T.C.

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THE EFFECTS OF REGULAR YOGA PRACTISE ON POSTURE AND BALANCE IN HEALTHY ADULT WOMEN DURING COVID-19

MASTER THESIS

DENİZ BOYKOY, PT

İSTANBUL-2022

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This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated ..... and numbered .....

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Director of Institute of Health Sciences

DECLARATION

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

05.04.2022

Deniz BOYKOY

DEDICATION

To my family...

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I would like to express my sincere thanks to mysupervisor, Assist. Prof. Çiğdem Yazıcı Mutlu, who has the brains of a genius: she convincingly directed and pushed me to be professional and do the right thing even when the going became rough. This project's goal would not have been achieved without her unwavering assistance.

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LIST OF SYMBOLS AND ABBREVIATIONS

HPA	Hypothalamo Pituitary Adrenal Axis
BMI	Body Mass Index
cm	Centimeter
kg	Kilogram
m	Meter
NYPRC	New York Posture Rating Chart
NYPR	New York Posture Rating
SD	Standard Deviation
BDI	Beck Depression Inventory
OLS	One leg stand test
FRT	Functional Reach test
QOL	Quality of Life
FTF	Fingertip-to-floor
YBT	Y balance test
SPSS	Statistical Package for Social Science
N	Number

ABSTRACT

Boykoy, D. (2022) The Effects of regular yoga practise on posture and balance in healthy adult women during Covid-19. Yeditepe University, Institute of Health Science, Department of Physiotherapy and Rehabilitation, Master Thesis, Istanbul.
This study was aimed to investigate the effectiveness of yoga on posture and balance in healthy adult women during Covid-19. 42 volunteer women between the ages of 25-45 who regularly do or do not do yoga participated in the study. Subjects were divided into two groups those who do yoga regularly (n=21) and those who do not (n=21). New York Posture Rating Scale, One-leg stand test, Y balance test, Functional Reach test, Fingertip-to-floor test, Quality of life Short Form 36 (SF 36) test, Beck Depression test, muscle strength and 30-second Sit and Stand test, and Modified Push-up test were evaluated for both of the groups. Independent T-test, Mann-Whitney-U test and Chi-square tests were used to compare the groups as statistical analyses. A statistically significant difference was observed in the New York Posture Rating score of the groups ($p<0.05$). It was found that the group doing yoga differed significantly in dynamic balance, flexibility, posture, and depression measurements compared to the group that did not do yoga ($p<0.05$). In addition, the physical function, limitations in physical activities because of health problems, role limitations because of emotional problems, social function, energy-fatigue, general health perceptions of the yoga group were also found to be statistically significant ($p<0.05$). In addition, it was observed that the static balance, bodily pain and mental health measures of the participants did not show a statistically significant difference between the groups ($p>0.05$). As a result of our study, we found that yoga had a positive effect on posture, dynamic balance, flexibility, muscle strength, endurance, and quality of life in healthy adult women.

Key words: Yoga, Posture, Balance, Yoga effects

ÖZET

Boykoy, D. (2022) Covid 19 Döneminde Yetişkin Sağlıklı Kadınlarda Düzenli Yoga Yapmanın Postür ve Denge Üzerine Etkisi. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Bölümü, Yüksek Lisans Tezi, İstanbul.

Bu çalışma sağlıklı kadın bireylerin yoga yapmasının denge ve postür üzerindeki etkilerini araştırmak amacıyla gerçekleştirilmiştir. Çalışmaya 25-45 yaş arası 42 kadın katılımcı dâhil edilmiştir. Katılımcılar düzenli yoga yapan ve yapmayan olmak üzere iki gruba ayrıldılar. Grupların değerlendirmesinde de New York Postür ölçeği, Tek Ayak Üzerinde Durma testi, Y denge testi, Fonksiyonel Uzanma testi, Parmak-zemin testi, Yaşam Kalitesi Kısa Form 36 (SF 36) testi, Beck Depresyon testi, 30 saniye Otur ve Kalk test ve Modifiye Push-up testleri uygulandı. İstatistiksel analizler olarak grupların karşılaştırılmasında, Independent T-test, Mann-Whitney-U test ve Chi-square testleri yapıldı. Grupların New York postür değerlendirmesi skorunda istatistiksel olarak anlamlı bir fark gözlenmiştir ($p<0.05$). Yoga yapan grubun dinamik denge, esneklik, postür ve depresyon ölçümlerinde yoga yapmayan gruba göre anlamlı olarak farklılaştığı bulundu ($p<0.05$). Ayrıca yoga yapan grubun fiziksel işlev, sağlık sorunları nedeniyle fiziksel etkinliklerde kısıtlamalar, duygusal sorunlar nedeniyle rol kısıtlamalar, sosyal işlev, enerji-yorgunluk, genel sağlık algılarının da istatistiksel olarak anlamlı olduğu görüldü ($p<0.05$). Bunların yanında katılımcıların, statik denge, beden ağrısı ve ruh sağlığı" ölçümleri gruplar arasında istatistiksel olarak anlamlı bir farklılık göstermediği görüldü ($p>0.05$). Çalışmamızın sonucunda, sağlıklı yetişkin kadınlarda yoganın postür, dinamik denge, esneklik, kas kuvveti, enduransı ve yaşam kalitesi üzerinde olumlu bir etkisi olduğunu bulduk.

Anahtar kelimeler: yoga, postür , denge, yoganın etkileri

1. INTRODUCTION AND PURPOSE

Yoga is a discipline for thousands of years aiming to provide balance and health to the physical, mental, spiritual, and emotional qualities of the individual. While it has long been popular in India, it has recently gained popularity in Western countries. Because it is thought to relieve stress and anxiety, improve physical fitness, and improve mood (1).

Yoga is a kind of exercise that affects the mind through the appropriate positioning of the human body combined with concentration, relaxation, breathing control, and exercises. Yoga practices include specific standing postures (asanas) for stretching, balance, and strength, as well as yoga mat exercises and breathing techniques (pranayama). Meditation exercises and repetitive verbal expressions are also included (2). Meditation tries to modify perception, attention, concentration, and cognition by intentionally concentrating on a thought while focusing on bodily awareness and pranama breath control (3).

Yoga is a holistic approach that is becoming increasingly popular as a therapy for maintaining health and alleviating symptoms of a variety of diseases (3). Yoga postures and practices are also used therapeutically in the treatment of health conditions (4). Yoga has some benefits for the human body. Yoga strengthens muscles, improves posture, increases flexibility, regulates breathing, teaches the body to relax, and reduces metabolic syndrome risks. It has been determined that individuals who do yoga daily have less aggression, anxiety and depression (5).

Yoga helps to regulate brain and sympathetic nervous system activity, as well as the hypothalamic-pituitary-adrenal axis (HPA) (1, 6). It regulates blood sugar by reducing the responses of the sympathetic nervous system to stress, lowers epinephrine and norepinephrine levels, increases immunoglobulin-A levels, which lessens the detrimental effects of stress on the immune system, and lowers heart rate, systolic, and diastolic blood pressures (1).

There are studies that have positive effects on many diseases, pain, and symptoms such as rheumatological, orthopedic, neurological diseases, cardiopulmonary system diseases, and cancer (7, 8, 9, 10, 11).

The position of each bodily component about the rest of the body is referred to as posture. Each movement of the body, it is the combination of positions taken by the joints. The brain controls posture to maintain balance, and the central nervous system maintains body segment alignment during stance and movement to manage the placement of the center of gravity. External forces like muscle activity, passive tension forces in fascia and tendons, gravity, continuity, and gravitational reaction forces all work together to help the body balance and achieve proper posture. Correct alignment of body segments aids in proper performance and increases movement effectiveness and endurance. It is critical to maintaining good posture for the body to function properly and to look good. It reduces joint stress and protects the organs, allowing them to function properly. It is also the stance that achieves maximum efficiency with the least amount of effort. A person in good posture does not tire himself out and does not expend more energy than is required (12, 13, 14).

Balance is the prerequisite for human movement. It is described as the capacity to keep the center of body mass within the boundaries of the support surface. Different strategies, such as the hip and ankle strategies, are used by the human body to maintain its balance (15). The regulation of the body's position in space for the goals of balance and orientation is known as postural control (16). In other words, it is the skill to use balance mechanisms to align and stabilize the body in response to gravity forces. To maintain the required posture, the central nervous system must receive and integrate data about the position of several body parts and their relationships with one another and the environment (17). To achieve posture control, complex sensorimotor interactions that combine afferent information from the proprioceptive, vestibular, and auditory senses are used (18, 19).

Reduced mobility and a higher risk of falling have been related to balance issues. Injuries caused by falling are an important source of morbidity and mortality in the elderly; therefore, exercise is recommended to prevent falls, particularly in the elderly (20).

Grabara et al. investigated the effect of hatha yoga exercises on the shaping of the anterior-posterior spine curvature in a study. The results showed that the 15-weeks of yoga caused a decrease in most people's thoracic kyphosis and lumbar lordosis angles. They discovered that hatha yoga exercises had a positive effect on the person's body posture in the sagittal plane in this study of the shaping of the anterior-posterior curvature of the spine (21). Donahoe-Fillmore et al. studied the effects of Yoga exercises on balance in children aged 10 to 12, and the findings showed a considerable improvement in balance (22). Koohboomi et al. investigated the effect of yoga on balance in elderly women in another study. To assess static and dynamic balance, the Sharpened-Romberg (with open eyes) and the achievement test were used. These tests were carried out both before and after the yoga program. Yoga had a significant impact on balance in elderly women, according to research findings (23).

In our study, we aimed to investigate the effect of healthy women practicing yoga on balance and posture. Two hypotheses were identified in this study:

Hypothesis 0 (HO): Regular yoga practice has no effect on posture and balance in healthy adult women during Covid 19.

Hypothesis 1 (H1): Regular yoga practice has an effect on posture and balance in healthy adult women during Covid 19.

2. GENERAL INFORMATION

2.1. Yoga

Yoga is a traditional practice that originated thousands of years ago in India (24). The word yoga is derived from Yug root in the Sanskritian. The word means "union." This union symbolizes the coming together of the body, spirit, and mind. It is also about bringing the individual's and the universe's consciousnesses together (25).

Yoga is a practice that aims to bring people's physical, mental, and spiritual well-being into balance (26). Yoga Patanjali's classic work, Yoga Sutras, which is based on Indian philosophy, organizes and systematizes it. Yoga practice, according to Patanjali, the father of yoga, is the key to health, happiness, and longevity (27).

Patanjali describes eight stages of yoga that represent the search for the soul in yoga. These stages are:

1. **Yama:** Moral guidelines

2. Niyama: Self-purification with discipline

3. Asana: Posture

4. Pranayama: Rhythmic breathing control

5. Pratyahara: Freeing the mind from the senses

6. Dharana: Concentration

7. Dhyana: Meditation

8. Samadhi: Meditation in its higher state, the state of perfected concentration (28).

There are various branches of yoga that include practices that are based on the same philosophy but have different lifestyles. Karma yoga (the way of unrequited service), Raja yoga (the way of meditation), Jnana yoga (the way of information and teaching), Bhakti yoga (the way to commitment and love), and Tantra yoga (the way of rituals) are examples of these types of yoga (29). Yoga, a traditional Indian practice, has recently gained popularity in Western societies (26). Physical movements in Hatha

yoga, in particular, are frequently regarded as a form of exercise that promotes body health and well-being (30).

