CANAN EREN

PHYSICAL THERAPY AND REHABILITATION

MASTER THESIS

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T.C.

YEDITEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF PHYSICAL THERAPY AND REHABILITATION

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MASTER THESIS

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ADVISER
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İSTANBUL-2023

**TEZ ONAYI FORMU**

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Tez Sahibi : Fzt. Canan Eren

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ONAY
Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun ……tarih ve ..... sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ
Sağlık Bilimleri Enstitüsü Müdür

## 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 that has been accepted for the award of any other degree except where due acknowledgment has been made in the text.*

Canan EREN, PT.

## DEDICATION

I dedicate my thesis to my family who supported me. I would especially like to thank my mother, Elif Eren, and my father, Kani Eren, for their financial and moral support regarding my education. I would also like to thank my brother Mehmet Ali Eren and my husband Mazhar Yurdakul, who always supported me.

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## LIST OF SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| AETD | American Association of Hand Therapists |
| DGI | Dynamic Gait Index |
| $FEV_1$ | Forced Expiratory Volume in 1 Second |
| $FEV_1$/FVC | Tiffeneau Index |
| FRC | Functional Residual Capacity |
| FT | Fagerstrom Test For Cigarette Dependence |
| FVC | Forced Vital Capacity |
| HG | Hand Grip |
| HRQOL | Health-Related Quality of Life |
| MEP | Maximal Expiratory Capacity |
| MIP | Maximum Inspiratory Capacity |
| PEDro | Physiotherapy Evidence Database Scale |
| PFT | Pulmonary Functions Test |
| SF-12v2 | Short Form 12 item version 2 |
| TLC | Total Lung Capacity |
| TUG | Timed Up and Go Test |
| TUIK | Turkish Statistical Institute |
| WHO | World Health Organization |

## 1.INTRODUCTION AND PURPOSE

The World Health Organization describes biological aging as the buildup of cellular and molecular damage. At the cell level, tissues, organs, and other systems, the human body undergoes irreversible changes from birth.(1) A decline in physical stamina and an increase in disease risk go hand in hand with these changes. Over the age of 65, these considerable reductions in quality of life become increasingly obvious. According to the World Health Organization (WHO), persons 65 and older are considered young elderly, those 75 to 84 are considered "advanced elderly," and people 85 and above are considered very old. This is due to the fact that aging has several stages and is not a uniform time span.(2)

The fact that more than 10% of the population is above the age of 10 is another sign that the population is aging. In Turkey, the senior population is growing faster than all other age groups combined. Despite the fact that our nation is undergoing "demographic change" and appears to have a young population, there are actually quite a few elderly people (TUIK 2013). The old population in our nation, which is defined as those 65 and over, was 8 million 451 thousand 669 individuals in 2023, according data from the Turkish Statistical Institute (TUIK). From 8.5% in 2017 to 9.9% in 2023, the senior population's share of the overall population grew.

The majority of sensory impairments occur in adults 65 and older, particularly in low- and middle-income nations. The diseases that cause the greatest loss of function include those that cause osteoarthritis, diabetes, dementia, and loss of muscle strength, as well as those that cause back and neck pain, chronic obstructive pulmonary disease, depression, falls, and decreased joint mobility and cognitive capacity (3) Both older people and society suffer harmful effects from these disorders. For the sake of both national and global public health, this circumstance presents new and significant issues.

Blood oxygen carrying capacity, cardiac output, and respiratory muscle strength all fall as physical ability declines. Weak neurological processes have an impact on balance and raise the possibility of falling. Loss of strength in the musculoskeletal system, decreased flexibility, and low aerobic capacity are caused by fear of falling and other reasons that may lead to inactivity. (4)

A lower quality of life is a result of poor flexibility and an inability to manage daily activities.(5).Therefore, it is crucial to pinpoint the processes via which exercise and physical activity can enhance health, functional ability, quality of life, and independence in the population as people live longer. (6)

In recent years, elderly folks have become more and more interested in the practice of yoga. It is a form of practice that promotes both physical and mental well-being by combining breathing techniques with postures known as asana and pranayama (Harvard Health Publishing, 2021). According to research, yoga can enhance lung function, lung flexibility, and muscle strength, particularly in the respiratory muscles. In a study, Taylor et al. (2019) discovered that practicing tai chi and yoga helped older persons with their balance and decreased their chance of falling. (7)Yoga courses can also help older folks feel less isolated by fostering stronger social ties.

There are studies in the literature that recommend yoga for groups with particular ailments, such as kids, adults, or seniors. Numerous research have been done on the benefits of yoga for elderly people

With chronic illnesses. The purpose of this study is to examine the effects of yoga on respiratory indices, functional exercise capacity, dynamic balance, and quality of life in older, medically stable individuals over the age of 65.

Hypothesis 0 **(H0):** The benefits of yoga practice on respiratory indices, functional exercise capacity, dynamic balance, and quality of life among older adult are not significantly different.

Hypothesis 1 **(H1):** The effects of yoga practice on breathing parameters, functional exercise capacity, dynamic balance, and quality of life vary significantly between older adult.

## 2. THEORETICAL INFORMATION AND LITERATURE

### 2.1. AGING

Aging is a process that starts from the first moment of formation after fertilization in the mother's womb, is affected by physiological, pathological, psychological, sociological, environmental and genetic effects, and covers the physical and cognitive processes together, and continues until the end of human life. There are many definitions of aging that are largely similar to each other. According to the World Health Organization, biological aging has been defined as the accumulation of molecular and cellular damage. Andrew Clegg et al. defined the negative changes that occur in the system as a result of the weakening of homeostasis due to physiological or psychological stress and the depletion of homeostasis reserves as fragility.(8). Frailty is a state of increased sensitivity to poor resolution of homeostasis after a stressful event that increases the risk of adverse outcomes such as falls, delirium, and disability.

Affecting the musculoskeletal system leads to osteoporosis, loss of strength, and joint-related diseases. Dysfunctions of the neurological system can cause balance problems. Musculoskeletal and balance system involvement is one of the factors that increase the risk of falling in individuals over 65 years of age.(9)

Cardiorespiratory system health is related to breathing and heart. With increasing age, the working capacity of the lungs and the activity of the diaphragm muscle may decrease. This may cause performance losses and decrease in physical activity.(10)

> There are 3 systems that concern balance. The visual vestibular and proprioceptive systems are components of the balance system. The losses in these components with age affect the balance.(11)

#### 2.1.1. RESPIRATORY SYSTEM CHANGES IN AGING

Age-related changes in the chest wall: In normal functioning, the anteroposterior diameter of the chest cavity expands during inspiration, allowing lung capacity to increase. Chest wall compliance gradually decreases with age(12). Calcium buildup in the joints in the ribs, sternum, and vertebral column can cause decreased joint space and flexibility. Structural dysfunction of the vertebral disc may occur as a result of calcium deposition in the joints. Osteoporosis, which occurs as we age, can cause fractures in the spine. As a result, kyphoscoliosis and barrel chest anomalies may occur. After all these changes, the A-P diameter increases(13). This change in the chest wall is the result of adaptation, but the curvature of the diaphragm also changes. This change also affects the functioning and strength of the diaphragm muscle, which is the tissue that releases force.

Changes in respiratory muscle function: There are many muscles involved in respiration, diaphragm being the most fundamental one. It is known that the decrease in chest wall compliance and geometrical changes are related to decrease in diaphragm's force-generating prospects. Fibre tension of the diaphragm weakens and contraction-relaxation mechanism slows down. When compared with young population(mean age 29, range 21±40 yrs), diaphragm durability of the elder population (mean age 73, range 67±81 yrs) is found to be significantly weaker(14). Specifically in the elderly, respiratory system muscles and body properties are interrelated .There is a correlation between maximal inspiratory (MIP) or expiratory (MEP) pressures and lean body mass or body weight. It is probable that with aging, changes in the skeletal muscles have an impact on skeletal muscles that assist respiration. Maximal inspiratory pressure (MIP) decreases progressively after the age of 20, and Maximal expiratory pressure (MEP) decreases rapidly after the age of 50(15). Additionally, MIP and MEP in elderly are separately correlated with peripheral muscle strength (handgrip)(16). The following factors play a significant role in the age-related decline in muscular strength and peak tetanic tension: a loss of muscle mass (cross-sectional fibre area); a reduction in the quantity of muscle fibers; especially type II "fast twitch" fibres and motor units; neuromuscular junctional changes; loss of peripheral motor neurons combined with specific type II muscle fiber denervation(57).

