T.C.

YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF SPORTS PHYSIOTHERAPY

EFFECTS OF YOGA ON PULMONARY PARAMETERS, POSTURE, BODY AWARENESS AND QUALITY OF LIFE AMONG CHRONIC SMOKERS

MASTER OF SPORTS PHYSIOTHERAPY THESIS

CANER ÖZBEK, PT

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İSTANBUL-2023

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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.

Caner Özbek, PT.

DEDICATION

I dedicate this to my family, for your constant love, support and encouragement.

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LIST OF SYMBOLS AND ABBREVIATIONS

ANB	Alternate Nostril Breathing
ANS	Autonomic Nervous System
ATS	American Thoracic Society
BAQ	Body Awareness Questionnaire
CG	Control Group
COPD	Chronic Obstructive Pulmonary Disease
DRG	Dorsal Respiratory Group
ERS	European Respiratory Society
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
HRV	Heart Rate Variability
MEP	Maximal Expiratory Capacity
MIP	Maximum Inspiratory Capacity
NO	Nitric Oxide
NRT	Nicotine Replacement Therapy
NYPRC	New York Posture Rating Chart
PEF	Peak Expiratory Flow
PFT	Pulmonary Functions Test
PTSD	Post-traumatic stress disorder
RCT	Randomized Controlled Trial
ROS	Reactive Oxygen Species
SG	Smokers Group
SPSS	Statistical Package Analysis for Health Sciences
TLC	Total Lung Capacity
TSROM	Thoracic Spine Torsional Range of Motion
TSROM L	Thoracic Spine Torsional Range of Motion to Left
TSROM R	Thoracic Spine Torsional Range of Motion to Right
VRG	Ventral Respiratory Group
WHOQOL-BREF	World Health Organisation Quality of Life Short Form

ABSTRACT

Özbek, C. (2023). Effects of Yoga on Pulmonary Parameters, Posture, Body Awareness and Quality of Life Among Chronic Smokers.
Yeditepe University Institute of Health Sciences, Department of Sports Physiotherapy Master Thesis, Istanbul.

The aim of the study was to evaluate the effects of yoga practice on pulmonary parameters, respiratory muscle strength, posture, body awareness, and quality of life among chronic smokers. This case-control study included 28 volunteers who were divided into the Smokers Group (SG)(n=14) and Control Group (CG)(n=14) according to Fagerström Cigarette Dependence Test (FT). All the participants did Yoga exercises, including active movements and poses while standing(Asana) and voluntarily regulated breathing(Pranayama) practice twice a week for six weeks. All 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. Moreover, Posture, body awareness, and quality of life were evaluated using the New York Postural Rating Chart (NYPRC), Thoracic Spine Range of Motion (TSROM), Body Awareness Questionnaire(BAQ), and World Health Organisation Quality of Life(WHOQOL-BREF) questionnaire before and after interventions. The study results showed that yoga led to statistical differences in pulmonary functions, respiratory muscle strength, posture, and quality of life at the end of the study in both groups ($p<0.05$). Moreover, results showed that there is a statistical difference in MIP and MIP% values compared two groups ($p<0.05$). The change in MIP (CG: 26.57±16.18; SG: 13.64±9.17) and MIP% (CG: 29.02±16.47; 12.71±9.07) was higher at the end of the intervention in CG. Lastly, SG has statistically lower scores in FT ($p=0.001$). In conclusion, we might consider that Yoga training can improve pulmonary parameters, posture, body awareness, and quality of life in smokers. We may suggest that attending Yoga practice may slow the progression of problems caused by smoking and reduce nicotine addiction in chronic smokers.

Keywords: Addiction; Body Awareness; Pulmonary Functions; Posture; Quality of Life; Smoking; Yoga

ÖZET

Özbek, C. (2023). Sigara İçen Yetişkinlerde Yoganın Pulmoner Parametreler, Postür, Beden Farkındalığı ve Yaşam Kalitesi Üzerine Etkileri.
Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Spor Fizyoterapisi Anabilim Dalı Yüksek Lisans Tezi, İstanbul.

Bu çalışmanın amacı, kronik sigara içicilerinde yoga uygulamaslarının pulmoner parametreler, solunum kas gücü, postür, vücut farkındalığı ve yaşam kalitesi üzerindeki etkilerini değerlendirmektir. Bu vaka-kontrol çalışmasına, Fagerström Sigara Bağımlılık Testine (FT) göre Sigara İçenler Grubu (SG) (n=14) ve Kontrol Grubu (KG) (n=14) olarak ayrılan 28 gönüllü dahil edilmiştir. Tüm katılımcılar altı hafta boyunca haftada iki kez ayakta aktif hareketler ve duruşlar (Asana) ve gönüllü olarak düzenlenmiş nefes (Pranayama) uygulamalarını içeren Yoga egzersizleri yapmıştır. Tüm gönüllüler, sırasıyla bir spirometre ve solunum basıncı ölçer kullanılarak Maksimum İnspiratuar Basınç (MIP) ve Maksimum Ekspiratuar Basınç (MEP) dahil olmak üzere pulmoner fonksiyonlar ve solunum kas gücü açısından değerlendirilmiştir. Ayrıca, duruş, vücut farkındalığı ve yaşam kalitesi New York Postüral Değerlendirme Tablosu (NYPRC), Torasik Omurga Hareket Açıklığı (TSROM), Vücut Farkındalığı Anketi (BAQ) ve Dünya Sağlık Örgütü Yaşam Kalitesi (WHOQOL-BREF) anketi kullanılarak müdahalelerden önce ve sonra değerlendirilmiştir. Çalışma sonuçları, yoganın her iki grupta da çalışma sonunda solunum fonksiyonları, solunum kas gücü, postür ve yaşam kalitesinde istatistiksel farklılıklara yol açtığını göstermiştir ($p<0.05$). Ayrıca, iki grubun sonuçları karşılaştırıldığında MIP ve MIP% değerlerinde istatistiksel bir fark bulunmuştur ($p<0.05$). MIP (KG: 26.57±16.18; SG: 13.64±9.17) ve MIP% (KG: 29.02±16.47; 12.71±9.07) değişimi uygulama sonunda KG'de daha yüksekti. Son olarak, SG istatistiksel olarak daha düşük FT skorlarına sahipti ($p=0.001$). Sonuç olarak, Yoga uygulamasının sigara içenlerde pulmoner parametreleri, postürü, vücut farkındalığını ve yaşam kalitesini iyileştirebileceğini düşünebiliriz. Yoga uygulamasına katılmanın sigaranın neden olduğu sorunların ilerlemesini yavaşlatabileceğini ve kronik sigara içicilerinde nikotin bağımlılığını azaltabileceğini önerebiliriz.

Anahtar Kelimeler: Bağımlılık; Postür; Pulmoner Fonksiyonlar; Sigara; Yaşam Kalitesi; Yoga; Vücut Farkındalığı

1.INTRODUCTION AND PURPOSE

Smoking is considered one of the most important public health problems in developed and developing countries and each year, more than 8 million people are killed by tobacco [1]. The Global Burden of Disease Study indicated there were more than one billion smokers worldwide in 2019; thus, prevention and control of the global tobacco epidemic may have a crucial priority for public health [2]. Middle and low-income nations consume about 80% of the world's tobacco production and have the most impacted populations [3]. Turkey is one of the ten countries with the highest number of smokers in the world, with more than 26 million people still smoking [2]. Although there are preventative strategies conducted by the Ministry of Health in Turkey as public announcements and tax increases, the rate of tobacco product use is still more than thirty percent [2,4]. Smoking can cause poor blood circulation, elevated C-reactive protein, low hemoglobin concentrations, decreased erythrocyte oxygen-carrying capacity, and reduced mitochondrial activity [5]. Moreover, smokers have a higher risk for cancer, chronic obstructive pulmonary disease, atherosclerotic and cardiovascular disease, coronary heart disease, stroke, depression, anxiety disorders, and post-traumatic stress disorder [6-11]. It is reported that most smokers are aware of the effects of smoking on their health, and they frequently attempt to quit smoking with nicotine replacement therapy and pharmaceutical support. On the other hand, only 6% of smokers who attempt to quit smoking can be successful [12]. Nicotine dependence and activation of reward circuits in dopaminergic pathways are indicated to be the cause of this low rate of smoking cessation [13].

Yoga is one of the practical disciplines, including eight physical and mental practices based on the spiritual concept for the harmonious development of the body and mind [14]. Asana for physical postures and Pranayama for control of breath are the most used practices for therapeutic purposes in clinical studies [15]. It is indicated that Yoga could improve cardiorespiratory endurance, flexibility, muscular strength including respiratory muscles and pulmonary functions [16-23]. Moreover, Yoga can also improve pain, posture, mood, quality of life, and body awareness and decrease perceived stress, fatigue, and the feeling of depression and anxiety [24-26]. In the literature, limited published studies focused on the effects of Pranayama practice indicated that Yoga can decrease the intensity of urges and cigarette cravings among

smokers [27]. Thus, this study aims to investigate the effects of Pranayama and Asana practice on pulmonary parameters, posture, body awareness and quality of life among chronic smokers.

Hypothesis 0 (H0): There is no difference in regular yoga practice effects on respiratory functions, respiratory muscle strength, spinal flexibility, posture, body awareness and quality of life in smokers without a comorbid condition compared to non-smokers.

Hypothesis 1 (H1): Regular yoga practice leads to different outcomes in respiratory functions, respiratory muscle strength, spinal flexibility, posture, body awareness and quality of life of smokers without a comorbid condition compared to non-smokers.

2. THEORETICAL INFORMATION AND LITERATURE

2.1. Respiratory System

The human body has a respiratory system that extends from the nose to the alveoli. The respiratory system is separated into two body segments. The nose, larynx, and pharynx make form the upper respiratory tract. After the trachea, our lower respiratory tracts consist of the bronchi and bronchioles [32]. [Figure 2.1]

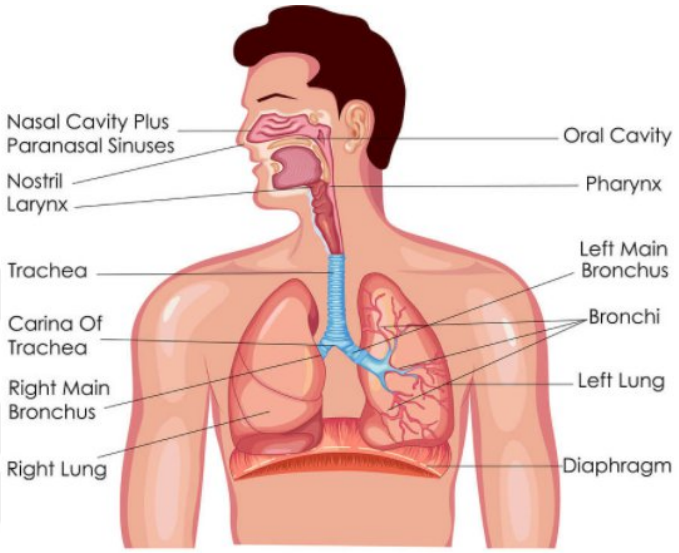

Figure 2.1. Structures of the Lung System [28]

2.1.1. Upper Respiratory Tract

The human body's respiratory system extends from the nose to the alveoli. The nose, throat, and larynx comprise the upper respiratory system and are placed exactly on the vocal cords. The airway system and Eustachian tube constitute the upper pulmonary tract. These structures are responsible for removing hazardous compounds from the body, humidifying the air entering the lungs, regulating the temperature of the air entering the lungs, and ensuring that the air is free of particles and toxic substances [32].

2.1.2. Lower Respiratory Tract

The components of the lower respiratory system consist of the trachea and lungs. Beginning at the sixth cervical vertebra, the trachea extends to the fourth and fifth thoracic vertebrae. The trachea separates into the major bronchi on the right and left. The trachea is composed of three different tissues. The outer stratum is fibrous and produces elastic tissue, covering the cartilage. The middle layer consists of cartilage, while the inner layer is made of ciliated columnar epithelium containing smooth muscle

goblet cells. The right primary bronchus exits the trachea at an angle between 20 and 30 degrees. The left bronchus forms a 45-degree angle. The right bronchus is shorter and wider. This explains why aspirations for the ideal bronchi are so prevalent.

The right bronchus separates into three branches, while the left bronchus divides into two. When cartilages reach the base of the bronchi, they develop an uneven form [33,34].

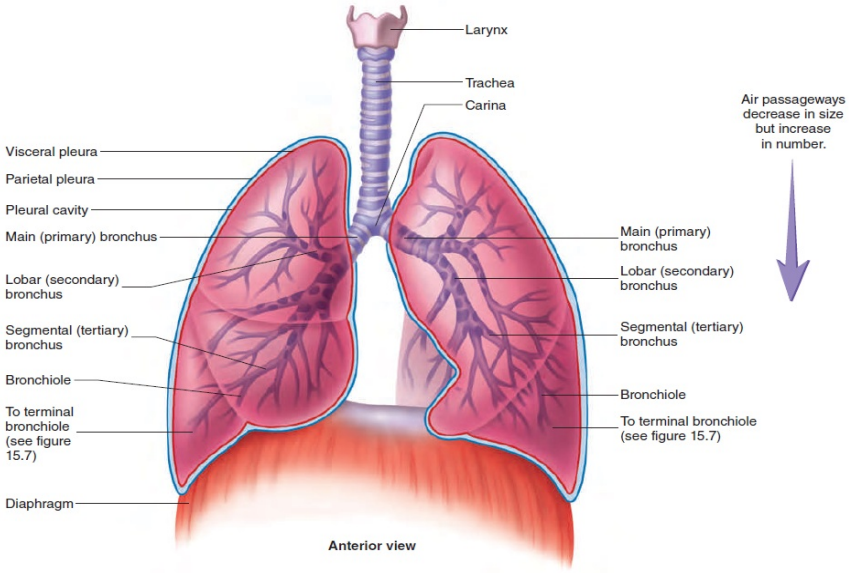

Figure 2.2. Front View of the Respiratory System [29]

Human bronchioles split into terminal bronchioles and respiratory bronchioles. The respiratory bronchioles continue as alveolar ducts and subsequently divide into alveoli. A healthy adult lung includes around 150 million alveoli. The alveoli regulate the gas exchange within the lungs. All alveolar ducts are composed of fundamental squamous epithelial cells surrounded by many capillary networks. The membrane responsible for gas exchange is the respiratory membrane. Made up of alveoli and capillary walls [34].

