

T.C.

YEDITEPE UNIVERSITY

INSTITUTE OF HEALTH SCIENCES

DEPARTMENT OF SPORTS PHYSIOTHERAPY

**Ergonomic Analysis and Awareness In Office Work
and It's Impact On Postural, Physical and
Functional Parameters Of Spine Health**

MASTER OF SCIENCE THESIS

HAMZA ALZEER, PT

ISTANBUL 2021

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APPROVAL

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 .

Prof. Dr. Bayram Yılmaz
Director of Institute of Health Science

DECLARATION

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

HAMZA ALZEER

28/01/2022



DEDICATION

I'd like to dedicate this thesis to my parents, Taleb and Wadha, as well as my lovely sister Sanaa and my brothers, Dr. Mohammad, Eng. Omar, Fzt. Wesam and especially to my uncle, Asst. Prof. Abdulhamid Alzeer, whose support made this thesis possible.



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LIST of SYMBOLS & ABBREVIATIONS

AROM	Active Range Of Motion
ANOVA	Analysis Of Variance
AWH	Annual Working Hours
ALL	Anterior Longitudinal Ligaments
BMI	Body Mass Index
BMI C	Body Mass Index Categories
CP	Cumulative Percentage
CTDs	Cumulative Trauma Disorders
DWH	Daily Working Hours
°	Degree
DWP	Degree With Pain
ED	Exercise Duration
EH	Exercise Habits
ET	Exercise Type
Ex	Extension
Fx	Flexion
IPAQ-Short Form	International Physical Activity Questionnaire - Short Form
IVD	Intervertebral Discs
IDP	Intradiscal Pressure
Lat	Lateral
LT	Left

LBP	Low Back Pain
L	Lumbar
M	Mean
M MET- m/w	Moderate Metabolic Equivalent Task- m/w
Mix. – Max.	Minimum and Maximum
MVPA	Moderate To Vigorous Physical Activity
MODI	Modified Oswestry Disability Scale
MSDs	Musculoskeletal disorders
NIOSH	National Institute For Occupational Safety And Health
NYPRC	New York Posture Rating Chart
NYPRC Cl	New York Posture Rating Chart Classification
N	Number
ODI Cl	Oswestry Disability Index Classification
PIIM	Pain Intensity In Movement
PIIR	Pain Intensity In Rest
%	Percent
PLL	Posterior Longitudinal Ligaments
ROM	Range Of Motion
RT	Right
R	Correlation Coefficient
SD	Standard Deviation
SPSS	Statistical Package Of Social Sciences

S	Strength
ST	Stretching
T.NYP	Total New York Posture
T.ODI	Total Oswestry Disability Index
T.PA	Total physical activity
T. PA MET- m/w	Total Physical Activity Metabolic Equivalent Task- m/w
T	Trunk
V MET- m/w	Vigorous Metabolic Equivalent Task- m/w
VAS	Visual Analog Scale
VDU	Visual Display Unit
W-H C R	Waist - Hip Circumference Ratio
W MET- m/w	Walking Metabolic Equivalent Task- m/w
WRMSDs	Work-Related Musculoskeletal Disorders
WHO	World Health Organization

ABSTRACT

Hamza A. (2021) Ergonomic analysis and awareness in office work and it's impact on Postural, physical and functional parameters of spine health. Yeditepe University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, MSc thesis, Istanbul.

The aim of this study was to find out how much the office worker's profession affects the vertebral column health in terms of the impact of ergonomic behavior and awareness in the office work on postural, physical, and functional parameters of spine health. 70 volunteers (35 M and 35 F) aged between 35 and 46 years participants were assessed once during the study. Demographic parameters, age categories, gender, body mass index, anthropometric measurements, ergonomic working hours, ergonomic awareness, exercise habits and stretching were the independent factors in the study. The clinical parameters of pain intensity, physical parameters of lumbar spine range of motions, muscle strength, and the international physical activity questionnaire-short form, and the functional parameters in the modified Oswestry disability scale, all, were the dependent variables in the study. Significant effects of office ergonomic working hours, gender, age category, and exercise habits on clinical, physical, postural and functional parameters of spine health among office workers ($P \leq 0.05$). The group that worked for fewer hours had more range of motion and less pain intensity. While men had better physical activity levels than women, they had a higher rate of disability in posture and functional abilities. Working hours, postural alignment, and physical activities, were inextricably linked. BMI categories and Oswestry disability levels, were in positive correlation. Furthermore, negative relationship between BMI categories and exercise habits, as well as between BMI categories and stretching, and between stretching and the physical categories of the New York scale. In conclusion, poor ergonomic results and awareness have a negative impact on physical, postural, and functional parameters of spine health among office workers.

Keywords: office work, ergonomic analysis, awareness, physical, postural, functional, spine health

ÖZET

Hamza A. (2021) Ofis çalışmalarında ergonomik analiz , farkındalık ve omurga sağlığının postüral, fiziksel ve fonksiyonel parametreler üzerindeki etkisi. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Anabilim Dalı, Yüksek Lisans tezi, İstanbul.

Bu çalışmada , ofiste çalışmanın vertebral kolon sağlığını ne kadar etkilediği araştırılmıştır. Bu çalışma, işyerindeki ergonomik davranış ve farkındalığın, omurga sağlığının postural, fiziksel ve fonksiyonel yönleri üzerindeki etkisini bulmak amacıyla yapılmıştır. Yaşları 35 ile 46 arasında değişen 70 gönüllü (35 Erkek ve 35 Kadın) çalışma sırasında bir kez değerlendirildi. Demografik özellikler, yaş kategorileri, cinsiyet, vücut kitle indeksi", antropometrik ölçümler, ergonomik çalışma saatleri, ergonomik farkındalık, egzersiz alışkanlıkları ve esneme ,çalışmadaki bağımsız faktörlerdi. Ağrı şiddetindeki klinik parametreler, lumbar omurga hareket açıklığındaki fiziksel parametreler , kas gücü ve uluslararası fiziksel aktivite anketi-kısa formu ve modifiye Oswestry ölçeğindeki fonksiyonel parametrelerin tümü, çalışmadaki bağımlı değişkenlerdi. Ofis çalışanları arasında ofisteki ergonomik çalışma saatlerinin, cinsiyet, yaş kategorisi ve egzersiz alışkanlıklarının, omurga sağlığının klinik, fiziksel, postural ve fonksiyonel parametreleri üzerindeki anlamlı etkileri değerlendirildi ($P \leq 0.05$). Daha az saat çalışan grup, daha fazla hareket açıklığına ve daha az ağrı yoğunluğuna sahipti. Erkekler kadınlara göre daha iyi fiziksel aktivite seviyelerine sahipken, postüral analizde ve fonksiyonel aktivitelerde daha yüksek bir sakatlık oranına sahiptiler. Çalışma saatleri, postür ve fiziksel aktiviteler ayrılmaz bir şekilde bağlantılıydı. BMI kategorileri ve OSWESTRY engellilik seviyeleri pozitif korelasyon içindeydi. Ayrıca, BMI kategorileri ile egzersiz alışkanlıkları , BMI kategorileri ile esneme ve ayrıca esneme ve New York ölçeğinin fiziksel kategorileri arasında negatif ilişki bulunmuştur. Sonuç olarak, düşük ergonomik sonuçlar ve düşük farkındalık, ofis çalışanları arasında omurga sağlığının fiziksel, postural ve fonksiyonel parametreleri üzerinde olumsuz bir etkiye sahiptir.

Anahtar kelimeler: ofis işi, ergonomik analiz, ergonomik farkındalık, fiziksel, postüral, fonksiyonel, omurga sağlığı

1. INTRODUCTION

Ergonomic hazards are frequently associated with musculoskeletal disorders (1). It is common to use the terms "postural, physical, and functional" when discussing ergonomic analysis and awareness among office workers, as well as the impact on postural, physical, and functional aspects of the spine. Musculoskeletal disorders (MSDs) are frequently reported among office workers all over the world (2). The World Health Organization (WHO) defines MSDs as health issues involving the locomotor apparatus of the human body, which includes defects in muscles, tendons, ligaments, and nerves. MSDs are caused by wear and tear that does not allow for adequate self-repair time. MSDs can result in a wide range of issues, including chronic discomfort, pain, and even functional impairment (3).

There are numerous ergonomic issues to consider. Frequent movements with awkward posture for long periods cause impairments in musculoskeletal structures. Movement-related pain is frequently caused by muscle lesions accumulating in the affected structures, and this is harmful to one's health (4). According to studies, office workers suffer from MSDs in a variety of situations, and prolonged computer use can cause joint and muscle stress and strain. Occupational musculoskeletal disorders are disorders that can affect negatively on postural, physical, and functional which lead to impairment in the musculoskeletal (5). Inflammatory and degenerative changes can affect soft tissues such as the neck, back, shoulders, elbows, wrists, and fingers. Work disability is common among these disorders, and it can also result in medical leave due to physical injuries, lowering workers' financial productivity and efficiency. Musculoskeletal disorders have a negative impact on both an individual's quality of life and the productivity of an organization (6, 7).

Ergonomic analysis and awareness in workers, together with the modern literature, focus on knowing environmental factors, work procedures, equipment, and organizational factors. Repetition, force, prolonged and uncomfortable postures, and infrequent rest periods are all examples of the main reasons for MSDs (8).

Based on previous research, the percentages of occupational who suffer from MSD while using computers range from 25% to 35% (9). Other recent studies

revealed that musculoskeletal discomfort symptoms in the back (66.33%) and lower back (59.49%) are combined in employees who use a computer on a daily basis and experience computer-usage disruption. Ardahan, M., & Simsek, H (10).

Poor ergonomic design, prolonged computer use, awkward postures, psychosocial environments, and high work demands may all contribute to discomfort. Increased biomechanical pressure can result from careless loading and decreased rest between movements, as well as a combination of bad postures and movements, repetitive motions, force, and vibrations. The two types of postures are active and passive postures. Active postures involve active muscle contractions, whereas passive postures involve the passive shaping of bones, muscles, tendons, and ligaments (11).

As a rule, when explaining ergonomics awareness to office workers, they must see if the use of desks and awareness is linked to the pattern of sedentary behavior in office workers, researchers looked into it. Differences in sedentary behavior are usually based on desk type and awareness of the importance of posture diversity and break length. According to a study of office workers conducted through observation. The results showed that ergonomics awareness was not associated with any sedentary pattern variable among those who used a desk. Inclinometers recorded sitting positions, where the staff were checked within a day, differences in behavior based on desk type, and awareness of the importance of torso position variation and break periods. Straker, L., Abbott, R. A., Heiden, M., Mathiassen, S. E., & Toomingas, A. (12).

In 2003, the percentage of workers who used a computer was 43%. The percentage also increased. In 2008, the percentage of employed rose to 61% and in 2017 it increased to 78%, so it has become an integral part of employee work these days (13, 14). In recent years, computer-based jobs have become more common in the workplace, resulting in skeletal malformations, muscle imbalances, and joint instability in many employees as a result of prolonged sitting. Poor posture at work can cause non-specific low back pain (15, 16).

Any prolonged posture causes static loading of the soft tissues, which causes pain. In terms of mobility, force exertion, energy consumption, circulatory demands, coordination, and motion control, standing and sitting have distinct advantages and disadvantages. Inactivity caused by sitting leads to an accumulation of metabolites that accelerates disc degeneration and leads to disc herniation (17). Musculoskeletal problems can also be caused by office worker postures. Postural stress is common among office workers, resulting in back, neck, and upper extremity pain (18). This aggravates the vibration-related issues. Fixed postures should be avoided at all costs. In the office, good lumbar support should be used. The height of the lumbar vertebrae decreases or deforms when the spine is loaded in a forward-bending posture, according to the study. At low trunk moments, such as those seen in upright postures, antagonistic co-contraction is beneficial (19). In a chair, a seated person's posture is influenced by not only the chair's design but also their sitting habits and the task at hand. The height and inclination of the chair's seat, the backrest, and other types of support all have an impact on the posture that results. In addition, the chair should allow for frequent and simple posture changes (20).

Occupational back pain has been linked to a number of physical parameters (21). Physical demands such as heavy manual labor, frequent lifting, pulling, or pushing, trunk flexion or rotation, prolonged sitting or standing, and whole-body vibration are all biomechanical factors. In terms of investigating the effect of physical load on the occurrence of spine injuries. An anthropometric and demographic count will be taken, and each variable will be analyzed, with age, sex, and other factors taken into account (22).

Back pain is a major health problem that can have a profound impact on the level, according to the functional activity of the individual. Because the goal of treatment is frequently to improve workers' function, functional status is a key outcome in clinical trials looking into low back pain. Physiologic measures such as spine mobility and trunk strength have traditionally been used to evaluate the impact of low back pain on functional ability. In many cases, however, such measures are unrelated to outcomes that are more important to patients and society, such as symptom relief, daily functional ability, and work status (23, 24).

The aim of the present study is to find out how much the office workers profession affects the health of the vertebral column, In terms of the extent to which there is comfortable ergonomic analysis and awareness in office work and its impact on Postural, physical, and functional parameters of spine health.

Two hypotheses were identified in the study:

H_0 Poor ergonomic analysis results and awareness have no impact on postural, physical and functional parameters of spine health among office workers.

H_1 Poor ergonomic analysis and awareness have a negative impact on postural, physical and functional parameters of spine health.



2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Brief functional anatomy of spine

The distinct difference between the styling and purpose of the spine is one of the features of the feasible anatomy of the spine described in this chapter. The vertebral column is made up of intervertebral discs (IVD) and alternating vertebrae, which are fixed together in the back by strong ligaments and muscles. The structural integrity of the spine is dependent on the presence of bony, ligamentous, muscular elements, and cartilaginous. The spine serves to carry out tasks such as transmitting body weight and protecting the spinal cord and nerves. The extent to which the spine can perform flexion, extension, lateral flexion, and rotation movements, however, varies by region. These four curves are formed by the cervical, thoracic, lumbar, and sacrococcygeal spines (25). Figure 2.1 shows a lateral view of the vertebral column, illustrating the spinal curvatures (26)

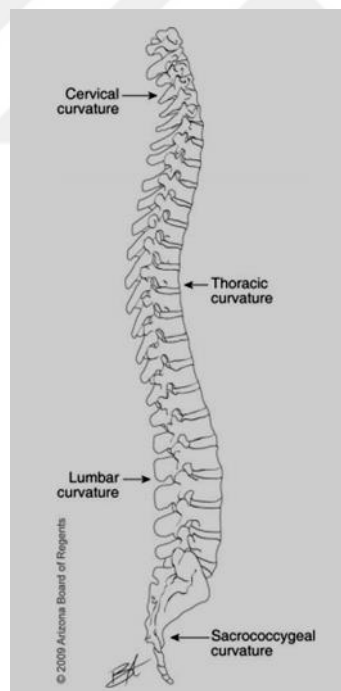


Figure 2.1 Lateral view of the vertebral column, illustrating the spinal curvatures. Drawing by Brent Adrian (26)

The back (dorsum) is located between the top of the buttocks and the (cervical) neck. The spine serves numerous functions, including housing the spinal cord, maintaining the head and body upright, and adjusting the movements of the upper and lower limbs (27).

2.1.1. Bones

The spine is supported by numerous muscles, ligaments, and tendons. It is made up of a chain of 33 interconnected vertebrae and the joints that link them (27).