### 2.1.2. MUSCULO-SKELETAL SYSTEM CHANGES İN AGING

The musculoskeletal system, which includes muscles, bones, joints, tendons, ligaments, fascia, and the neuromuscular interface, is incredibly functional and supports a person's stability, mobility, aerobic capacity, and anaerobic capacity as well as offering structural support for internal organs (58).

Age-related changes in the musculoskeletal system lead to sarcopenia, a loss of muscle strength and power, a reduction in muscle flexibility, and a loss of balance and coordination in the muscles. A decline in basal metabolic rate, an increase in fat mass, and a loss of bone mineral density are further age-related alterations(17).

Musculoskeletal problems like osteoarthritis, back pain, diabetes, obesity, and inflammatory illnesses may become more prevalent as a result of these alterations (59).

### 2.1.3. NEUROMUSCULER SYSTEM CHANGES IN AGING

Good balance is an important skill for daily living that requires complex integration of sensory information about the body's position relative to the environment and the ability to produce appropriate motor responses to control body movement. Balance requires contributions from vision, vestibular sense, proprioception, muscle strength and reaction time. The human bipedal posture is inherently unstable due to its inverted pendulum-shaped configuration (60). This imbalance is compensated by meticulous cooperative functions of the visual, vestibular, and somatosensory systems. Therefore, the deterioration of these functions due to aging significantly affects postural control in the elderly. One of the most well-known symptoms experienced by the elderly is increased body swaying when standing quietly compared to younger people. (18)

Due to the decrease in physiological functions due to aging, elderly individuals may be more affected during standing tasks. If we consider postural changes as responses

to avoid discomfort and fatigue, it is possible that older individuals show a higher frequency of postural changes during prolonged standing. (19)

Balance disorders represent a growing public health problem due to their association with falls and fall-related injuries, especially in regions where the population is largely elderly. One in every three people over the age of 65 living in the community falls at least once every year, and 10-15% of these falls are associated with serious injuries(20).

## 2.2. HEALTHY AGING

Slowing down cellular aging is just one of the things that can be done to minimize health-related problems. There are many systems in the human body that are grouped physiologically. The fact that each system works separately and is compatible with each other is one of the steps that prevent the occurrence of diseases.
Nutrition, sleep and exercise remain important to protect the physiological and psychological system and to age healthily(21).

### 2.2.1. EXERCISE

There is a strong relationship between maximum aerobic exercise capacity and the muscle strength and telomere length of the human body. Long-term physical exercise can increase the level of physical fitness to maintain telomere length and improve the health of the human body. Regular exercise eliminates fear of aging, including loss of function, in older adults (22).

### 2.2.2 EATING

Nutrition plays a key role for the human body at all ages. Studies continue on the importance of balanced and adequate nutrition for survival from birth, as well as growth, staying healthy and healthy aging(61).
In cases where there is no adequate and balanced nutrition in old age, the risk of many systemic diseases will increase and the speed of recovery will decrease. When necessary, additional nutrition is also essential to prevent functional decline and support the postoperative recovery process (62)
Frailty is one of the serious issues that determine the quality of life in old age, and malnutrition reduces this quality by increasing the risk of frailty(63).There are also studies showing that malnutrition in this age group can cause other health problems such as depression and cognitive decline.(64)

## 2.3. YOGA

Yoga originated in ancient India as a philosophical or spiritual practice to free its practitioners from suffering or illness (duhkha). Through coordinated breathing (pranayama), movement (asana), and meditation (dhyana), which has been shown to improve wellbeing and lessen stress, yoga unites the mind and body(23)

The Pranayama section includes various breathing techniques. The intensity and posture of breathing exercises may vary depending on the person's age, exercise capacity and health condition. Clients assume the poses in standing, sitting, prone or supine positions during the asana portion of the exercise(24).

### 2.3.1. Breathing Practice

All living organisms are supported by prana, which is their vital force and energy. You become strong and healthy as prana moves through your body's cells during breathing. By breathing properly, you may balance your body's prana and unblock any regions that may be obstructed. Your awareness of the flow of prana in your body will increase as a result of visualizing this energy flow. The three-part breath workout builds chest, lung, and diaphragm strength while expanding lung capacity(25)

The autonomic nerve system (ANS) is significantly impacted by pranayam (controlled rhythmic breathing). The physiology and psychology of the body are both impacted by breathing in both directions. Diaphragmatic breathing alters the ANS and Heart Rate Variability (HRV) and is influenced by the muscles employed, whether mouth or nose breathing is done, the frequency of breathing, and the depth of each breath. The metabolic and autonomic functions can even be affected by inhaling via a certain nostril, according to studies. Following Right Nostril Yogic Breathing, there is a considerable increase in systolic, diastolic, and mean blood pressure. Following Alternate Nostril Yogic Breathing, systolic and diastolic pressure declined; however, after Left Nostril Yogic Breathing, systolic and mean pressure decreased. Yoga breathing exercises that use only one nostril have a different effect on blood pressure because of this. These findings suggest possible therapeutic uses. (26)

The impact of yoga training on respiratory functions as forced expiratory volume (FEV), forced expiratory volume in one second (FEV1), and peak expiratory flow rate (PEFR) has been the subject of numerous studies (27).

## 3. MATERIAL AND METHODS

### 3.1. Subjects

20 volunteers aged 65 and over with stable medical conditions were included in this study. The study protocol was approved by Yeditepe University Ethics Committee (no:2020305Y0401).
Each patient gave informed written consent after hearing the study objectives and strategy. The Declaration of Helsinki was followed while conducting the study. Participants were also informed that they could leave the study at any time they wanted.
We analyzed power using the software G*Power version 3.1.9.2 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf Germany).A total of 20 cases with a power independence of 0.8 and alpha (α) error of 0.05 were identified for initial analysis.

#### 3.1.1. Inclusion Criteria

- Individuals over the age of 65
- Volunteering for research
- Being medically stable

#### 3.1.2. Exclusion Criteria

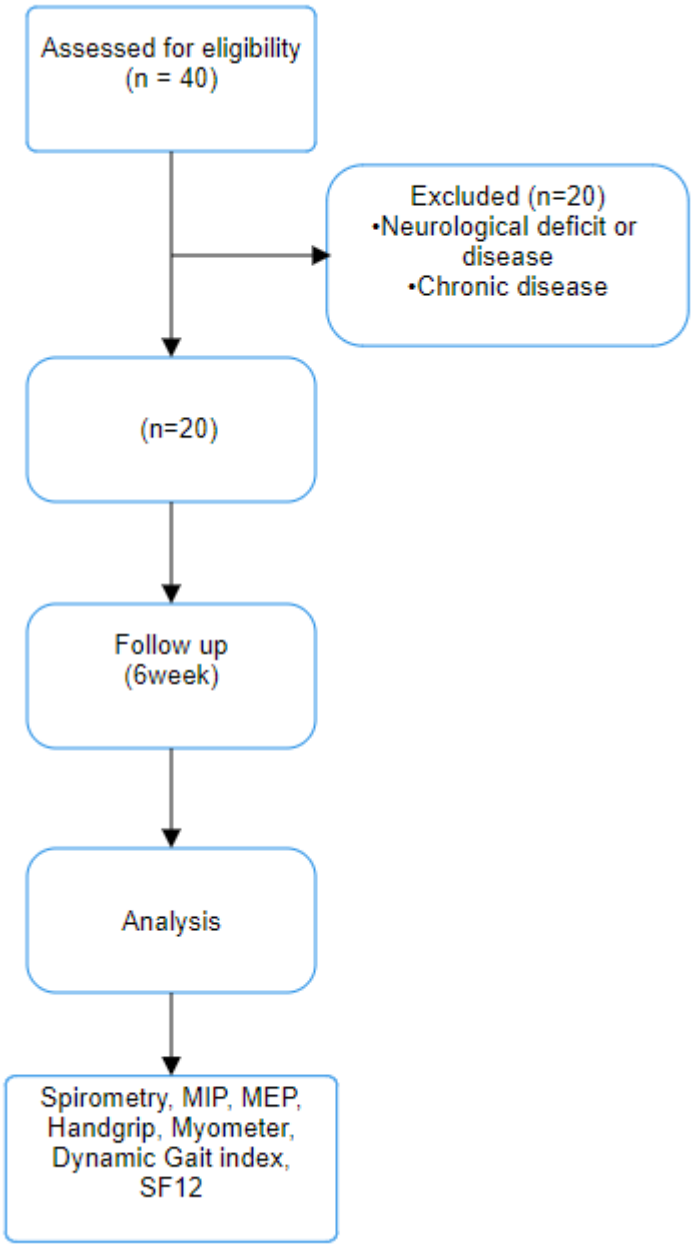
- Neurological deficit or disease
- Chronic disease
- People with total knee replacement
- People with total hip replacement