Yoga is a comprehensive program that incorporates both breathing and physical exercises. Yoga practices include regular and controlled breathing (pranayama) as well as a series of physical postures (asanas) that require concentration (meditation). Asanas are yoga exercises that can be done standing, sitting, or reclining, and can include forward/ backward bends or twists. It consists of specific postures designed to increase flexibility and strength. Meditation practices and repeated verbal expressions (mantra) are also included in these poses (31).

Yoga styles that have an impact on the mind through proper body positioning, concentration, and relaxation have recently become the most popular in the United States (32). It is viewed as a comprehensive approach to health in Western nations, and the National Institutes of Health classifies it as Complementary and Alternative Medicine (CAM) (9). It is also becoming more popular as a therapeutic method (33).

Physiotherapists have begun to incorporate yoga into their treatment plans, using breathing exercises, posture exercises, and relaxation techniques (34). Yoga comes to mind, and it has been the subject of research in many diseases that require physical therapy and rehabilitation, including neurological, orthopedic, cardiopulmonary diseases, stress, cancer, and depression.

2.1.1. Yoga Effects

Yoga has recently been integrated into rehabilitation techniques for the prevention and treatment of a variety of disorders, and numerous studies have found it to be beneficial (34).

Yoga can be viewed as a musculoskeletal health alternative to physical activity. Yoga helps to strengthen muscles, improve posture, and increase flexibility as well as maintain posture, according to studies (35, 36, 37).

Some studies show it is beneficial on the musculoskeletal system in chronic pain such as chronic neck and low back pain, and so on, both in terms of exercise and in terms of reducing stress with breathing exercises and thus reducing pain (38, 39, 40). Yoga's effects on reducing pain, increasing physical activity, and improving quality of

life in patients with osteoporosis, osteoarthritis, and any rheumatic disease were studied, and its positive effects were emphasized (41, 42).

Regular breathing exercises are advised for relaxation, stress reduction, the organization of psychophysiological situations, and the maintenance of organ health in the body. Yogic breathing, in which the breathing movement is produced in a resistive, controlled manner, modulates immune system, sympathetic nervous system, and HPA axis functions, as well as lowering inflammatory substances like C-reactive protein, interleukin-6, and lipid profile (1, 26, 43, 44).

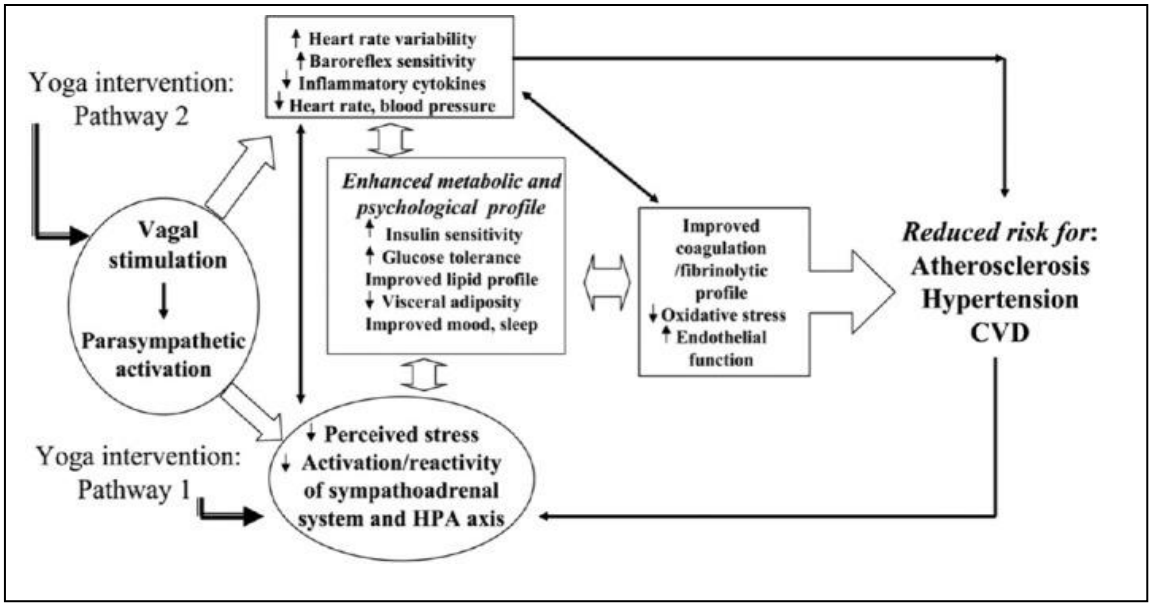

Figure 2.1. The mechanism of blood pressure-lowering is caused by yoga (Sengupta P).

Many "stress relief" treatments, including yoga, are known to reduce cortisol levels. The decrease in cortisol can be explained in several ways. Yoga stimulates the parasympathetic (vagal) nervous system. Increased parasympathetic activity decreases norepinephrine output by acting on the medulla nucleus. This causes relaxation as well as a decrease in breathing and heart rate. Reduced norepinephrine entry into the hypothalamic paraventricular nucleus leads to a decrease in corticotropin-releasing hormone and cortisol. Yoga also stimulates the prefrontal cortex, boosting glutamate transmission in the medial hypothalamus arcuate nucleus, leading to beta-endorphin release and a decrease in cortisol (45).

With its mood-enhancing effect, yoga is seen as a means to relieve stress and anxiety. According to studies, those who practice yoga regularly have lower levels of anger, anxiety, and depression. This implies that those who practice yoga regularly report increases in their mood, ability to manage stress, as well a social, emotional feeling of well-being (46, 47, 48). Yoga has also been shown to help with sleep difficulties due to its benefits on breathing and mental control (49, 50).

Yoga is an auxiliary activity in the treatment options of diseases such as Multiple Sclerosis, Parkinson's, and Hemiplegia, where respiratory problems and movement disorders occur, due to its positive effects on the regulation of breathing and concentration when combined with appropriate asana selection and breathing exercises (51, 52). An 8-week yoga program has been shown to enhance motor function, balance, and gait in Parkinson's patients while also reducing the risk of falling (53).

Breathing techniques used in yoga to control breathing have a favorable impact on respiratory functions. Intensive and long-term breathing exercises have been shown in studies to aid medical treatment in patients with pulmonary dysfunction. Yoga exercises, which last on average 10 weeks, help to improve physical fitness and pulmonary function (54, 55). Yoga is beneficial to one's cardiorespiratory health. Surya namaskar (sun greeting) cardiorespiratory asana affects heart rate of resting and blood pressure in the system, according to a study. Suryanamaskar practice was found to improve cardiopulmonary efficiency and improve cardiovascular, respiratory efficacy, and reaction time parameters in healthy adolescents (56).

Yoga is used to treat fatigue, sleep disturbances, stress, loss of appetite, chemotherapy, and radiotherapy-induced side effects, and pain in cancer patients. Yoga, when combined with mindfulness meditation, is more effective for cancer patients in studies (57).

Yoga is beneficial for the cardiovascular system. As a result, it prevents obesity, which is associated with ischemic heart disease and high blood pressure. Yoga practice regularly lowers the serum lipid profile, prevents hyperlipidemia, and aids in the maintenance of cardiovascular health. Furthermore, it positively contributes by regulating the hormonal mechanism in people with diabetes mellitus. Yoga has been shown to help with chronic hypertension complications such as left ventricular

hypertrophy. According to the findings of this study, one of the yoga asanas, head-down body upright exercise (Sarvangasana), is beneficial in preventing left ventricular hypertrophy and diastolic dysfunction caused by hypertension (58). Furthermore, yoga has been shown to reduce diabetes symptoms by affecting fasting blood sugar, insulin, and glucagon activity in patients with diabetes mellitus. Combining yoga asanas with traditional medical treatment may result in improved metabolic control (59).

In people with diabetes mellitus, yoga can help control the disease by reducing symptoms and complications by affecting insulin and glucagon activity (60). Yoga also reduced HbA1c, LDL (low-density lipoprotein), and increased HDL (high-density lipoprotein) value in patients with type 2 diabetes mellitus, according to a meta-analysis study (61).

Yoga is beneficial to women who practice it regularly during pregnancy for a variety of issues, including pain from muscle shortness, joint limitations due to limited movement, stress from changing hormone levels, and insomnia (62). Furthermore, a study found that combining mindfulness and yoga had a regulating effect on blood sugar control and nutritional habits in pregnant women with gestational diabetes (63).

Yoga is good for all body regions. It makes the body more flexible, strengthens the muscles, and teaches you to relax when necessary (14). Ulger et al. discovered that a 4-week yoga program has a beneficial impact on balance and gait parameters in women with musculoskeletal disorders that produce gait and balance abnormalities (64). It has also been shown to reduce falling risk, particularly in the elderly, because it improves balance and mobility (65).

Yoga can be used as a form of preventive physiotherapy in healthy people of all ages. Yoga practices can help you break free from a sedentary lifestyle, maintain your current level of physical activity and flexibility, socialize with group lessons, maintain proper posture, escape from intense work stress, calm down, and improve your overall well-being.

2.2. Posture

The word "posture" refers to the body's overall position about the adjacent section. In other words, while the body is moving or standing, it is the combination of

joint positions. The body achieves proper posture by cooperating so that it can move and maintain stability during muscle activity (12).

Active and inactive postures are the two types of posture. Moving or keeping the body still is considered an active posture, whereas resting or sleeping is considered an inactive posture. There is two kinds of active postures: static and dynamic. In static posture, the person must resist gravity by engaging in isometric muscle contractions, resulting in joint stabilization. Standing and sitting are two examples of this. To form a foundation for a movement in dynamic posture, environmental conditions, and continuous variables must adapt. Walking, running, and pushing are some examples. The postural mechanism, or the formation of dynamic and static postures, varies according to muscle strength, posture in it, and physical characteristics of the person. Antigravity muscles are the muscle groups that hold the body upright against gravity and generally extend it (12).

Good posture (standard posture) is defined biomechanically as a posture in which the body's balance and posture are good with the least amount of effort, the joints and organs are not overworked, and maximum efficiency is achieved. Poor posture, on the other hand, is a poorly balanced posture with insufficiently contracted muscles and body compensations. To give an example of how the body compensates, shortening the hip flexors causes hyperextension in the lumbar region, resulting in lordosis. The antagonist’muscles are lengthened and weakened, while the agonist’muscles are shortened. Muscle shortness, weakness, muscle strength imbalances, fatigue, and a person's psychological state are all factors that can lead to poor posture (13, 66).

In the standing position, it uses a pendulum string to determine where gravity passes. The center of gravity of the body is the place at which all of its parts are in equilibrium with one another. In neutral posture, the center of gravity is in front of the first and second sacral vertebrae. The pendulum is fixed in place on the patient. The pendulum passes through the center of both heels, both knee joints, all vertebral spinal processes, and the head. Laterally, the pendulum should pass 3-3.5 cm in front of the ankle joint, in front of the knee joint, slightly behind the hip joint, behind the center of the lumbar vertebrae, from the thoracolumbar junction (T10), in front of the center of

the thoracic vertebrae, over the cervicothoracic junction (C7), cervical passes slightly behind the center of the vertebrae and terminates on the mastoid process (12, 13).