2.1.2. Vertebral column

The series of vertically aligned vertebrae makes up the vertebral column. Cervical lordosis, thoracic kyphosis, lumbar lordosis, and sacral kyphosis are the four curvatures of the vertebral column caused by vertebral alignment. Lordoses are concave in the front, whereas kyphoses are concave in the back. The vertebral foramen (spinal canal), which runs through the center of the vertebral column, is where the spinal cord passes (28). As shown in figure 2.2, the vertebral column anatomy (29).

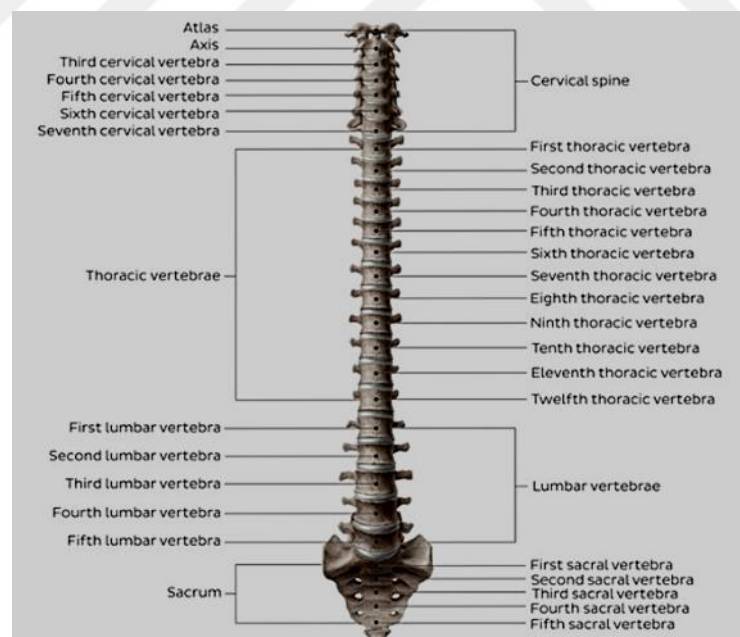


Figure 2.2 Vertebral column anatomy (29)

2.1.3. Vertebra

The vertebrae are the structural constituents of the spine. Each vertebra has three processes, a body, and an arch. (C1-C7) Cervical spine: 7 vertebrae of the neck, (T1-

T12) Thoracic spine: 12 vertebrae of the mid-back, (L1-L5) Lumbar spine: 5 vertebrae of the lower back, Sacrum, and Coccyx. The groups of vertebrae differ from one another. This is due to their function and the amount of weight each vertebra carries (30). The following appears in figure 2.3. (31).

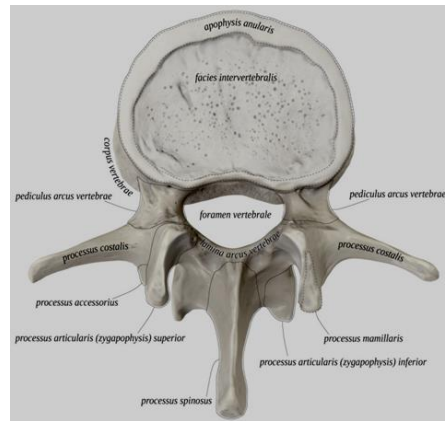


Figure 2.3 Vertebral body (31)

2.1.4. Vertebral joints

Two intervertebral joints that connect adjacent vertebrae are known as intervertebral discs. The superior and inferior articular processes of adjacent vertebrae form zygapophyseal joints. Figure 2.4 shows the intervertebral joint's components (32), sacroiliac joints connect the spine to the pelvis. The back muscles act on these joints, presenting the movement of the spine. The spine's ligaments support and stabilize its joints during spinal movements. The anterior longitudinal ligaments (ALL) and posterior longitudinal ligaments (PLL) run the length of the spine. The ligamenta flava, supraspinous, interspinous, nuchal, and intertransverse ligaments are also accessory ligaments that support the spine. The costocorporeal joint is the articulation between the rib head and the vertebral body (33).

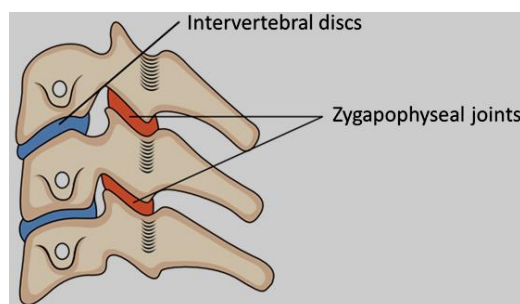


Figure 2.4 Intervertebral joints components (32)

2.1.5. Back muscles

Anatomically, the back muscles are divided into superficial (extrinsic) and deep (intrinsic) layers. Although the extrinsic back muscles are located in the back, they aid in shoulder movements and breathing. The thoracolumbar fascia divides the intrinsic and extrinsic back muscles. The suboccipital muscles, trapezius, latissimus dorsi, levator scapulae, rhomboids, and serratus posterior muscles are all extrinsic muscles. There are three layers to the deep back muscles: superficial, intermediate, and deep (34). Displaying the deep back muscles in table 2.1 below (35)

Table 2.1 deep back muscles (35)

Superficial layer	Splenius muscles: - Splenius capitis - Splenius cervicis
Intermediate layer	Erector spinae muscles: - Iliocostalis: cervicis, thoracis, lumborum - Longissimus: capitis, cervicis, thoracis - Spinalis: cervicis, thoracis
Deep layer	Transversospinalis muscles: - Semispinalis: capitis, cervicis, thoracis - Multifidis: cervicis, thoracis, lumborum - Rotatores: breves, longi

2.1.6. Nerves and vessels

The dorsal branches of the vertebrae, the ascending cervical, deep cervical, occipital, intercostal, subcostal, lumbar, and lateral sacral arteries are all located in the back. The veins of the spine, known as basivertebral and intervertebral veins, are composed of a venous network of longitudinal channels. Internal and external vertebral venous plexuses pour these into the segmental and vertebral veins. The occipital vein, posterior intercostal vein, subcostal vein, and lumbar veins drain the skin and back muscles into the vertebral veins, the azygos venous system, and the inferior vena cava. The skin, vertebral column, and deep muscles of the back are all innervated by the posterior spinal nerve (ramus). As shown in figure 2.5., (36) the supply to the back skin follows the standard segmental dermatome pattern, whereas deep muscles are innervated by posterior spinal nerves. The trapezius and serratus posterior muscles

supply the superficial muscles. Spinal nerves from regions of the spinal cord form four plexuses: cervical (C1-C4), brachial (C5-T1), lumbar (L1-L4), and sacral (L4-S4) plexuses.(37).

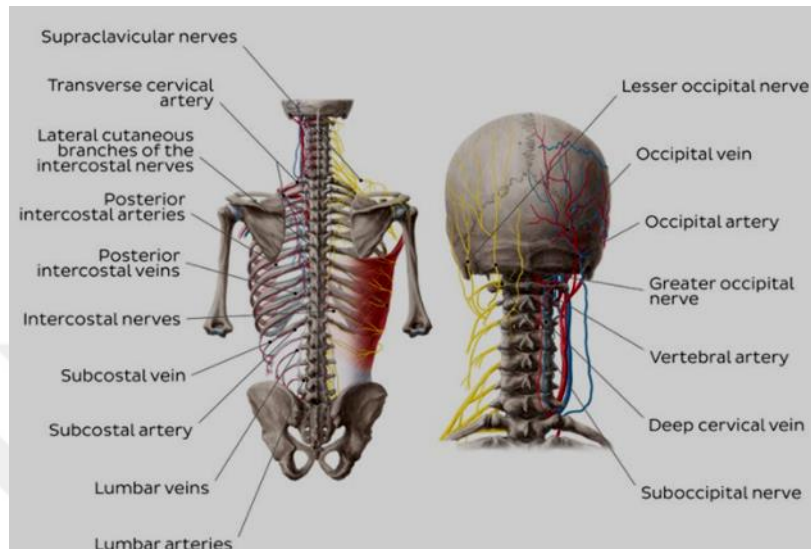


Figure 2.5 Nerves and vessels of the back (36)

2.1.7. Functions of the back

The back function of the vertebral column is the trunk's main structural component. Its functions include protecting the spinal cord, assisting respiration, maintaining body posture, and transmitting body weight. In the sagittal and coronal planes, the vertebral column's curvatures and overall flexibility enable shock resilience, while the intervertebral discs have a high capacity to absorb shock in the transverse plane. The head's position is coordinated with the body's movements by the backbones and muscles, preventing extreme extension and flexion (38).

2.2. Introduction to Ergonomics

Ergonomics is the study of the nature of workers' responses to their workplace and the factors that influence this interaction. Its goal is to improve the performance of human-computer interaction. This is achieved by creating a better interface or designing factors in the workplace. Better work environment training is important for educating office employees while they are using a computer about a healthy office work

environment. Muscles, tendons, ligaments, nerves, and blood vessels, as well as cumulative trauma disorders (CTDs), are known to contribute to occupational ergonomic injuries and illnesses. MSDs are the name for these kinds of injuries (39). "The study of people's problems adjusting to their environment; especially the science that seeks to adapt work or working conditions to suit the individual worker," according to Webster's New World Dictionary (College Edition) (40). The ergonomics comes from the Greek words "ergo", which means "work", and "nomics," meaning "laws concerning, or measuring" (41).

2.2.1. Ergonomic Techniques for the Body worker

Identify the body's neutral checkpoints and determine the correct biomechanical positions of your body while applying therapeutic techniques would like to determine how to modify the client's position in the office to improve workers' ergonomics and identify props used to aid in work (42).

2.2.2. Good working positions for office workers

Office workers should understand the importance of posture in maintaining a comfortable computer workstation. The computer worker must consider the position of the head; it should be parallel to the body while maintaining the correct angles for both hands and arms at a straight angle and parallel to the ground. Maintain a relaxed posture with both shoulders and arms close to the body. If the desk is stable and high, the worker will not be happy, so it is preferable to use a footrest to support the feet. Furthermore, when sitting vertically or slightly leaning back, the back is fully supported by appropriate lumbar support. And because the thighs and hips are generally parallel to and supported by the floor, the knees are about the same height as the hips when the feet are slightly forward. (43). In upright sitting posture, in figure 2.6a., the user's torso and neck are approximately vertical and in-line, the thighs are approximately horizontal, and the lower legs are vertical. Figure 2.6b. (44).



Figure 2.6a Upright sitting posture (44)



Figure 2.6b Sitting posture (44)

2.2.3. Workstation Components

When choosing and arranging the components of the workstation, the components and accessories for the desktop computer workstation should be placed in such a way that they allow you to work in neutral body positions, allowing you to perform more efficiently while also being more comfortable and safe (43).

2.2.3.1. Chairs

A well-designed chair for office workers is an important part of a comfortable workstation. A well-balanced chair provides the back, knees, buttocks, and arms with the necessary protection to reduce strenuous efforts. Increased adjustability ensures a perfect fit for the individual, as well as ample comfort in a variety of seating postures and the ability to change positions throughout the day. This is especially relevant if the chair is used by many people. It is important to test out several chairs before buying one to guarantee that it can provide enough help. Table 2.2. Simulates parts of the chair that should be considered in creating a safe and productive workstation, including the hazards and solutions for the backrest, seat, armrest, and base (43).

Table 2.2 Chair parts and hazards and solutions consequential (43)

Backrest	Possible hazards: Back pain and fatigue. Possible solutions: Use a removable back support pillow if your current chair lacks lumbar support. The user can tilt at least 15 degrees from the vertical position with this adjustment. To provide sufficient resistance to the movement of the lower back.
Seat	Potential hazards: Fatigue-restricted circulation, swelling, numbness, and pain. Possible Solutions: A footrest can be used. The seat pan should be "depth" adjustable. It should support the majority of the thigh while avoiding contact between the back of the user's knee and the seat pan's front edge. The footrest may slightly elevate the knee to relieve back pressure.
Armrest	Potential hazards: The lower back, arm, and shoulder may become fatigued and strained Possible Solutions: Armrests should be wide enough to allow easy entry and exit from the chair, close enough to provide support for your lower arms while keeping your upper arms close to the body, and should only make contact with your lower arms when positioned comfortably at your sides.
Base	Potential Hazards: Muscle strain and fatigue. Possible Solutions: A strong, five-legged base is required for chairs. Make sure the casters on the chairs are suitable for the type of flooring at the workstation.

2.2.3.2. Desks

A properly adjusted desk will give you enough legroom, allow you to suitably place a computer, and reduce awkward postures and exertions. Hazards that could occur with limited space on the work surface may cause users to place components and devices in undesirable positions. This placement may need more force is needed to complete the task (43).

2.2.3.3. Monitors

Choosing the right monitor and putting it in the right spot can help you avoid overexertion and awkward postures. This reduces the risk of health problems like excessive fatigue, neck and back pain. For ideal viewing distance keep yourself at a distance between 50 and 100 cm from the eye to the surface of the computer monitor. The top of the screen should be at or slightly below eye level, It is best if the center of the computer screen is located 15-20 degrees below horizontal eye level (43).

2.2.4. Workstation environment for occupational safety and health application

The workplace environment and workstation design are critical to employee productivity, safety, and optimal health. A properly designed, ergonomically designed workstation helps prevent work-related musculoskeletal disorders, reduces health care costs and workers' compensation, increases productivity, morale, and improves quality of life (45).

2.3. Office workers Ergonomics

In recent years, the use of computers has increased and automatically led to a decreased use of paper, creating new employment opportunities and modifying existing jobs' efforts and demands. Because of the increased use of computers and the decreased use of paper and typewriters. As a result of hours of working uninterrupted without a break period, the prevalence of work-related musculoskeletal disorders (WRMSDs) has increased (46).

2.3.1. Ergonomic analysis for office workers

WRMSD research has received a lot of attention. And academics have concentrated on job organization, which includes physical and psychosocial workplace factors. (47). In numerous studies. The interval of visual display unit (VDU) work has been determined as a risk factor for musculoskeletal pain (intro 9,48). The onset of musculoskeletal symptoms in the neck, shoulder, and back has been linked to a number of psychosocial factors, including a high level of work effort, a limited amount of time, mental stress, salary dissatisfaction, a heavy workload, and a lack of support from coworkers and directors. In both experimental and field studies, job technique changes while performing VDU work have been examined. It has been found that office workers with poor VDU technique have higher muscle tension in the neck and back (47). Many studies have been conducted to determine the cumulative or average duration of computer usage or the use of computer tools such as the mouse and keyboard over a given time period, It also revealed that workers overestimate their use of computers. (49). Due to the long hours that employees spend in the office over the course of days and years, job time control is especially important in the workplace. If he does not have

control over his work environment, it will have a negative impact on his health and productivity (50). Physical job demands, work-related psychosocial factors, cognitive factors, and individual differences have all been identified as factors that contribute to the development of WRMSDs (51). The National Institute for Occupational Safety and Health (NIOSH) has compiled a list of five psychosocial factors associated with musculoskeletal disorders, job satisfaction, workload, repetitive work, job control, and social support. Age, gender, culture, educational background, and personality type were all identified as individual risk factors for the development of WRMSDs (52).

2.3.2. Ergonomic awareness for office workers

Employees who do not perform exercise or stretching training while on the job are at a greater risk of injury. Lack of medical awareness can lead to unnoticed and untreated musculoskeletal signs and symptoms (53). For office workers, the solution options should devote time to obtaining awareness about ergonomics training, specific computer component-related factors and realizing the cause of the person's discomfort, also how to use and adjust components and environmental variables correctly (54).