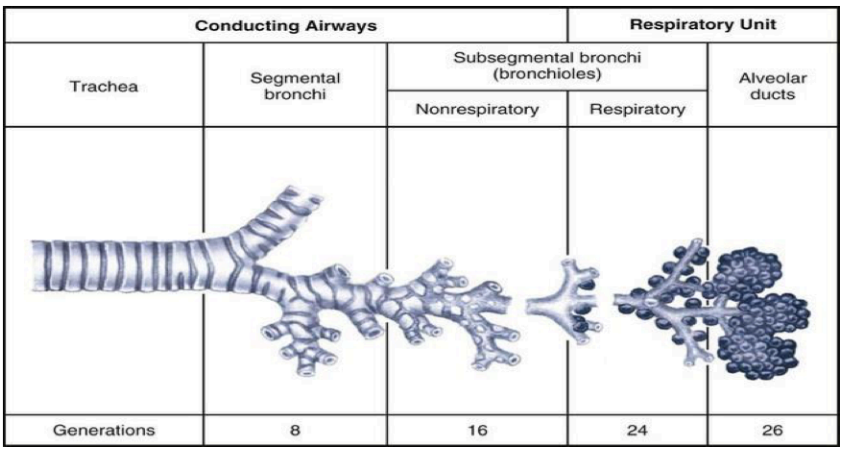

Figure 2.3. Bronchi, Bronchioles and Alveolar Ducts [30]

2.2. Respiratory Physiology

Pulmonary ventilation is the exchange of air traveling in the lungs with the surrounding air. The air from openings from the nose and mouth is transported to other components of the respiratory system. The temperature of the air entering the conducting components of the respiratory system adapts to that of the body. As air flows through the windpipe, it is filtered and saturated with water. Large first-generation airways, which serve as the principal conduits in the lungs, direct incoming air to the two bronchi, where the ventilation process proceeds. Lung gas exchange surfaces allow blood to be separated from the surrounding alveolar gas environment. When oxygen travels from the alveolus to the alveolar-capillary, carbon dioxide in the blood goes toward the alveolar chambers. As a result, carbon dioxide is released into the atmosphere. On the sidewalls of the chest cavity, there are numerous foldings on the humid and vascularized surfaces of the lungs [32-35].

The membranes of the lungs fold over so they can interact with the blood in order to oxygenate it. Over 600 million alveoli and an elastic, thin layer of sacs make up the lungs. Moreover, alveoli are necessary for the exchange of gases between airway tissue and blood. Many short capillaries with thin walls and alveoli coexist in the lung. Blood and air flow in opposite directions. As gases and changing amounts of exercise pass across the frail membrane of capillary and alveolar cells, their diffusion distance is almost constant. Small Kohn pores in each alveolus minimize alveolar swelling and surface tension by distributing themselves uniformly. Kohn pores let gas move between alveoli next to each other, which protects damaged or closed alveoli. [32-35].

Around 250 ml of oxygen enters the blood each minute from the alveoli during rest. At the same time, around 200 ml of carbon dioxide is diffused. During exercise, pulmonary ventilation ensures a balanced and comfortable flow of oxygen and carbon dioxide to the alveoli. Blood departs the lungs and circulates throughout the body following gas exchange when airflow is adequate [32-35].

2.2.1. Ventilatory Control

Two components in the brainstem area comprise the respiratory center. These structures are ventral (VRG) and Dorsal (DRG) respiratory groups. Afferent stimulation from the DRG governs automatic rhythm, particularly in the intercostal muscles, diaphragm, and peripheral chemoreceptors. VRG comprises of respiratory and

inspiratory neurons, and as ventilation demand increases, more VRG activation is produced. The pons has apneustic and pneumatic centers that modify the depth and velocity of inspiration. The hypothalamus, cortex, and limbic system are also capable of modifying respiratory patterns in the event of disease [34].

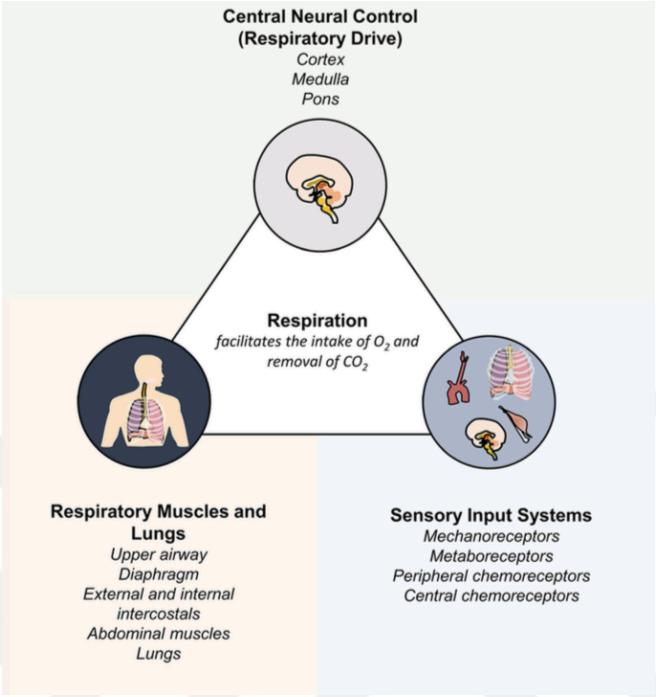

Figure 2.4. Ventilatory Control Mechanism [31]

2.3. Mechanics of Breathing

Mechanical movement for breathing happens with the motion of the lungs and the muscles used during inhalation and exhalation; the chest wall expands. After testing, airflow resistance develops, and a breathing device is created. Changes to these structures have an effect on respiration. [34,36]

Key inspiratory muscles are; diaphragm, internal and exterior intercostal muscles. The diaphragm divides the anterior (abdominal, thoracic) where lung cavities are located, and the diaphragm is dome-shaped. The contraction of the diaphragm increases the volume of the thoracic cavity, whereas the abdominal cavity flattens. The upward protrusion of the front ribs enlarges the anterio-posterior diameter of the thoracic cavity, causing the external intercostal muscles to contract. As the chest continues to expand, the intrapleural space's negative pressure reduces. The resulting suction force causes the lungs to enlarge. As the lung expands by raising the front chest wall, the alveolar pressure drops below atmospheric pressure, allowing air to enter the lungs. [34,36]

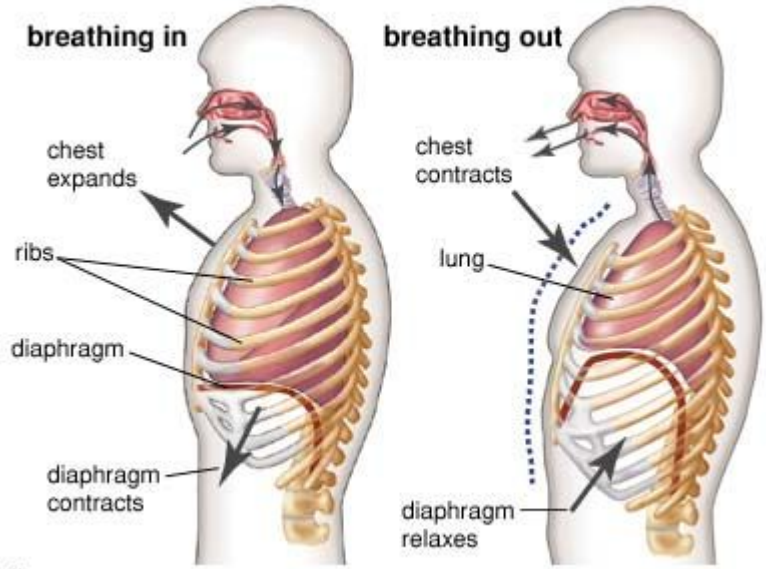

Figure 2.5. Formation of Inhalation and Exhalation [32]

The sternocleidomastoid and scalene muscles serve as the accessory muscles of inspiration. The forces operate according to the same principles as the external intercostal. Whenever the respiratory rate rises because of vigorous exercise or illness, accessory muscles help inspiration more. Normal expiration is a passive process, which explains why the expiratory muscles do not participate in breathing. When the minute volume rate increases, for instance, the abdominal and intercostal muscles, which are auxiliary muscles of expiration, assist in inspiration due to airway blockage caused by coughing. The abdominal pressure increases with the first contraction of the abdominal muscle [34,36].

The chest wall expands during inspiration. Exhalation diminishes intrathoracic volume and facilitates alveolar pressure. Passive expiration is elastic recoil, which permits the lungs to return soon after stimulation. Balance is vital for elastic recoil in the chest wall and lungs. Compliance is the surface tension of the alveoli and the elastic recoil of the lungs. Loss of elastic recoil in the lungs is noted with excessive swelling.

The function of breathing is performed by the activity of the muscles during ventilation. Hence, oxygen consumption increases. However, due to airway obstruction, increased oxygen consumption induces bronchospasm or mucus blockage [34].

2.4. Pulmonary Pathophysiology

Lung disorders can be categorized as either obstructive or restrictive. Even further, it is categorized as infectious and non-infectious [34,38]. When lung parenchyma is damaged by inflammation, tiny alveolar airways are disrupted, leading to reduced lung elastic recoil. The modifications impede the opening of the airways during expiration. This obstruction in airflow is most accurately measured via spirometry. Hence, spirometry is the most commonly employed test for lung functions [37,38].

2.5. Harms of Smoking Tobacco

It is very well known in the literature that smoking tobacco can lead to several adverse health consequences. Inhaling more than 7000 chemicals into the lungs results in poor blood circulation in almost every tissue in the body. Along with elevated levels of C-reactive protein, smokers also have elevated levels of proinflammatory cytokines.[8] Cigarette smoke has an extensive amount of these possibly cytotoxic compounds (e.g., carbon monoxide, free radicals and their precursors, nitrosamines, phenolic compounds, and other polynuclear aromatic compounds, which may be directly cytotoxic, damage neuronal or glial cell organelles, and promote oxidative damage. For instance, carbon monoxide levels are much greater in smokers, and this rise is connected to lower effective hemoglobin concentrations, decreased oxygen carrying capacity of erythrocytes, and decreased mitochondrial respiratory chain efficiency. Moreover, cigarette smoke contains significant amounts of free radical types (e.g., reactive nitrogen species; reactive oxygen species, ROS) that are known to increase oxidative damage or stress to cellular structures and macromolecules, including membrane lipids, proteins, carbohydrates, and DNA [5,10].

Other than systemic effects, we have gathered the main effects of habitual cigarette smoking on important tissues and organs;

- **Brain**: Habitual cigarette smoking is linked to deficits in cognitive functions like executive functioning, cognitive flexibility, general intellectual ability, learning and memory processing speed, and working memory. Also, smoking is associated with global brain atrophy and anatomical and biochemical anomalies in subcortical nuclei, anterior frontal regions, and commissural white matter. Prolonged smoking may also be connected with an elevated risk of

neurodegenerative disorders of various types. The cumulative pattern of neurocognitive data indicates major impairment in neurocircuitry implicated in decision-making, impulse control, judgment, planning, and reasoning skills, as well as in the start and continuation of substance use disorders. Specifically, the pattern of neurocognitive and neurobiological findings in chronic smokers indicates brain reward system impairments. The dorsolateral prefrontal cortex, orbitofrontal cortex, insula, anterior cingulate cortex, hippocampus, amygdala, nucleus accumbens, ventral tegmental region, and other nuclei in the basal forebrain and ventral pallidum are major components of the brain's reward system. All substance use disorders, including nicotine dependence and other maladaptive behaviors, are associated with structural changes in the brain's reward system [10].

- **Respiratory System:** Smoking can result in diseases of the respiratory tract such as cancer and COPD, specifically lung cancer and cancers of the tongue and larynx, bronchopulmonary diseases, prolonged breathing difficulties due to pulmonary emphysema impairment in COPD, and chronic cough frequently associated with pneumonia [8].

- **Vascular diseases:** On endothelial cells, cigarette smoke and its contents exert a great deal of influence on early atherogenesis, according to the literature. Smoking initiates vascular dysfunction by reducing nitric oxide (NO) bioavailability, followed by an increase in adhesion molecule expression and dysfunction of endothelial cells. Increased smoking-induced adhesion of platelets and macrophages induces the formation of a proinflammatory and procoagulant setting. Smoking increases the chances of getting atherosclerotic cardiovascular disease and coronary heart disease [8,9,40].

- **Heart:** The heart and its blood flow are more negatively impacted by smoking than any other organ except the lungs. A smoker's heart is 2-4 times more susceptible to developing coronary artery disease compared to a non-smoker's [39]. When smoking interacts with other risk factors, such as diabetes, the risk is considerably increased. Smoking raises blood pressure, lowers exercise tolerance, and elevates the potential for blood to clot [43]. Moreover, smoking

increases the risk of coronary heart disease after bypass surgery and multiplies the incidence of abdominal aortic aneurysms by five.

- **Distal Extremities:** The hands and feet are constantly poorly oxygenated and cold because of insufficient circulation. Tobacco use can cause peripheral vascular disease, which can make walking uncomfortable and even lead to amputation. The blood veins in the fingertips that grip cigarettes can deteriorate to the point of gangrene and amputation, leading intractable smokers to swap to the other hand [39].

- **Skin:** Chronic vascular injuries result in poor blood circulation, which impairs the oxygen supply to the skin, causing permanent damage to collagen and epithelial tissue. This condition also contributes to poor tissue repair, making both elective and urgent surgical procedures riskier [39].

- **Mouth:** Smoking can cause smelly breath, cancer in the jaw and mouth, recurring pharyngitis, a diminished sense of taste and smell, and stained, yellowed teeth and plaque in the mouth. Because saliva cleanses the inside of the teeth and mouth and protects them from decay, smoking lowers saliva production, which increases the risk of infection [39].

- **Bones:** Osteoporosis, vertebral and hip fractures, and disc degeneration are significantly associated with smoking. Because of poor circulation, bones generally lose their density [39].

- **Reproductive system:** Infertility is a common consequence for heavy smokers in both genders. While smoking affects sperm counts and motility in males, it impairs ovulation and egg development in women [39]. Many pregnancy problems are connected with maternal smoking, such as abruption of the placentae, placenta accreta, hemorrhage during pregnancy, early and delayed membrane rupture, and preterm delivery. Pregnancy smoking also inhibits fetal growth and reduces birth weight on average [41]. Increased nicotine levels have even been discovered in cervical mucous, promoting cervical cancer [42].

- **Malignancy**: Smoking also raises the risk of getting cancers of the esophagus, pancreas, stomach, bladder, kidneys, and colon, as well as acute myeloid leukemia [40, 43-45].

- **Eye**: Cigarette smoking might be associated with earlier and more severe macular degeneration [46].

2.6. Stress and smoking

According to the discussed clinical and epidemiological studies, brain stress systems play an important part in tobacco addiction. Smokers report smoking for stress reduction and relaxation. Real-world or laboratory exposure to stressors increases the number of cigarettes smoked. A substantial comorbidity exists between smoking and stress-related psychiatric diseases such as depression, anxiety disorders, and post-tramuatic stress disorder. Around twice as many individuals with these diseases smoke in the overall population. According to the analyzed studies, there is a two-way relationship between depression and smoking. Depressed children and teenagers are more prone to begin smoking than their non-depressed counterparts. Non-depressed smokers have a greater likelihood of developing depression than non-smokers. Tobacco use, on the other hand, increases the likelihood of acquiring anxiety disorders such as panic disorder, phobias, and generalized anxiety disorder. Moreover, smokers are more prone to acquire PTSD after experiencing a distressing event [47].

2.7. Smoking Epidemiology

Worldwide in 2019, 1.14 billion (95% confidence interval 1.13–1.16) people were regular smokers, consuming 7.41 trillion (7.11–7.74 trillion) cigarette-equivalents. Although smoking rates have decreased since 1990, population increase has led to a substantial increase in the total number of smokers, from 0.99 billion (0.98–1.00) in 1990. In 2019, global smoking tobacco use caused 7.69 million (7.16–8.20) fatalities and 200 million (185–214) disability-adjusted life-years, and it was the greatest risk factor for male mortality (202%). Among regular smokers, 6.68 million (86.9%) of the 7.69 million deaths are associated with smoking tobacco [2].