2.2.1. Postural Reflex

The postural reflex is responsible for determining posture. A reflex is an involuntary response to a stimulus, according to the definition. A receptor organ, an afferent neuron, an effector neuron, and an effector organ are the anatomical structures that make up the reflex arc. In response to the afferent stimulus, an efferent response is produced. Reflex arcs in the spinal cord are in charge of maintaining the muscle tone required for proper posture (66).

The skin, muscle, and tendon all have receptor organs. Muscles, eyes, and ears are the receptors that ensure proper posture development. The antigravity muscles are the most important effector organ. The central nervous system receives and interprets stimuli from all sources before stimulating joint, muscle, and tendon receptors, allowing for coordination between the visual, auditory, and musculoskeletal systems as well as postural control (67). The cerebral cortex, cerebellum, nucleus rubber, vestibular system, reticular formation, and proprioceptive pathways are the centers that provide coordination (12).

2.2.2. Posture Analysis

In a posture analysis, the person is evaluated while standing upright. It's made up of the body's anterior, lateral, and posterior parts. The goal of the postural analysis is to determine current postural status and, if there is a disorder, to aid in the preparation of a treatment program. It becomes a future reference source, with progress and regressions in the person's condition being tracked. Potential deformations are prevented. The following factors influence posture: heredity, race, gender, seasons, diet, socioeconomic status, occupation, psychology, emotional conditions, hygiene, sleep, exercise, fatigue, musculoskeletal disorders, and soft tissue disorders (12).

The following are the methods used in posture analysis:

- Postural analysis with grid chart and Posture test (68)
- New York Posture Scale (69)
- Radiographic tests (70)

- 3D posture analysis (71)
- PostureScreen mobile application (72).

Anterior Posture Analysis

The presence of hallux valgus and hammertoe deformities in the feet; inversion/eversion of the feet; and the presence of tibial torsion, genu varum, and genu valgum deformities in the knees are all checked during the anterior postural analysis. There should be no difference in hip height between the right and left hip. Upper abdominal wall protrusion indicates weak abdominal muscles. The rib cage can take the shape of a Collapsed chest, Funnel-type chest, Barrel-shaped chest, Pigeon chest, or Harrison's groove depending on the type of deformity. There should be no difference in levels of the two shoulders, and neither should roll forward. The head position, the cubital angle of the elbows and arm length, and the equality of the waist concavities were all checked by comparing both sides (12).

Table 2.1. Anterior Posture Analysis

Foot/ankles	straight, not flattened/ internally or externally rotated
Knees	parallel with toes, not adducted/ abducted
LPHC	both anterior superior iliac spines in the same level
Shoulders	equal level, not elevated
Head	neutral, not tilted/ rotated

Lateral Posture Analysis

When the longitudinal arch of the foot is not normal, it can cause deformities such as decreased arch (pes planus) and increased arch (pes cavus). Analyze the knees and pelvis for neutrality. If the level of the anterior superior of the spine iliaca is lower than the level of the posterior superior of the spine iliaca, there is anterior pelvic tilt. If the opposite is true, there is posterior pelvic tilt. Furthermore, evaluating the pelvic tilt with an electrogoniometer or a gravity goniometer yields more objective results. The cervical vertebrae are slightly anteriorly convex, the thoracic vertebrae are slightly posteriorly convex, and the lumbar vertebrae are slightly anteriorly convex. An increase in lumbar convection is a good thing. Lordosis is characterized by an increase in the

normal posterior thoracic curvature. Barber appearance of kyphosis, kyphosis, and lordosis Kyfolordosis, or rounded back, is a condition in which the spine curves backward. There are flat back deformities in which the thoracic and lumbar folds are flattened. The shoulders are protracted (rounding forward) and retracted (rounding back), as well as the condition of the head and chin (12).

Table 2.2. Lateral Posture Analysis

Foot/ankles	Neutral
Knees	neutral, not flexion or hiperextension
LPHC	neutral pelvis position, not anterior/ posterior pelvic tilt
Shoulders	not rounded
Head	neutral, not anterior tilt

Posterior Posture Analysis

The presence of pronation or supination in the feet, as well as whether the right and left knee and gluteal lines are equal, are all examined. One leg shortness, scoliosis, and lateral pelvic tilt deformities are highlighted if they exist (12).

Table 2.3. Posterior Posture Analysis

Foot/ankles	heels are straight and parallel
Knees	neutral, not adducted/ abducted
LPHC	same pelvis level with both posterior superior iliac spines
Shoulders scapulae	equal level, not elevated or protracted
Head	neutral, not tilted/ rotated

2.3. Balance and Postural Control

The ability to keep the body's center of gravity on the support surface is known as balance. The body surface on which the pressure created by the effect of body weight and gravity is carried is known as the support surface. When standing, the support surface is the feet, and when sitting, it is the thighs and hips (73). The concept of

coordination is used to assess balance. The ability to make smooth and controlled movements with a specific purpose is known as coordination. Daily activities such as fine motor movements, walking, and running require coordination (74, 75).

Postural control is the ability to maintain balance during activity. Maintaining balance during any activity, providing stability, and regaining balance after a loss of balance are all essential. Integration of complex sensory information regarding the body's location is required for postural control, and the brain generates appropriate motor responses to control body movements. It contains a complex sensorimotor interaction process that constantly integrates data from relevant senses such as vestibular, proprioceptive, auditory, and visual modalities (75, 76).

2.3.1. Vestibular system

The vestibular system, which coordinates spatial orientation and balance, is both a sensory and a motor system. By providing visual fixation during coordinated head and trunk movements, the vestibular system helps to bring the somatosensory and visual systems into balance. There are two types of vestibular systems: peripheral and central. With its special receptors, the peripheral vestibular system transmits information about head position and movement to the central vestibular system, where it is integrated into the relevant brain stem and cerebellum centers. The peripheral vestibular system consists of the otolithic system (utriculus and sacculus), semicircular canals (lateral, superior, and posterior), nervus vestibular, and ganglion vestibular. The central region consists of lateral, medial, superior, and inferior vestibular nuclei in the puncto-bulbar region, second neurons beginning here, and synaptic connections (77).

There are two types of movement: linear and rotational. The saccule and vesicle are two otolith organs in the vestibular system that are sensitive to linear acceleration movements (gravity and translational movements). There are three semicircular canals in the vestibular system that are sensitive to angular acceleration (rotational movements) (78).

There are reflex pathways that help maintain body position by regulating compensation movements. Maintains balance and visual acuity during movement by autonomously coordinating postural and ocular reflexes.

The vestibulo-ocular reflex is defined as the stimulation of all labyrinth receptors at the same time in response to sudden head movements and compensatory eye movements. It is responsible for the harmony of head and eye movements by ensuring that the eye remains fixed on the object during head movements. When the head is rotated in one way and the eyes move in the other direction, the semicircular canals detect movement. By stabilizing the head and trunk during movement, the vestibulospinal reflex prevents falls. At the same time, it keeps your balance and posture in motion by allowing you to move your antigravity muscles in a coordinated manner. The vestibuloreticular reflex is a functional inhibitor that forms connections between the vestibular nuclei and the labyrinth (79).

2.3.2. Proprioception and Somatosensory system

Proprioception is the awareness of an extremity's location and movement in space by the central nervous system. In addition, the forces affecting the relevant region and the creation of safe appropriate answers. By providing information about the body's current position, proprioception aids in movement control. Proprioceptors provide continuous feedback to the control system about limb orientation and environmental factors in the body during movement, and this information helps organize the movement. Sensory receptors in peripheral proprioception include cutaneous touch and pressure receptors, mechanoreceptors in joints and muscle spindles, and tendon Golgi organs. Proprioception is considered synonymous with terms like kinesthesia, joint position sense, balance, and reflex joint stability (80, 81).

The somatosensory system consists of sensory receptors and neurons in peripheral structures, and also deep neurons in cortical structures. Proprioception is part of the somatosensory system concept. There are also thermoreceptors, photoreceptors, mechanoreceptors, and chemoreceptors. These receptors carry proprioception, touch, heat, and somatic sensations from the skin and epithelium, skeletal muscle, bones and joints, and internal organs to the upper centers. The Meissner, Pacinian, Merkel, and Ruffini mechanoreceptors carry the touch, pressure, vibration, and cutaneous tension senses (82).

2.3.3. Visual System

Vision is critical for maintaining balance control, especially when there are postural disturbances. The warnings from semicircular canals lead the eyes to rotate in the same and reverse direction as the head when the head is rapidly tilted. This is known as the vestibulo-ocular reflex (83).

In the visual system, there are three components: central, ambient (peripheral), and retinal slip. The central visual system is responsible for detecting and detecting object movement. Peripheral vision is sensitive to movement in the scene as well as the visual field's perimeter. It has an effect on both self-motion perception and postural control at the same time. The retinal slip, which is a component of afferent motion perception, The retinal slip is related to a person's displacement and is used as feedback for compensatory sway (84).

2.3.4. Balance Evaluation

Balance assessment determines fall risk and treatment options for preventing falls. Balance is evaluated using dynamic and static tests. Static balance is assessed by using One-leg Stand, Flamingo, and Romberg Test. Dynamic balance assessments include Star Excursion, Timed Get-up-and-Go, Y Balance, Functional Reach, Stability Limit Test, Berg Balance, Tinetti Balance, and Gait Score tests. Clinical balance tests and laboratory balance tests can both be used to measure balance. Clinical balance tests are performed with closed/ open eyes, on stable/ unstable surfaces (85).

Computerized static and dynamic balance platforms provide more objective results and quantifiable measurements. AMTI AccuSway Plus Static Balance, NeuroCom Equitest and Balance Master Series, Biodex Stability System, and Portable Computerized Kinesthetic Ability Trainer (KAT 2000, SportKAT 550) are examples of high-tech balance systems (86, 87). Furthermore, Nintendo Wii Fit balance evaluation is a technological application equipped with a balance board and television for this purpose (88).

2.4. Yoga and Postural Control

As previously stated, the sensory (vestibular, visual, and proprioceptive systems), nervous, and musculoskeletal systems, which comprise the motor processes,

work in concert to provide the postural control process, in which many systems and structures are involved in a complex way. During yoga practice, participants consider all aspects of postural control, as well as control their breathing and keep their body in a stable and proper state to ensure and maintain movement during transitions between asanas. Yoga improves motor learning, speed, and accuracy by increasing attention and body awareness. It improves the control of sensorimotor rhythms (89).

In a study, they examined the effect of an 8-week therapeutic yoga program on postural control in elderly people. Activity-Specific balance scale, the 4-square step, Berg balance, timed floor-to-stand, and gait speed were all assessed. Yoga improved postural control according to the findings (90). Statistically, the same significant improvements were observed in another study with a longer duration of 12 weeks, which supported the findings.

The following is a description of the situation. Tree pose strengthens the muscles of gastrocnemius-soleus and tibialis anterior by encouraging active involvement of the gastrocnemius, hamstring muscles, heels, and toes. The gastrocnemius-soleus muscle group is essential for the push-off phase of walking and preventing excessive energy consumption during ambulation. The tibialis anterior muscle is essential for foot mobility and reducing the risk of falling during gait. Tree pose can help you walk faster by improving your balance in a unilateral stance. Chair pose improves quadriceps strength, which is necessary for facilitating complete full knee extension between terminal stance and pre-swing, as well as contributing to proper step length. Many positions like these enhance ankle stability, activate intrinsic foot muscle, which contributes to walking speed and stability (91).