2.4. Work-related Musculoskeletal Disorders in Office Work WRMSDs

2.4.1. General overview of MSDs among office workers

Musculoskeletal disorders are a major problem in all types of jobs, affecting muscles, tendons, ligaments, joints, peripheral nerves and vascular structures. As a result, clinical syndromes such as tendinitis and tenosynovitis were contained, as well as nerve compression problems such as sciatica, osteoarthritis, low back pain and other regional pain syndromes. (55, 56) Many risk factors associated with office work have been linked to these issues in studies of office workers. Physical factors associated with diseases include intense, repetitive, or constant tasks, unusual, continuous, or excessive body positions, insufficient recovery time, vibration, and temperature differences (57). Computer users are surrounded by musculoskeletal symptoms, that have a high incidence, particularly in the neck, shoulder, and back areas. As a result of these

symptoms, the costs and effects on quality of life are significant. The use of computers in the workplace has increased significantly over the last two decades (58).

2.4.2. Spine disorders among office workers

Office workers suffer from a plethora of spinal musculoskeletal symptoms. Workers who experienced these signs were more likely to consider their workstations insufficient. Office work is commonly correlated with long periods of sitting. Extended sitting can cause musculoskeletal injuries in the spine due to raised compression and load on ligaments and muscles in the intervertebral discs, decreased tissue mobility, differentiated spinal curvature, and weakened paravertebral muscles (59). Constant movement can result in disc injuries. Periodic bending of the back damages the disc in the spinal cord (60). When you use poor posture, this can injure you with a number of stress points in the muscle tissues especially in the lumbar region, and the discs. This stress may be relieved once the offending posture is corrected. In an unsupported sitting position, the spine bends forward slightly. Over time, the forward bend in the spine may result in herniation. Poor lifting technique can cause your lumbar disc to herniate, causing pain in your lower back and/or radiating pain into your leg via a nearby spinal nerve. Working on a computer while lying on your stomach can cause your lower back and hip to extend (bend backward) excessively, changing the dynamics of your lower spinal curve. Maintaining a proper posture usually necessitates less effort than maintaining an incorrect posture. Breaking free from a habitual incorrect posture may take time and constant awareness (61).

2.5. Assessment in office work Ergonomics

2.5.1 Postural Changes and assessment in Office Ergonomics

Poor working posture includes mechanical forces such as body weight, muscle tension, and ligaments that affect the spine (62). Workers who always sit in an upright ergonomic seated position with their backs, feet supported, and keep their arms relaxed, are the ones who maintain their body posture (63). The ischial tuberosities and soft tissues shift body weight to supporting areas when sitting. Your weight will be distributed among the backrest, floor, and armrests. When sitting without lumbar

support, intradiscal pressure (IDP) is higher than when standing (64). Increased IDP occurs during sitting as a result of increased trunk moment as the pelvis rotates backward and disc deformation as the lumbar spine flattens. Lumbar supports contribute to increasing lordosis and reducing disc deformation. The center of mass is directly above the ischial tuberosity in the middle position. During working at a desk, a forward-leaning position of around 60-70 degrees is used. Thighs and the trunk for an extended period of time, the tissues' flexibility decreases, and tension in the hamstring muscles restricts hip joint movement. As a result of hamstring tension, a balanced flexion of the lumbar spine is required to maintain the vertical position of the trunk (65). Sitting working positions are more common in modern societies and businesses, which is becoming habitual and contributing to physical symptoms in a variety of ways (66, 67). When sitting at a desk, an office worker adopts flexible lumbar spine postures, which may result in a greater contribution of passive tissues to maintaining an upright body (68). Biomechanical studies have shown that an incorrect seated posture can cause a posterior rotation of the pelvis, resulting in decreased sacral inclination and lumbar lordosis, as well as increased forces on the discs (69).

2.5.2. Spine Physical health assessment among Office Workers

A healthy lifestyle among workers is a necessary component of physical activity that has been coupled with a variety of health benefits (70). Muscle activity is required for performing physical activity at work and is generally considered to be health-promoting, as mechanical loading is required to ensure the viability of the musculoskeletal tissues (71). A physically active lifestyle can help to keep muscles strong and prevent repetitive strain injuries. It is widely acknowledged that a physically active lifestyle has numerous health benefits and is linked to lower risks of coronary heart disease, stroke, high blood pressure, cancer, and a variety of other illnesses (72). In general, recent international guidelines, such as the World Health Organization guidelines, recommend 150 minutes of moderate to vigorous physical activity (MVPA) per week. According to literature reviews, 150 minutes of moderate to vigorous physical activity per week has a significant impact on health by lowering the risk of various chronic diseases and premature mortality. It's worth noting that physical activity as a behavior and health-related physical fitness as a state of mind are linked to chronic

conditions and mortality, on the other hand. Nonetheless, health-related physical fitness is linked to a reduction in risk factors in general (73). Physical activity is commonly observed in occupational studies as being excessive or engaging in harmful activities. According to a study, physical activity should be thought of as a continuum rather than a binary, as a study explained the relationship between activity level and low back pain as a U-shaped curve; for example, both too little and too much physical activity are harmful to spinal health (74).

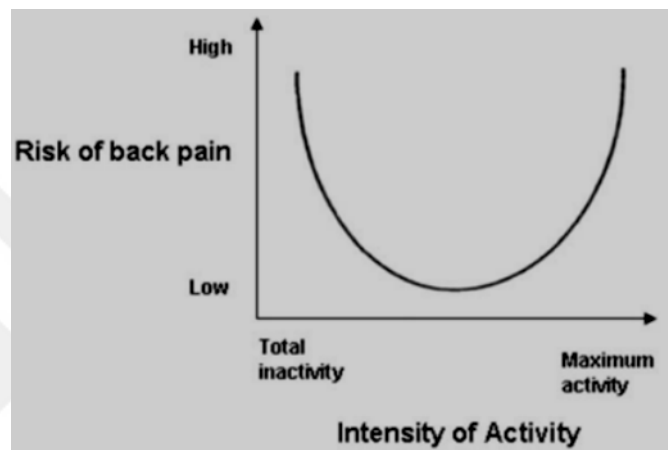


Figure.2.7 Theoretical relation between physical activity and back pain (74)

There are several components to a physical examination for patients with low back pain. Both ranges of motion and muscle strength are an important part of most physical examinations. Assessing spinal function, responding to therapeutic input, determining work restrictions, functional capacity, or even permanent impairment, are all made easier with tools used by therapists(75).

2.5.3. Functional restrictions and assessment among Office Workers

Low back pain is one of the most common health problems that people face throughout their lives, causing functional limitations and decreased productivity (76). In both the activity and participation domains, a worker may be fully functional. Furthermore, and particularly in the case of participation, problems that an individual may encounter in engaging in life situations, can be viewed as issues caused by an inhospitable physical environment and other aspects of the social environment. The accumulation of work in a sitting position will negatively affect the function of the

spine and, automatically, will affect the health of the worker (77). Pain is a subjective experience, and functional limitations in relation to work demands may make continuing to work difficult (78). Self-reports, the authors concluded, may be more accurate in identifying unusual or high-risk demands. The small correlation between pain and functional limitations, on the other hand, suggests that these outcomes may develop somewhat independently during the recovery period after acute low back pain (79). Functional restrictions and barriers to a worker's ability to perform activities or roles in the context of his or her life are also thought to have an impact on health outcomes and the recovery process (80). The loss of paraspinal muscle strength and endurance is a major risk factor for the onset of low back pain. Furthermore, patients with low back pain have lower body muscle strength than healthy people. Lumbar pain is three times more likely in patients with reduced muscle strength. As a result, exercise is one of the most common treatments for non-specific low back pain. Its goal is to improve posture, trunk muscle strength, and aerobic capacity, resulting in decreased pain and improved functional status (81, 82). In the treatment of low back pain, a variety of conservative treatment modalities such as exercise, physical therapy, and medication are used. The goal of these techniques is to improve mobility, reduce pain, and improve functional status (83).

2.6. Management of MSDs among office workers

2.6.1. Self-Care: Exercise

Workers spend an average of 4-6 hours per day sitting in their offices, which is a source of concern for their health (84, 85). Exercises that target the trunk muscles can alleviate low back pain, and there is evidence that a home exercise program can reduce the pain induced by sitting for long periods of time in the office (86). Workers recommend certain exercises to relieve lower back pain. The total training volume of one hour per week was determined using the American College of Sports Medicine's guidelines for novice endurance training, in figure 2.8., showing the exercises (87).



Figure 2.8 Exercises taught with increasing difficulty from top to bottom (87)

2.6.2. Self-Care: Self Massage

Massage is the manipulation of soft tissues with one's hands or a mechanical device. It is also a simple way to relieve pain, as well as relax, and promote a sense of well-being (88). Self-massage is one of the first options for workers who suffer from lower back pain. The massage can be applied to the lower back area or to the entire body (89). Self-massage provides instant relief from aches and pains, helps retrain muscle memory, prevents injuries from overuse, reduces scar tissue, and restores muscle balance (90).

2.6.3. Self-Care: Stress Busters

Physical stressors/mental stressors, and work-related stressors are all sources of stress for workers. Stress exhibits itself in a variety of ways. Physical symptoms include weight gain/loss, and, sleep problems. Changes in food and alcohol consumption, procrastination, and withdrawal are all the result of workplace stress (91). Muscle inflammation is worsened by a tight, tense feeling that becomes chronic, together with work-related stress. The Ergonomic Consequences of Stress If left unchecked, improved muscle tension, breathing effects, posture, and movement efficiency all contribute to a vicious cycle (92). Employees should pay attention to diet, exercise, and sleep, all of which are important components of a healthy lifestyle, in addition to deep breathing and relaxation, to manage stress (93).

3. MATERIALS AND METHODS

3.1. Study Design: This study was conducted in the physiotherapy laboratory of Yeditepe University, and it is a descriptive research design that is used because it is appropriate to achieve the study objectives.

3.1.1. Sample Size: The power analysis was done for the determination of the study sample size. According to the analysis, 70 participants were needed to perform this study.

3.2. Ethics Approval Statement: This study was submitted for approval to the Bezmialem Vakıf Üniversitesi Clinical Research Ethical Committee, and it was approved (App. A).

3.3. Participants: The office workers (secretaries) were recruited on the Yeditepe University campus. The employees had over five years of experience. These years of experience confirm the presence of musculoskeletal disorders among office workers, which is why we recommend attracting them in our study. By asking employees from their offices if they would be willing to volunteer, explaining that the trial would involve the spine region and that it would be a one-time session lasting up to 40 minutes. The participants were then given consent forms with more information about the trial. The participants all agreed to participate in the study voluntarily and signed an informed consent form. There were 70 volunteers in total, 35 men and 35 women. The participants all agreed to participate in the study voluntarily and signed an informed consent form (App. B, C).

Table 3.1 Inclusion / Exclusion Criteria

Inclusion criteria	• Male and female participants. • Being in-between 35 and 46 years of age. • Full-time employment. • Works more than four hours per day. • Should carry out their functions in a sitting posture. • Maintain office work for a year or longer. • It must involve using office equipment such as a computer (monitor, keyboard, and mouse), a phone, and documents.
Exclusion criteria	• Participants with neck pain due to a traumatic injury. • Severe degenerative changes in the spine as seen on x-rays and/or MRI • Spinal stenosis with or without upper motor neuron lesion, systemic diseases such as rheumatoid arthritis and/or ankylosing spondylitis. • Specific diagnosis of neurological or musculoskeletal conditions.

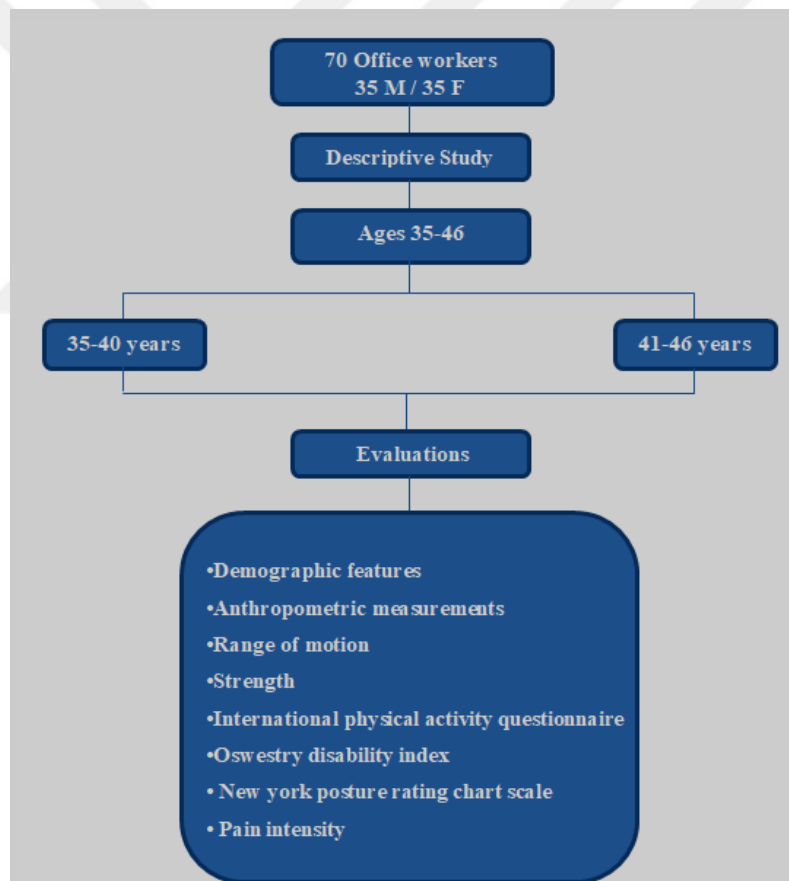


Figure 3.1 Flow Chart of Study

3.4. Assessment method

The sample was divided into two age groups, the first from (35-40) and the second from (41-46) (94). The researcher tries to check the effect of many independent variables from which was the age, statistical wise the age as an independent variable was significantly affecting some dependent variables of the study, thus the researcher tries to indicate such an effect. Mean wise early adulthood category extend between 18-40 years old, while middle adulthood extend between 40-60 years old, the study sample was recruited from those two categories this leads the researcher to think about the effect of those two age categories on the dependent variables in the study. All of the participants went through the same evaluation procedure in the same order, were given their own time, and were assessed using questionnaires. demographic characteristics, anthropometric measurement, Body Mass Index (BMI), pain intensity via visual analog scale (VAS), ergonomic analysis of office work like working hours, ergonomic awareness like exercise habits and stretching, and a physical examination for spine parameters including muscle strength via MicroFET3 dynamometer, range of motion (ROM) via Goniometer, hand grip strength via Jamar Hand Dynamometer, and functional parameters via Modified Oswestry Disability Scale (MODI). Additionally, spine postural parameters by the New York Posture Rating Chart (NYPRC) and the International Physical Activity Questionnaire-Short Form (IPAQ-Short Form).

3.4.1. Demographic Features

The demographic questionnaire asked about the participant's name, age, weight, height, sitting height, dominant side as well as any diseases or previous surgeries, prescribed medicine, Inquire about any active pain in their musculoskeletal system.

3.4.2. Anthropometric Measurements

Anthropometric dimensions such as head circumference, waist circumference, waist-hip ratio, and arm span were measured for ergonomic compliance. These requirements specify the need to account for a spinal-elongation factor in

anthropometric measurements. Based on anthropometrics (size and shape of people) (95).

3.4.3. Body Mass Index (BMI)

After taking measurements of height and weight, the BMI was calculated.

3.4.4. Visual Analogue Scale (VAS)

The Visual Analogue Scale (VAS) is a numerical scale that ranges from 0 to 10 and is used to evaluate pain severity. It's been done twice already, once in the rest position and once in the movement position. (96).