#### 3.1.3. Flow Chart: Study Process

Participants were recruited for the study between April 2023 and June 2023 among Abhyasa Physical Therapy Center clients. We invited all the clients who applied to our Physical Therapy center were invited to study. Clients who agreed to participate voluntarily were assessed for eligibility (n=40). We included 20 clients who met the criteria for inclusion in the study.

The volunteers were assessed in terms of pulmonary functions and respiratory muscle strength, including Maximum Inspiratory Pressure (MIP) and Maximum Expiratory Pressure (MEP), using a spirometer and respiratory pressure meter, respectively. Then, the time up and go test was performed and the dynamic walking index was checked. Hand grip muscle strength was evaluated with a hand dynamometer, and quadriceps muscle was evaluated with a myometer. Volunteers' HRQOL was assessed before and after with SF-12v2.

**Figure 2.6. Flow Chart**



### 3.1.4. Study Protocol

All the volunteers did Yoga exercises under the supervision of a certified Yoga Teacher Physiotherapist twice a week for six weeks. The Yoga exercise program consisted of Asana (Yoga postures) and Pranayama (Regulated rhythmic breathing). Data were collected from all patients at baseline and the end of the study (6 weeks)

## 3.2. Assessment Methods

### 3.2.1. Pulmonary Function Test

The subjects' pulmonary functions were assessed using the Medical International Research Spirodoc® Spiro spirometry. For each participant's measurement, we employed a unique disposable Medialp mouth filter. Before taking the measurements, the spirometry was calibrated in accordance with the recommendations of the American Thoracic Society and the European Respiratory Society. First, we explained the test to the participants and demonstrated it to them. We also showed them how to breathe only through their mouths, connect a nose clip, sit upright, straighten their posture, inhale quickly and fully, place the device in the proper place, and exhale maximally until no more air could be released. Participants have been guided and encouraged to push their boundaries while instructions have been reiterated at each stage. The subject was instructed to inhale deeply and exhale slowly. The individual was instructed to inhale deeply and forcefully expel for the entire six seconds that the instrument beeped. The top scores have been recorded after the testing movement has been performed at least three times. We recorded the subjects' FVC, FEV1, PEF, and FEV1/FVC values. **(Figure 3.1.)**(29)

**Figure 3.1. Spirometry Test**

### 3.2.2. Respiratory Muscle Strength Testing

Using a Micro Medical MicroRPM respiratory pressure meter, we assessed the r espiratory muscles' strength.According to ATS/ERS recommendations, maximum inhal ation and maximum expiration pressures (MIP and MEP) were measured.According to ATS/ERS statements, MIP and MEP vary depending on lung volume.This is caused by t he respiratory muscles' forcelength relationship and the fluctuating contribution of the re

spiratory system's passive elastic recoil pressure.By dividing the predicted value of the participants by their age, gender, and height, we were able to reduce the bias. Tests are conducted until the researcher is satisfied and the maximum value of three tests varies by less than 10%. Measurements require complete cooperation. The best result was noted. Before beginning, we performed a demonstration, and the researcher provided guidance at each stage. We measured using a nose clip, and while performing the tests in a comfortable sitting position, we instructed the participants to only breathe through their mouths. Participants have been encouraged and instructed to maintain airtightness during the test. The participant exhales until he reaches functional residual capacity (FRC), inserts the device into their mouth, and inhales for 1 to 3 seconds while exerting force. After the participant inhales to reach total lung capacity (TLC), they put the device in their mouth and vigorously exhale for 1 to 3 seconds to measure MEP. **(Figure 3.2.)(**30)


**Figure 3.2. Respiratory Muscle Strength Test [65]**

### 3.2.3. Timed Up and Go Test

Participants were instructed to get out of a conventional chair (seat height: 44–47 cm), walk three meters, then turn around and get back into the chair(40). They were instructed to put on comfortable shoes and refrain from using canes or other assistive equipment during the exam. The participants received no tangible support. The physiotherapist used a stopwatch to calculate the amount of time that had passed. The participants were informed about the test prior to the measurement, which was conducted following one trial(31).

### 3.2.4.Dynamic Gait Index

This index includes assessments for activities like walking on a level surface, varying walking speed, walking while turning, climbing stairs, and walking around obstacles(32). The range from "0 points" to "3 points" denotes the points' values. There are 8 categories, and the maximum possible score is 24. A score of 22 or higher means you can move around safely, whereas a score of 19 or lower means you run the risk of falling. The physiotherapist asked the questions directly to the patient, and the patient's responses were written down (APPENDIX D)

### 3.2.5.Hand Grip Muscle Strength Test

By asking the subjects which hand they favored for tasks requiring strength in their daily life and which hand they used for writing, it was possible to identify the dominant hand. The Jamar hand dynamometer, which has been endorsed by the American Association of Hand Therapists (AETD) and has been shown to have good validity and reliability in numerous investigations, was used to measure the strength of the hands' grips (13). The standard position advised by AETD for measuring hand grip and finger grip strength was a seated position with the shoulder in adduction, the elbow at 90˚ flexion, the forearm supported in midrotation, and the wrist in neutral. Three measures of the hand grip and finger grip strengths were taken during the test procedure, with a one-minute pause in between each measurement, and the averages were recorded. Hand grip strength has been discovered as a reliable test-retest measure and an indication of good physical performance in older persons(33).**(Figure 3.3.)**


**Figure 3.3. Hand Grip Strength Test**

### 3.2.6. Muscle Strength Assessment With Myometer

The Medical Council Research Scale, a manual muscle test measurement technique, is not accurate enough to be used as an objective measure of muscle strength. In comparison to manual muscle testing, the myometer analyzes muscle strength objectively and provides more accurate results. While the patient uses all of his force to push on the myometer, the physiotherapist provides resistance(34).

The patient is initially positioned for measurement. After that, the distal side of the area to be measured is where the myometer is placed. Force-exposed patients are instructed to hold their positions. The force application is halted and the maximum force measured by the device is reported when the patient is unable to continue the movement. The average of the test is recorded in kilos, with each measurement being done three times (35). **(Figure 3.4.)**


**Figure 3.4. Myometer Test**

### 3.2.7. Short Form 12v2 Health Survey

It was intended to use the SF-12v2 to gauge the participants' HRQOL. There are a total of 8 subdomains: social functionality, coping with emotional health problems, mental health(36), bodily discomfort, general health, vitality, and coping with physical health problems. There are 12 questions in the survey. Gündüz et al. provided the validity and reliability of the SF 12v2 in Turkey in 2021 (37). Better HRQOL is shown in higher scores (38). The researcher asked the survey questions to the participants face-to-face, and the responses were recorded (APPENDIX E)

# 4. INTERVENTION

All volunteers performed Yoga exercises twice a week for six weeks, under the supervision of a certified Physical Therapist Yoga Teacher. Compensation classes were held for those who could not come for any reason. Each participant completed a yoga session 12 times in total. The yoga exercise program consisted of Asana (Yoga postures) and Pranayama (Regular rhythmic breathing).