Sanjari et al studied 8-week yoga exercises'effect on postural control in female hearing disabled adolescents. Stork balance stand test and Y balance test were assessed. Yoga exercises were found to be effective for improving balance (92). Prado et al investigated the effects of a 5-month Hatha yoga program on postural control in healthy young adults. Using field methods, they evaluated postural control and identified the limit of stability as well as the speed of oscillation (dynamic test, four-position, flamingo, hopscotch, plane). This study found strong evidence that hatha yoga can improve postural control (93).

3. MATERIALS AND METHOD

3.1. Subject

This research will be conducted in Bursa between January 2021 and December 2021. We asked the women if they would be willing to participate in our study as volunteers. Our study included 42 healthy women between the ages of 25 and 45 who met the inclusion criteria. The Yeditepe University Clinical Research Ethics Committe approved this study. Yeditepe University Ethical Committee accepted the study procedure on the date of 05.10.2021 with issue number 202106078 (Appendix 1). According to the reference study with GPower 3.1 Power Analysis, the sample size for the study was determined to be 96 people (80 percent power and 0.05 type 1 error) (94). All of the women were split into two groups based on whether or not they practiced yoga: the Yoga Group (YG) and the Non-Yoga Group (NYG).

This study's inclusion and exclusion criteria are listed below.

1. Inclusion criterias for the experimental group:

- Being a healthy woman,
- Age between 25-45,
- Not having any cardiovascular or heart disease,
- Not having any surgery in the last 6 months,
- Doing yoga online for at least 6 months,
- Not doing any sport other than yoga,
- Volunteering to participate in the study was included.

2. Inclusion criterias for the control group:

- Being a healthy woman,
- Age between 25-45,
- Not having any cardiovascular or heart disease,
- Not having any surgery in the last 6 months,
- Not doing any sports,
- Volunteering to participate in the study was included.

3. Exclusion criterias:

- Those with heart disease,
- Individuals with chronic systemic conditions,
- Those who have undergone surgery in the last 6 months, those with a previous history of spinal surgery,
- Cancer, vertebral inflammatory, infectious and malignant diseases,
- To be diagnosed with inflammatory, fracture, cauda equina, neurological disease,
- Using antidepressants was excluded.

3.1.1. Study Protocol

The healthy women (n=42) voluntarily participated in the study. Before the assessments began, all participants were kept informed of the study. All of the women were split into two groups based on whether or not they practiced yoga: the Yoga Group (YG) (n=21) and the Non-Yoga Group (NYG) (n=21). For their approval, a demographic information questionnaire was administered and a consent form was signed.

Both groups were subjected to the New York posture assessment, one-leg stand, Y balance, functional reach, 30-second sit and stand, modified push-up, fingertip-to-floor, SF-36 quality of life test, and Beck's depression inventory tests. The one-leg stand test, Y balance, 30-second sit and stand, modified push up, fingertip-to-the-floor, and functional reach tests were repeated 3 times with 1-minute rest was given between repetitions. The results were analyzed collectively, and the average of the results was calculated. Evaluations took approximately 50 minutes. The study was conducted face to face with the participants.

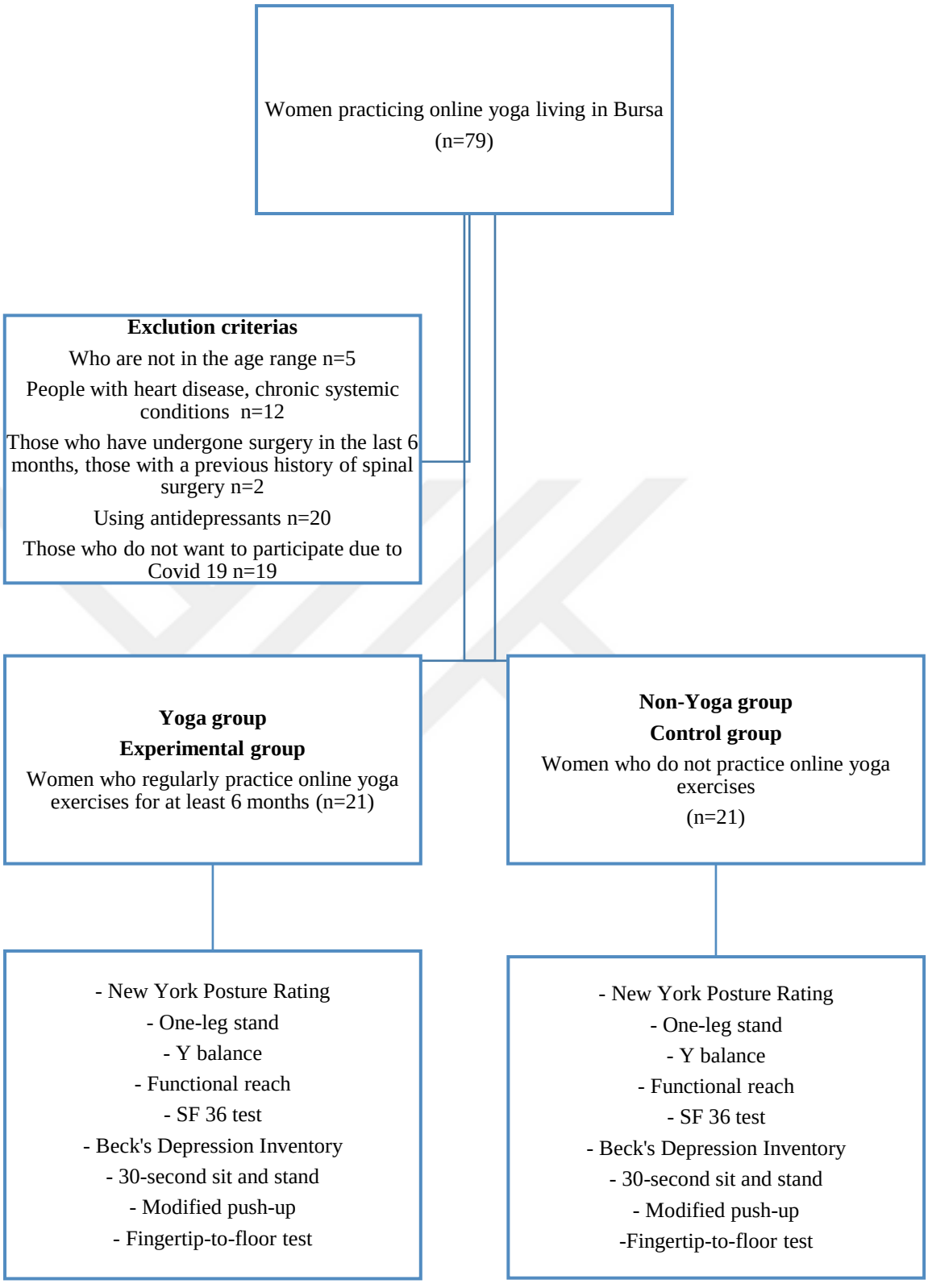

Figure 3.1. Flow Chart of Study

Evaluation Forms

It took 3 months to identify volunteers according to the criteria of the study. Nine different evaluations were used to evaluate the participants. The evaluations were applied face to face with participants. Two of them are in the form of questionnaires. Others had physical assessments.

3.2.1. Demographic Information

The General Information, Evaluation Form contains questions about the demographic and social status of the participants such as age, weight, height, education status, health information, and sports habits were answered. General Information Evaluation Form was filled face to face (Appendix 3).

3.2.2. New York Posture Assessment

The New York Posture Rating Scale (NYPR) was used to assess the postures of the individuals. In 1958, the NYPR was published as "The New York Physical Fitness Test." It was revised in 1992 by Howley and Franks (95). This exam, in its 1958 edition, provides information regarding posture from the posterior and lateral perspectives. This examination makes it possible to determine a person's posture analysis quickly and precisely (96).

For each of the thirteen body parts that contribute to total postural alignment, NYPR generated three-figure illustrations. The evaluation is scored based on the changes in posture.

Even before the evaluation, participants were instructed to wear tight clothing that revealed their body lines, to stand with bare feet, and to face the opposite wall in a comfortable position with an equal load on both feet. They remained in their positions until the assessment was completed. The participants are observed from the posterior and lateral.

- The position of the head, the level of the shoulders with each other, the straightness of the spine, and the equality of the level of the two sides of the hips and feet are all evaluated from the posterior.

- The foot arch, chest, upper back, shoulders, neck, trunk, lower back, and abdomen are evaluated when viewed from the lateral.
- Whichever of the three pictures available for each body segment fits the person is marked. Each segment is assigned points based on its grade.

It was given 5 points if the participant's posture was correct; 3 points if it was impaired moderately; and 1 point if it was severely damaged. The total score evaluation score is formed by scoring 13 sections in this manner. The test score values from 65 to 13 points. A total score of 45 or higher is accepted "very good", 40-44 is "good", 30-39 is "middle", 20-29 is "weak", and 19 or less is "bad". The low score indicates posture problems (97) (Appendix 4).

3.2.3. Static Balance: One-leg Stand Test

The balance and ability to stand still are assessed in this test.

- Participants were informed about the test. Before the test, participants were shown how to perform the test in practice.
- The test was performed on the dominant leg. The test was done with eyes open and barefoot.
- For 30 seconds, participants were instructed to stand on one foot and cross their arms over their chest.
- A timer was used to time the participants' ability to stand on one leg without losing their balance. Each time, the physiotherapist counted and informed the person.
- The test was repeated three times with a one-minute break in between. The average of the results was evaluated.

The test was canceled and repeated if the lifted leg touched the floor, the supporting leg touched, or there was too much loss of balance (98, 99). The capacity to stand on one leg for a long time indicates how static balance is. Elderly people who can't stand on one leg for more than 5 seconds are at falling risk (100). The test has a high level of reliability. The ICC value ranges from 0.84 to 0.97 (101).

Figure 3.3. One-leg stand test

3.2.4. Dynamic Balance: Y Balance Test

This test is used to determine dynamic balance. The ICC score of 0.95 indicates the test's validity and reliability (102).

- The test was performed on the dominant leg. The test was done with eyes open and bare feet.
- The lower extremities of the participants were measured in centimeters from the anterior superior iliac spine to the lower end of the medial malleolus.
- To prepare for the test, a Y platform was created by stacking three pieces of the same color duct tape to the floor at equal angles (90°, 135°) to form a Y shape.
- During the test, participants are asked to stand on a specially prepared Y platform on one barefoot, with their hands on their hips, maintaining their balance in the anterior, posterolateral, and posteromedial directions, and

reaching the longest distances with their toes. The participant is instructed to touch the point as far away as her toes can reach.

- With the unstable ankle, six repetitive warm-ups were performed in all directions.
- The tests were then repeated three times in each direction. A board marker was used to mark the distance traveled, and a tape measure was used to measure it. It was measured in centimeters, and the average score was calculated.
- This data is used to calculate reach values in three different directions. To calculate the reach distance in each direction, the reach distance average/limb lengthx100 formula was used (103). The composite score was calculated by taking the sum of 3 reach directions divided by 3 times the limb length then multiplied by 100.

$$\text{The composite score} = \frac{(\text{anterior}+\text{posteromedial}+\text{posterolateral})}{3\times\text{limb length}} \times 100$$

During the tests, it is important not to interrupt the sole's contact with the platform, not to support the moving foot on the platform, not to touch the ground outside the line with the foot, and to return to its starting point. If the participants did not comply with these conditions, the test was canceled and repeated. For the test to be successful, the initial balance must not be disturbed.