3.4.5. Ergonomic analysis

Despite the designed environment having a clear impact on worker behavior, we go back to the ways of calculating the temporal workload, which is done by asking participants questions about the office work environment, such as how long they worked and the number of hours they worked each day, including the hours worked during the week and the number of hours worked in the year. (97).

3.4.6. Ergonomic awareness

Work can be physically exhausting due to the loss of awareness of the importance of taking the necessary rest and practicing stretching exercises. We can use our bodies to actually calm down and feel more centered at work, which improves our professional performance during the normal working period without feeling pain. Here, an inquiry is made about whether the participant is aware that his posture during work is correct or not, does he take a break, and does he/she practice stretching exercises while at work (98). When participants answer questions about their exercise habits, they choose three options (less than three times a week, do exercise more than three times a week). (99).

3.4.7. Range Of Motion

Range of Motion (ROM) The amount of movement around a specific joint or body part is measured by ROM. It's usually measured as part of a physical therapy evaluation. Active Range of Motion (AROM) is when you use your muscles to help move a body part; this is known as active range of motion. There is no need for another person or device to assist you in moving (100). All spine motions have already been subjected to this test. The range of motion will be measured three times before an average is calculated and the free-pain ROM will be recorded.

Table 3.2 Normal Range Of Motion (Hislop, H., Avers, D., & Brown, M., ACSM & Magee) (101)

Spine Motion	Normal ROM
Flexion	0°–80°
Extension	Thoracic spine: 0°–10°
Extension	Lumbar spine: 0°–25°
Rotation	0°–45°
Lateral Flexion	0°–25°



Figure 3.2 Assessment of Spine Range Of Motion

3.4.8. Muscle Strength

Muscle strength was taken using a handheld dynamometer (microFET2™) (102). Muscle strength in the spine has already been subjected to muscle strength testing. It is examined three times, and then the average is taken (103).



Figure 3.3 Assessment of trunk muscles strength: a) Trunk flexor; b) Trunk extensor; c) Trunk rotator; and d) Trunk lateral flexor

3.4.9. Hand Grip Strength

The hand-grip strength was measured via the Jamar Hand Dynamometer. Under standard bio-kinetic circumstances, the power grip is the result of the vigorous flexion of all finger joints combined with the supreme willful force that the subject is capable of exerting. Examined the workers in the sitting position, making their shoulders adducted and their elbows flexed 90 degrees, and keeping the forearm and wrist in a position of neutrality (104). The maximum grip strength was calculated for both hands by taking the highest value within the first five seconds of the test protocol (105). The mean of three grip strength tests for each hand was calculated after the measurement. Between each attempt, one-minute rests were given, and hands were alternated to reduce fatigue. All of the subjects were assessed in the same way (106).

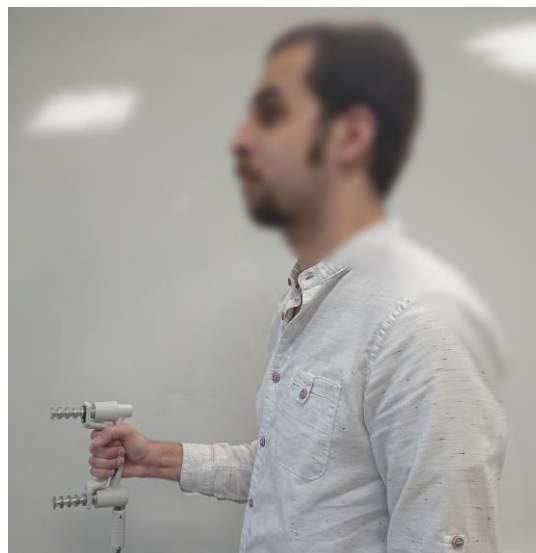


Figure 3.4 Jamar Hand Dynamometer was used to measure handgrip strength.

3.4.10. New York Posture Rating Chart (NYPRC)

In the university laboratory, the postural assessment was performed using the New York Posture Rating Chart (NYPRC) (107). The participants were evaluated while wearing their T-shirts. However, to eliminate the researcher's deception, the participants also palpated the area that was observed using the rating chart for office workers. The NYPR is assessing overall postural alignment, and each of the 13 body alignments received one of three scores: 5 for ideal posture, 3 for slight deviation, and 1 for pronounced deviation. in a specific anatomical position. The participants were positioned ten feet apart and then tagged with the relevant visuals. The vertical reference line is created by a straight line placed very close to the participant, between the observer and the participant. Which aids the observer in determining the relative positions of body parts (108). The scores of the 13 body alignment segments are added together, allowing a range of overall scores between 13 and 65. (109).

Table 3.3 Scoring of the New York Posture Rating Chart Scale (110)

Classification	Very good	Good	Tolarable	Weak	Severe
Total Score	≥ 45	40-44	30-39	20-29	≤ 19

3.4.11. International Physical Activity Questionnaire (IPAQ-Short Form)

International Physical Activity Questionnaire (IPAQ-Short Form) (111). This is used to specify the level of physical activity among office workers (112). This questionnaire is applicable to ages 15 to 69 years. The short form records activity at four different levels of intensity (97): high-intensity exercises, moderate-intensity activities, walking, and sitting.

The following are the values generated for the analysis of IPAQ data.

- 3.3 walking minutes per day.
- 4.0 minutes of moderate-intensity activity.
- 8.0 minutes of vigorous-intensity activity on vigorous-intensity days.
- Total MET-minutes/week of physical activity = the sum of walking, moderate, and vigorous MET-minutes/week.

Physical activity is categorized into 3 levels, as seen below: (115)

- 600 MET-min/wk for low-inactivity.
- Active Minimum: 600–3000 MET-min/wk
- > 3000 MET-min/wk for Vigorous Active.

3.4.12. Modified Oswestry Disability Questionnaire (MODI)

It is a self-administered survey that is made up of ten questions that cover various aspects of function. That breaks down various daily activities into their constituent elements and indicates whether or not you have any disabilities. Each item is graded on a scale of 0 to 5, with higher scores indicating greater disability (116). The tool's purpose is to assess pain-related disability in people who have low back pain (LBP) (117). The test is regarded as the "gold standard" in terms of determining low back functional outcomes. You compute the index by taking the total score and dividing it by 100, then multiplying it by the percentage of that total to arrive at the final number. It takes 3–5 minutes to fill out and a minute to score (118).

Table 3.4 Interpretation of scores via (Jc, F., & Pynsent, P. B.) (119)

0% to 20%: minimal disability:	The patient can cope with most daily activities. Usually, no treatment is indicated apart from advice on lifting, sitting and exercise.
21%-40%: moderate disability:	The patient experiences more pain and difficulty with sitting, lifting, and standing. Travel and social life are more difficult, and they may be disabled from work. Personal care, sexual activity, and sleeping are not grossly affected, and the patient can usually be managed by conservative means.
41%-60%: severe disability:	Pain remains the main problem in this group, but activities of daily living are affected. These patients require a detailed investigation.
61%-80%: crippled:	Back pain impinges on all aspects of the patient's life. Positive intervention is required.
81%-100%:	These patients are either bed-bound or exaggerating their symptoms.

3.5 STATISTICAL ANALYSIS

Study results will be displayed through common factors of the study (independence) by gender, age categories, and exercise habits, as well as daily working hours and annual working hours on dependent variables like postural, physical, functional, and clinical. Statistical methods were used to analyze the data, including the calculation of descriptive statistics such as the frequency and percentage for categorical variables, the mean (M), median, the standard deviation (SD), and the minimum and maximum for continuous variables. The Kolmogorov-Smirnov test of normality was applied, since the data supports parametric assumptions. When we differentiate between males and females, we use an independent t-test. When we compare the range of motion (ROM) with the normal range, they use a one-sample t-test. To see the effect of exercise habits on physical parameters, use analysis of variance (ANOVA). For multiple group comparisons, as to make for categories in exercise habits, daily working hours, and annual working hours. the Tukey post hoc test was applied, and the results were evaluated accordingly. When we looked at a relationship between Body Mass Index categories with exercise habits and with stretching and classification (Oswestry and New york) we used the Spearman correlation test. And to evaluate the hours working in terms of continuous variables using Pearson correlation. The level of significance was defined as $\alpha = 0.05$. All calculations and analyses were carried out with the SPSS (Statistical Package of Social Sciences Demo Version 22.0) program. In our research, we distinguished between independence and dependence. Physical, postural, functional, and clinical variables are examples of dependent variables. In addition to anthropometric measurements (gender, age category, BMI), ergonomic analysis (daily and annual working hours), and ergonomic awareness, there are independent variables (exercise habits, stretching, exercise duration).

4. RESULT

Table 4.1 Demographic characteristics of the respondents.

	Categories	N	%
Gender	Female	35	50
	Male	35	50
Age categories	35-40	41	58.6
	41-46	29	41.4
BMI categories	Normal (<26)	24	34.3
	Overweight (26-30)	21	30.0
	Obesity grade 1 (30-36)	17	24.3
	Obesity grade 2 (>36)	8	11.4
Dominant side	Right	58	82.9
	Left	12	17.1
Smoking habit	Never	18	25.7
	Quit	13	18.6
	Yes	39	55.7
Alcohol	Never	4	5.7
	Only special days	24	34.3
	Several times a month	25	35.7
	Few times a week	17	24.3
Disease status	No	34	48.6
	Vestibular	2	2.9
	Orthopedic	15	21.4
	Neurologic	4	5.7
	Different type	15	21.4
Medication	Yes	34	48.6
	No	36	51.4
Surgery	Yes	28	40.0
	No	42	60.0

N: Number, %: percent.

A total of seventy respondents took part in the analysis. Males made up (35, 50 %) of the respondents, while females made up (35, 50 %). According to the age distribution of the respondents, (41, 58.6 %) were 35-40 years old and (29, 41.4 %) were 41-46 years old. The respondents' BMIs revealed that (24, 34.3 %) were normal and (21, 30.0 %) were overweight. (58, 82.9%) of the respondents used their right side and (12, 17.1%) left side. The respondents' demographics are presented in Table 4.1.

Table 4.2 Exercise characteristics of the respondents.

	Categories	N	%
Exercise habit	Never	36	51.4
	Less than 3 days	24	34.3
	3 days or more	10	14.3
Exercise type	Never	36	51.4
	Fitness	9	12.9
	Swimming	7	10
	Strength	8	11.4
	Running	4	5.7
	Walking	4	5.7
	Basketball	2	2.9
Exercise duration	Never	36	51.4
	20-30 minutes	8	11.4
	30-60 minutes	14	20.0
	More than 60 minutes	12	17.1

N: Number, %: percent.

As mentioned in table 4.2, a total of (34, 48.6%) of the respondents were doing exercise as follows: (24, 34.3%) less than 3 days and (10, 14.3%) doing their exercise 3 days or more. The most common types of exercise were fitness (9, 12.9%) and strength (8, 11.4%). The exercise duration was varied between the respondents, (8, 11.4%) of the respondents did their exercise for 20-30 minutes and (14, 20.0%) their exercise for 30-60 minutes.

Table 4.3 Working hour's characteristics of the respondents.

	Categories	N	%
Daily working hours	5-6 Hours/day	19	27.1
	7 Hours/day	30	42.9
	8-9 Hours/day	21	30
Annual working hours	Less 1200 Hours/year	20	28.6
	1200-1500 Hours/year	27	38.6
	More Than 1500 Hours/year	23	32.9

N: Number, %: percent.

As table 4.3. Showed, there were (30, 42.9%) people who worked 7 hours per day on a daily basis, while the largest group for annual working hours was 1200–1500 (27, 38.6%). More details about the working hours are available in Table 4.3.

Table 4.4 Descriptive statistics of qualitative functional data for Oswestry disability index

Functional variables	Answers of variables	N	%	CP
Pain Intensity	0	53	75.7	75.7
	1	15	21.4	21.4
	2	2	2.9	2.9
Personal Care	0	70	100	100
Lifting	0	19	27.1	27.1
	1	37	52.9	80
	2	14	20	100
Walking	0	44	62.9	62.9
	1	21	30	92.9
	2	5	7.1	100
Sitting	0	49	70	70
	1	18	25.7	95.7
	2	3	4.3	100
Standing	0	41	58.6	58.6
	1	26	37.1	95.7
	2	3	4.3	100
Sleeping	0	29	41.4	41.4
	1	28	40	81.4
	2	11	15.7	97.1
	3	2	2.9	100
Social Life	0	43	61.4	61.4
	1	21	30	91.4
	2	5	7.1	98.6
	3	1	1.4	100
Traveling	0	36	51.4	51.4
	1	20	28.6	80
	2	11	15.7	95.7
	3	3	4.3	100
Employment Home Making	0	29	41.4	41.4
	1	39	55.7	97.1
	2	2	2.9	100
Disability Level	Minimal Disability	61	87.1	87.1
	Moderate Disability	9	12.9	100

CP: Cumulative percentage, N: Number, %: percent.

As the above table demonstrated, the Oswestry scale showed more than 75% of respondents' pain intensity can tolerate the pain without having to use pain medication. Plus, they are all able to personal care of themselves. 87.1% of respondents had a minimal disability, and 12.9% had a moderate disability. No severe disabilities were found in either gender. All variable answers are available and exist in data form in the appendix. Table 4.4 shows more details about the Oswestry scale.

Table 4.5 Descriptive statistics of qualitative postural data for New york

Postural variables	Answers of variables	N	%	CP
Head alignment	3	24	34.3	34.3
	5	46	65.7	100
Shoulder level alignment	3	24	34.3	34.3
	5	46	65.7	100
Neck alignment	3	29	41.4	41.4
	5	41	58.6	100
Chest alignment	3	35	50	50
	5	35	50	100
Shoulder alignment	3	27	38.6	38.6
	5	43	61.4	100
Upper back alignment	1	2	2.9	2.9
	3	27	38.6	41.4
	5	41	58.6	100
Spine alignment	3	6	8.6	8.6
	5	64	91.4	100
Hip level alignment	3	13	18.6	18.6
	5	57	81.4	100
Trunk alignment	3	18	25.7	25.7
	5	52	74.3	100
Stomach shape	3	19	27.1	27.1
	5	51	72.9	100
Low back alignment	3	19	27.1	27.1
	5	51	72.9	100
Feet alignment	1	5	7.1	7.1
	3	20	28.6	35.7
	5	45	64.3	100
Feet contact with floor	1	2	2.9	2.9
	3	17	24.3	27.1
	5	51	72.9	100
Classification	>=45 Very good	66	94.3	94.3
	40-44 Good	4	5.7	100

CP: Cumulative percentage, N: Number, %: percent.

As the above table demonstrated, the New York Posture Rating Chart Scale showed 94.3% of the respondents had a ≥ 45 very good rating, and the rest had a good rating classified. No tolerable, weak, or severe categories were found. Regarding head alignment, 65.7% of respondents the head vertical gravity line passes directly through the center. 58.6% of workers have normal upper back alignment, 74% have upright trunk alignment, and 72.9% have normal low back alignment. Table 4.5 shows more details about the NYPRC scale.

Table 4.6 Characteristics of the respondents stratified by their gender.