A study published in 2021 showed that in Turkey, the age-standardized prevalence in 2019: 18.4 % (16.6 to 20.3) of females and 43.2 % (41.6 to 44.9) of males are chronic smokers. Despite a significant decrease in smoking prevalence among males (-27.5% [26.5–28.5]) and females (-35.7% [35.4–39.9]) aged 15 and older since 1990 globally, in Turkey this change percentage between 1990-2019 is -21.8 % (-26.3 to -17.2) for males and +14.6 % (-3.48 to +33.5) for females. These demographics also show that smoking is more prevalent in males than females globally, but in Turkey, data pointed to smoking is getting more prevalent in females with time, and younger people are still prone to be addicted to cigarettes [2].

2.8. Smoking Cessation

2.8.1. Pharmacological Treatments

There are three main pharmacological substances known to help with smoking cessation. These substances are bupropion, varenicline and nicotine replacement therapy(NRT). NRT is applied by nicotine gums, transdermal patches, inhalers, and intranasal sprays. NRT is considered pretty safe and can be used for smokers who have cardiovascular diseases. There is no evidence suggesting NRT raises heart attack possibility. Bupropion on the other hand, when given directly known for the possibility to cause seizures, but healthcare professionals are recommended slow release formula to prevent this side effect.

A meta-analysis of pharmacological treatments for smoking cessation was published in 2018. There were 61 studies with 27,647 people involved. Less than 40% of intervention group participants were abstinent at three months (bupro pion: 37.1%; NRT: 34.8%; varenicline: 39.3%); approximately a fourth were abstinent at six months after the intervention (NRT: 26.6%; bupropion: 25.9%; varenicline: 25.4 %); and roughly a fifth of the participants were abstinent at one year. (NRT: 19.8%; bupropion: 19.8%; varenicline: 18.7%) The number of smokers who benefit from using smoking cessation pharmaceuticals declines over the period of their first year, although there is still a net benefit at 12 months [48].

Each kind of NRT raises the possibility of an individual's success in quitting smoking. The likelihood of quitting increased by 50 to 60 percent. NRT is effective with or without extra counseling and requires no doctor's prescription. The adverse effects of nicotine replacement therapy are product-specific and include allergic

reactions to the skin from patches and irritation of the inner mouth from gum and pills [49]. In another study published in 2018, we discovered high-quality data that combining behavioral assistance and pharmacological treatment doubles the likelihood of quitting successfully after a minimum of six months. The data indicate that the likelihood of success increases from 70 to 100 percent compared to brief guidance or support alone. Some research indicated that the impact tended to be greater when subjects were gathered in healthcare facilities [50].

2.8.2. Non-pharmacological Treatments

Non-pharmacological treatments for smoking include motivational interviews, counseling and coaching, behavioral changes, psychotherapy, hypnotherapy, relaxation exercises, breathing exercises, physical activity, mindfullness and Yoga.

A systematic review published in 2014 inspected exercise interventions for smoking cessation showed that people who underwent the exercise program were considerably more inclined to discontinue smoking at the end of therapy in four studies compared to those who received only a stop-smoking program. Only two out of the twenty trials provided evidence that exercise aids in the long-term cessation of smoking. In one of these trials, the participants in the exercise group had considerably higher quit rates at the three-month and 12-month follow-up points compared to those in the control group. In this study, those who participated in the exercise program were over two times as likely to be smoke-free 12 months later. At the six-month follow-up, a combination of exercise and smoking cessation intervention was associated with considerably greater stop rates than brief smoking cessation advice. Other studies did not demonstrate an effect of exercise programs on quitting rates. However, this may have been due to the small sample sizes or insufficient intensity of the exercise programs. They found that very little data suggests that fitness programs assist smokers in quitting smoking, and they said additional research is required. There were problems with the study design, the potential for bias, and differences among the studies [51].

A randomized controlled trial published in 2022 found no statistically significant difference in the abstention percentage between the breathing practice group and the control group. However, the breathing exercise group showed considerable pre-post improvements in craving cigarettes, symptoms of nicotine withdrawal, mood, and quality of life [52].

Another study demonstrated the acute effects of Pranayama on smoking cessation-related cravings and withdrawal symptoms. In an immediate follow-up, all measures of cravings were lower in the Pranayama group than in the control group. (cigarette craving, $p=0.001$, the intensity of urges, $p<0.001$, and desire to smoke, $p=0.012$). There was no impact on either mental or physical complaints. Following 24 hours of breathing exercise, adherence was poor, and there was no indication of reduced desires in the Pranayama group compared to the controls. Thus they recommended further study is required to determine the applicability of this to field conditions [27].

Investigating aerobic exercises for smoking cessation, a rising number of research experiments have demonstrated that brief periods of aerobic exercise positively affect smokers' moods and cravings. However, a number of RCTs have found that exercise has little impact on smoking cessation or symptoms of withdrawal during attempts to quit. They concluded that more research had been needed and that the effects of exercise on proposed smoking cessation mechanisms appear to be temporary, necessitating adequate and sustained adherence to exercise regimens in order to influence smoking cessation success [53].

A study conducted in 2012 included only women participants in determining the effectiveness of Yoga for smoking cessation controlled with general health and wellness program. After treatment, the yoga group had a higher 7-day percentage of points abstinence rate than the control group. Yoga participants maintained a greater rate of abstinence during the six-month evaluation. However, the differences were no more statistically significant. Compared to controls, women who participated in the yoga program demonstrated lower anxiety and improvements in reported health and well-being. Therefore, they found that Yoga might be a successful complementary therapy for helping women quit smoking [54].

2.9. Yoga

Yoga is a state of elevated consciousness attained by having a fully rested, relaxed body and a fully awake, calm mind. Pranayama, as a word, consists of two parts: prana and ayama. Prana translates as "vital energy" or "life force." Ayama translates to "extension" or "expansion." Thus, Pranayama implies "extension or enlargement of the dimension of prana." [55]

2.9.1. Breathing Practice, Yoga, and Autonomic Nervous System

Pranayam (regulated rhythmic breathing) has a substantial effect on the autonomic nervous system(ANS). Breathing has bidirectional effects on the physiology and psychology of the body. Diaphragmatic breathing affects ANS, Heart Rate Variability(HRV), and changes depending on which muscles are used, mouth or nose breathing, breathing frequency, and depth. Studies showed that even breathing through a particular nostril can alter metabolism and autonomic activities.[56] There is a significant rise in systolic, diastolic, and mean blood pressure following Right Nostril Yogic Breathing. Systolic and diastolic pressure fell following Alternate Nostril Yogic Breathing, but systolic and mean pressure decreased following Left Nostril Yogic Breathing. Therefore, unilateral nostril yogic breathing activities affect blood pressure differently. These results indicate potential therapeutic applications [57].

A study conducted in 2013 conducted Alternate Nostril Breathing (ANB) training for 15 minutes daily for six weeks, indicating that the subjects' parasympathetic tone was significantly increased.[58] Another study done in 2009 showed that after 5 minutes of slow bhastrika pranayama (respiratory rate of 6 breaths per min), both systolic and diastolic blood pressure lowered statistically significantly, along with a small decrease in heart rate. However, following oral administration of hyoscine-N-butylbromide(Buscopan®, a compound that blocks parasympathetic activity) in a control group, neither blood pressure nor heart rate changed significantly in volunteers who completed the same breathing exercise for the same period. This study shows that Pranayama can be practiced daily for stress reduction and mental relaxation, especially when needed [59].

2.9.2. Asana Practice and Posture

The definition of healthy posture is "...the state of muscular and skeletal balance that protects the body's supporting structures from injury or progressive deformity..." and poor posture as "...a misaligned relationship between the body's various parts that increases stress on the supporting structures...". Most physiotherapists believe optimal posture involves an upright lordotic spine alignment, a lordotic lumbar spine, relaxed thoracic spine, and head retraction. [60]

Phasic reactions are connected to movement in the context of neuromuscular physiology, whereas tonic responses are connected to mental attitude, and a persistent mental attitude results in a specific posture (the way an individual stands, seats ect.). If mental attitude may affect the posture, then specific positions can likewise be utilized to change mental attitude. This is the fundamental concept behind the definition of Asana, which is a position that influences one's mental attitude rather than the motions associated with the postures. Additionally, it makes clear that Yoga is defined as the deliberate alteration of one's physical and mental status. [61]

2.9.3. Yoga on Brain Chemistry

Yoga practice has been shown to improve levels of brain-derived neurotrophic factor (BDNF) and oxytocin, both of which are essential for cognitive function. Yoga practice has also been shown to increase gamma-aminobutyric acid (GABA), a neurotransmitter that has antidepressant and anxiety-reducing properties. In addition, pranayama-like slow pace breathing patterns that stimulate the vagus nerve have been shown to increase serotonin, dopamine, prolactin, and norepinephrine levels. [61,62]

3. MATERIAL AND METHODS

3.1. Subjects

This case-controlled study was included 28 volunteers who were assigned to the Smokers Group (n=14, 34.0±13.3 years old) or Control Group (n=14, 40.8±14.0 years old) according to smoking habits. The study protocol was approved by Yeditepe University Ethical Committee (protocol number: E.83321821-805.02.03-162). The clinical registration number is NCT05810298. The aim and plan of the study were explained, and informed written consent was obtained from each patient. We analyzed the power using G*Power version 3.1.9.2 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf Germany) software. Based on a priori analysis of differences between two dependent instruments (matched pairs) in sample size calculated. A total of 24 cases for an initial investigation was determined with a power independent of 0.8 and an alpha (α) error of 0.05.

3.1.1. Inclusion Criteria

- Being a healthy adult between 18-60 years of age
- Volunteering participation in the study
- Being a smoker or never smoked

3.1.2. Exclusion Criteria

- History of exercise in 3 months prior to the study
- Acute or chronic lung diseases
- Allergic disorders
- History of major surgery in the last two years
- Neurological deficit or disease
- Fractures or orthopedic problems
- Systemic rheumatismal diseases

3.1.3. Flow Chart: Study Process

Participants were recruited for the study between January 2023 and March 2023 among Fizyoram 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=100). We included 14 smokers and 14 non-smokers who met the inclusion criteria for the study. The aim and plan of the study were explained to each volunteer and informed written consent was obtained.

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. Moreover, posture, body awareness, and quality of life were evaluated using the New York Postural Rating Chart (NYPRC), Thoracic Spine Range of Motion (TSROM), Body Awareness Questionnaire(BAQ), and World Health Organisation Quality of Life(WHOQOL-BREF) questionnaire before and after interventions. (Figure 2.6.)

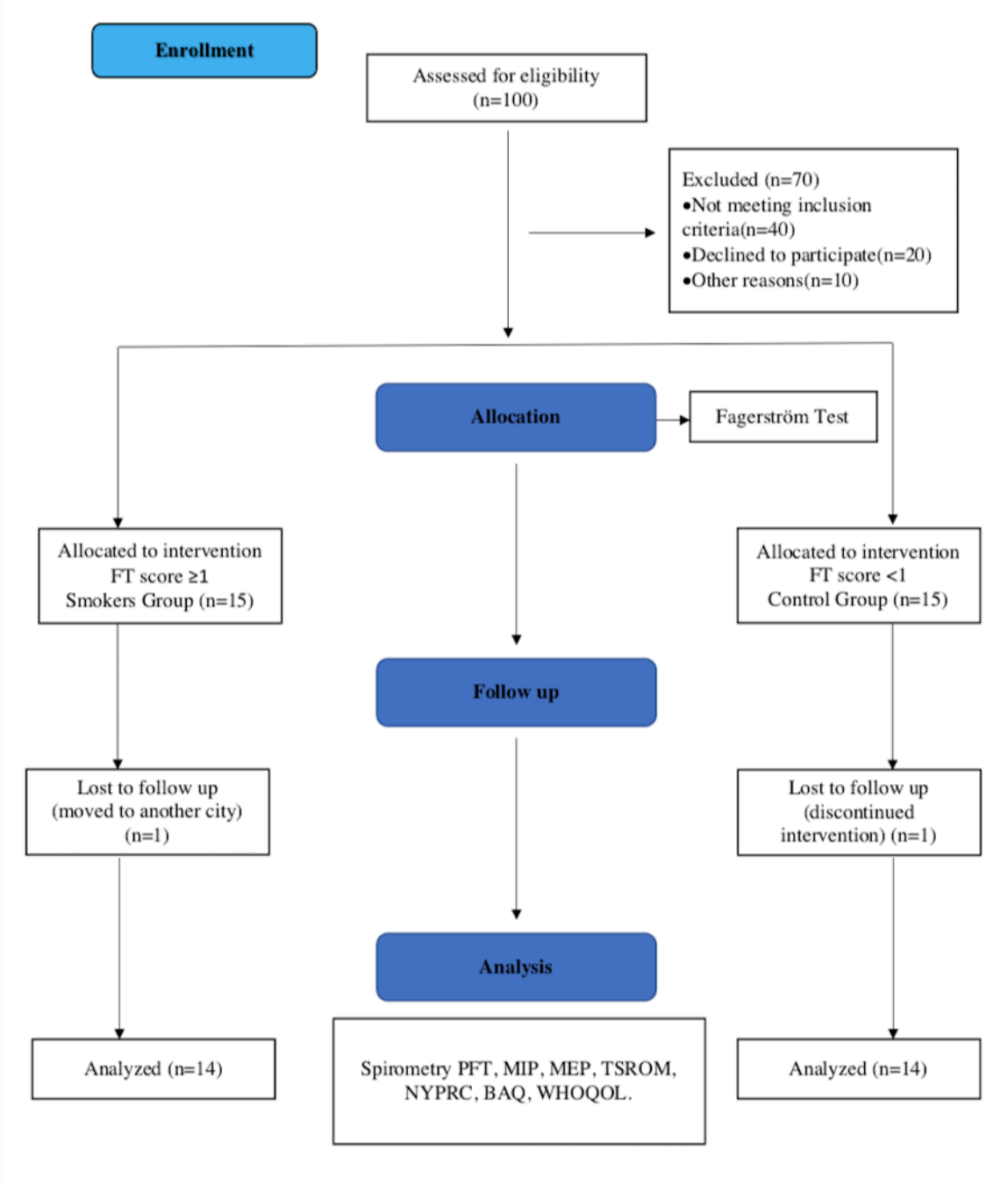

Figure 2.6. Flow Chart

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. We taught using the web-based video conference program to each participant, and Yoga exercise sessions were done synchronously using video conference. The Yoga exercise program consisted of Asana (Yoga postures) and Pranayam (Regulated rhythmic breathing).