Figure 3.4. Y balance test

3.2.5. SF 36 Quality of Life Scale

The SF 36 is a short, well-presented, and simple-to-understand quality-of-life scale. It was developed by Ware in 1987 and was arranged for use in clinical research evaluations (104). Koçyiğit et al. evaluated the reliability and validity of the Turkish version of the test by investigating the quality of life in women with osteoporosis. The scale's test-retest reliability coefficient is 0.94, and its internal consistency is 0.92 (105). It's frequently used as a measurement of life quality.

- First and primarily, the participants were informed about the test. In this 36-question test, explanations were provided for questions that they could not read or understand. Physical function (10 items), bodily pain (2 items), limitations in physical activities because of health problems (4 items), limitations in the usual role because of emotional problems (3 items), perceptions of general health (5 items), social function (2 items), mental health (5 items), energy-fatigue (4 items), are all included in the test.

- Participants were asked about their health, how they felt, and how well they were able to perform their daily activities in the previous month. They were asked to choose the sentence that best expressed them. There was no time limit when testing.
- The formula was used to calculate the overall score. Scoring ranges from 0 to 100. A high score indicates a high quality of life (Appendix 6).

In each question item, numbers written in lowercase letters next to the checkboxes exist. The number of the option marked by the patient is will be used interchangeably by the instructions given.

- The following replacement instruction was used for items 1, 2, 20, 22, 34, 36.
  Example: If the participant checked the "excellent" option for question 1, the value 1 next to the checked box was used. According to the table below, item 1 value was converted to 100 points.
  (1: 100 points, 2: 75 points, 3: 50 points, 4: 25 points, 5: 0 points)
- The following replacement instruction was used for items 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
  (1: 0 points, 2: 50 points, 3: 100 points)
- The following replacement instructions were used for items 13, 14, 15, 16, 17, 18, 19.
  (1: 0 points, 2: 100 points)
- The following replacement instructions were used for items 21, 23, 26, 27, 30.
  (1: 100 points, 2: 80 points, 3: 60 points, 4: 40 points, 5: 20 points, 6: 0 points).
- The following replacement instructions were used for items 24, 25, 28, 29, 31.
  (1: 0 points, 2: 20 points, 3: 40 points, 4: 60 points, 5: 80 points, 6: 100 points).
- The following replacement instructions were used for items 32, 33, 35.
  (1: 0 points, 2: 25 points, 3: 50 points, 4: 75 points, 5: 100 points).

Table 3.1. Total SF-36 score calculation formulas (105)

Physical function	(3+4+5+6+7+8+9+10+11+12) / 10
Bodily pain	(21+ 22) / 2
Limitations in physical activities because	(13+14+15+16) / 4

of health problems	
Limitations in usual role because of emotional problems	(17+18+19) / 3
Social function	(20+32) / 2
Mental health	(24+25+26+28+30) / 5
Energy and fatique	(23+27+29+31) / 4
General health perceptions	(1+33+34+35+36) / 5

3.2.6. Beck's Depression Inventory

It is a questionnaire with 21 questions about one's depression status. Each category has four evaluation items. All of the numbers you marked in each four-item group are added up to find the score.

- First of all, the test was explained to the participants, they were made to feel comfortable and safe, and their privacy was respected. Explanations were given for the questions they could not read or understand.
- Participants were asked to choose an option with a sentence that best described their feelings in the past week, including today. There was no time limit during testing.
- The total score was calculated by adding the scores of the sentences that were chosen. The scoring ranged from 0 to 63.

If the total score is between 0 and 10, it is classified as "no depression," between 11 and 17 as "mild depression", between 18 and 23 as "moderate depression", and 24 or higher as "severe depression." High scores indicate a high level of depression (106) (Appendix 5).

3.2.7. 30-Second Sit and Stand Test

It is a test that assesses the lower extremity strength of the participant (12, 107) (Appendix 6).

- The participants were informed about the test. Participants were instructed to sit and stand up in the middle of the chair without armrests for 30 seconds, with their arms crossed over her chest.

- The back was straight during the test, the arms were crossed in front, and the feet did not break contact with the ground. The height of the armless chair was 90° hip-knee flexion.
- Using a stopwatch, the physiotherapist counted how many times the participant stood up completely during 30 seconds. The test was repeated three times with a one-minute break in between. The results were evaluated as a whole and averaged.

Figure 3. 7. 30-second Sit and Stand Test

3.2.8. Modified Push-up Test

The Modified Push-up test assesses upper body strength and endurance.

- The participants were informed about the test. The physiotherapist demonstrated the modified push-up position to the participants who did not understand.
- Before the test, participants were given a brief warm-up.
- The participants were positioned prone on the mat, hands at shoulder level and elbows flexed next to the body. At the same time, the knees were locked in flexion.

- The participants were instructed to lift the trunk from the ground by extending their elbows while keeping their knees flexed. Participants lifted their heads, shoulders, and trunk off the ground, fully extended elbows.
- The physiotherapist used a stopwatch to take measurements. The number of repetitions performed in 30 seconds by each participant was recorded.
- The test was repeated three times with a one-minute break in between. The results were evaluated as a whole and averaged (108).

Figure 3.8. Modified Push-up Test

3.2.9. Fingertip-to-floor Test

The Fingertip-to-floor test assesses spinal mobility. It demonstrates the mobility of the whole spine as well as the pelvis in the overall movement of the forward bend.

- Participants stood barefoot or with their feet together on a 30 cm high platform.
- Participants were told to bend forward far as possible while holding their arms and fingers completely extended and not bending their knees.
- A tape measure was used to evaluate the vertical distance between the tip of each participant's middle finger and the platform, which was recorded in centimeters.
- If a knee was bent during the test, it was canceled and repeated, and the test was repeated without affecting knee extension. The test was repeated three times with a one-minute rest period in between. The results were compared and the average was calculated.

If the person's fingers are above the platform, the values are negative; if it touches the platform, it is evaluated as 0; if it extends below the platform, it is evaluated as positive (109).

Figure 3. 9. Fingertip-to-floor test

3.2.10. Functional Reach Test

The test is used to evaluate anterior-posterior body stability and dynamic balance.

- The participants were given instructions on how to carry out the test.
- Participants were instructed to stand sideways near a wall and wait with their shoulders bent 90 degrees, elbows extended and fists closed, arms not touching the wall. The alignment of the metacarpal head was marked on the wall. The patient was instructed to lie down as straight as possible without stepping. The new placement of the third metacarpal's head was marked. The distance between the beginning and end positions was used to quantify the results.
- Each participant took the test three times, taking breaks for a one-minute break in between. The average was calculated after the results were compared.

While those who are 15 cm or less have a higher risk of falling, those who are 18 to 25 cm have a moderate risk (110).

Figure 3.10. Functional Reach test

3.3. Statistical Analysis

The sample size of the study 'Effects of Regular Yoga Practice on Posture and Balance during Covid-19 in Healthy Adult Women' was determined with at least 80% Strength and 5% Type-1 error for each variable. The study provided normality distributions of the measurements based on the Shapiro-Wilk (n<50) test results. In group comparisons, "Parametric tests (Independent T-test)" were used for the measurements made under the impression of normalcy, and "non-parametric tests (Mann-Whitney-U Test)" were used for the measurements without the assumption of normality. The Chi-square test was used to determine the relationships between variables of categories. The descriptive statistics for the study's continuous variables are provided as "Mean, Standard Deviation, Median, Minimum, and Maximum". The statistical significance level (a) was set at 5% in the calculations. For analysis, the SPSS (IBM SPSS for Windows, ver.26) statistical package application was utilized.

4. RESULTS

The posture, balance, and functional activities of 42 women between the ages of 25 and 45 were evaluated. The groups were divided based on whether or not they practiced yoga. The first group included women who had been practicing yoga for at least 6 months, and the second group included women who had never done yoga before.

Tables 4.1 show the demographic characteristics of the participants, including mean age and BMI values. According to the independent samples t-test ($p>0.05$), there was no statistically significant difference in groups in terms of age and BMI.

Table 4.1. The demographic characteristics of participants

	Yoga Group Mean ± SD	Non-Yoga Group Mean ± SD	Test	P Values
Age	31.95 ± 6.22	32.29 ± 6.28	Z: -0.114	*.909*

**Mann-Whitney-U Test; # Independent T-test; SD: Standard Deviation*

Table 4.2 demonstrates the means and standard deviations of BMI, educational status, frequency of participation in sports, and type of sport in groups, as well as differences between groups. The factors "Educational status, Frequency of doing sports, Type of sport," and "Doing Yoga" were found to have a statistically significant relationship ($p<0.05$).

Table 4.2. Comparison of BMI, educational status, frequency of doing sports, type of sport between groups.

		Yoga Group (%) N	Non-Yoga Group (%) N	χ^2	P*
BMI	<18.5	14.3% 3	14.2% 3	*1.029*	*.598*
	18.5 - 24.95	85.7%	81%		

		18	17		
	25 - 29.9	0 0	4.8% 1		
	30 - 35	0 0	0% 0		
	> 40	0 0	0% 0		
Educational Status	Primary School	0% 0	14.3% 3	*13.846*	***.003***
	High School	0% 0	33.3% 7		
	University	85.7% 18	38.1% 8		
	Master's degree	14.3% 3	14.3% 3		
Frequency of doing sports	Not doing	0% 0	90.5% 19	*39.000*	***.001***
	Once/twice a week	0% 0	4.8% 1		
	3-4 times a week	14.3% 3	4.8% 1		
	Everyday	85.7% 18	0% 0		
Type of sport	Not doing	0% 0	90.5% 19	*42.000*	***.001***
	Yoga	100% 21	0% 0		
	Walking	0% 0	9.5% 2		

BMI: Body mass index, N: number, * Chi-square test, *p<0,05 statistical difference.

Table 4.3 showed Beck's depression inventory score and the New York posture score for each group. In groups, there was a statistically significant relationship between Beck's depression inventory and the New York posture score ($p<0.05$). In other words, "New York Posture scores and Beck's depression inventory scores" differed between groups and were higher in the "Yoga group."

Table 4.3. Comparison of New York Posture and Beck's Depression Inventory in between groups.

		Yoga Group (%) N	Non-Yoga Group (%) N	χ^2	P*
Beck's depression Inventory	No depression	95.2% 20	61.9% 13	*6.985*	***.030***
	Mild depression	4.8% 1	33.3% 7		
	Moderate depression	0% 0	4.8% 1		
	Severe depression	0% 0	0% 0		
New York Posture	Bad posture	0% 0	0% 0	*5.676*	***.049***
	Weak posture	0% 0	0% 0		
	Middle posture	0% 0	4.8% 1		
	Good posture	0% 0	19.0% 4		
	Very good posture	100% 21	76.2% 16		

N: number, * Significance level according to chi-square test results, χ^2: Chi-square test value, *p<0,05 statistical difference.

The results of the one-leg stance, the Y balance (anterior, posteromedial, posterolateral, total score), the 30-second sit-and-stand, the modified push-up, the fingertip-to-floor, and the functional reach test values were compared between the two groups (see **Tables 4.4** and **4.5.**). The "One leg stand test" measurements of the participants according to the groups did not reveal a statistically significant relationship ($p>0.05$). The measurements of the participants in the "Y Balance test, 30-second sit and stand test, Modified push-up test, Fingertip-to-floor test, and Functional reach test" were statistically significant ($p<0.05$).