	Categories	Male		Female	
		N	%	N	%
Age Categories	35 – 40 Years	19	54.3	22	62.9
	41 – 46 Years	16	45.7	13	37.1
BMI	Normal less than 25.9	5	14.3	19	54.3
	Overweight 26 – 29.9	9	25.7	12	34.3
	30 – 35.9 Obesity Grade 1	13	37.1	4	11.4
	≥ 36 Obesity Grade 2	8	22.9	0	0
Dominant side	Right	33	94.3	25	71.4
	Left	2	5.7	10	28.6
Smoking Habit	Never	6	17.1	12	34.3
	Quit	5	14.3	8	22.9
	Yes	24	68.6	15	42.9
Alcohol Habit	Never	1	2.9	3	8.6
	Only Special days	10	28.6	14	40
	Several times a month	12	34.3	13	37.1
	Few times a week	12	34.3	5	14.3
Medication	Yes	14	40	20	57.1
	No	21	60	15	42.9
Surgery	Yes	16	45.7	12	34.3
	No	19	54.3	23	65.7
Disease	No	20	57.1	14	40
	Vestibular	2	5.7	0	0
	Orthopedic	2	5.7	13	37.1
	Neurologic	4	11.4	0	0
	Different type	7	20	8	22.9

N: Number, %: percent.

As shown in table 4.6, the majority of participants in the 35–40 age range were females (22, 62.9 %), while the male gender was more common in the 41–46 age range (16, 45.7 %). The right side was more common in both males and females (33, 94.3% and 25, 71.4%), respectively). Female participants who had never smoked before had higher mean scores than males (12, 34.3%) and (6, 17.1%), respectively. Females who smoke less than males (15, 42.9%) (24, 68.6%), which reflects a higher smoking percentage among male participants. Table 4.6 contains more information about the respondents' characteristics.

Table 4.7 Exercise habits of the respondents stratified by their gender.

	Categories	Male		Female	
		N	%	N	%
Exercise Habit	Never	21	60	15	42.9
	Less than 3 days	8	22.9	16	45.7
	3 days or more	6	17.1	4	11.4
Exercise Type	Never	21	60	15	42.9
	Fitness	0	0	9	25.7
	Swimming	2	5.7	5	14.3
	Strength	6	17.1	2	5.7
	Running	2	5.7	2	5.7
	Walking	2	5.7	2	5.7
	Basketball	2	5.7	0	0
Exercise Duration	Never	21	60	15	42.9
	20 – 30 minutes	0	0	8	22.9
	30 – 60 minutes	6	17.1	8	22.9
	More 60 minutes	8	22.9	4	11.4

N: Number, %: percent.

As Table 4.7 shows, the majority of males never do any exercise (21, 60%) and (15, 42.9%) of females never do any exercise. According to the type of exercise, the most common exercise in females was fitness (9, 25.7%) and fitness exercises were not done by any males. Females were divided equally in the time of exercise (8, 22.9%) and did their exercise for 20–30 minutes and 30–60 minutes. For males, no one exercises for 20–30 minutes, and most do not exercise for more than 60 minutes (8, 22.9%).

Table 4.8 Working hours of the respondents stratified by their gender.

	Categories	Male		Female	
		N	%	N	%
Daily working hours	5-6 Hours/day	2	5.7	17	48.6
	7 Hours/day	17	48.6	13	37.1
	8-9 Hours/day	16	45.7	5	14.3
Annual working hours	Less 1200 Hours/year	2	5.7	18	51.4
	1200-1500 Hours/year	17	48.6	10	28.6
	More Than 1500 Hours/year	16	45.7	7	20

N: Number, %: percent.

As Table 4.8 showed, the majority of males worked 7 hours/day (17, 48.6%) and 5–6 hours/day (17, 48.6%) of females. According to annual working hours, most males worked 1200–1500 hours/year (17, 48.6%) and most females worked 1200 hours/year (18, 51.4%).

Table 4.9 Descriptive and inferential statistics of anthropometric measurements stratified by their gender.

Anthropometric variables	Male	Female	t	p
	M $\pm$ SD	M $\pm$ SD		
Age	40.34 $\pm$ 3.1	39.54 $\pm$ 3.59	-0.99	0.32
Weight	94.86 $\pm$ 15.88	73.54 $\pm$ 10.32	-4.87	0.00*
Height	173.57 $\pm$ 6.5	166.60 $\pm$ 5.33	-6.65	0.00*
BMI	31.54 $\pm$ 5.37	26.43 $\pm$ 3.04	-4.88	0.00*
Sitting Height	93.11 $\pm$ 6.21	89.0 $\pm$ 8.88	-2.24	0.02*
Head Circumference	54.83 $\pm$ 0.78	53.73 $\pm$ 0.98	-5.19	0.00*
Waist circumference	84.20 $\pm$ 8.14	102.22 $\pm$ 8.80	-8.88	0.00*
Hip circumference	115.80 $\pm$ 10.51	101.51 $\pm$ 12.04	-5.28	0.00*
W-H C R	0.87 $\pm$ 0.02	0.83 $\pm$ 0.04	-5.83	0.00*
Arm Span / Cm	186.23 $\pm$ 10.53	172.51 $\pm$ 18.93	-3.74	0.00*

M: Mean, SD: standard deviation. # Independent t test was applied. * Significant difference at $p < 0.05$, W-H C R: Waist - Hip Circumference Ratio

Based on the respondents' gender and anthropometric variables, the male respondents had a significantly higher mean weight compared to females (94.86 $\pm$ 15.88) (73.54 $\pm$ 10.32) ($p < 0.05$), respectively. In comparison to females, male respondents had a significantly higher mean height. (173.57 $\pm$ 6.5) (166.60 $\pm$ 5.33) ($p < 0.05$), respectively. In comparison to males, females had a significantly larger waist circumference. (102.22 $\pm$ 8.80) and (84.20 $\pm$ 8.14)($p < 0.05$), respectively. More details about the anthropometric variables are available in Table 4.9.

Table 4.10 Descriptive and inferential statistics of physical parameters stratified by their gender.

Physical parameters	Male	Female	t	p
	M ± SD	M ± SD		
T Fx ROM	64.48 ± 7.96	74.45 ± 3.33	6.83	0.00*
T Ex ROM	8.48 ± 2.43	8.51 ± 1.42	0.06	0.95
L Ex ROM	8.75 ± 1.45	20.68 ± 3.14	20.36	0.00*
T Rt Rot ROM	38.91 ± 4.40	41.06 ± 3.89	2.15	0.03*
T Lt Rot ROM	38.77 ± 4.30	40.37 ± 4.29	1.55	0.12
L Rt Lat Fx ROM	18.43 ± 2.57	20.60 ± 2.64	3.48	0.00*
L Lt Lat Fx ROM	18.34 ± 1.73	20.98 ± 2.76	4.78	0.18
T Fx S	23.20 ± 6.01	14.69 ± 2.73	-7.62	0.00*
T Ex S	21.17 ± 5.31	11.0 ± 2.95	-9.90	0.00*
L Ex S	14.97 ± 4.69	10.29 ± 2.75	-5.09	0.00*
T Rt Rot S	21.74 ± 4.04	15.08 ± 3.72	-7.16	0.00*
T Lt Rot S	19.46 ± 4.61	14.09 ± 2.81	-5.87	0.00*
L Rt Lat Fx S	19.83 ± 4.21	13.71 ± 2.48	-7.39	0.00*
L Lt Lat Fx S	18.91 ± 4.40	13.23 ± 2.47	-6.65	0.00*
Rt hand palm S	37.83 ± 8.53	17.94 ± 2.54	-13.2	0.00*
Lt hand palm S	34.40 ± 10.55	16.31 ± 2.16	-9.93	0.00*
W MET- m/w	733.54 ± 318.27	527.05 ± 357.53	-2.48	0.01*
M MET- m/w	435.43 ± 203.04	343.43 ± 257.75	-1.65	0.10
V MET- m/w	422.86 ± 346.72	243.43 ± 340.15	-2.18	0.03*
T. PA MET- m/w	1591.80 ± 744.74	1113.91 ± 677.14	-2.80	0.00*

M: mean, SD: standard deviation. # Independent t test was applied. * Significant difference at $p < 0.05$, Trunk (T), Lumbar (L), Flexion (Fx), Extension (Ex), Right (Rt), Left (Lt), Lateral (Lat), Strength (S), ROM: range of motion, Walking Metabolic Equivalent Task- m/w (W MET- m/w), Moderate Metabolic Equivalent Task- m/w (M MET- m/w), Vigorous Metabolic Equivalent Task- m/w (V MET- m/w), Total Physical Activity Metabolic Equivalent Task- m/w (T. PA MET- m/w)

Depending on the respondents' gender and physical parameters, when compared to females, male respondents had a significantly lower mean trunk flexion range of motion. (64.48 ± 7.96) (74.45 ± 3.33) ($p < 0.05$), respectively. In comparison to females, male respondents had a significantly lower mean lumbar extension range of motion. (8.75 ± 1.45) (20.68 ± 3.14) ($p < 0.05$), respectively. Female trunk flexion strength was significantly lower than male trunk flexion strength. (14.69 ± 2.73) (23.20 ± 6.01) ($p < 0.05$), respectively. More details about the physical parameters are available in Table 4.10.

Table 4.11 Statistical results of one sample t-test for range of motion stratified by their gender.

Physical parameters	Male				Female			
	M $\pm$ SD	t	MD	p	M $\pm$ SD	t	MD	p
T Fx ROM	64.48 $\pm$ 7.96	-11.5	-15.51	.00*	74.45 $\pm$ 3.33	-9.82	-5.54	.00*
T Ex ROM	8.48 $\pm$ 2.43	-3.67	-1.51	.00*	8.51 $\pm$ 1.42	-6.18	-1.48	.00*
L Ex ROM	8.75 $\pm$ 1.45	-65.9	-16.24	.00*	20.68 $\pm$ 3.14	-8.12	-4.31	.00*
T Rt Rot ROM	38.91 $\pm$ 4.40	-8.16	-6.08	.00*	41.06 $\pm$ 3.89	-5.99	-3.94	.00*
T Lt Rot ROM	38.77 $\pm$ 4.30	-8.56	-6.22	.00*	40.37 $\pm$ 4.29	-6.37	-4.62	.00*
L Rt Lat ROM	18.42 $\pm$ 2.57	-15.1	-6.57	.00*	20.60 $\pm$ 2.64	-9.84	-4.40	.00*
L Lt Lat ROM	18.34 $\pm$ 1.73	-22.6	-6.65	.00*	20.98 $\pm$ 2.76	-8.58	-4.01	.00*

MD: Mean Difference, M: mean, SD: Standard Deviation, ROM: Range of Motion, T: trunk, L: lumbar, Fx: flexion, Ex: extension, Rt: right, Lt: left, Rot: rotation, Lat: lateral

Depending on the respondents' gender and physical parameters, the mean trunk flexion ROM for males (64.48 $\pm$ 7.96) was lower than the population's 'normal' trunk flexion range of motion score of 80 ($p < 0.05$). The mean trunk flexion ROM (74.45 $\pm$ 3.33) for females was lower than the population's 'normal' trunk flexion range of motion score of 80 ($p < 0.05$). The mean lumbar extension range of motion for males (8.48 $\pm$ 2.43) was lower than the population's 'normal' trunk flexion range of motion score of 10 ($p < 0.05$). The mean lumbar extension range of motion (8.51 $\pm$ 1.42) for females was lower than the population's 'normal' trunk flexion ROM score of 10 ($p < 0.05$). More details about the physical parameters in this age group are available in Table 4.11.

Table 4.12 Descriptive and inferential statistics of visual analog scale stratified by their gender

Variables	Male	Female	Total	t	p
	M $\pm$ SD	M $\pm$ SD	M $\pm$ SD		
Pain in rest	0.39 $\pm$ 0.69	0.37 $\pm$ 0.59	0.37 $\pm$ 0.64	0.00	0.619
Pain in movement	2.11 $\pm$ 2.06	1.83 $\pm$ 1.48	1.97 $\pm$ 1.79	-0.66	0.005*

Independent t-test was applied. * Significant difference at $p < 0.05$.

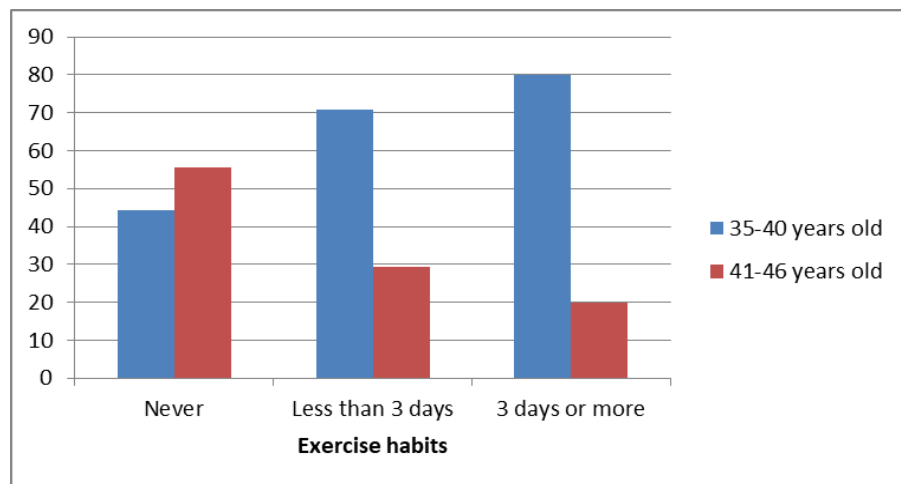
As the above table showed, the male had a higher mean of pain in movement compared to the female, with a significant difference (2.11 $\pm$ 2.06) (1.83 $\pm$ 1.48) (0.005) respectively. More details are available in Table 4.12.

Table 4.13 Descriptive and inferential statistics in lumbar spine movements pain by gender.

Variables	Male	Female	Total	t	p
	M ± SD	M ± SD	M ± SD		
T Fx DWP	1.37 ± 1.76	1.14 ± 1.89	1.42 ± 1.81	-0.58	0.55
T Ex DWP	1.72 ± 2.36	1.68 ± 1.54	1.71 ± 1.98	-0.09	0.92
L Ex DWP	16.38 ± 1.51	5.2 ± 4.15	10.79 ± 6.43	-14.97	0.00*
T Rt Rot DWP	5.91± 4.36	4.51 ± 4.62	5.21 ± 4.52	-1.30	0.19
T Lt Rot DWP	6.45±4.34	5.00±4.69	5.72 ± 4.54	-1.34	0.18
L Rt Lat Fx DWP	7.11± 2.93	4.52 ± 2.61	5.82 ± 3.04	-3.86	0.00*
L Lt Lat Fx DWP	7.11 ± 2.31	4.12 ± 2.94	5.62 ± 3.02	-4.72	0.00*

Independent t-test was applied. * Significant difference at $p < 0.05$, T: trunk, L: lumbar, Fx: flexion, Ex: extension, Rt: right, Lt: left, Rot: rotation, Lat: lateral, DWP: degree with pain

Depending on gender and pain in 7 movements, In comparison to females, male respondents had a significantly higher mean lumbar right lateral flexion degree with pain. (7.11± 2.93) (4.52 ± 2.61) ($p < 0.05$), respectively. The male respondents had a significantly higher mean of lumbar left lateral flexion degree with pain compared to females (7.11 ± 2.31) (4.12 ± 2.94) ($p < 0.05$), respectively. The highest degree of pain was in the lumbar extension degree, with a total of (10.79 ± 6.43) and males showed higher pain compared to females (16.38 ± 1.51) (5.2 ± 4.15) ($p < 0.05$), respectively. More details about the pain and gender are available in Table 4.13.

**Figure 4.1.** Percentage of exercise habits stratified by age category.

As figure 1 demonstrated, 80% of the participants between 35-40 years old do their exercises 3 days or more a week. This percentage decreases to 20% in participants who are 41-46 years old. Participants between the ages of 35 and 40 who exercised less than three days per week made up 70% of the group, while those between the ages of 41 and 46 made up around 30%.