3.2. Assessment Methods

3.2.1. Structured Questionnaire and Fagerström Test

Allocated participants were asked the structured questionnaire comprising social and demographic information. The structured questionnaire included information of their age, height, weight, educational status, systemic diseases, use of pharmaceutical medication, exercise habits, and cigarette use status. (APPENDIX C)

The participants also were asked for Fagerström Test for Cigarette Dependence questionnaire (FT) to evaluate the severity of their physical nicotine addiction related to cigarette smoking. A reliability and translation study of FT has been done by Uysal et al. [63], which showed good validity in the Turkish population. Therefore, we selected the FT to measure not only the physical addiction aspect of smoking cigarettes but observing the psychological and behavioral aspects of cigarette addiction. FT questions the participant about how soon they smoke after waking up, if they have a hard time refraining from smoking where it is forbidden, how many cigarettes they consume in a day, are they smoking even if they are ill and spending most of the day in the bed and are they smoking more in the morning than the rest of the day. The answer to these questions determines the level of nicotine addiction that they have. Four questions score 0 or 1 point, while the remaining two questions have a Likert-type scale which scores 0 to 3 points. The sum of total points is assessed as the final score, which varies between 0 and 10. A higher total Fagerström score means more intense physical dependence on cigarettes for the participant. (APPENDIX D)

In 2011 Karl Fagerström, who developed the FT assessment, released a new study to propose changing the Fagerström Test for Nicotine Dependence name to Fagerström Test for Cigarette Dependence because recent studies showed that, although nicotine is the most important addictive component of tobacco smoke, it is probably not the only substance involved in developing tobacco dependence [64]. Numerous different tobacco-containing alkaloids, like as myosmine, anatabine, anabasine, and nornicotine, also appear to have rewarding effects in the sense that they substitute for nicotine in discrimination tests and increase self-administration of nicotine [65].

3.2.2. Pulmonary Function Test

The pulmonary functions of the participants were measured with Medical International Research Spirodoc® Spiro spirometry. We used a special disposable Medialp mouth filter for each participant's measurement. We followed the guidelines of the American Thoracic Society and European Respiratory Society [66].

Spirometry has been calibrated before taking the measurements. First, we instructed and demonstrated the test while informing them about breathing with only the mouth, attaching a nose clip, sitting down and correcting the posture, inhaling rapidly and completely, positioning the device, and exhaling maximally with force until no more air could be expelled. Instructions have been repeated at every step, and participants have been coached and motivated to push their limits. We asked the participant to take the deepest breath they can and exhale with force until the device beeps which is for 6 seconds. The testing maneuver has been repeated at least three times, and the highest scores have been recorded. We noted the values of the FVC, FEV_1, PEF, and FEV_1/FVC of the participants [67]. (Figure 3.1.)

Figure 3.1. Spirometry Test [68]

3.2.3. Respiratory Muscle Strength Testing

We evaluated the respiratory muscle strength with the Micro Medical Micro RPM respiratory pressure meter. Maximal Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP) were measured according to ATS/ERS guidelines. ATS/ERS statements showed that MIP and MEP differ based on lung volume. This is because of the force–length relation of the respiratory muscles and the variable contribution of the respiratory system's passive elastic recoil pressure [69]. We minimized the bias by calculating the participants' predicted value by their age, gender,

and height. Measurements require full cooperation, and tests are done until the researcher is satisfied and the maximum value of three tests varies less than 10%. The highest score was recorded.

We did a demonstration before starting, and instructions were given by the researcher at every step. We used a nose clip while taking the measurements, and we informed the participants to use only their mouths for breathing while doing the tests in a relaxed sitting position. Participants have been motivated and coached to not leak any air during the test. MIP is measured after the participant exhales until he reaches functional residual capacity (FRC), placing the device into their mouth and inhaling forcefully for 1 to 3 seconds. MEP is measured after the participant inhales until he reaches total lung capacity (TLC), placing the device into their mouth and exhaling forcefully for 1 to 3 seconds [70]. (Figure 3.2.)

Figure 3.2. Respiratory Muscle Strength Test [68]

3.2.4. Thoracic Spine Range of Motion

Thoracic spine range of motion was assessed by iPhone Compass mobile application. In the literature, a strong and significant correlation was found between the Universal Goniometer and the Compass app by Furness et al., demonstrating good concurrent validity [71]. Participants were told to stand with their feet flat on the ground, bend their knees and hips 90 degrees, and hold a neutral spine position with their lumbar lordosis maintained. The iPhone was placed with the axis fixed in the transverse plane at T1-T2. The iPhone was positioned so that magnetic north faced directly towards the participant, which was demonstrated by the Compass app dial showing 0. (Figure 3.3.) While the participant engaged in active thoracic rotation to their end range of motion, the

examiner firmly pressed an iPhone against the participant's back at the T1-T2 level. The maximum angle the participant reached at the end of their ROM was measured and recorded three times, and the highest results were noted for the score. (Figure 3.4.)

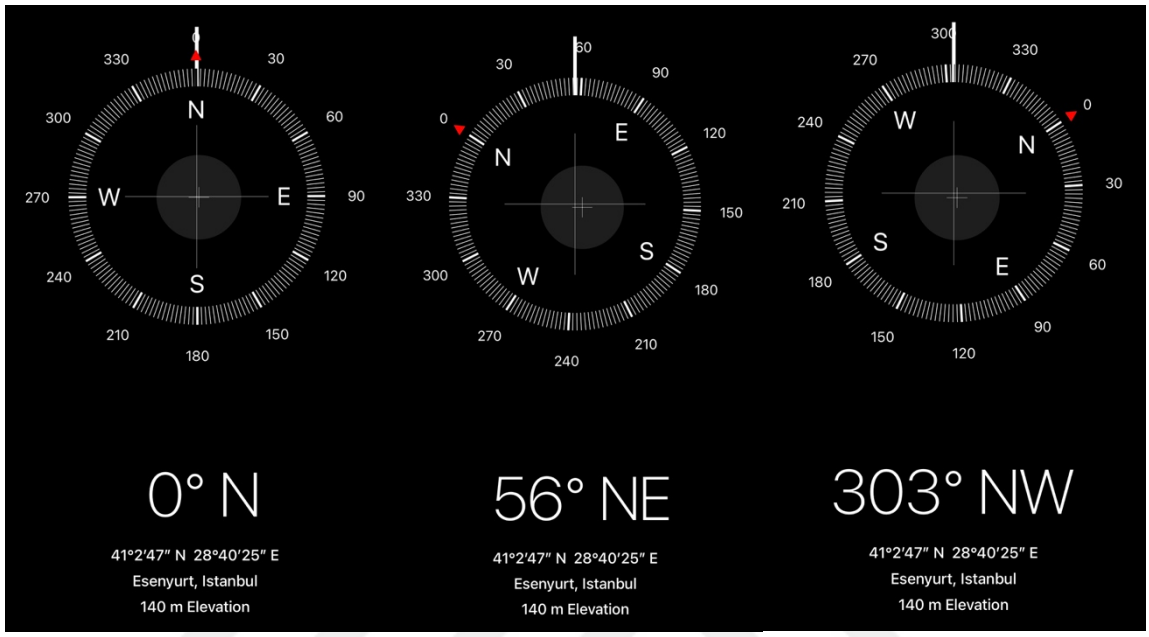

Figure 3.3. iPhone Compass Application while measuring TSROM

Figure 3.4. Thoracic Spine Range of Motion Test

3.2.5. Posture Assessment

The posture was assessed using the New York Posture Rating Chart. The NYPRC examines for potential abnormalities in posture. Five areas are observed while the researcher looks at the participant from the back and five areas are observed from the side. Using NYPRC, it is possible to see if their neck, spine, shoulders, back, abdomen, ribs, waist, hips, pelvic tilt, and feet have deteriorated. According to the chart on the NYPRC paper, the examiner observed the participant while they were standing comfortably and gave them a score of ten (10) for good posture, five (5) for mildly deteriorated posture, and zero (0) for severely deteriorated posture. The sum of the total points is noted as the final score. Results ranged from 0 to 100, The subject's posture better as the total score increases [72]. (APPENDIX E)

3.2.6. Body Awareness and Quality of Life

Body awareness, in its simplest definition, refers to an individual's awareness of body parts or dimensions. It is essential to comprehend the complex relationship between mind and body. Mehling et al. stated that the Body Awareness Questionnaire (BAQ) included emotional and physical components more extensively than other measurement tools used in assessing body awareness. BAQ was used in this study to determine participants' level of awareness of their body processes and reactions, sleeping cycle, and prediction of disease onset [73]. Turkish version of BAQ was used in this study, and a validation study was done by Karaca in 2021 [74]. Items score 1 to 7 numerical scale, with the total score calculated as a sum of the items. (APPENDIX F)

The study group was assessed with the World Health Organization Quality of Life Assessment (WHOQOL-BREF) to provide numerical data on their Quality of Life. The WHOQOL-BREF is a questionnaire that has 26 questions, which asks participants about their opinions on activities of daily living, general physical and mental health, participation in the life, quality of life, and social interactions over the previous two weeks. Domains of quality of life has been shown in Figure 2.10. Each response to questions is on a 1 to 5 numerical Likert scale where 1 means "disagree" or "not at all" and 5 means "completely agree" or "extremely". Turkish version of the WHOQOL-BREF questionnaire was used in this study as given by WHO, and the sum of the scores is assessed as a total score [75]. (APPENDIX G)

4. INTERVENTION

All the volunteers did Yoga exercises under the supersion of certified Yoga Teacher Physiotherapist twice a week for six weeks. We teach using the web-based video conference program to each participant and Yoga exercise seesions were done syncroniosly using video conference. The Yoga exercise program consisted of Asana (Yoga postures) and Pranayam (Regulated rhythmic breathing).

4.1. Yoga Practice

4.1.1. Asana

Yoga practice consisted of Asana (Yoga postures) and Pranayam (Regulated rhythmic breathing). Practice starts with Upavinyasa (Palm tree postures), and active movements while standing on feet. The spine and limbs stretch and reach out, contracting eccentrically, respecting the movement patterns of the body without pushing limits. Transition in between poses will be synchronized and informed by the instructor with breathing pattern in zero resistance flow. Asana practice consisted of rotational spine movements assisted with limb movements, dynamic stretching and balance poses. Participants have been informed not to hurt themselves while doing the poses and transition between poses. Having pain while doing the pose was used as an indicator to stop pushing more than the body allows. We did not use an exercise mat or any equipment while doing asana practice because of the convenience of practicing anywhere participants wanted at any time. Participants only needed an open space to do poses while standing on their feet. (Figure 4.1.)

4.1.2. Pranayama

We used a chair to sit while performing the Pranayama and used Nostril-regulated breathing (Ujjayi). We started with a slow, mindful diaphragmatic breathing for 3 minutes to warm up the respiratory muscles. After warming up, Box Breathing started with 4 seconds fully inhalation followed by 4 seconds of holding and then letting go of breath for 4 seconds without pushing. After the lungs were emptied by exhalation, we held the breath for 4 more seconds and repeated this cycle for approximately 3-5 minutes. Next, with Anganyasa(placing the limbs onto certain parts of the body), we used the arms and shoulders to assist the chest and lungs in expanding more when

inhaling, holding, and exhaling again with breath-synchronized limb movements. After opening up the chest muscles with slower and more mindful movements, we went faster and more forceful with Bhastrika Pranayama. Bhastrika means "bellow" a term the blacksmith uses to keep his coal furnace alive. [76] While doing Bhastrika Pranayama, we did 1 second deep inhale passively and 1 second exhaling forcefully while contracting the abdominal muscles. At the end of 10 reps, we inhaled fully and held it for as long as possible. Participants were inexperienced, so we started with 1 set, and after 3 sessions, we did 2 sets of Bhastrika Pranayama. At the end, we did Bhramari Pranayama (bee humming breath), which consists of placing the hand onto the face. With closed eyes and ears, participants made the sound "OM" with their throats for as long as they could for 5 reps. We held the ``MMM`` sound while exhaling slowly for stimulating the diaphragm muscle and induce parasymphatetic dominance on cardiovascular system [77]. (Figure 4.1.)

Exercise Type	Intensity	Frequency
Asana	· 7 repetitions for each pose · Inhaling while rotating to right, exhaling while rotating to left. · Keep inhaling or exhaling until reaching maximum capacity while holding the pose for 3 to 5 seconds each	·Two times a week · For six weeks

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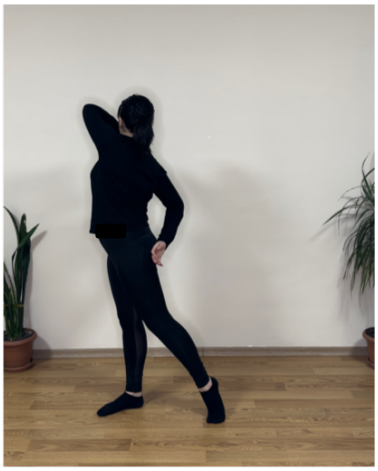









Pranayama

・Ujjayi (Nostril Regulated Breathing) to warm up respiratory muscles for 3 minutes ・Box Breathing (4 sec inhale, 4 sec hold, 4 sec exhale, 4 sec hold) for 5 minutes ・Anganyasa (Breathing with arm movements) 5 minutes ・Bhastrika (Bellow breath) for 1 set of 10 repetitions of fast inhale and exhale After 2nd week 2 sets of 10 repetitions ・Bhramari (Humming bee breath) for 5 repetitions	· Two times a week · For six weeks

The sitting position while doing Pranayama Practice

The sitting position while doing faster Bhastrika Pranayama

Figure 4.1. Components of the Yoga Exercises

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0 software (SPSS Inc. Chicago, IL, USA). Independent samples t test was used to evaluate the data before the intervention to determine the differences between the two groups. Paired samples t test has been used to evaluate the changes in groups before and after the intervention. Repeated measures Wilks-Lambda test was used to compare the data after the intervention to determine if the data of the study group had changed statistically different compared to the control group. Statistically significance of the p-value was set as <0.05.

5. RESULTS

Twenty-eight subjects (16 female, 12 male, age mean±SD: 37.46±.13.69 years old) participated in this case-control study, and the study group was divided into two groups, SG (n=14) and CG (n=14). The assessments were done prior to Yoga exercises and after six weeks for both groups.

5.1. Comparison of Baseline Statistics Between Groups

The gender distribution of the participants is shown in Table 5.1. There was a statistically significant difference between the groups.

Table 5.1. Comparison of Gender Distribution between groups

	SG		CG		p value
Gender	n	%	n	%	
Male	9	64.3	3	21,4	**0.022**
Female	5	35.7	11	78,6	
Total	14		14		

Data expressed as n and %.

Demographics and anthropometric characteristics have been analyzed and there was no statistically significant difference between groups. Demographics and anthropometric characteristics at baseline have been shown in Table 5.2.