Table 4.4. Comparison of One-leg stand, Y balance, 30-Second sit and stand, Modified push-up, Fingertip-to-floor, and Functional reach test in between groups.

	Yoga Group Mean ± SD	Non-Yoga Group Mean ± SD	Test	P Values
OLS Score (for seconds)	30 ± 0	29.24 ± 3.49	*Z:-1.000*	*.317*
30 STS	20.38 ± 2.00	17.27 ± 4.51	*T:2.890*	***.006**#*
Modified push-up	18.29 ± 2.23	14.62 ± 2.57	*T:4.945*	***.001**#*
FTF	17.54 ± 5.28	-4.64 ± 9.04	*T:9.715*	***.001**#*
FRT	43.17 ± 9.02	33.37 ± 8.20	*T:3.689*	***.001**#*
YBT anterior	101.84 ± 7.52	84.35 ± 12.75	*T:5.412*	***.001**#*
YBT posteromedial	103.98 ± 8.32	80.80 ± 8.68	*T:8.833*	***.001**#*
YBT posterolateral	102.72 ± 9.21	81.06 ± 9.72	*T:7.414*	***.001**#*
YBT Total	102.65 ± 7.90	86.07 ± 13.55	*Z:-3.937*	***.001**#*

SD: Standart deviation, OLS: One-leg stand test, 30STS: 30-Second sit-stand, FRT: Functional reach test, YBT: Y Balance test, FTF: Fingertip-to-floor test, * Mann-Whitney-U Test; # Independent T-test; SD: Standard Deviation; *p<0,05 statistical difference.

Table 4.5. Comparison of One-leg stand test and Fingertip-to-floor test in between groups.

		Yoga Group (%) N	Non-Yoga Group (%) N	χ^2	P* Values
OLS Test(do or not do)	>30 seconds	100% 21	95.2% 20	*1.024*	*.311*
	≤30 seconds	0% 0	4.8% 1		
FTF	Positive	100% 21	42.9% 9	*16.800*	***.001***
	Negative	0% 0	57.1% 12		

N: number, χ^2: Chi-square test value, *p<0,05 statistical difference. OLS: One-leg stand test, FTF: Fingertip-to-floor test

Physical function, bodily pain, limitations in physical activities because of health problems, social function, limitations in the usual role because of emotional problems, mental health, energy-fatigue, and perceptions of general health are all compared between the groups on the SF 36 Quality of Life Test (QOL). The participants' "Physical function, Limitations in physical activities because of health problems, Limitations in the usual role because of emotional problems, Social function, Energy-fatigue, General health perceptions" measurements showed a statistically significant relationship ($p<0.05$). The participants' "Bodily Pain and Mental Health" measurements showed no statistically significant differences between groups ($p>0.05$) (see **Table 4.6**).

Table 4.6. Comparison of the parts of the SF 36 Quality of Life test in between groups.

	Yoga Group Mean ± SD	Non-Yoga Group Mean ± SD	Test	P Values
Physical function	97.36 ± 10.91	90.00 ± 14.92	*Z:-2.904*	***.004****
Bodily pain	88.33 ± 18.02	76.67 ± 32.55	*Z:-0.854*	*.393*
Limitations in physical activities because of health problems	100 ± 0	79.76 ± 34.11	*Z:-2.605*	***.009****
Limitations in the usual role because of emotional problems	95.28 ± 11.85	61.91 ± 41.22	*Z:-3.169*	***.002****
Social function	92.86 ± 10.88	75.60 ± 25.46	*Z:-2.297*	***.022****
Mental health	76.38 ± 20.39	63.43 ± 22.28	*Z:-1.834*	*.067*
Energy-fatigue	73.33 ± 15.92	60.71 ± 21.81	*T:2.142*	***.038****
General health perceptions	84.52 ± 11.17	67.14 ± 15.38	*Z:-3.493*	***.001****

* Mann-Whitney-U Test; # Independent T-test; SD: Standard Deviation

5. DISCUSSION

Our research aimed to investigate the effectiveness of yoga on posture and balance in healthy adult women during Covid-19. According to the reference study, the sample size for the study was determined to be 96 people (94). For this study, 42 volunteer women between the ages of 25 and 45 will be divided into two groups: those who regularly practice yoga and those who do not. The groups had an equal number of participants. In terms of demographic information, age, and BMI, between the groups, there was no statistically significant difference. The comparison of the groups showed statistically significant differences in posture, dynamic balance, depression, quality of life, muscle strength and endurance, and flexibility. There was no statistical difference in static balance. On the SF-36 test, limitations in the usual role and physical activities, general health perceptions, physical function, social function, energy-fatigue, and the physical composite scale showed statistical differences between groups although bodily pain and mental health showed no statistical differences.

In our study, we found that healthy adult women who regularly practice yoga have a more correct posture and better balance compared to women who don't. In addition, with these findings, we can conclude that yoga improves women's posture and balance, as well as their flexibility, strength and endurance of muscle, quality of life, and reduces depression. When we looked at previous research on the relationship between posture and yoga in the literature, we couldn’t locate any research on the effect of yoga on posture on healthy individuals. However, there are many studies on this topic that focus on the effects of yoga on people who suffer from postural disorders. When we examine the literature, studies have mostly investigated the effect of yoga on spine health about posture. Additionally, the studies on the effect of yoga on spinal curvature are investigated at the effect of yoga on posture indirectly. Greendale et al. studied the effects of yoga exercises, reporting that those with hyperkyphosis who practiced yoga had statistically significant improvements in flexicurve kyphosis angles and kyphosis indices (111). Another study, conducted by Grabara and Szopa, discovered Hatha yoga program significantly improved the angles of lumbar lordosis and thoracic kyphosis (21). Grabara also has more investigations looking into the effect of yoga on spinal curvature (112).

In terms of the effect of yoga on balance in our study, we found that it had no effect on static balance but significantly improved dynamic balance. Although what we found, there are many studies in the literature that demonstrate it improves static balance as well. A static balance, our results may differ from other studies because our sample was small and the individuals we selected were all healthy. One of the reasons for this may be that they did it with eyes open and dominant leg in both groups. There is numerous other research that shows yoga has a statistically positive effect on static balance. According to Tuzun et al., they found a statistically significant difference in the one-leg stand test of postmenopausal women who do yoga exercises when compared to the other exercises group (43). An 8-week yoga exercise program was applied twice a week in the research undertaken by Nick et al., the elderly's fear of falling decreased, and static balance improved (113). Kumar et al. found that the 21-day yoga program showed improvements in the plank test (core stability) and single-leg stork test (balance) (114). Another study, made by Aslan and Livanelioglu, found that the 6-week hatha yoga program significantly improved the scores of flamingo and one leg stand with eyes closed in healthy young adults (115). In research, Polsgrove et al. was found yoga significantly improved stork and stand (balance) and flexibility (sit and reach and shoulder flexibility) (116). This study also supports our result on the effect of yoga on flexibility. Jorrake et al. searched for the effect of a 4-week yoga program on balance in obese participants. Standing times during one-leg stand with eyes open and closed, and also forward reach distance from the functional reach test, were measured every week at the end of the training session in both the yoga training and control groups. In the second, third, and fourth weeks, there were differences significantly in the one-leg stand test with the eyes closed. Furthermore, the functional reach results demonstrated a significant difference in the yoga group, according to the control group of the fourth week (94).

Jeter et al conducted a systematic review of the evidence that yoga improves balance in healthy individuals in their study. The inclusion criteria were met by 15 of 152 studies: 5 randomized controlled trials, 4 quasi-experimental, 2 cross-sectional, and 4 single-group designs. Eleven studies reported favorable effects on at least one balancing outcome. Yoga may have a beneficial effect on balance, but the results are obscured by inconsistent research design and poor reporting quality (117).

It is one of the results of our study that yoga improves dynamic balance**.** There is research in the literature that backs up the major conclusions we discovered concerning yoga's influence on dynamic balance. Galantino et al. researched the yoga effects on patients with chronic low back pain. In comparison with the control group, the yoga group had a significant increase in functional reach and stand-and-reach test, as well as a decrease in disability and BDI scores. This study also supports our conclusion about flexibility and depression (118). Hasan et al., investigated the effects of eight weeks of yoga training on balance and knee proprioception after mental fatigue in amateur male athletes. For assessments, the Stroop test, the Y balance test, and the Lafayette Stability Platform were used. After yoga training, the effects of time and groupxtime interaction on dynamic and semi-dynamic balances, and also active and passive knee proprioception, were significant (119). Khazaei et al. investigated the effects of 8 weeks Hatha Yoga significantly improved in static and dynamic balance, and also simple reaction time (120).

In another study, at the start and end of the 8 weeks yoga exercise, the Star Excursion and the Stork Stand tests were performed on either the dominant or non-dominant leg in women. They have noted that yoga exercises improved dynamic balance in dominant and non-dominant legs. Non-dominant legs balance improved more than dominant legs balance. The improvement of both legs in static balance was the same (121). Prado et al. examined the 5-month Hatha yoga program’s effects on balance in adults, and the results provided evidence that improve postural control in young adults (93).

According to the findings of our study, yoga has a positive effect on muscle strength and endurance, and flexibility. When we look at the literature, many studies support our findings. Csala et al. studied the effects of the Hatha yoga program and observed that increased young women's balance, flexibility, and core muscle strength (122). LaSala et al. found that a 7-week program of Hatha yoga had a significant effect on hamstring muscle flexibility in young adults (123). Lau et al. conducted a controlled clinical trial of a 3-month yoga program on muscle strength, endurance, and flexibility in adults. There was a considerable difference in the curl-up, the modified back-saver sit-and-reach, and push-up evaluations (124). In another study, it was observed that an applied 8-week yoga program significantly improved abdominal muscle endurance

(125). Gohel et al. looked at the effects of long-term yoga practice and found that flexibility and endurance increased statistically significantly (126).

Numerous articles in the literature are similar to ours in that they investigate the impact of yoga on life quality and depression. Prathkanti et al. found that an 8-week yoga program significantly decreases depression scores (127). Oken et al. found that yoga improved significantly in quality of life, also had a significant effect on social functioning, energy-fatigue, bodily pain, physical role, and the physical composite scale on the SF-36 (128). In this study different from our study, a significant difference was observed in the bodily pain. In Cramer et al.'s study, yoga practitioners had better overall health, greater physical functioning, and a higher physical component score than others. Mental scales, anxiety, sadness, life satisfaction, and health satisfaction showed no group differences (129). It supports our work with mental health findings but does not support depression findings. Halpern et al. conducted a nonrandomized, waiting-list-controlled study examining the effect of yoga on sleep and quality of life. In comparison to controls, the yoga group demonstrated significant improvements in a variety of subjective factors, including overall sleep quality, fatigue, general well-being, depression, anxiety, stress, tension, anger, vitality, and function in physical, emotional, and social roles (130). Although there are small differences in these studies, it is generally supported that yoga improves the quality of life.

The difference of our study from other studies is that no difference was found in the static balance evaluations. Silver et al., in a study where they measured static and dynamic balance tests, observed that 6 weeks yoga program did no affect on balance (131). Although this study supports our conclusion for static equilibrium, the sample size is very small. It also does not support our result for dynamic balance. In a study by Mahara et al., it was observed that there was an age-related difference in the effect of yoga on the balance of sedentary women. While the 8-week yoga exercise program created a statistically significant difference in balance in women between the ages of 30-40, it did not create a significant difference in women between the ages of 41-50 (132). This study showed that the effect of yoga on dynamic balance also depends on age, we could not establish a connection with this study because our age range was 25-45 our study.