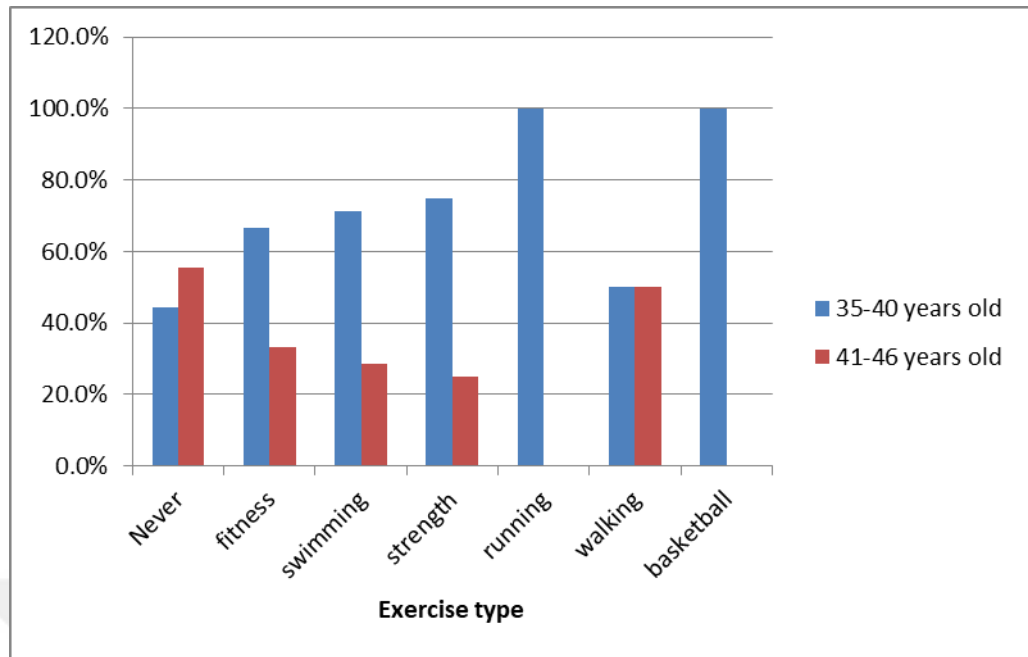


Figure 4.2. Percentage of exercise type stratified by age category.

As figure 2 demonstrated, no one of the 41-46 year old participants did any running or basketball. Around 65% of people aged 35–40 do fitness exercise, and more than 25% of those aged 41–46 do the same exercise. The participants who were between 35-40 years old and played swimming were around 70% and around 30% of the 41–46 year old participants.

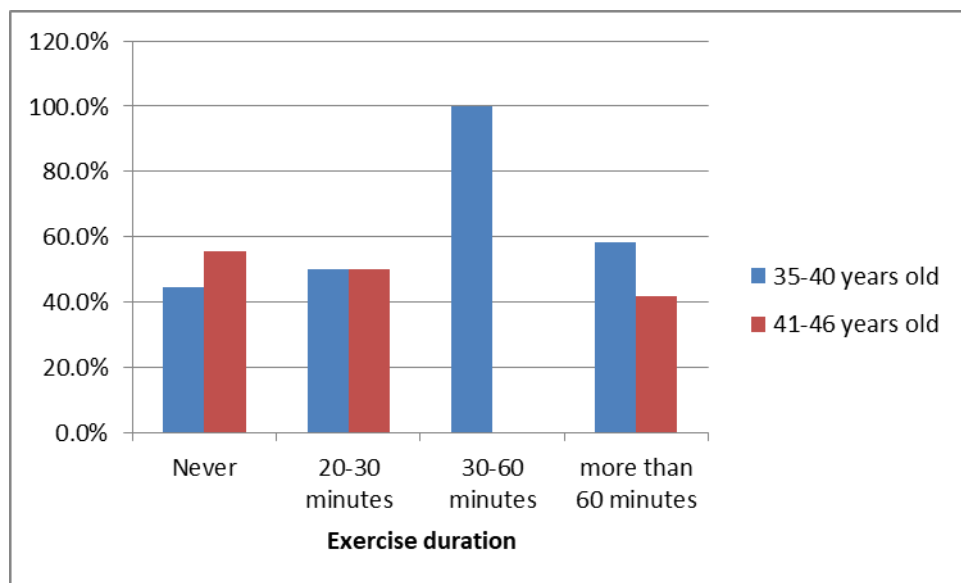


Figure 4.3. Percentage of exercise duration stratified by age category.

As figure 3 demonstrated the exercise duration of the participants, no one from the 41-46 year old group did their sports for 30-60 minutes. Around 60% of people aged 35–40 years old do exercise for more than 60 minutes, and more than 40% of those aged 41–46 years old do exercise for the same duration.

Table 4.14 Descriptive and inferential statistics of anthropometric measurements stratified by age groups.

Anthropometric variables	35-40 years	41-46 years	t	p
	M ± SD	M ± SD		
Age	-	-		-
Weight	79.00 ± 17.25	91.55 ± 14.08	-0.47	0.00*
Height	169.76 ± 7.05	170.55 ± 6.77	-3.22	0.63
BMI	27.24 ± 4.77	31.44 ± 4.40	-3.74	0.00*
Sitting Height	90.24 ± 8.27	92.21 ± 7.30	-1.02	0.30
Head Circumference	54.07 ± 1.09	54.56 ± 0.89	-1.95	0.05*
Waist circumference	89.39 ± 12.42	98.62 ± 10.30	-3.28	0.00*
Hip circumference	103.68 ± 12.61	115.69 ± 11.09	-4.12	0.00*
W – H C R	0.85 ± 0.03	0.84 ± 0.04	1.06	0.29
Arm Span / Cm	177.07 ± 16.93	182.62 ± 16.10	-1.37	0.17

M: mean, SD: standard deviation. # Independent t test was applied.

* Significant difference at <0.05. W-H C R: Waist - Hip Circumference Ratio

Based on the respondents' age group and anthropometric variables, the participants who were 35–40 years old had a significantly lower mean weight compared to those who were 41–46 years old (79.00±17.25) (91.55± 14.08) (p <0.05), respectively. 35–40 year olds had a significantly lower mean waist circumference compared to 41–46 year olds (89.39 ±12.42) (98.62± 10.30) (p <0.05), respectively. The mean body mass index for 35–40 year olds was significantly lower compared to 41–46 year olds (27.24 ±4.77)(31.44± 4.40)(p <0.05), respectively. More details about the anthropometric variables in age groups are available in Table 4.14.

Table 4.15 Descriptive and inferential statistics of physical parameters in lumbar spine movements stratified by age groups.

Physical parameters	35-40	41-46	t	p
	M ± SD	M ± SD		
T Fx ROM	72.26 ± 4.46	65.51±9.82	3.87	0.00*
T Ex ROM	9.22 ± 1.54	7.48 ±2.10	3.98	0.95
L Ex ROM	15.85 ± 6.37	13.12 ±6.39	1.76	0.00*
T Rt Rot ROM	41.49 ±2.46	37.86 ±5.31	3.83	0.03*
T Lt Rot ROM	40.80 ±2.45	37.83 ±5.70	2.98	0.12
L Rt Lat Fx ROM	20.34 ±1.90	18.34 ±3.44	3.10	0.00*
L Lt Lat Fx ROM	20.31 ±2.21	19.00 ±3.09	1.79	0.18
T Fx S	19.76 ±6.50	17.79 ±5.96	1.28	0.00*
T Ex S	17.46 ±6.67	14.14 ±6.26	2.10	0.00*
L Ex S	13.71 ±4.52	11.10 ±4.03	2.47	0.00*
T Rt Rot S	18.58 ±4.77	18.17 ±5.63	0.33	0.00*
T Lt Rot S	16.46 ±4.50	17.21 ±4.92	-0.65	0.00*
L Rt Lat Fx S	17.17 ±5.10	16.21 ±3.82	0.85	0.00*
L Lt Lat Fx S	16.20 ±4.84	15.90 ±4.19	0.26	0.00*
Rt hand palm S	27.54 ±12.60	28.38 ±10.78	-0.29	0.00*
Lt hand palm S	25.12 ±12.60	25.69 ±10.86	-0.19	0.00*
Walking MET- m/w	666.84 ±413.38	578.63 ±268.41	1.00	0.01*
Moderate MET- m/w	414.15 ±259.81	354.48 ±193.45	1.04	0.10
Vigorous MET- m/w	374.63 ±428.92	274.48 ± 194.12	1.17	0.03*
Total PA MET- m/w	1445.59 ±916.93	1207.60 ±366.89	1.37	0.00*

M: mean, SD: standard deviation. # Independent t test was applied. * Significant difference at $p < 0.05$, Trunk (T), Lumbar (L), Flexion (Fx), Extension (Ex), Right (Rt), Left (Lt), Lateral (Lat), Strength (S), ROM: range of motion, Walking Metabolic Equivalent Task- m/w (W MET- m/w), Moderate Metabolic Equivalent Task- m/w (M MET- m/w), Vigorous Metabolic Equivalent Task- m/w (V MET- m/w), Total Physical Activity Metabolic Equivalent Task- m/w (T. PA MET- m/w)

Depending on the respondents' age group and physical parameters, the 35–40 year old respondents had a significantly higher mean trunk flexion range of motion compared to the 41–46 year old respondents (72.26 ± 4.46) (65.51 ± 9.82) ($p < 0.05$), respectively. The 35-40 year old respondents had a significantly higher mean of lumbar extension range of motion compared to the 41-46 year old respondents (15.85 ± 6.37) (13.12 ± 6.39) ($p < 0.05$), respectively. The mean trunk flexion strength for 35-40 year old respondents was significantly higher compared to 41-46 year old respondents (19.76 ± 6.50) (17.79 ± 5.96) ($p < 0.05$), respectively. More details about the physical parameters in this age group are available in Table 4.15.

Table 4.16 Descriptive and inferential statistics of visual analog scale stratified by their age groups

Variables	35-40	41-46	t	p
	M ± SD	M ± SD		
Pain in rest	0.32 ± 0.56	0.45 ± 0.73	-0.84	0.40
Pain in movement	1.86 ± 1.75	2.38 ± 1.80	-1.61	0.11

Independent t-test was applied. * Significant difference at $p < 0.05$.

As the above table showed, older participants (41-46) years old had a higher mean of pain at rest compared to 35–40 year old participants without a significant difference (0.45 ± 0.73)(0.32 ± 0.56)($p = 0.40$) respectively. Older participants (41-46) years old had a higher mean of pain in movement compared to 35–40 year old participants without a significant difference (2.38 ± 1.80) (1.86 ± 1.75) ($p = 0.11$) respectively. More details about the pain at rest and movement are available in Table 4.16.

Table 4.17 Descriptive and inferential statistics in lumbar spine movements pain by age groups.

Variables	35-40	41-46	t	p
	M ± SD	M ± SD		
T Fx DWP	0.82 ± 1.27	1.82 ± 2.28	-2.33	0.02*
T Ex DWP	0.96 ± 1.60	2.76 ± 2.01	-4.14	0.00*
L Ex DWP	9.60 ± 6.27	12.46 ± 6.37	-1.86	0.06
T Rt Rot DWP	3.95 ± 3.27	7.00 ± 5.41	-2.92	0.00*
T Lt Rot DWP	4.48 ± 3.13	7.48 ± 5.61	-2.85	0.00*
L Rt Lat Fx DWP	4.97 ± 1.94	7.03 ± 3.86	-2.93	0.00*
L Lt Lat Fx DWP	5.06 ± 2.41	6.41 ± 3.62	-1.87	0.06

Independent t-test was applied. * Significant difference at $p < 0.05$, T: trunk, L: lumbar, Fx: flexion, Ex: extension, Rt: right, Lt: left, Rot: rotation, Lat: lateral, DWP: degree with pain

Depending on the age group and pain in the 7 movements, the 35-40 year old respondents had a significantly lower mean trunk extension degree with pain compared to the 41-46 year old respondents (0.96 ± 1.60) (2.76 ± 2.01) ($p < 0.05$), respectively. The 35-40 year old respondents had a significantly lower mean of lumbar right lateral flexion degree with pain compared to the 41-46 year old respondents (4.97 ± 1.94) (7.03 ± 3.86) ($p < 0.05$), respectively. The 35-40 year old respondents had a significantly lower mean trunk rotation degree with pain compared to 41-46 year old respondents (4.48 ± 3.13) (7.48 ± 5.61) ($p < 0.05$), respectively. The highest degree of pain was in the

lumbar extension degree, with a total (10.79 ± 6.43) and older participants showed more pain compared to younger ones (12.46 ± 6.37) (9.60 ± 6.27) ($p < 0.05$), respectively. More details about the pain and age group are available in Table 4.17.

Table 4.18 Descriptive and inferential statistics of anthropometric measurements stratified by their exercise habits.

Anthropometric variables	Never	<3 days	3 days or >	t	p
	M $\pm$ SD	M $\pm$ SD	M $\pm$ SD		
Age	41.00 $\pm$ 3.41	38.83 $\pm$ 2.88	38.80 $\pm$ 3.36	3.95	0.02*
Weight	89.39 $\pm$ 14.86	77.58 $\pm$ 17.88	81.40 $\pm$ 18.12	7.21	0.02*
Height	171.78 $\pm$ 6.51	166.17 $\pm$ 5.96	173.40 $\pm$ 6.65	3.89	0.01*
BMI	30.29 $\pm$ 4.80	27.91 $\pm$ 5.35	26.85 $\pm$ 4.09	2.78	0.00*
Sitting Height	93.47 $\pm$ 5.93	86.00 $\pm$ 9.12	94.50 $\pm$ 4.79	9.41	0.06
HC	54.71 $\pm$ 0.77	53.69 $\pm$ 1.17	54.09 $\pm$ 0.81	8.78	0.00*
WC	97.44 $\pm$ 10.70	86.75 $\pm$ 11.56	93.50 $\pm$ 14.35	6.17	0.00*
HC	113.47 $\pm$ 11.00	102.25 $\pm$ 12.77	106.70 $\pm$ 16.37	5.98	0.00*
W – H C R	0.85 $\pm$ 0.04	0.84 $\pm$ 0.03	0.87 $\pm$ 0.01	1.07	0.34
Arm Span / Cm	184.81 $\pm$ 15.06	171.17 $\pm$ 16.33	179.50 $\pm$ 16.64	5.41	0.00*

M: mean, SD: standard deviation. # ANOVA test was applied. * Significant difference at $p < 0.05$, HC: head circumference, WC: waist circumference, HC: hip circumference W-H C R: Waist - Hip Circumference Ratio

Based on the exercise habits of the respondents and anthropometric variables, the respondents who never do any exercise had a significantly higher mean age compared to those who do less than 3 days per week (41.00 ± 3.41) (38.83 ± 2.88) ($p = 0.02$). The respondents who never do any exercise had a significantly higher mean weight compared to those who do less than 3 days per week (89.39 ± 14.86) (77.58 ± 17.88) ($p = 0.02$), respectively. The respondents who never do any exercise had a significantly higher mean waist circumference compared to those who do less than 3 days per week (97.44 ± 10.70) (86.75 ± 11.56) ($p < 0.05$), respectively. More details about the anthropometric variables are available in Table 4.18.

Table 4.19 Descriptive and inferential statistics of physical parameters samples stratified by their exercise habits.