## 4.1. Yoga Practice

### 4.1.1. Asana

Asana (yoga postures) and pranayama (regular rhythmic breathing) were the two main components of yoga practice. The exercise starts with a standing warm-up, followed by weight transfers and relaxing breathing exercises. By contracting eccentrically, the spine and limbs flex and lengthen while remaining within the body's natural range of motion. The instructor will time the changes between postures to the zero resistance flow of the student's breathing. The asana practice included dynamic stretching, balance poses, and rotating spine motions supported by limb movements. Participants were warned not to hurt themselves while performing the poses or changing between them. When doing the pose, pain was used as a cue to quit exerting more force than the body could handle. Yoga courses were held in a hall on a yoga mat with participants having access to blankets, cushions, and yoga belts as needed. **(Table 4.1.)**

### 4.1.2. Pranayama

We practiced pranayama while seated on a yoga mat and inhaling through our noses (Ujjayi). In order to warm up the respiratory muscles, we started with three minutes of slow, deliberate diaphragmatic breathing. Following the warm-up, Box Breathing was performed by inhaling deeply for 4 seconds, holding the breath for 4 seconds, and then exhaling naturally for 4 seconds. We held the air for another 4 seconds after emptying our lungs, then we continued this cycle for about 3 to 5 minutes. Then, as we inhaled with anganyasa (putting the limbs on specific regions of the body), held it, and then exhaled again with limb movements coordinated with the breath, we used the arms and shoulders to assist further expand the chest and lungs. We practiced bee humming breathing, or Bhramari Pranayama. Participants closed their eyes and made five repeats of the "OM" sound with their throats as long as they could. In order to activate the diaphragm muscle and give the parasympathetic nervous system control over the cardiovascular system, we held the sound "MMM" while gently exhaling. **(Table 4.1.)**

### 4.1. EXERCİSE FREQUENCY, INTENSITY, TYPE, TIME

**Table 4.1.**

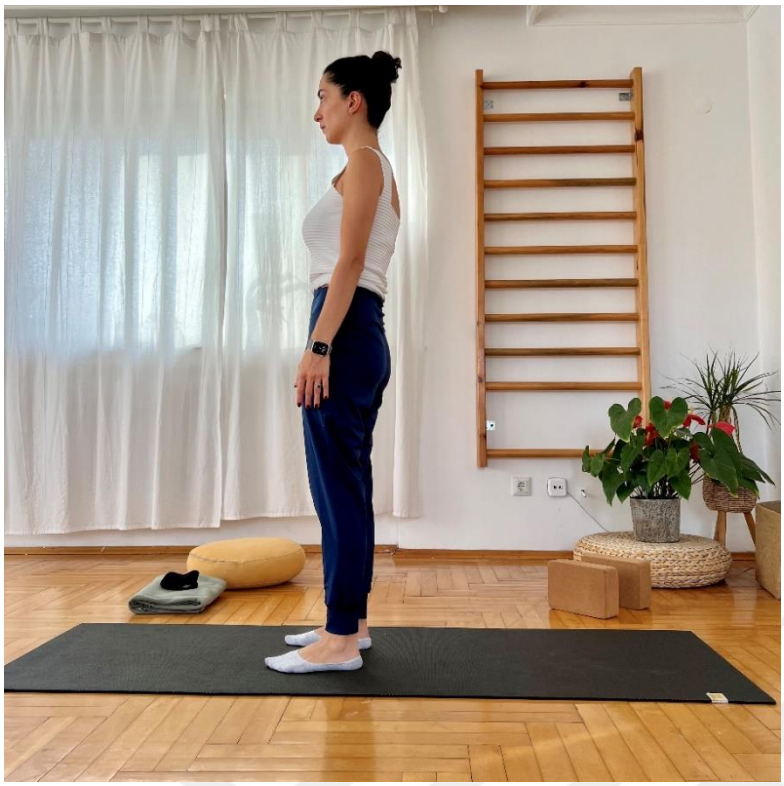
| | TYPE | INTENSITY | FREQUENCY |
|---|---|---|---|
| PRANAYAMA | a.Pranayama1 | 10 repeat | 6 WEEKS/2 TIMES |
| | b.Pranayama2 | 5 repeat | 6 WEEKS/2 TIMES |
| | c.Pranayama3 Nadi Shodhana | 10 repeat | 6 WEEKS/2 TIMES |
| ASANA | d.Bharmanasana (Table pose) | 5 repeat | 6 WEEKS/2 TIMES |
| | e.Tadasana | 10 repeat | 6 WEEKS/2 TIMES |
| | f.Adho Mukha Svanasana | 4 repeat | 6 WEEKS/2 TIMES |
| | g.Utkatasana | 2 repeat | 6 WEEKS/2 TIMES |
| | h.Virabhadrasana1 | 2 repeat | 6 WEEKS/2 TIMES |
| | i.Virabhadrasana2 | 2 repeat | 6 WEEKS/2 TIMES |
| | j.Vrksasana | 2 repeat | 6 WEEKS/2 TIMES |
| | k.Pigeon | 2 repeat | 6 WEEKS/2 TIMES |
| | l.Supta Padangustasana1 | 2 repeat | 6 WEEKS/2 TIMES |
| | m.Supta Padangustasana2 | 2 repeat | 6 WEEKS/2 TIMES |
| | n.Supta Padangustasana3 | 2 repeat | 6 WEEKS/2 TIMES |
| | o.Shavasana | 1 repeat | 6 WEEKS/2 TIMES |

a.Pranayama1

b.Pranayama2

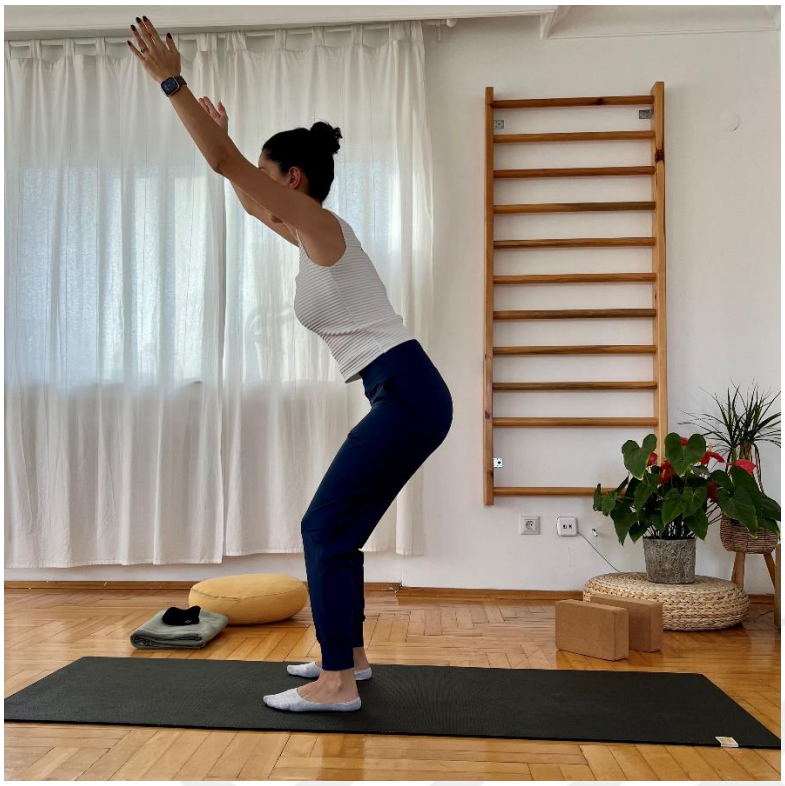
c.Pranayama3

d.Bharmanasana (Table pose)



e.Tadasana

f.Adho Mukha Svanasana



g.Utkatasana

h.Virabhadrasana1

i. Virabhadrasana2

j. Vrksasana

j. Vrksasana

j. Vrksasana

k. Pigeon pose

l. Supta Padangustasana1

m. SuptaPadangustasana 2

n.SuptaPadangustasana 3

o. Shavasana

## 5. RESULTS

Twenty people (18 women, 2 men, age mean±SD: 67.55 ± 1.791 years old) participated in this case study. Evaluations were made before and six weeks after yoga exercises.