Table 5.2. Comparison of demographic and anthropometric characteristics between groups

	SG	CG	
Variables	Mean±SD	Mean±SD	p value
Age(Years)	34.07±13.33	40.85±14.06	0.201
Weight(kg)	75.92±16.48	67.53±8.53	0.102
Height(m)	1.73±0.099	1.68±0.092	0.175
BMI(kg/m²)	25.11±5.15	23.76±2.92	0.403

Independent Samples t test, SD: Standard Deviation, BMI: Body Mass Index, kg: kilogram, m: meter, kg/m²: kilograms/meter square

Pulmonary function test and respiratory muscle strength assessment results by numbers and % of the predicted value of the participants have been shown in Table 5.3. There was a statistically significant difference in FEV_1 (p=0.031), PEF (p=0.038), MIP (p=0.001) and MEP (p=0.035) at the beginning. However, when we compared % of their predicted values for their height, gender, and age, there was no statistically significant difference between groups. (p>0.05)

Table 5.3. Comparison of Pulmonary Function Tests and Respiratory Muscle Strength Assessment in between groups at baseline

	SG	CG	
Variables	Mean±SD	Mean±SD	p value
FVC (L)	4.45±1.02	3.81±1.16	0.134
FVC %	98.57±8.58	101.95±8.36	0.301
FEV_1 (L/sec)	2.98±0.74	2.31±0.80	**0.031**
FEV_1 %	78.48±13.84	73.68±13.28	0.357
FEV_1/FVC(%)	70.54±15.79	69.18±7.69	0.774
FEV_1/FVC %	81.77±16.39	85.22±10.60	0.514
PEF (L/sec)	3.77±0.90	3.00±0.96	**0.038**
PEF %	45.04±14.90	41.53±14.21	0.529
MIP(cmH_2O)	108.35±22.32	83.85±17.65	**0.001**
MIP %	99.56±21.06	95.94±29.40	0.711
MEP(cmH_2O)	125.64±24.41	107.14±19.50	**0.035**
MEP %	63.16±15.68	66.73±15.90	0.555

Independent Samples t test, SD: Standard Deviation, L: liters, L/sec: liters in 1 second FVC: force vital capacity, FEV_1: forced expiratory volume in 1 second, FEV_1/FVC: Tiffaneu Ratio, PEF: peak expiratory flow, cmH_2O: centimeterH_2O, MIP: Maximal Inspiratory Pressure, MEP: Maximal Expiratory Pressure, %: Percentage of the predicted value by gender, age, and height

Independent samples t test was used to evaluate the difference between groups Thoracic Spine Range of Motion(TSROM), New York Postural Rating Chart(NYPRC), Body Awareness Questionnaire(BAQ), and World Health Organization Quality of Life Assessment(WHOQOL-BREF). Results are shown in Table 5.4. There was no statistically significant difference between the groups.

Table 5.4. Comparison of Posture, Body Awareness, and Quality of Life Assessment between groups at baseline

	SG	CG	
Variables	Mean±SD	Mean±SD	p value
TSROM Right	57.28±7.12	53.35±4.86	0.100
TSROM Left	54.57±7.15	51.50±9.09	0.329
NYPRC Score	36.78±11.70	38.21±12.18	0.754
BAQ	95.71±13.86	98.92±12.87	0.530
WHOQOL	97.50±14.91	95.21±11.17	0.650

Independent Samples t test, SD: Standard Deviation, TSROM: Thoracic Spine Range of Motion by Degrees, NYPRC: New York Postural Rating Chart, BAQ: Body Awareness Questionnaire, WHOQOL: World Health Organization Quality of Life Assessment

5.2. Comparison of results within the group and between groups at baseline and after the intervention

5.2.1. Pulmonary Function Tests and Respiratory Muscle Strength Assessment

Pulmonary function and respiratory muscle strength comparison of the Smokers Group before and after the intervention has shown in Table 5.5. There was no statistically significant change in FVC ($p=0.140$) and FVC % ($p=0.164$), but FEV_1($p=0.011$), FEV_1 % ($p<0.001$), FEV_1/FVC ($p=0.025$), FEV_1/FVC % ($p<0.001$), PEF ($p<0.001$), PEF % ($p<0.001$), MIP ($p<0.001$), MIP % ($p<0.001$), MEP ($p<0.001$), MEP % ($p<0.001$) values have shown a statistically significant increase.

Table 5.5. Pulmonary function tests and respiratory muscle strength assessment of the Smokers Group at baseline and after the intervention

	Baseline	After		
Variables	Mean±SD	Mean±SD	t	p value
FVC (L)	4.45±1.02	4.57±1.16	-1,570	0.140
FVC %	98.57±8.58	100.95±8.99	-1,477	0.164
FEV_1 (L/sec)	2.98±0.74	3.61±0.92	-2,949	**0.011**
FEV_1 %	78.48±13.84	97.4±6.84	-5,108	**0.001**
FEV_1/FVC (%)	70.54±15.79	80.36±5.55	-2,537	**0.025**
FEV_1/FVC %	81.77±16.39	98.26±8.01	-4,495	**0.001**
PEF (L/sec)	3.77±0.90	5.19±1.18	-4,647	**0.001**
PEF %	45.04±14.90	63.35±9.65	-6,036	**0.001**
MIP (cmH_2O)	108.35±22.32	122.00±24.02	-5,567	**0.001**
MIP %	99.56±21.06	112.27±22.58	-5,238	**0.001**
MEP (cmH_2O)	125.64±24.41	161.42±24.93	-6,825	**0.001**
MEP %	63.16±15.68	80.67±12.64	-6,874	**0.001**

Dependent Samples t test, SD: Standard Deviation, L: liters, L/sec: liters in 1 second FVC: force vital capacity, FEV_1: forced expiratory volume in 1 second, FEV_1/FVC: Tiffaneu Ratio, PEF: peak expiratory flow, cmH_2O: centimeterH_2O, MIP: Maximal Inspiratory Pressure, MEP: Maximal Expiratory Pressure, %: Percentage of the predicted value by gender, age, and height

Pulmonary function and respiratory muscle strength comparison of the Control Group before and after the intervention has shown in Table 5.6. There was a statistically significant increase in all parameters ($p<0.05$).

Table 5.6. Pulmonary function tests and respiratory muscle strength assessment of the Control Group at baseline and after the intervention

	Baseline	After		
Variables	Mean±SD	Mean±SD	t	p value
FVC (L)	3.81±1.16	4.11±1.08	-2,523	**0.025**
FVC %	101.95±8.36	111.55±18.57	-2,424	**0.031**
FEV_1 (L/sec)	2.31±0.80	3.07±0.83	-5,313	**0.001**
FEV_1 %	73.68±13.28	96.07±13.62	-5,277	**0.001**
FEV_1/FVC (%)	69.18±7.69	75.86±6.73	-3,674	**0.003**
FEV_1/FVC %	85.22±10.60	93.94±9.58	-4,131	**0.001**
PEF (L/sec)	3.00±0.96	4.28±0.98	-4,575	**0.001**
PEF %	41.53±14.21	60.40±10.24	-5,441	**0.001**
MIP (cmH_2O)	83.85±17.65	110.42±18.39	-6,141	**0.001**
MIP %	95.94±29.40	124.97±27.48	-6,593	**0.001**
MEP (cmH_2O)	107.14±19.50	139.60±15.39	-5,467	**0.001**
MEP %	66.73±15.90	87.07±17.15	-5,926	**0.001**

Dependent Samples t test, SD: Standard Deviation, L: liters, L/sec: liters in 1 second FVC: force vital capacity, FEV_1: forced expiratory volume in 1 second, FEV_1/FVC: Tiffaneu Ratio, PEF: peak expiratory flow, cmH_2O: centimeterH_2O, MIP: Maximal Inspiratory Pressure, MEP: Maximal Expiratory Pressure, %: Percentage of the predicted by gender, age, and height

General linear model, repeated measures test was used to evaluate pulmonary function tests and respiratory muscle strength between the Smokers Group and the Control Group. Results are shown in Table 5.7. There were statistically significant changes in MIP (p=0.015) and MIP % (p=0.003) between groups. There were no statistically significant difference in FVC, FVC %, FEV_1, FEV_1 %, FEV_1/FVC FEV_1/FVC %, PEF, PEF %, MIP, MIP %, MEP, MEP % values.

Table 5.7. Comparison of pulmonary function tests and respiratory muscle strength between groups pre and post intervention

Variables	SG					CG					f	p value‡
	Pretest	Posttest	Δ	t	p value †	Pretest	Posttest	Δ	t	p value †		
FVC (L)	4.45±1.02	4.57±1.16	0.12±0.29	-1,570	0.140	3.81±1.16	4.11±1.08	0.29±0.44	-2,523	**0.025**	1.550	0.224
FVC %	98.57±8.58	100.95±8.99	2.38±6.03	-1,477	0.164	101.95±8.36	111.55±18.57	9.60±14.81	-2,424	**0.031**	2.853	0.103
FEV1 (L/sec)	2.98±0.74	3.61±0.92	0.62±0.79	-2,949	**0.011**	2.31±0.80	3.07±0.83	0.75±0.53	-5,313	**0.001**	0.270	0.608
FEV1 %	78.48±13.84	97.4±6.84	18.92±13.86	-5,108	**0.001**	73.68±13.28	96.07±13.62	22.38±15.87	-5,277	**0.001**	0.379	0.543
FEV1/FVC (%)	70.54±15.79	80.36±5.55	9.82±14.48	-2,537	**0.025**	69.18±7.69	75.86±6.73	6.68±6.80	-3,674	**0.003**	0.540	0.469
FEV1/FVC %	81.77±16.39	98.26±8.01	16.50±13.73	-4,495	**0.001**	85.22±10.60	93.94±9.58	8.72±7.90	-4,131	**0.001**	3.374	0.078
PEF (L/sec)	3.77±0.90	5.19±1.18	1.42±1.15	-4,647	**0.001**	3.00±0.96	4.28±0.98	1.28±1.04	-4,575	**0.001**	0.123	0.729
PEF %	45.04±14.90	63.35±9.65	18.31±11.35	-6,036	**0.001**	41.53±14.21	60.40±10.24	18.87±12.98	-5,441	**0.001**	0.015	0.904
MIP (cmH_2O)	108.35±22.32	122.00±24.02	13.64±9.17	-5,567	**0.001**	83.85±17.65	110.42±18.39	26.57±16.18	-6,141	**0.001**	6.759	**0.015**
MIP %	99.56±21.06	112.27±22.58	12.71±9.07	-5,238	**0.001**	95.94±29.40	124.97±27.48	29.02±16.47	-6,593	**0.001**	10.534	**0.003**
MEP (cmH_2O)	125.64±24.41	161.42±24.93	35.79±19.62	-6,825	**0.001**	107.14±19.50	139.60±15.39	32.46±22.22	-5,467	**0.001**	0.176	0.678
MEP %	63.16±15.68	80.67±12.64	17.51±9.53	-6,874	**0.001**	66.73±15.90	87.07±17.15	20.34±12.84	-5,926	**0.001**	0.439	0.514

† Dependent samples t test, ‡ Repeated Measures Anova Test. Data expressed as mean±SD. Δ: difference between pretest and posttest. L: liters, L/sec: liters in 1 second FVC: force vital capacity, FEV_1: forced expiratory volume in 1 second, FEV_1/FVC: Tiffaneu Ratio, PEF: peak expiratory flow, cmH_2O: centimeter water MIP: Maximal Inspiratory Pressure, MEP: Maximal Expiratory Pressure.

5.2.2. Postural Assessment, Body Awareness and Quality of Life

Dependent samples t test was used to compare the postural assessment, Thoracic Spine Range of Motion, Body Awareness, and Quality of Life assessment in the Smokers Group before and after the intervention, as shown in Table 5.8. There was a statistically significant increase in TSROM Right, TSROM Left, NYPRC, BAQ($p<0.001$), and WHOQOL scores($p=0.035$).

Table 5.8. Postural Assessment, Body Awareness, and Quality of Life of Smokers Group at the baseline and after the intervention

	Baseline	After		
	Mean±SD	Mean±SD	t	p value
TSROM Right	57.28±7.12	68.57±4.44	-6,452	**0.001**
TSROM Left	54.57±7.15	67.78±4.37	-7,585	**0.001**
NYPRC	36.78±11.70	64.57±16.43	-13,488	**0.001**
BAQ	95.71±13.86	108.42±9.39	-5,908	**0.001**
WHOQOL	97.50±14.91	101.71±11.91	-2,356	**0.035**

Dependent Samples t test, SD: Standard Deviation, NYPRC: New York Postural Rating Chart, TSROM: Thoracic Spine Range of Motion by Degrees, R: Right, L: Left, BAQ: Body Awareness Questionnaire, WHOQOL-BREF: World Health Organization Quality of Life Assessment

Dependent samples t test was used to compare the postural assessment, Thoracic Spine Range of Motion, Body Awareness, and Quality of Life assessment in the Control Group before and after the intervention has shown in Table 5.9. There was a statistically significant increase in TSROM Right, TSROM Left, NYPRC($p<0.001$), BAQ($p=0.002$), and WHOQOL($p=0.003$) scores.

Table 5.9. Postural Assessment, Body Awareness, and Quality of Life of the Control Group at baseline and after the intervention

	Baseline	After		
	Mean±SD	Mean±SD	t	p value
TSROM Right	53.35±4.86	65.21±4.00	-12,737	**0.001**
TSROM Left	51.50±9.09	66.21±4.69	-7,466	**0.001**
NYPRC	38.21±12.18	70.35±9.70	-13,474	**0.001**
BAQ	98.92±12.87	110.50±8.26	-3,776	**0.002**
WHOQOL	95.21±11.17	106.42±10.82	-3,612	**0.003**

Dependent samples t test, SD: Standard Deviation, NYPRC: New York Postural Rating Chart, TSROM: Thoracic Spine Range of Motion by Degrees, R: Right, L: Left, BAQ: Body Awareness Questionnaire, WHOQOL-BREF: World Health Organization Quality of Life Assessment

A General Linear Model Repeated Measures test is used to evaluate TSROM and NYPRC. A comparison between groups before and after the intervention is shown in Table 5.10. There were no statistically significant changes in TSROM Right, TSROM Left, NYPRC Score, BAQ, and WHOQOL scores in between groups($p>0.05$).

Table 5.10. Comparison of TSROM, NYPRC, BAQ and WHOQOL scores in between groups at baseline and after the intervention

Variables	SG					CG					f	p value‡
	Pretest	Posttest	Δ	t	p value †	Pretest	Posttest	Δ	t	p value †		
TSROM Right	57.28±7.12	68.57±4.44	11.29±6.54	-6,452	**0.001**	53.35±4.86	65.21±4.00	15.93±6.56	-12,737	**0.001**	0.083	0.775
TSROM Left	54.57±7.15	67.78±4.37	13.21±6.52	-7,585	**0.001**	51.50±9.09	66.21±4.69	14.71±7.37	-7,466	**0.001**	0.325	0.573
NYPRC	36.78±11.70	64.57±16.43	27.79±7.71	-13,488	**0.001**	38.21±12.18	70.35±9.70	32.14±8.93	-13,474	**0.001**	1.911	0.179
BAQ	95.71±13.86	108.42±9.39	12.71±8.05	-5,908	**0.001**	98.92±12.87	110.50±8.26	11.57±11.47	-3,776	**0.002**	0.093	0.763
WHOQOL	97.50±14.91	101.71±11.91	4.21±6.69	-2,356	**0.035**	95.21±11.17	106.42±10.82	11.21±11.62	-3,612	**0.003**	3.816	0.062

† Dependent samples t test, ‡ Repeated Measures Anova Test. Data expressed as mean±SD. Δ: difference between pretest and posttest. NYPRC: New York Postural Rating Chart, TSROM: Thoracic Spine Range of Motion by Degrees, R: Right, L: Left, BAQ: Body Awareness Questionnaire, WHOQOL-BREF: World Health Organization Quality of Life Assessment

5.2.3. Fagerström Test for Cigarette Dependence

At the baseline SG participants had a mean of 6.8 cigarette pack year. Cigarette dependency assessment of the SG at baseline and after the intervention is provided in Table 5.11. The Smokers Group's FT scores decreased statistically significantly.