Physical parameters	Never	> 3 days	3 days or >	t	p
	M $\pm$ SD	M $\pm$ SD	M $\pm$ SD		
T Fx ROM	65.13 $\pm$ 8.17	74.12 $\pm$ 4.43	73.90 $\pm$ 3.21	16.17	0.00*
T Ex ROM	7.58 $\pm$ 1.94	8.95 $\pm$ 1.14	10.70 $\pm$ 1.63	15.00	0.00*
L Ex ROM	12.68 $\pm$ 5.84	17.72 $\pm$ 6.43	14.85 $\pm$ 6.50	4.86	0.01*
T Rt Rot ROM	37.83 $\pm$ 4.78	42.21 $\pm$ 1.79	42.40 $\pm$ 2.06	12.60	0.00*
T Lt Rot ROM	37.64 $\pm$ 5.03	41.58 $\pm$ 1.88	41.70 $\pm$ 2.54	9.03	0.00*
L Rt Lat Fx ROM	18.05 $\pm$ 2.93	20.95 $\pm$ 1.71	21.30 $\pm$ 1.33	13.74	0.00*
L Lt Lat Fx ROM	18.58 $\pm$ 2.59	20.79 $\pm$ 2.43	20.85 $\pm$ 1.70	7.27	0.00*
T Fx S	16.97 $\pm$ 4.80	19.21 $\pm$ 6.93	25.40 $\pm$ 5.58	8.52	0.00*
T Ex S	14.47 $\pm$ 5.51	16.08 $\pm$ 6.84	21.90 $\pm$ 7.40	5.49	0.00*
L Ex S	10.36 $\pm$ 3.59	14.17 $\pm$ 3.97	17.10 $\pm$ 3.84	15.60	0.00*
T Rt Rot S	17.13 $\pm$ 5.22	18.50 $\pm$ 4.36	22.80 $\pm$ 4.1	5.41	0.00*
T Lt Rot S	15.92 $\pm$ 4.78	16.58 $\pm$ 3.38	20.30 $\pm$ 5.57	3.77	0.02*
L Rt Lat Fx S	15.86 $\pm$ 3.79	16.25 $\pm$ 3.02	21.30 $\pm$ 7.54	6.59	0.00*
L Lt Lat Fx S	15.33 $\pm$ 4.17	15.54 $\pm$ 2.84	20.00 $\pm$ 7.13	4.82	0.01*
Rt hand palm S	27.69 $\pm$ 10.19	25.50 $\pm$ 11.32	34.30 $\pm$ 16.62	2.02	0.13
Lt hand palm S	24.75 $\pm$ 9.17	22.33 $\pm$ 10.05	34.80 $\pm$ 19.06	4.40	0.01*
W MET- m/w	564.20 $\pm$ 349.50	642.81 $\pm$ 403.94	838.20 $\pm$ 201.00	2.36	0.10
M MET- m/w	366.11 $\pm$ 200.73	385.83 $\pm$ 244.69	482.00 $\pm$ 318.95	0.95	0.39
V MET- m/w	230.00 $\pm$ 256.28	335.00 $\pm$ 324.49	700.00 $\pm$ 487.07	8.44	0.00*
T.PA MET- m/w	1160.31 $\pm$ 664.27	1363.64 $\pm$ 684.17	2020.10 $\pm$ 846.18	5.93	0.00*

M: mean, SD: standard deviation. # ANOVA test was applied. * Significant difference at $p < 0.05$, Trunk (T), Lumbar (L), Flexion (Fx), Extension (Ex), Right (Rt), Left (Lt), Lateral (Lat), Strength (S), ROM: range of motion, Walking Metabolic Equivalent Task- m/w (W MET- m/w), Moderate Metabolic Equivalent Task- m/w (M MET- m/w), Vigorous Metabolic Equivalent Task- m/w (V MET- m/w), Total Physical Activity Metabolic Equivalent Task- m/w (T. PA MET- m/w)

Depending on their exercise habits and physical parameters, participants who did exercise less than 3 days a week had a significantly higher mean trunk flexion range of motion compared to participants who never did any exercise (74.12 $\pm$ 4.43) (65.13 $\pm$ 8.17) ($p < 0.05$), respectively. Participants who did exercise less than 3 days a week had a significantly higher mean of lumbar extension range of motion compared to participants who never did any exercise (17.72 $\pm$ 6.43) (12.68 $\pm$ 5.84) ($p = 0.01$), respectively. The respondents who do their exercises 3 days or more a week had a significantly higher mean of trunk flexion strength compared to participants who never do any exercise (25.40 $\pm$ 5.58) (16.97 $\pm$ 4.80) ($p < 0.05$), respectively. More details about the physical parameters and exercise habits are available in Table 4.19.

Table 4.20 Descriptive and inferential statistics of visual analog scale stratified by their exercise habits.

Variables	Exercise habits			f	p
	Never	< than 3 days	3 days or >		
	M ± SD	M ± SD	M ± SD		
Pain in rest	0.61± 0.76	0.080± 0.28	0.20± 0.42	6.080	0.004*
Pain in movement	2.72± 1.75	1.38± 1.58	0.70± 1.16	8.519	0.001*

#ANOVA test was applied. * Significant difference at p <0.05.

According to the above table, participants who had never exercised had a higher mean of pain at rest than those who had exercised less than three days per week, with a significant difference (0.61± 0.76) (0.080± 0.28) (0.004). Participants who did exercise for three days per week or more had a higher mean of pain in movement compared to those who did exercise for less than three days per week, with a significant difference (0.70± 1.16) (1.38± 1.58) (0.001) respectively. More details about the pain at rest and movement are available in Table 4.20.

Table 4.21 Descriptive and inferential statistics in lumbar spine movements pain by their exercise habits.

Variables	Never	<3 days	3 days or >	t	p
	M ± SD	M ± SD	M ± SD		
T Fx DWP	1.94 ± 2.20	0.70±0.89	-	7.11	0.00*
T Ex DWP	2.65 ± 1.81	1.20 ±1.43	-0.50 ± 1.58	15.74	0.00*
L Ex DWP	13.01 ± 5.58	7.60±6.42	10.45 ± 6.58	5.82	0.00*
T Rt Rot DWP	7.47 ± 5.12	2.87 ± 1.75	2.70 ± 2.11	12.27	0.00*
T Lt Rot DWP	7.75 ± 5.32	3.41 ±1.88	4.00 ± 2.35	9.11	0.00*
L Rt Lat Fx DWP	7.25 ± 3.30	4.41 ±1.85	4.10 ± 1.79	10.26	0.00*
L Lt Lat Fx DWP	6.77 ± 3.06	4.41± 2.68	4.35 ± 2.02	6.23	0.00*

ANOVA test was applied. * Significant difference at p <0.05, T: trunk, L: lumbar, Fx: flexion, Ex: extension, Rt: right, Lt: left, Rot: rotation, Lat: lateral, DWP: degree with pain

Respondents who never do any exercise had a significantly higher mean trunk extension degree with pain than those who exercise 3 days a week or more, depending on the exercise and pain in lumbar spine movements. (2.65 ± 1.81) (-0.50 ± 1.58) (p <0.05). The respondents who never do any exercise had a significantly higher mean lumbar right lateral flexion degree with pain compared to those who do exercise 3 days or more a week (7.25 ± 3.30) (4.10 ± 1.79) (p <0.05). The respondents who never do any exercise had a significantly higher mean lumbar left lateral flexion degree with pain compared to those who do exercise 3 days or more a week (6.77 ± 3.06) (4.35 ± 2.02) (p

<0.05). The highest degree of pain was in the lumbar extension degree, with a total (10.79 ± 6.43) the participants who never do any exercise had a higher level of pain compared to those who do exercise less than 3 days a week and those who do exercise 3 days or more (13.01 ± 5.58) (7.60±6.42) and (10.45 ± 6.58) (p <0.05). More details are available in Table 4.21.

Table 4.22 Descriptive and inferential statistics of ergonomic analysis among subjects of study samples stratified by Daily working hours.

Variables	5-6 h	7 h	8-9 h	f	p
	M ± SD	M ± SD	M ± SD		
T Fx ROM	72.32 ±5.56	67.90 ±9.93	69.14 ±5.62	1.906	0.157
T Ex ROM	8.21 ±1.44	8.60 ±2.33	8.62 ±1.92	.273	0.762
L Ex ROM	19.00 ±4.94	14.27 ±6.90	11.50 ±5.03	8.24	0.001*
T Rt Rot ROM	39.63 ±4.18	39.70 ±4.42	40.71 ±4.24	.43	0.651
T Lt Rot ROM	39.21 ±4.42	39.77 ±4.56	39.62 ±4.15	.09	0.910
L Rt Lat Fx ROM	19.39 ±2.69	19.55 ±2.97	19.57 ±2.82	.023	0.977
L Lt Lat Fx ROM	19.63 ±2.83	19.95 ±2.59	19.29 ±2.65	.38	0.684
T Fx S	15.58 ±3.82	18.50 ±5.63	22.62 ±7.30	7.52	0.001*
T Ex S	11.74 ±4.07	16.33 ±5.89	19.67 ±7.51	8.67	0.000*
L Ex S	10.16 ±3.184	12.90 ±3.99	14.48 ±5.28	5.29	0.007*
T Rt Rot S	14.79 ±4.18	19.40 ±5.06	20.29 ±4.44	8.13	0.001*
T Lt Rot S	13.89 ±2.90	17.77 ±4.95	17.95 ±4.59	5.65	0.005*
L RtLatFS	14.58 ±2.67	16.43 ±4.43	19.24 ±5.22	5.98	0.004*
L Lt Lat FS	13.74 ±2.86	16.43 ±4.77	17.67 ±4.83	4.23	0.019*
Rt H P S	19.32 ±7.30	28.70 ±11.69	34.48 ±1.88	10.69	0.000*
Lt H P S	18.42 ±6.41	25.73 ±12.89	31.10 ±11.19	6.69	0.002*
P I I R	0.21 ±0.42	0.57 ±0.73	0.24 ±0.625	2.55	0.085
PI I M	1.42 ±1.26	2.07 ±2.05	2.33 ±1.77	1.38	0.259
T.ODI	12.74 ±6.08	11.20 ±9.65	6.10 ±7.91	3.67	0.031*
T.NYP	55.21 ±5.77	57.67 ±5.86	56.14 ±7.47	.927	0.401
T.PA	1220.37 ±703.94	1521.93 ±854.19	1231.19 ±585.81	1.36	0.263

SD: standard deviation. # ANOVA test were applied. * Significant difference at p <0.05. TFROM: Trunk flexion range of motion, TEROM: Trunk extension range of motion, LEROM: Lumbar extension range of motion, TRtRotROM: Trunk right rotation range of motion, TLtRotROM: Trunk left rotation range of motion, LRtLatFROM: Lumbar right lateral flexion range of motion, LLtLatFROM: Lumbar left lateral flexion range of motion, TFS: Trunk flexion strength, TES: Trunk extension strength, LES: Lumbar extension strength, TRtRotS: Trunk right rotation strength, TLtRotS: Trunk left rotation strength, LRtLatFS: Lumbar right lateral flexion strength, LLtLatFS: Lumbar left lateral flexion strength, RtHPS: Right hand palm strength, LtHPS: Left hand palm strength, PIIR: Pain intensity in rest, PIIM: Pain intensity in movement, T.ODI: Total oswestry disability index, T.NYP: Total new york posture, T.PA: Total physical activity.

Depending on the daily working hours and ergonomic analysis parameters, the respondents who worked 5–6 hours per day had a significantly higher mean of lumbar extension range of motion compared to participants who worked 8–9 hours per day

(19.00 $\pm$ 4.94) (11.50 $\pm$ 5.03) ($p < 0.05$), respectively. The respondents who worked 8–9 hours per day had a significantly higher mean of lumbar extension strength compared to participants who worked 5–6 hours per day (14.48 $\pm$ 5.28) (10.16 $\pm$ 3.184) ($p < 0.05$), respectively. The respondents who worked 7 hours per day had a significantly higher mean of left-hand palm strength compared to those who worked 5–6 hours per day (25.73 $\pm$ 12.89) (18.42 $\pm$ 6.41) ($p < 0.05$), respectively. The respondents who worked 7 hours per day had a significantly higher mean of pain intensity at rest compared to those who worked 5–6 hours per day (0.57 $\pm$ 0.73) (0.21 $\pm$ 0.42) ($p < 0.05$), respectively. More details are available in Table 4.22.

Table 4.23 Descriptive and inferential statistics of ergonomic analysis among subjects of study samples stratified by annual working hours.

Variables	>1200 h	>1200 - 1500 h	> 1500 h	f	p
	M $\pm$ SD	M $\pm$ SD	M $\pm$ SD		
T Fx ROM	72.32 $\pm$ 5.56	67.90 $\pm$ 9.93	69.14 $\pm$ 5.62	1.906	0.157
T Ex ROM	8.21 $\pm$ 1.44	8.60 $\pm$ 2.33	8.62 $\pm$ 1.92	.273	0.762
L Ex ROM	19.00 $\pm$ 4.94	14.27 $\pm$ 6.90	11.50 $\pm$ 5.03	8.24	0.001*
T Rt Rot ROM	39.63 $\pm$ 4.18	39.70 $\pm$ 4.42	40.71 $\pm$ 4.24	.43	0.651
T Lt Rot ROM	39.21 $\pm$ 4.42	39.77 $\pm$ 4.56	39.62 $\pm$ 4.15	.09	0.910
L Rt Lat Fx ROM	19.39 $\pm$ 2.69	19.55 $\pm$ 2.97	19.57 $\pm$ 2.82	.023	0.977
L Lt Lat Fx ROM	19.63 $\pm$ 2.83	19.95 $\pm$ 2.59	19.29 $\pm$ 2.65	.38	0.684
T Fx S	15.58 $\pm$ 3.82	18.50 $\pm$ 5.63	22.62 $\pm$ 7.30	7.52	0.001*
T Ex S	11.74 $\pm$ 4.07	16.33 $\pm$ 5.89	19.67 $\pm$ 7.51	8.67	0.000*
L Ex S	10.16 $\pm$ 3.184	12.90 $\pm$ 3.99	14.48 $\pm$ 5.28	5.29	0.007*
T Rt Rot S	14.79 $\pm$ 4.18	19.40 $\pm$ 5.06	20.29 $\pm$ 4.44	8.13	0.001*
T Lt Rot S	13.89 $\pm$ 2.90	17.77 $\pm$ 4.95	17.95 $\pm$ 4.59	5.65	0.005*
L RtLatFS	14.58 $\pm$ 2.67	16.43 $\pm$ 4.43	19.24 $\pm$ 5.22	5.98	0.004*
L Lt Lat FS	13.74 $\pm$ 2.86	16.43 $\pm$ 4.77	17.67 $\pm$ 4.83	4.23	0.019*
Rt H P S	19.32 $\pm$ 7.30	28.70 $\pm$ 11.69	34.48 $\pm$ 1.88	10.69	0.000*
Lt H P S	18.42 $\pm$ 6.41	25.73 $\pm$ 12.89	31.10 $\pm$ 11.19	6.69	0.002*
P I I R	0.21 $\pm$ 0.42	0.57 $\pm$ 0.73	0.24 $\pm$ 0.625	2.55	0.085
PI I M	1.42 $\pm$ 1.26	2.07 $\pm$ 2.05	2.33 $\pm$ 1.77	1.38	0.259
T.ODI	12.74 $\pm$ 6.08	11.20 $\pm$ 9.65	6.10 $\pm$ 7.91	3.67	0.031*
T.NYP	55.21 $\pm$ 5.77	57.67 $\pm$ 5.86	56.14 $\pm$ 7.47	.927	0.401
T.PA	1220.37 $\pm$ 703.94	1521.93 $\pm$ 854.19	1231.19 $\pm$ 585.81	1.36	0.263

SD: standard deviation. # ANOVA test were applied. * Significant difference at $p < 0.05$. TFROM: Trunk flexion range of motion, TEROM: Trunk extension range of motion, LEROM: Lumbar extension range of motion, TRtRotROM: Trunk right rotation range of motion, TLtRotROM: Trunk left rotation range of motion, LRtLatFROM: Lumbar right lateral flexion range of motion, LLtLatFROM: Lumbar left lateral flexion range of motion, TFS: Trunk flexion strength, TES: Trunk extension strength, LES: Lumbar extension strength, TRtRotS: Trunk right rotation strength, TLtRotS: Trunk left rotation strength, LRtLatFS: Lumbar right lateral flexion strength, LLtLatFS: Lumbar left lateral flexion strength, RtHPS: Right hand palm strength, LtHPS: Left hand palm strength, PIIR: Pain intensity in rest, PIIM: Pain intensity in movement, T.ODI: Total oswestry disability index, T.NYP: Total new york posture, T.PA: Total physical activity.