At the same time, although many studies have found the pain-reducing effect of yoga, it is thought-provoking that there is no statistical significance in the pain parameter in the SF 36 quality of life test (38, 39, 40, 41). Studies are showing that yoga improves mental health, which is another parameter that was not statistically significant in our study. Taspınar et al. investigated the efficacy of hatha yoga and resistance training on mental health and well-being in sedentary individuals in randomized controlled pilot research. Fifty-one individuals were randomly assigned to one of three groups: yoga, resistance exercise, and control. Hatha yoga increased the aspects of fatigue, self-esteem, and quality of life more than resistance exercise training. Hatha yoga and resistance exercise both reduced depressive symptoms to a similar level. Both exercise groups have a positive effect on mental health and well-being in sedentary adults, according to this study (133).

Our study has limitations:

- They could be doing different types of yoga. The study did not go into detail on this.

- A comparison could also be made according to the weekly frequency of yoga exercises performed. Results may differ between those who do yoga every day, those who do yoga 2-3 times a week, and those who do yoga 1-2 times a week.

- In the one-leg stand and Y balance tests, no measurements were taken with the eyes closed. At the same time, the measurements were restricted to the dominant leg and did not include the non-dominant leg. Performing the tests with both eyes closed and open; doing it with both the dominant and non-dominant legs would have given more comprehensive and reliable results.

- The details of the occupations and socioeconomic status of the participants were not included. A comparison could be made in this area as well.

-It was conducted during the Covid-19, it was difficult to find volunteers, and the number of participants was small. More study with bigger sample sizes is required to support our findings of the effect of yoga practice on posture and balance in healthy adult women.

In conclusion;

-Yoga has a positive effect on posture, dynamic balance, flexibility, muscle strength, endurance, and quality of life in healthy adult women during the Covid-19. As a result, physiotherapists can combine personalized modified yoga programs with exercise programs to correct posture, improve balance, and increase muscle strength.

The findings of our research guide future research on the subject. In addition, it is expected that yoga exercises are included in physiotherapy programs for various diseases. According to the physiotherapist's assessments of the patients, yoga can be transformed into a purposeful exercise program without causing injury or discomfort when modified specifically for the patient's needs. Increasing the number of studies on yoga exercises for symptom relief or preventative physiotherapy programs in healthy and sick persons, as well as research done over a longer length of time and with a bigger number of participants, can assist to solve this issue.

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7. APPENDIX 7.1. Appendix 1. Ethical Approval

T.C. YEDİTEPE ÜNİVERSİTESİ
GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR
ETİK KURULU

Versiyon No
1.0
Sayfa 1 / 2

KARAR FORMU

21.12.2021

ETİK KURUL BİLGİLERİ	Etik Kurulun Adı	Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu
	Açık Adres	Yeditepe Üniversitesi Diş Hekimliği Fakültesi, Bağdat Cad. No. 238 Göztepe 34728 Kadıköy, İstanbul
	İnternet Sayfası	http://goetik.yeditepe.edu.tr/
	Telefon	0216 363 60 44
	E-posta	goetik@yeditepe.edu.tr

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

KARAR BİLGİLERİ	Başvuru Numarası	202106078
	Toplantı Tarihi	05.10.2021
	Toplantı Yeri	Çevirim İçi (Google Meet)
	Karar No	3

Araştırmanın Başlığı: Covid 19 Döneminde Yetişkin Sağlıklı Kadınlarda Düzenli Yoga Yapmanın Postür ve Denge Üzerine Etkisi

Araştırmacılar: Boykoy D., Yazıcı Mutlu Ç.

BAŞVURU NUMARASI: 202106078

KARAR 21.12.2021

☒ **KABUL**	☐ **RET** ☐ *KAPSAM DIŞI (GİRİŞİMSEL)* ☐ *BİLİMSEL VE/VEYA ETİK KURALLARA AYKIRI* ☐ *BİR SORUMLU ARAŞTIRMACININ (TEZ İSE TEZ DANIŞMANI), BİR TOPLANTIYA **İKİ (2)** **ADETTEN FAZLA ÇALIŞMA BAŞVURUSUNDA** BULUNMASI* ☐ *KURUM İÇİ BAŞVURULARINDA **YEDİTEPE UZANTILI E-POSTA HESABI** İLE GİRİŞ YAPILMAMIŞ OLMASI* ☐ *ŞARTLI KABULDE BELİRTİLEN REVİZYONLARIN ZAMANINDA VE/VEYA İSTENİLDİĞİ ŞEKİLDE YAPILMAMIŞ OLMASI*

T.C. Yeditepe Üniversitesi
Girişimsel Olmayan Klinik Araştırmalar
Etik Kurulu adına

Prof. Dr. Didem ÖZDEMİR ÖZENEN
Başkan

Araştırmanın Başlığı: Covid 19 Döneminde Yetişkin Sağlıklı Kadınlarda Düzenli Yoga Yapmanın Postür ve Denge Üzerine Etkisi

Araştırmacılar: Boykoy D., Yazıcı Mutlu Ç.

7.2. Appendix 2. Informed Voluntary Consent Form

Bilgilendirilmiş Gönüllü Olur Formu

Sayın katılımcı,

Davet edildiğiniz "Covid 19 döneminde yetişkin sağlıklı kadınlarda düzenli yoga yapmanın postür ve denge üzerine etkisi " isimli bu çalışma; Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü Fizyoterapi ve Rehabilitasyon Bölümü tarafından yürütülmektedir ve yüksek lisans öğrencisi Fzt. Deniz Boykoy'un uzmanlık tez çalışmasıdır. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü Fizyoterapi ve Rehabilitasyon Anabilim Dalı'nda Dr. Çiğdem YAZICI MUTLU gözetiminde yapılacaktır.

Bu çalışmanın temel amacı, sağlıklı kadın bireylerin yoga yapmasının denge ve postür üzerindeki etkisini araştırmaktır. Çalışmada katılımcıların; New York Postür Derecelendirme Testi ile postürü, Tek Ayak Üzerinde durma testi, Y Balance testi ve Fonksiyonel Uzanma testi ile dengesi, Beck Depresyon Değerlendirmesi ile depresyon durumu, SF 36 Kısa Form ile yaşam kalitesi, 30 sn Otur Kalk testi ve Modifiye Push Up testi ile endurans ve kas kuvveti, ve Parmak-Zemin testi ile esnekliği değerlendirilecektir. Demografik bilgiler alındıktan sonra katılımcılar yoga yapıp yapmamasına göre iki gruba ayrılarak fizyoterapist tarafından bir kez olmak üzere değerlendirilecektir. Testler 3 defa tekrarlı olarak yapılacaktır. Değerlendirmelerden elde edilen veriler bilgisayara kaydedilecek ve sonuçlar analiz edilecektir. Yoga yapan 21 ve yapmayan 21 olmak üzere 42 kadını bu çalışmaya dahil etmeyi hedefliyoruz.

Bir araştırma projesine davetlisiniz. Karar vermeden önce bu araştırmanın neden ve nasıl yapılacağını anlamanız çok önemlidir. Lütfen biraz zaman ayırın ve aşağıdaki bilgileri dikkatlice okuyun, dilerseniz başkalarıyla tartışın. Net olmayan bir bölüm varsa veya daha detaylı bilgiye ihtiyaç duyuyorsanız bizden bilgi alabilirsiniz. Araştırmamıza davetlisiniz çünkü dahil edilme kriterlerini karşıladığınızı düşünüyoruz. Katılımın isteğe bağlı olduğunu ve katılmayı reddetmenin herhangi bir cezaya veya herhangi bir menfaat kaybına yol açmayacağını belirtmek isteriz. Aynı şekilde istediğiniz zaman araştırmadan çekilebilirsiniz.

Araştırmamızda katılımcılara uygulanan değerlendirmelerin bilinen herhangi bir zararı bulunmamaktadır. Değerlendirme sürecinde veya rehabilitasyon sürecinde beklenmedik bir hasar olması durumunda, size hemen bilgilendirme yapılacaktır. Katılımcıların herhangi bir zarar görmesi durumunda, gerekli başvurular herhangi bir yardım kaynağı araştırmacılar tarafından karşılanacaktır.

Bunun için ne sizden ne de sosyal güvenlik sigortanızdan herhangi bir ücret alınmayacaktır. Araştırmaya katılmak size hemen yardımcı olmamakla birlikte, araştırma sonuçlarımızın gelecekte organizasyon, toplum veya bilim için faydaları olacağı umulmaktadır. Araştırmanın amaçları için veya bağlı olduğunuz sosyal güvenlik kurumu için sizden herhangi bir ücret alınmayacaktır.

Danışman

Dr Öğr Üyesi Çiğdem YAZICI MUTLU
Yeditepe Üniversitesi
Sağlık Bilimleri Fakültesi
Fizyoterapi ve Rehabilitasyon Bölümü

Araştırmacı

Fzt Deniz Boykoy
Yeditepe Üniversitesi
Sağlık Bilimleri Enstitüsü
Spor Fizyoterapisi Bölümü

Onay Formu

Bilgilendirme formundaki tüm açıklamaları okudum. Bana, yukarıda konusu ve amacı belirtilen çalışma ile ilgili yazılı ve sözlü açıklama araştırmacı tarafından yapıldı. Araştırmaya katılmaya gönüllü olduğumu, istediğim zaman gerekçeli veya gerekçesiz olarak araştırmadan ayrılabileceğimi biliyorum. Söz konusu çalışmaya hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı ve sonuçlarımın kullanılmasını kısıtlamamayı, yayın, rapor ve benzeri bilimsel dokümanlarda kullanılmasını kabul ediyorum.

Gönüllünün
Adı Soyadı:
İmza:
Tlf:
Tarih:

Araştırmacının
Adı Soyadı:
İmza:
Tlf:

Tanık
Adı Soyadı:
İmza:
Tlf:
Tarih:

7.3. Appendix 3. Demographic Form

GENERAL INFORMATIONS

Name and Surname:

Day of birth:

Age:

Gender:

Weight:

Height:

BMI:

Job:

Do you smoke? (Weekly / package):

Do you use alcohol ? (Weekly / Glass):

1. **Do you have a diagnosis by any doctor?**

   ( ) Yes , if yes what is your diagnosis? _____

   ( ) No

2. **Do you take medication?**

   ( ) Yes , if yes, what's its name? _____

   ( ) No

3. **Have you had surgery?**

   ( ) Yes if yes, what surgery? When?_____

   ( ) No

4. **Do you have a chronic illness?**

   ( ) No

   ( ) Vestibular disease

   ( ) Cardiovascular diseases (Heart rhythm disorder, blood pressure, anemia, etc.)

( ) Respiratory diseases (Asthma, allergies etc.)

( ) Ear diseases (Hearing problems etc.)

( ) Nervous System Disorders (Vertigo, epilepsy, neuropathy, loss etc.)

( ) Infectious Diseases (Tonsillitis, otitis etc.)

( ) Hormonal Diseases (Diabetes, goiter, insulin resistance etc.)

( ) Musculoskeletal system diseases (Muscle, joint, rheumatic diseases, etc.)