Table 5.11: Cigarette Dependency Assessment of the SG at baseline and after the intervention

	Baseline	After	
Variable	Mean±SD	Mean±SD	p value
FT Score	2.78±2.15	1.64±1.82	**0.001**

SD: Standard Deviation, FT: Fagerström Test for Cigarette Dependence

6. DISCUSSION

The findings of this study showed that participating in Yoga practices improves pulmonary parameters, respiratory muscle strength, posture, quality of life, and body awareness in smokers. Furthermore, smokers' cigarette dependence scores decreased at the end of the study.

The study indicated that respiratory muscle strength, FEV_1, PEF, and Tiffeneau ratio statistically increased after the Yoga practice in both groups. On the other hand, only CG statistically improved FVC after six weeks of Yoga practice. Moreover, there was a statistically greater change in inspiratory muscle strength in the CG comparing both groups. Madanmohan et al. demonstrated the effects of six weeks of Yoga practice in 46 healthy adults aged between 17 and 20. They found significant changes in MIP, MEP, and respiratory muscle endurance, and they suggested that Yoga training may have improved the endurance as well as strength of respiratory muscles, which might have led to an improved level of voluntary control over breathing [78]. Another study included 27 male students between 18-21 years old and given 30 minutes of Yoga training for 12 weeks. They found statistically significant improvement in MIP, MEP, breath-holding time after expiration, and breath-holding time after the inspiration of the participants [16]. Jiwtode et al. also stated that Yoga training for 45 minutes consisting of 15 minutes of Asana, 15 minutes of relaxation techniques, and 15 minutes of Pranayama, five days a week for eight weeks had an increase in FVC, FEV_1, PEF, MIP, and MEP values in sedentary adults [79]. A study done by Cebrià i Iranzo et al. included 81 older adults. Participants were assigned to the Yoga breathing exercises group, inspiratory threshold training group, and control group, Yoga practice has undergone five days a week for six weeks. The yoga group showed significant changes in MIP, MIP%, MEP, and MEP% at 3, 6, and 9 weeks compared to other groups. They suggested that Yoga breathing techniques are more effective for improving respiratory muscle strength than other interventions in older adults [80]. Santaella et al. also investigated the effects of 30 minutes of Yoga practice twice a week for four months on 29 healthy elderly participants. They randomized the participants into the Yoga group and control group. They found improvement in FVC, FEV_1, MIP, MEP, and quality of life assessment values [81]. Consistent with the literature, our study showed similar results regarding pulmonary parameters in groups. However, CG had a greater improvement in MIP compared to SG. Smokers may have increased airway resistance,

contractile diaphragmatic effort, and inspiratory neural drive to the diaphragm with more significant exertional dyspnea and lower exercise tolerance than healthy controls [82]. We believe that CG participants controlled their diaphragm better during the Yoga practices.

The current study showed that participants in both groups had improved their range of motion and posture assessment scores. Also, there was no statistically significant difference between groups regarding improvement. In the literature, we have seen that the number of studies on posture, body awareness, and quality of life of yoga in smokers is limited. However, in different studies on smokers, it has been reported that carbon monoxide exposure is increased in smokers and that nicotine may affect the neuromuscular junction. It has been reported that this will cause decreases in muscle tone, especially in the quadriceps, which is known as the primary ambulatory muscle, resulting in decreases in posture and body awareness. Iki et al. stated that smokers have a more unstable posture compared to non-smokers. They also indicated that smoking affects posture more if a person smokes more frequently, and the effects can be aggravated by aging [83]. Tekur et al. conducted a study with 80 participants with chronic low back pain. The participants were intervened with a week intensive residential Yoga program consisting of Asana practice, Pranayama practice, and meditation. Spinal flexibility measures improved at the end of the intervention [24]. Another study included 59 young students. Participants had done Yoga practice once a week, 90 minutes for 13 weeks. They revealed a statistically significant increase in the spinal forward bending, lateral bending, and torsional range of motion after Yoga practice for the study group [84]. The current study showed that spinal flexibility increased after the six weeks of Yoga intervention in smokers as effectively as non-smokers. Thus, we suggest enrolling in Yoga practice as a preventative approach for both pulmonary and postural problems. Another study finding was that body awareness and quality of life showed statistically significant improvement after the intervention compared to the baseline values. However, there was no statistically significant difference between the groups. A study conducted by Rani and Rao investigated the effects of 3 months of daily 1 hour Yoga practice, including Asana and Pranayama interventions. It showed a statistically significant increase in BAQ scores of the Yoga compared to the control group [85]. Another study conducted by Daubenmier included 139 females and investigated the relationship of Yoga practice with body awareness and body responsiveness to self-objectification and disordered eating. With the results of

this study, Yoga practice has been linked with higher body awareness and responsiveness, which are associated with lower trait self-objectification, greater body pleasure, and less disordered eating attitudes [86]. Strine et al. showed a significantly poorer health-related quality of life among current smokers than non-smokers. They also reported that smokers were significantly more inclined to be physically inactive than non-smokers [87]. Although we did not find a statistically significant difference between the two groups in terms of posture, body awareness, and quality of life when the pretest data of groups were compared, we think that the posture, body awareness, and quality of life in the smoking group may decrease as exposure to cigarettes increases. Thus, we may suggest that practicing Yoga can be a novel therapeutic approach to maintaining a good posture, body awareness, and quality of life among smokers at the early smoking stage and later for correcting the expected distorted functions.

We also found that Yoga practice significantly decreased cigarette dependence among smokers. Human motivation operates in multiple levels, but one crucial neurotransmitter for cigarette addiction is dopamine, which is critical in the acute reward pathways associated with nicotine and other forms of drug abuse [88]. A few of the fundamental goals of Yoga are to gain mental peace and achieve physical fitness, produce a sense of well-being, relaxation, greater self-confidence, higher productivity, heightened attention, decreased irritation, and an optimistic attitude toward life. The posterior or sympathetic region of the hypothalamus gets inhibited by Yoga practice. This inhibition enhances the body's sympathetic reactions to stressful stimuli and recovers stress-associated autonomic regulating reflex systems. Yogic techniques suppress the regions of the brain responsible for rage, aggression, and fear while stimulating the rewarding pleasure pathways in the middle forebrain and other regions that lead to a feeling of joy and pleasure [89]. We believe that effective autonomic nervous system regulation while practicing Yoga, especially the breathing regulation aspect, improving parasympathetic activity and decreasing sympathetic activity, affected cigarette dependence among smokers.

The limitations of this study were that we conducted practice sessions online, which resulted in greater engagement in practice, but we were only able to correct some of the participants. In addition, we had a relatively small sample size. However, this practice is applicable anywhere online without needing an exercise mat or any material, which makes it convenient and shows that this study is applicable to a much larger

sample size. Also, the gender and age distribution differed between groups, which was compatible with global demographics, but this difference could affect the improvement and results. Thus, we also calculate percentages of our variables according to age and gender. Lastly, the intervention duration was relatively short, and we did not gather data about long-term follow-up.

7. CONCLUSION

Yoga training can improve pulmonary parameters, posture, body awareness, and quality of life in smokers as non-smokers. In addition, smokers could also use Yoga to decrease cigarette dependence. Therefore, further studies, including larger sample size and long-term follow-up, are needed to investigate the relationship between Yoga training and pulmonary parameters, respiratory muscle strength, spinal flexibility, body awareness, quality of life and cigarette dependence.

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Conflict of interests

The author declares no conflict of interest.

REFERENCES

1. St Claire S, Gouda H, Schotte K, et al. Lung health, tobacco, and related products: gaps, challenges, new threats, and suggested research. *American Journal of Physiology - Lung Cellular and Molecular Physiology.* 2020;318(5):L1004-L1007.
2. Reitsma MB, Kendrick PJ, Ababneh E et al. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019. 2021;*The Lancet,* 397(10292), 2337–2360.
3. Jha, P. Avoidable global cancer deaths and total deaths from smoking. *Nature Reviews Cancer* 2009;9:655–64.
4. Öncel S, Gebizlioğlu Ö, Alioğlu F. Risk Factors for Smoking Behavior Among University Students. *Turkish Journal of Medical Sciences*. 2011;41 (6).
5. Caliri AW, Tommasi S, and Besaratinia A. Relationships among smoking, oxidative stress, inflammation, macromolecular damage, and cancer. *Mutation Research/Reviews in Mutation Research*. 2021;787, 108365.
6. Jemel A, Thun MJ, Ries LA, et al. Annual report to the nation on the status of cancer, 1975-2005, featuring trends in lung cancer, tobacco use, and tobacco control. *J Natl Cancer Inst.* 2008;100(23):1672-1694.
7. Messner B. and Bernhard D. Smoking and Cardiovascular Disease: Mechanisms of Endothelial Dysfunction and Early Atherogenesis. *Arteriosclerosis, Thrombosis, and Vascular Biology,* 2014;34(3), 509–515.
8. Gallucci G, Tartarone A, Lerose R, Lalinga AV, and Capobianco AM. Cardiovascular risk of smoking and benefits of smoking cessation. *Journal of thoracic disease*, 2020;12(7), 3866–3876.
9. Peto R. Smoking and death: the past 40 years and the next 40. *BMJ.* 1994;309(6959):937-939.
10. Durazzo TC, Meyerhoff DJ, & Nixon SJ. Chronic Cigarette Smoking: Implications for Neurocognition and Brain Neurobiology. *International Journal of Environmental Research and Public Health,* 2010;7(10), 3760–3791.

11. Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. *N. Engl. J. Med.* 2013, 368, 341–350.
12. Balmford J, Borland R. What does it mean to want to quit? *Drug Alcohol Rev.* 2008, 27, 21–27
13. Brody AL, Olmstead RE, London ED, et al. Smoking-Induced Ventral Striatum Dopamine Release. *American Journal of Psychiatry*, 2004, 161(7), 1211–1218
14. Taimni, I. The science of Yoga: the yoga-sutras of Patanjali in Sanskrit with Transliteration in Roman, Translation and Commentary in English. 1999, Theosophical Publishing House
15. Barmola KC. Role of Bhastrika, Kapalbhati and Anulom Vilom Pranayam in Mental Health. In: Relevance of Mental Health during Covid-19; 2020. p. 1-6.
16. Madanmohan, Thombre DP, Balakumar B, et al. Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Indian J Physiol Pharmacol* 1992; 36:229–233.
17. Madanmohan, Jatiya L, Udupa K, Bhavanani AB. Effect of yoga training on handgrip, respiratory pressures and pulmonary function. *Indian J Physiol Pharmacol* 2003;47:387–392.
18. Joshi LN, Joshi VD, Gokhale LV. Effect of short term ‘‘Pranayam’’ practice on breathing rate and ventilatory functions of lung. *Indian J Physiol Pharmacol* 1992;36:105–108.
19. Makwana K, Khirwadkar N, Gupta HC. Effect of short term yoga practice on ventilatory function tests. *Indian J Physiol Pharmacol* 1988;32:202–208.
20. Birkel DA, Edgren L. Hatha yoga: Improved vital capacity of college students. *Altern Ther Health Med* 2000;6:55–63.
21. Telles S, Nagarathna R, Nagendra HR, Desiraju T. Physiological changes in sports teachers following 3 months of training in Yoga. *Indian J Med Sci* 1993;47:235–238.
22. Yadav RK, Das S. Effect of yogic practice on pulmonary functions in young females. *Indian J Physiol Pharmacol* 2001;45:493–496.
23. Lau C, Yu R, Woo J. Effects of a 12-Week Hatha Yoga Intervention on Cardiorespiratory Endurance, Muscular Strength and Endurance, and

Flexibility in Hong Kong Chinese Adults: A Controlled Clinical Trial. *Evid Based Complement Alternat Med*. 2015;2015:958727.

24. Tekur P, Singphow C, Nagendra HR, and Raghuram N. Effect of Short-Term Intensive Yoga Program on Pain, Functional Disability and Spinal Flexibility in Chronic Low Back Pain: A Randomized Control Study. *The Journal of Alternative and Complementary Medicine*, 2008;14(6), 637–644.
25. Michalsen A, Grossman P, Acil A, et al. Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. Medical Science Monitor : *International Medical Journal of Experimental and Clinical Research.* 2005 Dec;11(12):CR555-561.
26. Michalsen A, Jeitler M, Brunnhuber S, et al. Iyengar Yoga for Distressed Women: A 3-Armed Randomized Controlled Trial. *Evidence-Based Complementary and Alternative Medicine,* 2012(), 1–9.
27. Shahab L, Sarkar BK, & West R. The acute effects of yogic breathing exercises on craving and withdrawal symptoms in abstaining smokers. *Psychopharmacology* 2013;225, 875–882.
28. Şimşek İE. Omurga. 1. baskı ed. Şimşek İE, editor. Ankara: Hipokrat Kitapevi; 2017.
29. Çetin B. *Multipl Skleroz Hastalarında Grup Egzersizlerinin, Yürüyüş, Plantar Basınç Dağılımı ve Yaşam Kalitesi Üzerine Etkisi* [Yüksek Lisans]. Ankara: Hacettepe Üniversitesi; 2016.
30. Kalaycı M, Güleroğlu F, Gönülütaş B, Kalaycı MC. Covid-19 Pandemisinde Fiziksel Aktivite ve Egzersizin Önemi. *Germenica Beden Eğitimi ve Spor Bilimleri Dergisi.* 2021; 2(1): 30-40.
31. Manith E, Ean S, and Yoo K-H. X3D Modeling and Animation for Human Respiratory Organ. The 24th International Conference on 3D Web Technology. 2019. New York, USA.
32. Hall JE. Guyton And Hall Textbook Of Medical Physiology. 2015; *Elsevier Health Sciences.*
33. Waugh, A. and A. Grant, Ross & Wilson Anatomy And Physiology In Health And Illness. 2014: *Elsevier Health Sciences*.
34. Mccance, K.L. and S.E. Huether, Pathophysiology: The Biologic Basis For Disease In Adults And Children. 2015; *Elsevier Health Sciences.*

35. Neumann, D.A. Kinesiology Of The Musculoskeletal System: Foundations For Rehabilitation. 2013; *Elsevier Health Sciences.*
36. Hasleton, P. & D.B. Flieder, Spencer's Pathology Of The Lung. 2013: *Cambridge University Press.*
37. Global Strategy For The Diagnosis, Management And Prevention Of COPD. Global Initiative For Chronic Obstructive Lung Disease (GOLD) 2016.
38. Pryor, J.A. and A.S. Prasad. Physiotherapy For Respiratory And Cardiac Problems: Adults And Paediatrics. 2008: Elsevier Health Sciences.
39. Office of the Surgeon General of the United States. The health consequences of smoking–nicotine addiction; 2014. Accessed 23.02.2023. https://www.hhs.gov/surgeongeneral/reports-and-publications/tobacco/index.html
40. Jemel A, Thun MJ, Ries LA, et al. Annual report to the nation on the status of cancer, 1975-2005, featuring trends in lung cancer, tobacco use, and tobacco control. *J Natl Cancer Inst.* 2008;100(23):1672-1694.
41. Shiverick KT, Salafia C. Cigarette smoking and pregnancy I: ovarian, uterine, and placental effects. *Placenta*. 1999;20(4):265-272.
42. McCann MF, Irwin DE, Walton LA, Hulka BS, Morton JL, Axelrad CM. Nicotine and cotinine in the cervical mucus of smokers, passive smokers, and non-smokers. *Cancer Epidemiol Biomarkers Prev*. 1992;1(2):125-129.
43. Office of the Surgeon General of the United States. The health consequences of smoking: a report of the surgeon general. Accessed 23.02.2023. http://www.surgeongeneral.gov/library/smokingconsequences
44. American Association for Cancer Research. "Cigarette smoking increases colorectal cancer risk." ScienceDaily. 3.12.2009. Accessed 23.02.2023. <www.sciencedaily.com/releases/2009/12/091203090103.htm>.
45. Office of Surgeon General of the United States. The Health Benefits of Smoking Cessation: A Report of the Surgeon General. Accessed 23.02.2023. http://profiles.nlm.nih.gov/NN/B/B/C/T/.
46. Thornton J, Edwards R, Mitchell P, et al. Smoking and age-related macular degeneration: a review of association. *Eye* 2005;19, 935–944.
47. Bruijnzeel AW. Tobacco addiction and the dysregulation of brain stress systems. *Neuroscience & Biobehavioral Reviews*, 2012;36(5), 1418–1441.