### 5.1 Comparison of Gender, Demographic and Anthropometric

| **Variables** | **Mean** |
|---|---|
| **Age (Years)** | 67,55 ± 1,791 |
| **Gender N (%)**<br>**Kadın**<br>**Erkek** | <br>18 (90%)<br>2 (10%) |
| **Weight (kg)** | 64.30 ± 6.86 |
| **Height (m)** | 1.62 ± 0.05 |
| **BMI (kg/m$^2$)** | 24.46 ± 2.04 |

Data expressed as %, BMI: Body Mass Index, kg: Kilogram, m: meter, kg/m²: kilograms/meter square

### 5.2 Comparison of outcomes within group at baseline and post-intervention

The comparison of respiratory function and respiratory muscle strength of the group before and after the intervention is shown in Table 5.5. There was no statistically significant change in FEV1/FVC(%)(p=0.058), but there was no statistically significant change in FVC (p=0.001), FVC% (p=0.14), FEV1(p=0.001), FEV1% (p<0.001). ), MIP (p<0.001), MEP (p<0.001), TUG (p<0.001), DGİ (p<0.000), HG (p<0.000), MM (p<0.000), SF12 (p<0.001) A statistically significant increase was observed in the values.

| | **Baseline** | **After** | | |
|---|---|---|---|---|
| Variables | Mean ± SD | Mean ± SD | t | p value |
| FVC (L) | 2.76±0.28 | 2.96±0.27 | -12,910 | 0.001 |
| FVC (%) | 97.35±15.66 | 102.80±12.92 | -2,696 | 0.014 |
| $FEV_1$ (L/sec) | 2.05±0.30 | 2.24±0.30 | -10,782 | 0.001 |
| $FEV_1$ (%) | 89.10±12.22 | 97.50±12.48 | -9,669 | 0.001 |
| $FEV_1$/FVC | 72.70±6.67 | 74.95±5.45 | -2,019 | 0.058 |
| MEP | 74.20 ± 7.675 | 76.00 ± 7.987 | -8.461 | 0.001 |
| MIP | 65.50 ± 5.745 | 67.10 ± 5.884 | -5.812 | 0.001 |
| TUG | 12.390 ± 1.0234 | 11.795 ± 1.2450 | 4.731 | 0.001 |
| DGI | 16.40 ± 2.010 | 17.90 ± 2.751 | -4.807 | 0.000 |
| HG | 24.52±4.120 | 25.64±4.55 | -6,681 | 0.000 |
| MM | 62.48±4.61 | 65.57±4.52 | -6,705 | 0.000 |
| SF12 | 33.15 ± 1.618 | 34.25 ± 0.875 | 3.928 | 0.001 |

Paired sample t test mean ± Std. Deviation

Dependent Samples t test, SD: Standard Deviation, L: liters, L/sec: liters in 1 second FVC: force vital capacity, FEV1: forced expiratory volume in 1 second, FEV1/FVC: Tiffaneu Ratio MIP: Maximal Inspiratory Pressure, MEP: Maximal Expiratory Pressure, %: Percentage of the predicted by gender, age, and height, TUG: Timed Up and Go Test, DGI: Dynamic Gait Index, HG:Hand Grip, MM: myometer, , SF-12v2: Short Form 12v2 Health Survey

## 6. DISCUSSION

This study showed that respiratory muscle strength, functional exercise capacity, dynamic balance and quality of life increased statistically in healthy elderly individuals after 6 weeks of yoga practice.

Study results showed a statistical increase in respiratory muscle strength, FVC, FEV1 ratio as a result of yoga practices. Bezerra at al.showed the effects of 12-week yoga practice in 36 healthy women between the ages of 50 and 76. MIP,MEP showed significant improvements in ventilatory capacity (VC), respiratory rate and heart rate(41). Kuniko Yamamoto-Morimoto at al. performed asana and pranayama practice for 8 weeks with 28 participants who were healthy, inactive, and whose average age was 52,7. Only asana practice was added to 14 participants, and pranayama practice was added to the control group in addition to asana practice. As a result of the study, general respiratory and physical Improvement in functions was observed. However, MIP value improved only in the pranayama group (42). 46 healthy adults between the ages of 17 and 20 were shown the results of six weeks of yoga practice by Madanmohan et al. They discovered substantial increases in MIP, MEP, and respiratory muscle endurance, and they hypothesized that yoga training might have enhanced respiratory muscle endurance and strength, which might have resulted in a higher degree of breathing control under voluntary control(43). Obstructive sleep apnea syndrome was examined in 44 patients by Eyübolu et al. 22 patients received both exercise and yoga, while the other 22 received only exercise. For 12 weeks, the yoga program was practiced for 60 minutes each day. Respiratory muscular strength (MIP, MEP) was assessed at the start, midpoint, and end of the sixth and twelfth weeks. They discovered that MIP values dramatically increased. They discovered that yoga exercises will help patients with obstructive sleep apnea syndrome maintain their respiratory muscle power (44). A total of 60 healthy, sedentary adults between the ages of 20 and 45 were chosen, with 32 men and 28 women, according to Manoj T. Jiwtode and Mukesh Mahajan et al. After 45 minutes of yoga training five days a week for eight weeks, he discovered substantial variations in the Maximum Inspiratory Pressure (MIP) and Maximum Expiratory Pressure (MEP) parameters(45). Q R Ahmed and his friends practiced yoga for 1 hour a day with 50 clients aged between 30 and 50. There were two schedules for the study: 30 and 60 days. A multipurpose computerized spirometer was used to measure the respiratory parameters FVC, FEV1, PEFR, FEF(25-75%), and MVV. Lung metrics did not significantly improve after a month of practicing yoga (postures and pranayamas). However, after 60 days, or whether respondents maintained doing this for the following 30 days, significant changes were observed(46).When we look at the literature, research have looked into how yoga affects pulmonary function measures, usually in people with specific conditions, and have demonstrated its therapeutic benefits. In our study, older participants with stable medical conditions dramatically improved their respiratory metrics after practicing yoga. We know that there are studies showing the decrease in musculoskeletal system and lung functions with aging, and we think that breathing practices in yoga can prevent this decrease and be a protective approach.

Masoumeh Koohboomi et al. conducted a 6-week yoga practice with 45 women aged between 58 and 70, all of whom were in good general health. The application included asanas for 45 minutes two days a week. Measurements were taken before the beginning of the study and at the end of the 6th week. They found a significant difference in the timed up and go test (47). Kelley et al. conducted a study of older adults for 60 minutes

twice a week for a total of 12 weeks. All 13 participants attended at least 19 of 24 lessons (80% participation). Statistically significant test results in Timed Up and Go test (p = 0.045). improvements were seen(48). Krishna Ketan Patel et al. conducted a study involving 40 participants, healthy older adults between the ages of 60-75. participants were divided into 2 groups. Asana practices were applied to the experimental group 5 times a week for a total of 4 weeks. No intervention was made to the control group. When comparison was made with the control group at the end of 4 weeks, a significant difference was observed in the tug values of the yoga group(49). 8 application participants with an average age of 84 and 8 control participants with an average age of 81 were selected for the study. Participants were included in an 80-minute yoga practice twice a week for 8 weeks. tug test results showed significant improvement at the end of 8 weeks.Irene Hamrick et al. In their study with 154 participants with an average age of 44, half of the group practiced a total of 16 sessions of yoga for 8 weeks and the other half did not do any yoga practice. They found a significant difference in dynamic gait index test results before and after the study (50). When we examine the articles, we can see the studies on fall risk. We can see tug test and dgi in many studies in the literature, both in terms of not needing equipment and in terms of their reliability. In our study, significant differences were observed in both the tug test and dgi in all of our participants after 6 weeks of yoga practice. The movements in the asana part of yoga practices vary, such as prone, supine, sitting, standing on one leg. These poses provide many benefits to the system regarding balance, both proprioceptively and vestibularly. We think that yoga practices can have positive effects on these systems, which are negatively affected by aging, as well as on an inactive lifestyle, and can reduce the risk of falling by positively affecting balance.