( ) Digestive system, metabolic diseases (Gastritis, ulcer, ulcer, intestinal diseases etc.)

( ) Visual impairment

5. **Do you do exercise? If so, how long have you been doing?**

( ) I don't.

( ) Once or twice a week

( ) 3-4 times a week

( ) Everyday

( ) Less than 3 days a month .....

6. **Which exercises do you prefer ?**

( ) Walk ( ) Yoga ( )Basketball ( ) Voleyball ( ) Tennis ( ) Running ( ) Swimming

Other _____

7. **How much time do you spend on exercises?**

( ) 20 minutes or less

( ) 21-30 minutes

( ) 31-50 minutes

( ) 50 minutes or more

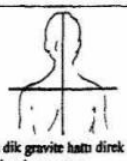
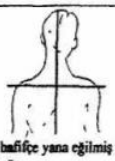
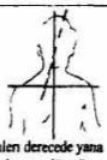
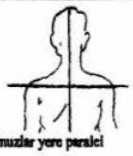
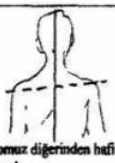
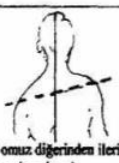
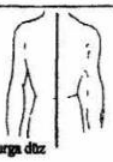
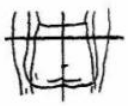
7.4. Appendix 4. New York Posture Assesment

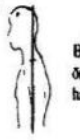
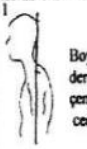
NEW YORK POSTÜR DEĞERLENDİRME TESTİ

Adı Soyadı: TARİH:

Yaş:

Cins:

				1.	2.	3.
A	5  Baş dik gravite hattı direk merkezden geçiyor	3  Baş hafifçe yana eğilmiş veya dönmüş	1  Baş ileri derecede yana eğilmiş veya dönmüş			
B	5  Omuzlar yere paralel	3  Bir omuz diğerinden hafifçe yukarıda	1  Bir omuz diğerinden ileri derecede yukarıda			
C	5  Omurga düz	3  Omurga hafif yana eğilmiş	1  Omurga ileri derecede eğilmiş			
D	5  Kalçalar yere paralel	3  Bir kalça diğerinden hafifçe yukarıda	1  Bir kalça ileri derecede diğerinden yukarıda			
E	5  Ayaklar düz	3  Ayaklar dışarıya dönük	1  Ayaklar pronasyonda			
F	5  Arkalar yüksek	3  Arklar hafif düşük	1  Arklar düşük düz taban			
	5 normal	3 orta seviyede	1 ileri seviyede			

				1.	2	3
G	 Boyun dik çene içerde.baş omuz üstünde dengede	 Boyun hafif önde çene hafif dışarıda	 Boyun ileri derecede önde çene ileri derecede dışarıda			
H	 Göğüs yukarda sternum vücut önünde ilerde	 Göğüs hafif derecede çökmüş	 Göğüs ileri derecede çökmüş (düz)			
I	 Omuzlar merkezde	 Omuzlar hafif ilerde	 Omuzlar protrakte			
J	 Üst sırt normal	 Üst sırt hafif yuvarlak	 Üst sırt ileri derecede yuvarlak			
K	 Gövde dik	 Gövde hafif geriye açılı	 Gövde geriye ileri derece açılanmış			
L	 Karın düz	 Karın protrakte	 Karın protrakte ve sarkmış			
M	 Alt sırt normal	 Alt sırt hafif çukur	 Alt sırt ileri derece çukur			
	5 normal	3 orta seviyede	1 ileri seviyede			
	1.Eğer sol kolondakı açıklamaya uygun ise 5 puan 2.Eğer orta kolondakı açıklamaya uygun ise 3 puan 3.Eğer sağ kolondaki açıklamaya uygun ise 1 puan ekleyin.			TOPLAM SKOR		

7.5. Appendix 5. Beck Depression Scale

1. 0 I do not feel sad.
   1 I feel sad
   2 I am sad all the time and I can't snap out of it.
   3 I am so sad and unhappy that I can't stand it.

2. 0 I am not particularly discouraged about the future.
   1 I feel discouraged about the future.
   2 I feel I have nothing to look forward to.
   3 I feel the future is hopeless and that things cannot improve.

3. 0 I do not feel like a failure.
   1 I feel I have failed more than the average person.
   2 As I look back on my life, all I can see is a lot of failures.
   3 I feel I am a complete failure as a person.

4. 0 I get as much satisfaction out of things as I used to.
   1 I don't enjoy things the way I used to.
   2 I don't get real satisfaction out of anything anymore.
   3 I am dissatisfied or bored with everything.

5. 0 I don't feel particularly guilty
   1 I feel guilty a good part of the time.
   2 I feel quite guilty most of the time.
   3 I feel guilty all of the time.

6. 0 I don't feel I am being punished.
   1 I feel I may be punished.
   2 I expect to be punished.
   3 I feel I am being punished.
7. 0 I don't feel disappointed in myself.
   1 I am disappointed in myself.
   2 I am disgusted with myself.

3 I hate myself.

8. 0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9. 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. 0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11. 0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
2 I am quite annoyed or irritated a good deal of the time.
3 I feel irritated all the time.

12. 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13. 0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
3 I can't make decisions at all anymore.

14. 0 I don't feel that I look any worse than I used to.

1 I am worried that I am looking old or unattractive.

2 I feel there are permanent changes in my appearance that make me look unattractive

3 I believe that I look ugly.

15. 0 I can work about as well as before.

1 It takes an extra effort to get started at doing something.

2 I have to push myself very hard to do anything.

3 I can't do any work at all.

16. 0 I can sleep as well as usual.

1 I don't sleep as well as I used to.

2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.

3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.

1 I get tired more easily than I used to.

2 I get tired from doing almost anything.

3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.

1 My appetite is not as good as it used to be.

2 My appetite is much worse now.

3 I have no appetite at all anymore.

19. 0 I haven't lost much weight, if any, lately.

1 I have lost more than five pounds.

2 I have lost more than ten pounds.

3 I have lost more than fifteen pounds.

20. 0 I am no more worried about my health than usual.

1 I am worried about physical problems like aches, pains, upset stomach, or constipation.

2 I am very worried about physical problems and it's hard to think of much else.

3 I am so worried about my physical problems that I cannot think of anything else.

21. 0 I have not noticed any recent change in my interest in sex.

1 I am less interested in sex than I used to be.

2 I have almost no interest in sex.

3 I have lost interest in sex completely.

7.6. Appendix 6. SF-36 Quality of Life Test

SF-36 QUESTIONNAIRE

Name:_____ **Ref. Dr:**_____ **Date:** _____

ID#: _____ **Age:** _____ **Gender: M / F**

Please answer the 36 questions of the **Health Survey** completely, honestly, and without interruptions.

GENERAL HEALTH:
In general, would you say your health is:
○ Excellent ○ Very Good ○ Good ○ Fair ○ Poor

Compared to one year ago, how would you rate your health in general now?
○ Much better now than one year ago
○ Somewhat better now than one year ago
○ About the same
○ Somewhat worse now than one year ago
○ Much worse than one year ago

LIMITATIONS OF ACTIVITIES:
The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.
○ Yes, Limited a lot ○ Yes, Limited a Little ○ No, Not Limited at all

Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Lifting or carrying groceries
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Climbing several flights of stairs
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Climbing one flight of stairs
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Bending, kneeling, or stooping
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Walking more than a mile
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Walking several blocks
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Walking one block
○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

Bathing or dressing yourself

○ Yes, Limited a Lot ○ Yes, Limited a Little ○ No, Not Limited at all

PHYSICAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

Cut down the amount of time you spent on work or other activities

○ Yes ○ No

Accomplished less than you would like

○ Yes ○ No

Were limited in the kind of work or other activities

○ Yes ○ No

Had difficulty performing the work or other activities (for example, it took extra effort)

○ Yes ○ No

EMOTIONAL HEALTH PROBLEMS:

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

Cut down the amount of time you spent on work or other activities

○ Yes ○ No

Accomplished less than you would like

○ Yes ○ No

Didn't do work or other activities as carefully as usual

○ Yes ○ No

SOCIAL ACTIVITIES:

Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

○ Not at all ○ Slightly ○ Moderately ○ Severe ○ Very Severe

PAIN:

How much bodily pain have you had during the past 4 weeks?

○ None ○ Very Mild ○ Mild ○ Moderate ○ Severe ○ Very Severe

During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

○ Not at all ○ A little bit ○ Moderately ○ Quite a bit ○ Extremely

ENERGY AND EMOTIONS:
These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the answer that comes closest to the way you have been feeling.

Did you feel full of pep?
- ○ All of the time
- ○ Most of the time
- ○ A good Bit of the Time
- ○ Some of the time
- ○ A little bit of the time
- ○ None of the Time

Have you been a very nervous person?
- ○ All of the time
- ○ Most of the time
- ○ A good Bit of the Time
- ○ Some of the time
- ○ A little bit of the time
- ○ None of the Time

Have you felt so down in the dumps that nothing could cheer you up?
- ○ All of the time
- ○ Most of the time
- ○ A good Bit of the Time
- ○ Some of the time
- ○ A little bit of the time
- ○ None of the Time

Have you felt calm and peaceful?
- ○ All of the time
- ○ Most of the time
- ○ A good Bit of the Time
- ○ Some of the time
- ○ A little bit of the time
- ○ None of the Time

Did you have a lot of energy?
- ○ All of the time
- ○ Most of the time
- ○ A good Bit of the Time
- ○ Some of the time
- ○ A little bit of the time
- ○ None of the Time

Have you felt downhearted and blue?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel worn out?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Have you been a happy person?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

Did you feel tired?

- All of the time
- Most of the time
- A good Bit of the Time
- Some of the time
- A little bit of the time
- None of the Time

SOCIAL ACTIVITIES:
During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

- All of the time
- Most of the time
- Some of the time
- A little bit of the time
- None of the Time

GENERAL HEALTH:
How true or false is each of the following statements for you?

I seem to get sick a little easier than other people

Definitely true | Mostly true | Don't know | Mostly false | Definitely false

I am as healthy as anybody I know

Definitely true | Mostly true | Don't know | Mostly false | Definitely false

I expect my health to get worse

Definitely true | Mostly true | Don't know | Mostly false | Definitely false

My health is excellent

Definitely true | Mostly true | Don't know | Mostly false | Definitely false

7.7.Appendix 7. CURRICULUM VITAE

Kişisel Bilgiler

Adı	Deniz	**Soyadı**	Boykoy

Öğrenim Durumu

Derece	Alan	Mezun Olduğu Kurumun Adı	Mezuniyet Yılı
Doktora			
Yüksek Lisans	Spor Fizyoterapisi	Yeditepe Üniversitesi	2022
Lisans	Fizyoterapi ve Rehabilitasyon	Medipol Üniversitesi	2018
Lise	-	Bursa Anadolu Erkek Lisesi	2009

Bildiği Yabancı Dilleri	Yabancı Dil Sınav Notu (#)
İngilizce	75 (YDS)

Başarılmış birden fazla sınav varsa(KPDS, ÜDS, TOEFL; EELTS vs), tüm sonuçlar yazılmalıdır

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	Kurum	Süre (Yıl - Yıl)
-	-	-
-	-	-

Bilgisayar Bilgisi

Program	Kullanma becerisi
Word	Orta
Excel	İyi

*****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)

-