbox"/> BİR SORUMLU ARAŞTIRMACININ (TEZ İSE TEZ DANIŞMANI), BİR TOPLANTIYA İKİ (2) ADETTE FAZLA ÇALIŞMA BAŞVURUSUNDA BULUNMASI <input type="checkbox"/> KURUM İÇİ BAŞVURULARINDA KURUMSAL E-POSTA HESABI İLE GİRİŞ YAPILMAMIŞ OLMASI <input type="checkbox"/> ŞARTLI KABULDE BELİRTİLEN REVİZYONLARIN ZAMANINDA VE/VEYA İSTENİLDİĞİ ŞEKİLDE YAPILMAMIŞ OLMASI
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Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu adına
Prof.Dr.Didem Özdemir ÖZENEN
Başkan

Curriculum Vitae

Personal Informations

Name	Beyza	Surname	Başer Öztürk
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Education

Degree	Department	The name of the Institution Graduated From	Graduation year
Doctorate			
Master			
University	Physiotherapy and Rehabilitation	Yeditepe University	2018
High school	Science	Kocaeli Atılım High School	2013

Languages	Grades (#)
English	92,5- YÖKDİL

All the grades must be listed if there is more than one (KPDS, ÜDS, TOEFL; EELTS vs),

Work Experience (Sort from present to past)

Position	Institute	Duration (Year - Year)
Physiotherapist	Romatem Kocaeli Hastanesi	2019-2021
Physiotherapist	SportsCareClinic	2021-2022
Lecturer	Biruni University	2022-

Computer Skills

Program	Level
Microsoft Office Programs	Excellent

*Excellent , good, average or basic

Scientific works

The articles published in the journals indexed by SCI, SSCI, AHCI

Articles published in other journals

Ozturk, B. B., & Oztürk, B.(2020). Evaluation of the Effects of Therapeutic Posture Exercise on Spine Problems with Digital Analysis Method. International Journal of Basic and Clinical Studies, 9(2),46-54.

Proceedings presented in international scientific meetings and published in proceedings book.

Journals in the proceedings book of the refereed conference / symposium

Others (Projects / Certificates / Rewards)