Madanmohan et al. They formed two groups with 46 people aged between 17 and 20. 23 people practiced yoga and the other group was the control group. Hand grip strength was measured before and after the 6-week study. Significant differences were found between the results (51). M. dash et al. The study was conducted with 3 different groups consisting of 37 adults, 86 children and 20 patients with rheumatoid arthritis. An equal number of 3 different groups that did not do yoga were included in the study as a control group. Yoga and control group subjects were evaluated after 30 days for adults, after 10 days for children, and after 15 days for patients. Hand grip strength, measured with a grip dynamometer of both hands, increased after yoga in normal adults, children, and rheumatoid arthritis patients.(52). Dinesh et al. 91 adults were randomized into slow pranayama (SPG) (n=29), fast pranayama (FPG) (n=32), and control (CG) (n=30) groups. Yoga classes were held three times a week for 30 minutes for 12 weeks. Hand grip strength (HGS) parameters were recorded using a hand grip dynamometer at baseline and after 12 weeks of pranayama training, and significant differences were found between the results(53). When we examine the literature, there are studies showing that hand grip strength and endurance increase with yoga exercises. There are also studies explaining the relationship between hand grip strength and sarcopenia. (Strength and Function Response to Clinical Interventions of Older Women Categorized by Weakness and Low Lean Mass Using Classifications From the Foundation for the National Institute of Health Sarcopenia Project Maren S. Fragala)(Yoga education program for older women diagnosed with sarcopenia: A multicity 10-year follow-up experiment Samta P. Pandya). Menek et al. They included 50 individuals diagnosed with type 2 DM, aged between 30 and 65, in their study. Aerobic and strengthening exercises were applied 3 days a week for 12 weeks, and quadriceps muscle strength was measured before and 12 weeks after the application. They found significant differences between the results (65). Evaluation

of muscle strength with myometer in yoga practice studies in healthy elderly individuals is limited in the literature. We think that the strength of this muscle can be increased with leg exercises and single-leg asanas aimed at increasing the strength of the quadriceps muscle in the asana part of yoga. In our study, it was aimed to increase peripheral muscle strength by activating the core muscles during 6 weeks of yoga practices and to increase hand grip strength with poses in which the hands transfer weight on the yoga mat.
De manincor et al. A sample of 101 people with anxiety symptoms performed a 6-week randomized controlled trial. Yoga practices were applied in addition to their ongoing treatment. SF-12 results were not significantly different at the end of the study (54)(55).Benavidez et al. examined a total of 36 studies in their meta-analysis on pg-12, pg36 and yoga. These reviews found a significant difference regarding the effectiveness of yoga in improving health-related quality of life. Therefore, they thought it would be important for yoga scientists and practitioners to understand its effects on health-related quality of life(56). Banth et al. They created two groups in their study with 188 women aged between 30 and 45. One group was given 30-45 minutes of home exercises, and the other group was given awareness-based stress reduction exercises in addition to home exercises. At the end of 8 weeks, significant differences were found in the SF-12 survey results (39). When we look at the studies, we see that the Sf12 questionnaire is used after yoga practices because it is easy to apply, valid and understandable for elderly patients. In our study, we used the short form of this questionnaire on elderly individuals over 65 years of age and found significant differences in the analysis results..

## 7. CONCLUSION

As a result, we can think that Yoga training can improve general health, lung parameters, balance, muscle strength and quality of life in the elderly. Including breathing exercises has a positive effect on lung parameters, at the same time, activation of the diaphragm muscle positively affects core stabilization and contributes to balance. In asana practices, the musculoskeletal and vestibular system is supported from different angles in different sitting and standing positions. It has been reported in many studies in the literature that participating in a regular exercise program and group work have positive effects on the quality of life. We think that yoga is a practical and therapeutic model that can be applied in daily life among healthy elderly individuals and prevents the negative effects of old age.

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**Conflict of interests**
The author declares no conflict of interest.

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# APPENDIX A: ETHICAL COMMITTEE APPROVAL



T.C.
YEDİTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜ
Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu

Sayı : E.83321821-805.02.03-199
Konu : Etik Kurul Karar Yazısı

Sayın Dr. Öğr. Üyesi Elif Develi

Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kuruluna etik onay için başvuru yapılmış olan araştırma önerisinin başlığı, araştırmacılar, başvuru numarası, sunulan belgeler ve toplantı bilgileri aşağıda yer almaktadır. İlgili araştırma önerisi, etik kurulumuz üyeleri tarafından değerlendirilmiş olup, etik ve bilimsel açıdan **UYGUN** olduğuna karar verilmiştir.

| | |
|---|---|
| **Araştırma Başlığı:** | Yaşlı Bireylerde Yoganın Solunum Parametreleri, Fonksiyonel Egzersiz Kapasitesi, Dinamik Denge ve Yaşam Kalitesi Üzerine Etkisi |
| **Araştırmacılar:** | Fzt.Canan Eren,Dr.Öğr.Üyesi Elif Develi |
| **Başvuru Numarası:** | 202305Y0401 |

| **TOPLANTI BİLGİLERİ** | | | |
|---|---|---|---|
| **Toplantı Tarihi:** | 12.05.2023 | **Toplantı Yeri:** | Çevirim içi (Google Meet) |

| **SUNULAN BELGELER** |
|---|
| Islak imzalı başvuru dosyası, CD veya USB belleğe kaydedilmiş başvuru dosyası ve elektronik başvuru |
| Araştırma başlığı ve araştırmacıların isimleri |
| Başvuru dilekçesi |
| Başvuru formu |
| Araştırmanın; |
| • Niteliği |
| • Önemi ve özgün değeri |
| • Amaç ve hedefleri |
| • Yöntemi |
| • Yönetimi |
| • Yaygın etkisi |
| • Araştırma bütçesi (Mevcutsa) |
| • Süresi ve uygunluğu (Zaman cetveli) |
| • Kaynakları |

Bu belge, güvenli elektronik imza ile imzalanmıştır.
Belge Doğrulama Adresi : http://belgedogrulama.yeditepe.edu.tr/bg.aspx?id=A35361AE-873E-4E6C-82E6-154B081FA575

Yeditepe Üniversitesi 26 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755
Ataşehir / İSTANBUL
Telefon No: (0216) 578 00 00 Faks No : (0216) 578 02 99
İnternet Adresi www.yeditepe.edu.tr
Kep Adresi : yeditepeuniversitesi@hs03.kep.tr

Bilgi İçin: Sevgi BAYRAKTAR
Unvan: Uzman Yardımcısı
Telefon No: (0216) 578 00 00 / 6347

| |
|---|
| Bilgilendirilmiş Gönüllü Olur Formu (yapılan araştırmaya özel olarak hazırlanmış) |
| Taahhütname-1<br>Araştırmanın yapılacağı kurumdan izin alma sorumluluğunun araştırmacılara ait olduğuna dair taahhüt |
| Taahhütname-2<br>Dünya Tıp Birliği Helsinki Bildirgesinin son versiyonunun ve Sağlık Bakanlığı'nın ilgili tüm kılavuzlarının okunmasına dair taahhüt |
| Taahhütname-3<br>Daha önce yapılmış etik kurul başvuruları mevcut olup olmadığına dair taahhüt |
| Taahhütname-4<br>Araştırma sırasında araştırma bütçesinde yer almayan ve gönüllünün kendisine veya Sosyal Güvenlik Kurumuna ek yük getirecek hiçbir işlem uygulanmayacağına dair taahhüt |
| Taahhütname-5<br>COVID-19 hastalarında tedavi yaklaşımları ve bilimsel araştırmalar genelgesi okunmasına dair taahhüt |
| Taahhütname-6<br>Millî Eğitim Bakanlığı Araştırma Uygulama İzinleri konulu yazının okunmasına dair taahhüt |
| Araştırmacıların her birisine ait özgeçmiş formu |
| Ek belgeler (Varsa kullanılan ölçek) |

Prof. Dr. Didem ÖZDEMİR ÖZENEN
Başkan

Doç. Dr. Gökhan ERTAŞ
Başkan Yardımcısı

Doç. Dr. Elif SUNGURTEKİN EKÇİ
Raportör

Prof. Dr. Feryal SUBAŞI
Üye

Doç. Dr. Binnur OKAN BAKIR
Üye

Dr. Öğr. Üyesi Emine Nur ÖZDAMAR
Üye

Dr. Öğr. Üyesi Sevim ŞEN OLGAY
Üye



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Telefon No: (0216) 578 00 00 / 6347

## APPENDIX B: INFORMED WRITTEN CONSENT

**Araştırmanın adı:** Yaşlı Bireylerde Yoganın Solunum Parametreleri, Fonksiyonel Egzersiz Kapasitesi, Dinamik Denge ve Yaşam Kalitesi Üzerine Etkisi.