48. Rosen LJ, Galili T, Kott J, Goodman M, and Freedman LS. Diminishing benefit of smoking cessation medications during the first year: a meta-analysis of randomized controlled trials. *Addiction*, 2018;113(5), 805–816.
49. Hartmann-Boyce J, Chepkin SC, Ye W, Bullen C, & Lancaster T. Nicotine replacement therapy versus control for smoking cessation. 2018;*Cochrane Database of Systematic Reviews.*
50. Stead LF, Koilpillai P, Fanshawe, TR, & Lancaster T. Combined pharmacotherapy and behavioural interventions for smoking cessation. 2016;*Cochrane Database of Systematic Reviews*.
51. Ussher MH, Taylor AH and Faulkner GEJ. Exercise interventions for smoking cessation. 2014;*Cochrane Database of Systematic Reviews.*
52. Klinsophon T, Thaveeratitham P and Janwantanakul P. The effect of three-part breathing exercise on smoking cessation: A 6-month cluster-randomized clinical trial. *Journal of bodywork and movement therapies*, 2022;32, 156–162.
53. Williams DM, Dunsiger S, Whiteley JA, Ussher MH, Ciccolo JT and Jennings EG. Acute effects of moderate intensity aerobic exercise on affective withdrawal symptoms and cravings among women smokers. *Addictive Behaviors*, 2011;36(8), 894–897.
54. Bock BC, Fava JL, Gaskins R. et al. Yoga as a Complementary Treatment for Smoking Cessation in Women. *Journal of Women's Health*. 2012;21(2), 240–248.
55. Nivethitha L, Mooventhan A, and Manjunath NK. Effects of Various Prāṇāyāma on Cardiovascular and Autonomic Variables. *Ancient science of life,* 2016;36(2), 72–77.
56. Telles S, Nagarathna R, and Nagendra HR. Breathing through a particular nostril can alter metabolism and autonomic activities. *Indian journal of physiology and pharmacology*, 1994;38(2), 133–137.
57. Raghuraj P, and Telles S. Immediate Effect of Specific Nostril Manipulating Yoga Breathing Practices on Autonomic and Respiratory Variables. *Applied Psychophysiology and Biofeedback*, 2008;33(2), 65–75.
58. Sinha AN, Deepak D, Gusain VS. Assessment of the effects of pranayama/alternate nostril breathing on the parasympathetic nervous system

in young adults. Journal of clinical and diagnostic research : *JCDR*, 2013;7(5), 821–823.

59. Pramanik T, Sharma HO, Mishra S, Mishra A, Prajapati R, & Singh S. Immediate Effect of Slow Pace Bhastrika Pranayama on Blood Pressure and Heart Rate. *The Journal of Alternative and Complementary Medicine,* 2009;15(3), 293–295.
60. Korakakis V, O'Sullivan K, O'Sullivan PB, et al. Physiotherapist perceptions of optimal sitting and standing posture. *Musculoskelet Sci Pract.* 2019;39:24-31.
61. Govindaraj R, Karmani S, Varambally S, Gangadhar BN. Yoga and physical exercise - a review and comparison. *Int Rev Psychiatry*. 2016;28(3):242-53.
62. Kinser PA, Goehler LE, Taylor AG. How might yoga help depression? A neurobiological perspective. *Explore (NY).* 2012;8(2):118-26.
63. Uysal MA, Kadakal F, Karşidağ C, Bayram NG, Uysal O, Yilmaz V. Fagerstrom test for nicotine dependence: reliability in a Turkish sample and factor analysis. *Tuberk Toraks*. 2004;52(2):115-21.
64. Fagerstrom, K. Determinants of Tobacco Use and Renaming the FTND to the Fagerstrom Test for Cigarette Dependence. *Nicotine & Tobacco Research*. 2011;14(1), 75–78.
65. Clemens KJ, Caillé S, Stinus L, and Cador M. The addition of five minor tobacco alkaloids increases nicotine-induced hyperactivity, sensitization and intravenous self-administration in rats. *The International Journal of Neuropsychopharmacology*, 2009;12(10), 1355.
66. ATS/ERS Statement on Respiratory Muscle Testing. *American Journal of Respiratory and Critical Care Medicine*. 2002;166(4), 518–624.
67. Miller M, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. *Eur Respir J*. 2005; 26(2): 319-338.
68. Yalnız I. *The Effects of COVID-19 Infection on Respiratory Muscle Strength and Core Stabilization in Physically Active Individuals.* [Master Thesis] Istanbul, Yeditepe University; 2022.
69. Tobin, M.J. and Laghi F. Monitoring respiratory muscle function. In: Tobin MJ, ed. Principles and Practice of Intensive Care Monitoring. *McGraw-Hill New York,* 1998; pp. 497-545.

70. Laveneziana P, Albuquerque A, Aliverti A, et al. ERS statement on respiratory muscle testing at rest and during exercise. *Eur Respir J* 2019; 53: 1801214
71. Furness J, Schram B, Cox AJ, Anderson SL & Keogh J. Reliability and concurrent validity of the iPhone® Compass application to measure thoracic rotation range of motion (ROM) in healthy participants. *PeerJ*, 2018;6, e4431.
72. McRoberts LB, Cloud RM, Black CM. Evaluation of the New York Posture Rating Chart for assessing changes in postural alignment in a garment study. *Cloth Text Res J* 2013;31:81-96.
73. Mehling WE, Gopisetty V, Daubenmier J, Price CJ. Body awareness: construct and self-report measures. *PloS one*. 2009;4(5):56-63.
74. Karaca S & Bayar B. Turkish Version of Body Awareness Questionnaire: Validity and Reliability Study. *Türk Fizyoterapi ve Rehabilitasyon Dergisi*. 2021; 32(1): 44-50.
75. THE WHOQOL GROUP. Development of the World Health Organization WHOQOL-BREF Quality of Life Assessment. *Psychological Medicine*. 1998;28(3):551-558.
76. Bhavanani AB, Madanmohan, Udupa K. Acute effect of Mukh Bhastrika (a yogic bellows type breathing) on reaction time. *Indian J Physiol Pharmacol* 2003;47:297-300.
77. Pramanik T, Pudasaini B, & Prajapati R. Immediate effect of a slow pace breathing exercise Bhramari pranayama on blood pressure and heart rate. *Nepal Med Coll J*, 2010;12(3), 154-157.
78. Madanmohan, Mahadevan SK, Balakrishnan S, Gopalakrishnan M, Prakash ES. Effect of six weeks yoga training on weight loss following step test, respiratory pressures, handgrip strength and handgrip endurance in young healthy subjects. *Indian J Physiol Pharmacol*. 2008;52(2):164-170.
79. Jiwtode MT & Mahajan M. Effect of duration of yoga training on pulmonary function tests and respiratory pressures in sedentary healthy adult population of Nagpur. *AA J Med Sci*. 2016;9, 79-83.
80. Cebrià i Iranzo Md, Arnall DA, Igual Camacho C, Tomás JM. Effects of inspiratory muscle training and yoga breathing exercises on respiratory muscle function in institutionalized frail older adults: a randomized controlled trial. *J Geriatr Phys Ther*. 2014;37(2):65-75.

81. Santaella DF, Devesa CR, Rojo MR, et al. Yoga respiratory training improves respiratory function and cardiac sympathovagal balance in elderly subjects: a randomised controlled trial. *BMJ Open*. 2011;1(1):e000085.
82. Elbehairy AF, Guenette JA, Faisal A, et al. Mechanisms of exertional dyspnoea in symptomatic smokers without COPD. *European Respiratory Journal*. 2016;48(3):694-705.
83. Iki M, Ishizaki H, Aalto H, Starck J, and Pyykkö I. Smoking habits and postural stability. *American Journal of Otolaryngology*. 1994;15(2):124-128.
84. Grabara M. Effects of hatha yoga exercises on spine flexibility in young adults. *Biomedical Human Kinetics*, 2016;8(1), 113–116.
85. Rani NJ and Rao PVK. Body Awareness and Yoga Training. *Perceptual and Motor Skills*, 1994;79(3), 1103–1106.
86. Daubenmier, JJ. The Relationship of Yoga, Body Awareness, and Body Responsiveness to Self-Objectification and Disordered Eating. *Psychology of Women Quarterly*, 2005;29(2), 207–219.
87. Strine TW, Okoro CA, Chapman DP et al. Health-related quality of life and health risk behaviors among smokers. *American Journal of Preventive Medicine*, 2005;28(2), 182–187.
88. Rosenthal DG, Weitzman M and Benowitz NL. Nicotine Addiction: Mechanisms and Consequences. *International Journal of Mental Health*. 2011;40(1):22-38.
89. Woodyard, C. Exploring the therapeutic effects of Yoga and its ability to increase quality of life. *International Journal of Yoga*, 2011;4(2), 49–54.

APPENDIX A: ETHICAL COMMITTEE APPROVAL

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

Sayı : E.83321821-805.02.03-162
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:	Sigara İçen Erişkinlerde Yoga'nın Solunum Fonksiyonları, Postür, Vücut Farkındalığı ve Yaşam Kalitesi Üzerine Etkisi
Araştırmacılar:	Fzt.Caner Özbek,Dr.Öğr.Üys Elif Develi
Başvuru Numarası:	202302Y0365

TOPLANTI BİLGİLERİ			
Toplantı Tarihi:	10.03.2023	**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

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

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

Bu belge, güvenli elektronik imza ile imzalanmıştır.
Belge Doğrulama Adresi : http://belgedogrulama.yeditepe.edu.tr/bg.aspx?id=56B639E5-DF38-41BD-87C0-FA9277CA31D3

Yeditepe Üniversitesi 26 Ağustos Yerleşimi, İnönü Mahallesi Kayışdağı Caddesi 34755
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Kep Adresi : yeditepeuniversitesi@hs03.kep.tr

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

APPENDIX B: INFORMED WRITTEN CONSENT

Araştırmanın adı: Sigara içen erişkinlerde Yoga'nın solunum fonksiyonları, postür, vücut farkındalığı 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 sigara içen ve içmeyen bireylerin solunum kas gücü, solunum fonksiyonları, yaşam kalitesi, vücut farkındalıkları, omurga esneklikleri ve vücut postürünü gözlemlemek amaçlanmıştır. Nikotin bağımlılığı değerlendirmesi için bir anket doldurmanız istenecek ve skorunuza göre sigara içenler veya içmeyenler grubuna atanacaksınız. Solunum sistemlerinizi değerlendirmek için iki ayrı cihaza nefesinizi almanız ve vermeniz istenecek, sonrasında ölçümleriniz kaydedilecektir. Gövde omurga hareket aralığınızı ölçmek için yatakta oturarak belirlenmiş pozisyonda sağa ve sola dönmeniz istenecektir, üç tekrar sonrası en iyi skor kaydedilecektir. Vücut postürünüzü(duruş) değerlendirmek için bir ipin önüne geçip durmanız istenecektir. Araştırmacı bu sırada duruşunuzu değerlendirip form üzerinde işaretleyecektir. Ek olarak yaşam kalitenizi ve vücut farkındalığınızı ölçmek için değerlendirmek için belirlediğimiz anketi doldurmanız istenecektir. Sizden bu çalışmada ölçümleri yapmak için uygulama öncesi 1 saat, uygulama bittikten sonra 1 saat ayırmanız istenecektir. Egzersiz seanslarımız haftada 2 gün 1'er saat belirlenmiş online platformda 4 hafta sure boyunca yapılacaktır. Egzersiz seanslarımız sırasında sırayla belirli duruşlar, dinamik hareketler ve nefes egzersizleri uygulanacaktır. Egzersiz seanslarına katılım zorunludur ve 1'den fazla seansa katılmamanız durumunda çalışmadan çıkartılmanız uygun görülmüştür. Bunun size ve yakınlarınıza hiçbir zararı olmayacaktır. Çalışmaya katılmakta parasal yük altına girmeyeceksiniz ve size de herhangi bir ödeme yapılmayacaktır.

Çalışma başladığında sigara içen bireylere üç seçenek sunulacaktır. Sigarayı tamamen bırakma, tüketilen sigara sayısını azaltma veya alışkanlığınıza olduğu gibi devam etme. Hepsi bu çalışma için eşit şekilde yararlıdır fakat sigara içme alışkanlığınızdan kurtulmanız veya zehirlenme düzeyinizi azaltmanız sizin ve sevdikleriniz için en faydalısı olacaktır. Yapacağımız uygulamalarda sigarayı bırakmanın yan etkilerini azaltmak için günlük hayatta kullanabileceğiniz özel teknikler öğretilecektir. Egzersizleri haftada 2 günden fazla yapmak isteyenler için video hazırlanıp, çalışma başladığında dağıtılacaktır.

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.

Araştırma ile ilgili daha fazla bilgiye ihtiyaç duyarsanız araştırma yürütücüsüne caner.ozbek@std.yeditepe.edu.tr e-posta adresi veya 0531 589 69 98 numaralı telefondan ve sorumlu araştırmacıya elif.ustun@yeditepe.edu.tr e-posta adresi veya 0555 593 62 93 numaralı telefondan ulaşabilirsiniz.

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

T.C. YEDİTEPE ÜNİVERSİTESİ
Fizyoterapi ve Rehabilitasyon Anabilim Dalı

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?

Sigara kullanıyor musunuz? □Evet □Hayır Kullanıyorsanız Kaç yıldır?
Günde kaç tane?

Fagerström Nikotin Bağımlılık Ölçeği Skoru:

Torokal Omurga Hareket Açıklığı: Sağ: Sol:

New York Duruş Değerlendirmesi Skoru:

WHOQOL-BREF Skoru: **BAQ Skoru:**

Solunum Fonksiyon Testi
FEV_1:
FVC:
FEV_1/FVC:
PEF:

Solunum Kas Gücü
MIP:
MEP:

APPENDIX D: FAGERSTRÖM TEST FOR CIGARETTE ADDICTION

1. İlk sigaranızı sabah uyandıktan ne kadar sonra içersiniz?

a. Uyandıktan sonraki ilk beş dakika içinde

b. 6-30 dakika içinde

c. 31-60 dakika

d. Bir saatten fazla

2. Sigara içmenin yasak olduğu örneğin; otobüs, hastane, sinema gibi yerlerde bu yasağa uymakta zorlanıyor musunuz?

a. Evet

b. Hayır

3. İçmeden duramayacağınız, diğer bir deyişle vazgeçemeyeceğiniz sigara hangisidir?

a. Sabah içtiğim ilk sigara

b. Diğer herhangi biri

4. Günde kaç adet sigara içiyorsunuz?

a. 10 adet veya daha az

b. 11-20

c. 21-30

d. 31 veya daha fazlası

5. Sabah uyanmayı izleyen ilk saatlerde, günün diğer saatlerine göre daha sık sigara içer misiniz?

a. Evet

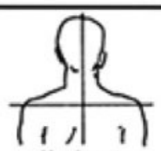
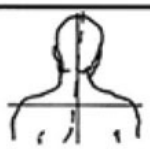
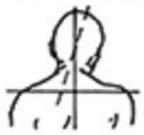
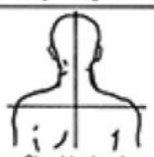
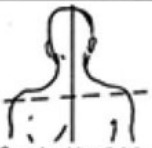
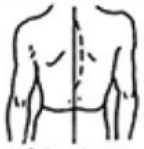
b. Hayır

6. Günün büyük bölümünü yatakta geçirmenize neden olacak kadar hasta olsanız bile sigara içer misiniz?

a. Evet

b. Hayır

APPENDIX E: NEW YORK POSTURAL RATING CHART

Posture score sheet	Name _____		
	Good—10	**Fair—5**	**Poor—0**
Head Left Right	 Head erect, gravity line passes directly through center	 Head twisted or turned to one side slightly	 Head twisted or turned to one side markedly
Shoulders Left Right	 Shoulder level (horizontally)	 One shoulder slightly higher than other	 One shoulder markedly higher than other
Spine Left Right	 Spine straight	 Spine slightly curved laterally	 Spine markedly curved laterally
Hips Left Right	 Hips level (horizontally)	 One hip slightly higher	 One hip markedly higher
Ankles	 Feet pointed straight ahead	 Feet pointed out	 Feet pointed out markedly, ankles sag in (pronation)
Neck	 Neck erect, chin in, head directly above shoulders	 Neck slightly forward, chin slightly out	 Neck markedly forward, chin markedly out
Upper back	 Upper back normally rounded	 Upper back slightly more rounded	 Upper back markedly rounded
Trunk	 Trunk erect	 Trunk inclined to rear slightly	 Trunk inclined to rear markedly
Abdomen	 Abdomen flat	 Abdomen protruding	 Abdomen protruding and sagging
Lower back	 Lower back normally curved	 Lower back slightly hollow	 Lower back markedly hollow

APPENDIX F: BODY AWARENESS QUESTIONNAIRE (TURKISH)

Aşağıdaki ifadelerde insanların kendileriyle ilgili hissettikleri bazı durumlar listelenmiştir. Her ifadeyi okuduktan sonra ifadenin solundaki boşluğa ifadenin sizin için hangi derecede doğru olduğunu 1'den 7'ye kadar değerlendirerek numarayı yazınız. Doğru veya yanlış cevaplar yoktur. En doğru cevap ifadenin sizin tecrübenize uygunluğunu dürüstçe yansıtandır.

Benim için hiç doğru değil Benim için tamamen doğru

1 2 3 4 5 6 7

1. Vücudumun çeşitli yiyeceklere verdiği tepkilerdeki farklılığı anlarım.

2. Bir yerimi çarptığımda berelenme olup olmayacağını her zaman söyleyebilirim.

3. Kendimi ertesi gün ızdırap duyacak kadar fiziksel olarak zorlayıp zorlamadığımı her zaman bilirim.

4. Bazı yiyecekleri yediğim zaman enerji düzeyimdeki değişimleri her zaman fark ederim.

5. Grip olacağımı önceden anlarım.

6. Dereceyle ölçmeden ateşimin olduğunu bilirim.

7. Açlıktan kaynaklanan yorgunluk ile uykusuzluktan kaynaklanan yorgunluk arasındaki farkı ayırt edebilirim.

8. Uykusuzluğun beni günün hangi saatinde etkileyeceğini doğru tahmin edebilirim.

9. Gün boyunca aktivite düzeyimdeki değişikliklerin farkındayım.

*10.Vücut fonksiyonlarımdaki mevsimsel ritim ve döngüleri fark etmiyorum.

11. Sabah uyanır uyanmaz gün boyunca ne kadar enerjim olacağını bilirim.

12. Yatağa gittiğimde o gece ne kadar iyi uyuyacağımı söyleyebilirim.

13. Yorgun olduğumda vücudumdaki belirgin tepkileri fark ederim.

14. Hava değişikliklerine karşı vücudumun verdiği tepkileri fark ederim.

15. Dinlenmiş bir şekilde uyanmak için gece ne kadar uyumam gerektiğini tahmin edebilirim.

16. Egzersiz alışkanlıklarım değiştiğinde enerji düzeyimin nasıl etkileneceğini tahmin edebilirim.

17. Benim için gece uyumaya gitmenin belli bir uygun zamanı vardır.

18. Aşırı açlık durumundaki özel vücut tepkilerimi fark ederim

*=ters skorlanan madde

APPENDIX G: WHO QUALITY OF LIFE ASSESSMENT (WHOQOL-BREF TURKISH)

WHOQOL-KISAFORM
Alan Çalışması Versiyonu
Aralık 1996
RUH SAĞLIĞI PROGRAMI
DÜNYA SAĞLIK ÖRGÜTÜ
CENEVRE

Yönerge

Bu anket sizin yaşamınızın kalitesi, sağlığınız ve yaşamınızın öteki yönleri hakkında neler düşündüğünüzü sorgulamaktadır. **Lütfen bütün soruları cevaplayınız.** Eğer bir soruya hangi cevabı vereceğinizden emin olamazsanız, **lütfen size en uygun görünen cevabı** seçiniz. Genellikle ilk verdiğiniz cevap en uygunu olacaktır.

Lütfen kurallarınızı, beklentilerinizi, hoşunuza giden ve sizin için önemli olan şeyleri sürekli olarak gözönüne alınız. Yaşamınızın **son iki haftasını** dikkate almanızı istiyoruz.

Son iki hafta boyunca başkalarından aldığınız desteğin miktarını en iyi karşılayan rakamı yuvarlağa almalısınız. Buna göre, eğer başkalarından çokça yardım aldıysanız, aşağıdaki gibi 4 rakamını yuvarlağa almanız gerekiyor, Örnek soru:

		Hiç	Çok az	Orta derecede	Çokça	Tamamen
	İhtiyacınız olan desteği başkalarından alabiliyor musunuz?	1	2	3	4	(5)

Son iki hafta içinde, ihtiyacınız olan desteği başkalarından hiç alamadıysanız, 1 rakamını yuvarlağa almalısınız.

Lütfen her soruyu okuyunuz, duygularınızı değerlendiriniz ve her bir sorunun ölçeğinde size en uygun olan yanıtın **rakamını yuvarlağa alınız.**

		Çok kötü	Biraz kötü	Ne iyi, Ne kötü	Oldukça iyi	Çok iyi
1	Yaşam kalitenizi nasıl değerlendirirsiniz?	1	2	3	4	5

		Hiç hoşnut değil	Çok az hoşnut	Ne hoşnut, ne de değil	Epeyce hoşnut	Çok hoşnut
2	Sağlığınızdan ne kadar hoşnutsunuz?	1	2	3	4	5

Aşağıdaki sorular son iki hafta içinde kimi şeyleri **ne kadar** yaşadığınızı soruşturmaktadır.

		Hemen hemen hiç	Çok az	Orta derecede	Çokça	Aşırı derecede
3	Ağrılarınızın yapmanız gerekenleri ne derece engellediğini düşünüyorsunuz?	1	2	3	4	5
4	Günlük işlerinizi yürütebilmek için herhangi bir tıbbi tedaviye ne kadar ihtiyaç duyuyorsunuz?	1	2	3	4	5
5	Yaşamaktan ne kadar keyif alırsınız?	1	2	3	4	5
6	Yaşamınızı ne ölçüde anlamlı buluyorsunuz?	1	2	3	4	5

		Hemen hemen hiç	Çok az	Orta derecede	Çokça	Son derecede
7	Dikkatinizi toplamada ne kadar başarılısınız?	1	2	3	4	5
8	Günlük yaşamınızda kendinizi ne kadar güvende hissediyorsunuz?	1	2	3	4	5
9	Fiziksel çevreniz ne ölçüde sağlıklıdır?	1	2	3	4	5

Aşağıdaki sorular son iki haftada kimi şeyleri ne ölçüde **tam olarak** yaşadığınızı ya da yapabildiğinizi soruşturmaktadır

.

		Hiç	Çok az	Orta derecede	Çokça	Tamamen
10	Günlük yaşamı sürdürmek için yeterli gücünüz kuvvetiniz var mı?	1	2	3	4	5
11	Bedensel görünüşünüzü kabullenir misiniz?	1	2	3	4	5
12	İhtiyaçlarınızı karşılamak için yeterli paranız var mı?	1	2	3	4	5
13	Günlük yaşantınızda gerekli bilgi ve haberlere ne ölçüde ulaşabilir durumdasınız?	1	2	3	4	5
14	Boş zamanları değerlendirme uğraşları için ne ölçüde fırsatınız olur?	1	2	3	4	5

Aşağıdaki sorularda, son iki hafta boyunca yaşamınızın çeşitli yönlerini ne ölçüde **iyi ya da doyurucu** bulduğunuzu belirtmeniz istenmektedir.

		Çok kötü	Biraz kötü	Ne iyi, ne kötü	Oldukça iyi	Çok iyi
15	Bedensel hareketlilik (etrafta dolaşabilme, bir yerlere gidebilme) beceriniz nasıldır?	1	2	3	4	5

		Hiç hoşnut değil	Çok az hoşnut	Ne hoşnut, ne de değil	Epeyce hoşnut	Çok hoşnut
16	Uykunuzdan ne kadar hoşnutsunuz?	1	2	3	4	5
17	Günlük işleri yürütebilme becerinizden ne kadar hoşnutsunuz?	1	2	3	4	5

18	İş görme kapasitenizden ne kadar hoşnutsunuz?	1	2	3	4	5
19	Kendinizden ne kadar hoşnutsunuz?	1	2	3	4	5
20	Diğer kişilerle ilişkilerinizden ne kadar hoşnutsunuz?	1	2	3	4	5
21	Cinsel yaşamınızdan ne kadar hoşnutsunuz?	1	2	3	4	5
22	Arkadaşlarınızın desteğinden ne kadar hoşnutsunuz?	1	2	3	4	5
23	Yaşadığınız evin koşullarından ne kadar hoşnutsunuz?	1	2	3	4	5
24	Sağlık hizmetlerini alma koşullarınızdan ne kadar hoşnutsunuz?	1	2	3	4	5
25	Ulaşım olanaklarınızdan ne kadar hoşnutsunuz?	1	2	3	4	5

Aşağıdaki soru son iki hafta içinde bazı şeyleri **ne sıklıkta** hissettiğiniz ya da yaşadığınıza ilişkindir.

		Hiçbir zaman	Nadiren	Arasıra	Çoğunlukla	Her zaman
26	Ne sıklıkta hüzün, ümitsizlik, bunaltı, çökkünlük gibi olumsuz duygulara kapılırsınız?	1	2	3	4	5

Bu formun doldurulmasında size yardım eden oldu mu?
……

Bu formun doldurulması ne kadar süre aldı?
……..

Soru formu ile ilgili yazmak istediğiniz görüş var mı?

YARDIMLARINIZ İÇİN TEŞEKKÜRLER.

APPENDIX H: CURRICULUM VITAE

Kişisel Bilgiler

Adı	Caner	**Soyadı**	Özbek

Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Doktora			
Yüksek Lisans			
Lisans	Fizyoterapi ve Rehabilitasyon	**Trakya Üniversitesi**	2017
Lise	Matematik-Fen	**Mehmet Niyazi Altuğ Anadolu Lisesi**	2013

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu (#)
Ingilizce	YDS 2018: 77, YÖKDIL 2023: 90

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	Kurum	Süre (Yıl - Yıl)
Kurum Sahibi, Fizyoterapist	Fizyoram Fizyoterapi Danışmanlık Merkezi	2022-Devam ediyor
Proje Danışmanı, Fizyoterapist	Inn Essence Retreat Center (Hollanda/Weert)	2019
Fizyoterapist	Özel Esençocuk Özel Eğitim ve Rehabilitasyon Merkezi	2019
Fizyoterapist	Esencan Hastanesi	2018-2019

Bilgisayar Bilgisi

Program	Kullanma becerisi
Microsoft Office	Iyi

*Çok iyi, iyi, orta, zayıf olarak değerlendirin

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)

RYS-500 Yoga Teacher Training, Traditional Chinese Medicine; Acupuncture, Reflexology, Cupping
Usui Reiki I-II, Advanced Spine Manipulative Therapy Course, Manual Lymphatic Drainage-Bandage Course

APPENDIX I: THESIS CONTROL LIST

Tezi son haline getirip çoğaltmadan önce aşağıdaki kontroller yapılmalıdır

☒ Kapak ve iç kapak sayfalarında YÜKSEK LİSANS veya DOKTORA şeklinde elde edilen unvanlar yazıldı (Kapak sayfasına danışman adı yazılmamalıdır).

☒ Kapak sayfasına mezun olunan PROGRAMIN (Anabilim dalının değil) adı yazıldı.

☒ Tez kapağı sırt kısmına kılavuzda belirtilen şekilde (yazının yönüne dikkat!) ad-soyad, enstitünün adı, program, yıl yazıldı.

☒ Kapakta yalnız tez başlığı 18 punto ve koyu renk, Enstitü ve Anabilim Dalı 14 punto ve diğer yazılar 12 punto ile yazıldı.

☒ Onay sayfası uygun şekilde hazırlandı (kazanılan unvanlar YÜKSEK LİSANS veya DOKTORA olmalıdır), imzalatıldı (Enstitü Müdürü'nün imzası da gereklidir, imzaların aynı renk kalemle atılmasına dikkat edilmelidir).

☒ Çıktılar kaliteli çıktı veren bir bilgisayar kullanılarak, kâğıdın tek yüzüne alındı.

☒ Dizinler kılavuzda belirtildiği gibi sıralandı.

☒ Ön sayfalara i, ii, iii şeklinde Roma rakamları konuldu.

☒ Sayfa numaraları kılavuzda belirtildiği şekilde konuldu.

☒ Sayfa düzeni kılavuzda belirtildiği şekilde yapıldı.

☒ Ana metin Times New Roman yazı tipi ile harf büyüklüğü 12 punto olacak şekilde basıldı.

☒ Dipnot harf büyüklüğü 8-10 punto olacak şekilde basıldı.

☒ Ana metin satır aralığı 1.5 olacak şekilde yazıldı.

☒ Türkçe ve İngilizce özet birbiri ile uyumlu olarak yazıldı.

☒ Türkçe ve İngilizce özete uygun anahtar kelimeler konuldu.

☒ Kısaltma ve semboller uygun şekilde yapıldı.

☒ Kaynaklar listesinde, her kaynağa numara verildi. Kaynak gösterme ilkelerine ve künye kurallarına uygun şekilde yazıldı.

☒ Tezde kullanılan bütün kaynaklar temin edildi.

☒ Ekler uygun başlıklarla, tezdeki sunuş sırasına göre, ayrı sayfalardan başlamak üzere verildi.