Sayın Katılımcı,

Yukarıda adı yazılı araştırmaya katılmak üzere davet edilmiş bulunmaktasınız. Çalışmaya katılıp katılmama kararı tamamen size aittir. Katılmak isteyip istemediğinize karar vermeden önce araştırmanın neden yapıldığını, bilgilerinizin nasıl kullanılacağını, çalışmanın neler içerdiğini, olası yararları ve risklerini ya da rahatsızlık verebilecek yönlerini anlamanız önemlidir. Lütfen aşağıdaki bilgileri okumak için zaman ayırınız. Sorularınız olursa çekinmeden sorunuz ve açıklayıcı yanıtlar isteyiniz.

Bu araştırma ile 65 yaş ve üzeri medical durumu stabil bireylerin 6 haftalık yoga uygulaması ile solunum kas gücü, solunum fonksiyonları, fonksiyonel hareketliliği, yürüyüşün uyum kapasitesini, bacak kas gücünü, el kavrama kuvvetini ve yaşam kalitesini gözlemlemek amaçlanmıştır. Solunum sistemlerinizi değerlendirmek için iki ayrı cihaza nefesinizi almanız ve vermeniz istenecek, sonrasında ölçümleriniz kaydedilecektir. Sizin için belirlenmiş bir mesafeyi sandalyeden kalkarak yürümeniz ve geri dönerek tekrar oturmanız istenecektir. Bacak kas gücünüz cihaz yardımı ile değerlendirilecek ve kaydedilecektir. El kavrama kuvvetinizi dominant eliniz belirlenerek ölçülecek, ölçüm 3 kez tekrarlanacak ve en iyi sonuç kaydedilecektir. Yürüyüşünüz ile ilgili ve yaşam kaliteniz ile ilgili soruları içeren anketi doldurmanız istenecektir. Sizden bu çalışmada ölçümleri yapmak için uygulamalar başlamadan önce 1 saat, uygulamalar bittikten sonra 1 saat ayırmanız istenecektir. Egzersiz seanslarımız haftada 2 gün 1'er saat belirlenmiş gün ve sattlerde 6 hafta sure boyunca yapılacaktır. Egzersiz seanslarımız sırasında sırayla belirli duruşlar, dinamik hareketler ve nefes egzersizleri uygulanacaktır. Egzersiz seanslarına katılım zorunludur. Bunun size ve yakınlarınıza hiçbir zararı olmayacaktır. Çalışmaya katılmakta parasal yük altına girmeyeceksiniz ve size de herhangi bir ödeme yapılmayacaktır.

Bu çalışmaya katılıp katılmamakta tümüyle özgürsünüz. Gerek duyduğunuz tüm bilgileri istemeye ve doğru, açık, anlaşılır bilgi almaya hakkınız vardır. Gerekli gördüğü takdirde araştırmanın herhangi bir kısmında katılımcı araştırmadan çıkabilir, araştırmacı çalışmayı sonlandırabilir. Araştırmanın tüm aşamalarında klinik bilgileriniz gizli tutulacaktır. Araştırma kapsamında elde edilen bilgiler bilimsel amaçlarla kullanılabilir, gizlilik kurallarına uyulmak kaydıyla sunulabilir ve yayınlanabilir.

Yukarıda yer alan ve araştırmaya başlamadan önce katılımcılara verilmesi gereken bilgileri içeren metni okudum (yada sözlü dinledim). Araştırma kapsamında elde edilen şahsıma ait bilgilerin bilimsel amaçlarla kullanılmasını, gizlilik kurallarına uymak kaydıyla sunulmasını ve yayınlanmasını, hiçbir baskı ve zorlama altında kalmaksızın kendi özgür irademle kabul ettiğimi beyan ederim.

İmza/Tarih İmza/Tarih

Katılımcı Adı Soyadı Araştırma Yürütücüsü Adı Soyadı

İmza/Tarih Tanık Adı Soyadı

## APPENDIX C: STRUCTURED QUESTIONNAIRE


Ad Soyad:

Yaş: Kilo: Boy:

Telefon Numarası:

Cinsiyetiniz: Kadın□ Erkek□ Belirtmek istemiyorum□

Eğitim durumunuz: Okuryazar değil□ İlköğretim□ Lise□
Üniversite ve üzeri□

Mesleğiniz:

Sistemik hastalığınız var mı? □Evet □Hayır Varsa: Nelerdir?

İlaç kullanıyor musunuz? □Evet □Hayır Kullanıyorsanız: Nelerdir?
Ne zamandır?

Son 3 aydır düzenli egzersiz yapıyor musunuz? □Evet □Hayır
Yapıyorsanız: Nelerdir? Haftada kaç gün ve kaç dakika?

Aşı oldunuz mu? Olduysanız ne zaman ve kaç doz?

**YARDIMLARINIZ İÇİN TEŞEKKÜRLER.**

## APPENDIX D: DYNAMİC GAİT İNDEX
## DİNAMİK YÜRÜME İNDEKSİ

A.Yürüme seviyesi düzeyi emir: normal yürüme hızında ilerideki noktaya yürü (20').

3 Normal: 20' yürüme, yardımcı cihaz yok, iyi hızda, imbalans yok, normal yürüme paterninde.

2 hafif yetmezlik: 20' yürüme, yardımcı cihaz kullanır, düşük hızda, hafif yürüme deviasyonu.

1 Orta yetmezlik: 20' yürüme, düşük hızda, anormal yürüme paterni, denge kaybı var.

0 Şiddetli yetmezlik: 20' yürüyemez, yardımlı yürür, şiddetli yürüme deviasyonu veya imbalans var.

B.Yürüme hızında değişiklik emir: normal hızda başlangıç, "yavaş" dedikten sonra yürüyebildiği kadar yavaş yürüyüş.

3 Normal: denge kaybı, deviasyon olmadan yürüme hızını değiştirebilir.

2 Hafif yetmezlik: hızını değiştirebilir, Takat hafif yürüyüş deviasyonu gösterir veya yürüyüş deviasyonu yoktur fakat belirgin bir yürüme
hızına ulaşamaz veya yardımcı cihaz kullanır.

1 Orta yetmezlik: belirgin yürüyüş deviasyonuyla hız değişikliği yapar, hızını değiştirir fakat dengesini kaybeder ama toparlayıp yürümeye
devam edebilir.

0 Şiddetli yetmezlik: yürüme hızını değiştirmez veya dengesini kaybeder, düşmeye yakın hal alır.

C.Horizantal baş hareketiyle yürüyüş emir: normal hızda yürümeye başlar, "sağa bak" "sola bak"" ileriye bak" emriyle yürümeye
devam edilir.

3 Normal: yürümede değişiklik yapmadan baş hareketlerini yapabilir.

2 Hafif yetmezlik: yürüme hızında hafif değişikliklerle baş dönmesi hareketlerini yapabilir. (Yürüme paterninde minör bozulmalar veya
yürüme yardımı alır).

1 Orta yetmezlik: yürüme hızında orta değişikliklerle baş dönmesi hareketlerini yapar, yavaşlayarak, fakat toparlayabilir ve yürümeye devam
edebilir.

0 Şiddetli yetmezlik: yürüme şiddetli bozulmalarla emirlere uyar (yürümede 15 derece sapmalar, denge kaybı, duraklama, duvara uzanma).

D.Vertikal baş hareketleriyle yürüme: emir: normal hızda yürümeye başlar, "yukarı bak" "aşağı bak" "karşıya bak" emrine kadar bu
şekilde yürümeye devam eder ve emirden sonra bakarak yürümeye devam eder.

3 Normal: yürümede değişiklik olmadan emirlere uyar.

2 Hafif yetmezlik: yürüme hızında hafif değişikliklerle emirlere uyar, (yürüme paterninde minör bozulma veya yardım ihtiyacı duyar).

1 Orta yetmezlik: yürüme hızında orta değişimle emirleri yapar, fakat toparlayıp yürümeye devam edebilir.

0 Şiddetli yetmezlik: yürümede şiddetli bozulma ile emirlere uyar (yürümeden 15 derecelik sapma, denge kaybı, duvara uzanmak için durma).

E.Yürüme ve pivot dönüş emir: normal hızda yürümeye başlar, “dur ve geri dön" emriyle hemen geri döner ve durur.

3 Normal: 3 sn. içinde dönüp durur ve denge kaybı yaşamaz.

2 Hafif yetmezlik: 3 sn.den fazla sürede dönüp durur fakat denge kaybı yaşamaz.

1 Orta yetmezlik: Yavaş döner, sözel işaretleme gerektirir, dönüş ve durma sonrasında dengeyi yakalamak için birkaç küçük adım gerektirir.

0 Şiddetli yetmezlik: güvenli dönmez, durmak ve dönmek için yardım gerekir.

F.Engel üzerinden atlama emir: normal hızda yürümeye başlar, bir kutuya denk gelince üzerinden atlar ve yürümeye devam eder.

3 Normal: yürüme hızını değiştirmeden engeli aşar ve imbalans yaşamaz.

2 Hafif yetmezlik: kutuyu güvenle aşabilir, fakat yavaşlar.

1 Orta yetmezlik: durduktan sonra engeli aşabilir, sözel em ire ihtiyaç duyar.

0 Şiddetli yetmezlik: yardımsız başaramaz.

G.Engeller etrafında adım alma emir: normal hızda yürümeye başlar, ilk engele gelince sağ tarafından döner, ikinci engele gelince sol
tarafından döner.

3 Normal: hızını değiştirmeden engellerin etrafından döner, denge kaybı yoktur.

2 Hafif yetmezlik: yavaşlayarak engellerin etrafında döner.

1 Orta yetmezlik: belirgin olarak hızını yavaşlatır, sözel emir gerekebilir.

0 Şiddetli yetmezlik: engelleri geçemez, çarpabilir veya fiziksel yardım gerekebilir.

H.Merdiven emir: merdivenleri çıkıp geri döner ve aşağı iner.

3 Normal: alternatif adımlarla yardım almadan çıkar.

2 Hafif yetmezlik: alternatif adımlarla yardım alarak çıkar.

1 Orta yetmezlik: tek tek adım alarak yardımla çıkar.

0 Şiddetli yetmezlik: güvenli çıkamaz

## APPENDIX E: SHORT FORM 12V2 HEALTH SURVEY
## SF-12v2 SAĞLIK ANKETİ

A. Genelde, sağlığınız;
   1. Mükemmel
   2. Oldukça iyi
   3. İyi
   4. Orta
   5. Kötü

Aşağıdaki maddeler, tipik bir gün sırasında yapabileceğiniz etkinlikler hakkındadır. Sağlığınız, bu etkinlikleri yaparken size kısıtlıyor mu? Eğer kısıtlıyorsa, ne kadar?

B. Öncelikle orta düzeydeki etkinlikler sırasında; örneğin: Masayı çekerken, elektrik süpürgesi kullanırken, yürüyüş yaparken sağlığınız sizi ne ölçüde kısıtlıyor?
   1. Çok kısıtlıyor
   2. Az kısıtlıyor
   3. Hiç kısıtlamıyor

C. Merdiven çıkarken sağlığınız sizi ne ölçüde kısıtlıyor?
   1. Çok kısıtlıyor
   2. Az kısıtlıyor
   3. Hiç kısıtlamıyor

D. Son dört hafta boyunca, fiziksel sağlığınıza bağlı olarak beklenenden daha az iş yaptığınız oldu mu?
   1. Hayır
   2. Evet

E. Son dört hafta boyunca, fiziksel sağlığınıza bağlı olarak, düzenli etkinlikleriniz veya işinizde kısıtlandığınız oldu mu?
   1. Hayır
   2. Evet

F. Son dört hafta boyunca, kendinizi depresif (çökkün) veya kaygılı hissetmek gibi duygusal bir sorun sonucunda beklenenden daha az is yaptıgınız oldu mu?
   1. Hayır
   2. Evet

G. Son dört hafta boyunca, kendinizi depresif (çökkün) veya kaygılı hissetmek gibi duygusal bir sorun sonucunda düzenli etkinlikleriniz veya isinizde her zamanki kadar dikkatli olamadığınız oldu mu?
   1. Hayır
   2. Evet

H. Son dört hafta boyunca, evde ve iste ne ölçüde agrı normal islerinize engel oldu?
   1. Hiç
   2. Hafif
   3. Orta
   4. Oldukça fazla
   5. Aşırı derecede

Asagıdaki sorular son dört haftada kendinizi nasıl hissettiginiz ve islerin nasıl gittigi ile ilgilidir. Her bir soru için size en yakın seçenegi isaretleyiniz.

I. Son dört hafta boyunca ne kadar sıklıkla kendinizi sakin ve huzurlu hissettiniz?
   1. Her zaman
   2. Çoğu zaman
   3. Ara ara
   4. Bazen
   5. Zamanın çok az bir kısmında
   6. Hiçbir zaman

J. Son dört hafta boyunca ne kadar sıklıkla enerji doluydunuz?
   1. Her zaman
   2. Çoğu zaman
   3. Ara ara
   4. Bazen
   5. Zamanın çok az bir kısmında
   6. Hiçbir zaman

K. Son dört hafta boyunca ne kadar sıklıkla kendinizi çökkün hissettiniz?
   1. Her zaman
   2. Çoğu zaman
   3. Ara ara
   4. Bazen
   5. Zamanın çok az bir kısmında
   6. Hiçbir zaman

L. Son dört hafta boyunca ne kadar sıklıkla fiziksel saglıgınız veya duygusal sorunlarınız, arkadas veya akraba ziyareti gibi sosyal etkinliklerinizi olumsuz etkiledi?
   1. Her zaman
   2. Çoğu zaman
   3. Bazen
   4. Zamanın çok az bir kısmında
   5. Hiçbir zaman

# APPENDIX F: CURRICULUM VITAE

**Kişisel Bilgiler**

| | | | |
|---|---|---|---|
| **Adı** | Canan | **Soyadı** | Eren |

**Öğrenim Durumu**

| Derece | Alan | Mezun Olduğu Kurumun Adı | Mezuniyet Yılı |
|---|---|---|---|
| **Doktora** | | | |
| **Yüksek Lisans** | | | |
| **Lisans** | Fizyoterapi ve Rehabilitasyon | **Dokuz Eylül Üniversitesi** | 2015 |
| **Lise** | Matematik-Fen | **Malatya Anadolu Lisesi** | 2010 |

| Bildiği Yabancı Dilleri | Yabancı Dil Sınav Notu (#) |
|---|---|
| | |

**İş Deneyimi (Sondan geçmişe doğru sıralayın)**

| Görevi | Kurum | Süre (Yıl - Yıl) |
|---|---|---|
| Kurum Sahibi, Fizyoterapist | Abhyasa Fizyoterapi Danışmanlık Merkezi | 2019-Devam ediyor |
| Fizyoterapist | Fiziform Sağlıklı Yaşam Merkezi | 2016-2018 |
| Fizyoterapist | Özel Yorum Özel Eğitim ve Rehabilitasyon Merkezi | Ocak-Haziran 2016 |

**Bilimsel Çalışmaları**

**SCI, SSCI, AHCI indekslerine giren dergilerde yayınlanan makaleler**

| |
|---|
| |
| |

**Diğer dergilerde yayınlanan makaleler**

| |
|---|
| |
| |

**Uluslararası bilimsel toplantılarda sunulan ve bildiri kitabında (*Proceedings*) basılan bildiriler**

| |
|---|
| |
| |

**Hakemli konferans/sempozyumların bildiri kitaplarında yer alan yayınlar**

| |
|---|
| |
| |

**Diğer (Görev Aldığı Projeler/Sertifikaları/Ödülleri)**