Depending on the annual working hours and ergonomic analysis parameters, the respondents who worked more than 1500 hours per year had a significantly higher mean trunk flexion range of motion compared to participants who worked more than 1200–1500 hours per year (70.11 ± 5.88) (66.65 ± 9.85) ($p < 0.05$), respectively. The respondents who worked more than 1500 hours per year had a significantly higher mean of trunk extension strength compared to participants who worked more than 1200–1500 hours per year (19.22 ± 7.24) (16.78 ± 6.05) ($p < 0.05$), respectively. The respondents who worked more than 1200-1500 hours per year had a significantly higher mean of right-hand palm strength compared to participants who worked less than 1200 hours per year (29.63 ± 11.65) (19.05 ± 7.20) ($p < 0.05$), respectively. The respondents who worked more than 1200-1500 hours per year had a significantly higher mean of total physical activity compared to participants who worked less than 1200 hours per year (1464.74 ± 865.20) (1195.20 ± 694.35) ($p < 0.05$), respectively. More details are available in Table 4.23.

Table 4.24 The spearman correlation between BMI categories, exercise habits, exercise duration, stretching, OSWESTRY classification, and New York classification.

Correlations								
		BMI Ca	EH	ET	ED	ST	ODI Cl	NYPRC Cl
BMI Ca	r	1.000						
	p	.						
EH	r	-.346**	1.000					
	p	.003	.					
ET	r	-.246*	-.346**	1.000				
	p	.040	.003	.				
ED	r	-.282*	-.246*	.939**	1.000			
	p	.018	.040	.000	.			
ST	r	-.304*	-.282*	.479**	.567**	1.000		
	p	.010	.018	.000	.000	.		
ODI Cl	r	.247*	-.304*	-.246*	-.250*	-.202	1.000	
	p	.039	.010	.040	.037	.094	.	
NYPRC Cl	r	-.029	.247*	-.223	-.225	-.243*	.089	1.000
	p	.814	.039	.063	.061	.042	.462	.

BMI C: body mass index categories, EH: exercise habits, ET: exercise type, ED: exercise duration, St: stretching, ODI Cl: oswestry disability index classification, NYPRC Cl: new york posture rating chart classification

The above table shows the Spearman correlation between several categorical variables. The table showed that there is a significant but moderate positive association between the exercise habit and stretching ($r = 0.51$, $p < 0.05$). The table showed that there was a significant but weak negative association between the stretching and the New York

scale classification ($r = -0.24$, $p < 0.05$). The table showed that there is a significant but weak positive association between the BMI categories and the OSWESTRY scale classification ($r = 0.24$, $p < 0.05$).

Table 4.25 The Pearson correlation between daily working hours, annual working hours, total score of oswestry, newyork, and physical activity

		Correlations				
		DWH	AWH	T. ODI	T. NYPRC	T. PA
DWH	r	1.000				
	p					
AWH	r	.916**	1.000			
	p	.000				
T. ODI	r	-.297*	-.295*	1.000		
	p	.013	.013			
T. NYPRC	r	.051	.027	-.516**	1.000	
	p	.677	.824	.000		
T. PA	r	-.001	.081	-.463**	.505**	1.000
	p	.994	.505	.000	.000	

DWH: daily working hours, AWH: annual working hours, T.ODI: total oswestry disability index, T. NYPRC: total new york posture rating chart, T. PA: total physical activity

The above table shows the Pearson correlation, which evaluates the linear relationship in terms of continuous variables. The table showed that there was a significant but weak negative association between the daily working hours and total OSWESTRY ($r = -0.297$, $p < 0.05$). The table showed that there is a significant weak negative association between the Annual working hours and Total OSWESTRY ($r = -0.295$, $p < 0.05$). The table showed that there is a significant moderate positive association between the total newyork and total physical activity ($r = 0.505$, $p < 0.05$).

Table 4.26 Inferential statistical results for the total score of oswestry disability index by gender, age categories, working hours, and exercise habits.

Characteristics	Median (Min- Max)	M ± SD	p
Gender			
Female	6(0-12)	7.43±9.74	0.00 [*]
Male	1(0-15)	12.74±6.41	
Age categories			
35-40	4 (0-12)	4.02±3.68	0.01 [*]
41-46	7 (0-15)	6.55±4.71	
Daily working hours			
5-6 hours per day	14 (2-24)	12.74±6.08	0.031 [*]
7 hours per day	8 (0-30)	11.20±9.65	
8-9 hours per day	0 (0-20)	6.10±7.91	
Annual working hours			
Less than 1200 hours	13 (0-24)	12.10±6.57	0.013 [*]
Averaged 1200-1500	12 (0-30)	12.22±9.88	
More than 1500	2 (0-20)	5.83±7.21	
Exercise habit			
Never	6 (0-15)	6.27 4.48	0.02 [*]
Less than 3 days	4 (0-12)	4.37 3.95	
3 days or more	1 (0-7)	2.40 2.87	

SD: standard deviation. # Independent t test and ANOVA test were applied. * Significant difference at $p < 0.05$.

Referring to the OSWESTRY scale, the male respondents had a significantly higher mean compared to females (12.74±6.41) (7.43±9.74) ($p < 0.05$), respectively. The older participants (41-46) years old had a higher mean compared to the younger participants (6.55±4.71) (4.02±3.68) ($p = 0.01$) respectively. More details about the OSWESTRY scale are available in Table 4.26.

Table 4.27 Inferential statistical results for the total score of new york posture rating chart scale by gender, age categories, working hours, and exercise habits.

Characteristics	Median (Min- Max)	M ± SD	p
Gender			
Female	57 (41-65)	54.26 ±6.70	0.00*
Male	61 (41-65)	58.83 ±5.11	
Age categories			
35-40	59 (41-65)	57.93 ±5.88	0.02*
41-46	55 (41-61)	54.59 ±6.57	
Daily working hours			
5-6 hours per day	57 (43-63)	55.21 ±5.77	0.401
7 hours per day	58 (43-65)	57.67 ± 5.86	
8-9 hours per day	61 (41-63)	56.14 ±7.47	
Annual working hours			
Less than 1200 hours	57 (43-63)	55.40 ± 5.68	0.363
Averaged 1200-1500	59 (43-63)	57.89 ±5.64	
More than 1500	61 (41-65)	55.96 ±7.58	
Exercise habit			
Never	57 (41-63)	55.11 ± 6.60	0.03*
Less than 3 days	58 (47-63)	56.83 ± 5.17	
3 days or more	63 (49-65)	61.00 ± 6.39	

SD: standard deviation. # Independent t test and ANOVA test were applied. * Significant difference at $p < 0.05$.

Referring to the New York rating chart, the male respondents had a significantly higher mean compared to females (58.83 ± 5.11) (54.26 ± 6.70) ($p < 0.05$), respectively. The older participants (41-46) years old had a lower mean compared to the younger participants (54.59 ± 6.57) (57.93 ± 5.88) ($p = 0.02$) respectively. The respondents who do exercise 3 days or more had a higher mean compared to those who never do any exercise (61.00 ± 6.39) (55.11 ± 6.60) ($p = 0.03$), respectively. More details about the New York rating chart are available in Table 4.27.

4.1. Results Summary

Seventy respondents participated in the analysis. The gender of the respondents was 35 males and 35 females. The age distribution of the respondents showed that 58.6% were 35–40 years old and that 41.4% were 41–46 years old. In anthropometric variables, the mean BMI for those 35–40 years old was lower compared to those 41–46 years old ($p < 0.05$). In physical parameter variables (range of motion, strength, and physical activity), the females got a high range on all spine motions. Males, on the other hand, received high scores in all spine strength muscles and in grip strength. Also, males obtained high scores in physical activity. The variables were different by age group, except for grip strength, all results were in favor of the ages (35–40). Variables stratified by exercise habits Respondents in all physical parameters who do their exercises 3 days a week or more had a significantly higher mean compared to participants who do exercises less than 3 days a week and those who never do any exercise. When it comes to range, males were most affected by lumbar extension, and females were most affected by trunk flexion ($p < 0.05$). According to the OSWESTRY scale, 88.6% of male participants had a minimal disability, and 11.4% had a moderate disability. The findings for females were very similar to those for males, with 85.7% having a minimal disability and 14.3% having a moderate disability. There were no severe disabilities found in either gender. The males had a significantly higher mean than the females. The older participants had a higher mean ($p = 0.01$). Respondents who had never exercised had a significantly higher mean age compared to those who had exercised for 3 days or more ($p = 0.02$). On the New York Posture Rating Chart scale, 94.3% of the respondents had a very good rating, and the rest had a good rating. No tolerable, weak, and severe classified were found in both genders. Regarding head alignment, 65.7% of respondents the head vertical gravity line passes directly through the center. 58.6% of workers have normal upper back alignment, 74% have upright trunk alignment, and 72.9% have normal low back alignment. Inferential statistical results for the total New York Posture Rating Chart Score by gender, age category, and exercise habits. Male respondents had a significantly higher mean ($p = 0.05$). When compared to younger participants, older participants had a lower mean ($p = 0.02$). Respondents who exercised three days a week or more had a higher mean than those who never exercised ($p = 0.03$). The difference in daily working hours did not show a

difference, but those who worked fewer hours had a greater range of motion. On the other hand, those who worked longer hours had more strength, while the intensity of pain in the rest and movement positions was lower in the groups who worked for fewer years. As a result, the table of annual working hours was examined, and it revealed a significant disparity in the data. It was discovered that the average annual working hours had a positive impact on the results of motor range, strength, pain intensity, physical activity, and both postural and functional status. Depending on movement degrees with pain among genders, the male respondents had a higher mean pain mean in lumbar (extension, right lateral flexion, and left lateral flexion). Various age groups have varying degrees of movement with pain. Demonstrates that the 41–46 year old respondents had a higher mean degree of pain with a higher pain ($p < 0.05$). Depending on the exercise habits and the degree of pain in the spine, the respondents who never did any exercise had a higher mean pain compared to those who did exercise for less than 3 days ($p < 0.05$). In the statistics of the visual analog scale among the age group, older participants had a higher mean of pain at rest. Older participants had a higher mean level of pain in movement. The BMI categories of exercise habit, stretching, OSWESTRY classification, and New York classification all have a spearman correlation. Stretching and exercise habits have a moderate positive correlation. There is also a weak positive correlation between BMI categories and OSWESTRY classification. Furthermore, there is a negative correlation between BMI categories and exercise habits. In addition, BMI categories and stretching have an inverse relationship. Finally, stretching and New York classification have an inverse relationship. There's also a moderate positive correlation between exercise duration and stretching. The Pearson correlation exists between daily working hours, annual working hours, total Oswestry scale, total New York score, and total physical activity. Daily working hours and annual working hours have a strong positive correlation. There is also a negative correlation between total Oswestry and daily working hours and annual working hours.

5. DISSCUSSION

Office work, which includes extensive computer use, has been identified as a risk factor for MSDs, and many other studies have bolstered this concern (120–123). According to recent literature on MSDs in office workers and their causes, which include a deficiency in physical activity and antigravity muscles that are weak, incorrect seated postural habits, and exposure to ergonomic risk factors (122). In our study, we have separated independence and dependence. The dependent variables are like physical, postural, functional, and clinical. As well as independent variables by anthropometric measurements (gender, age category, BMI), ergonomic analysis (daily and annual working hours), ergonomic awareness (exercise habits, stretching, exercise duration). Thus, the aim of the present study was to find out how much the office worker profession affects the health of the vertebral column in terms of the extent to which there is comfortable ergonomic analysis and awareness in office work and its impact on postural, physical, and functional parameters of spine health. Juul-Kristensen & Jensen et al., indicated that there have been few studies that compare these parameters based on gender (121).

In our study, there was a significant difference between the genders in terms of weight, height, BMI, sitting height, head circumference, waist circumference, hip circumference, waist-hip circumference ratio, and arm span of the subjects. Also, more than 65% of our participants had a BMI greater than normal, the BMI for males' higher than females, Karlqvista et al., conducted a study that included 1529 employees from Sweden. Aims to describe working conditions and the prevalence of musculoskeletal symptoms in males and females, assess associations between work-related physical and psychosocial exposures in limb symptoms by gender, and record the same result (122). One of the reasons your body mass index is high is that you stopped exercising and began living a life free of sports habits. The mean of body mass index BMI and weight for 35-40 years old was significantly lower compared to 41-46 years old ($p < 0.05$). Inoue et al was based on determining the degree of correspondence between BMI and weight among office workers aged 20 to 65, based on age and gender, with the results showing The body mass index (BMI) rises as people get older (123).

Females had a wider range of motion in all motions than males in terms of physical parameter variables. As Rabal-Pelay et al., study's goal was to look at changes in spinal sagittal alignment, height, and the perception of back pain in office workers throughout the day. A cross-sectional study of 41 Spanish office workers was conducted. Perceived lower and upper back pain were also measured before and after an 8-hour workday. Women have a greater lumbar range of motion than men, according to research(124). It all boils down to the fact that the average male form is larger than the female form, and muscle strength and the pliability of tendons and ligaments frequently show differences in a range of motion. Female hips widen as a result of estrogen, abdominal muscles become more mobile, and low mass can lead to increased mobility(125). Male strength is greater than female strength, according to our findings ($p < 0.05$). The goal of this study, conducted by Savinainen et al., was to determine musculoskeletal issues among employees in relation to workload over a 16-year period. As a result, males have more spine strength (126). Because males have a larger skeletal size and bone mass than females, and men have type II muscle fibers that produce more energy (127). In our study, male grip strength was greater than female grip strength ($p < 0.05$), and a similar finding was found in a study by Xiao et al. looked at isometric grip strengths of 193 males and females, and found that male grip strength was greater than female grip strength (128). Hand size naturally relates to gripping strength, and there is a positive correlation between hand surface area and grip strength (129, 130). In physical activity levels by gender, the mean of the total Physical Activity Metabolic Equivalent Task for males was significantly higher compared to females ($p < 0.05$). The same result was found as with Wanner et al., performed a study to check the physical activity by gender and the result showed the total effort (physical activity) of males was greater than that of females (131). Females in our sample have more diseases than males, which may lead to a very low level of physical activity among office workers as a result of poor leisure habits and a lack of awareness of the benefits of Physical Activity.

Regarding physical parameters variables according to age groups, younger aged 35-40 had a wider range of motion on all motions than the older age. The findings are similar to those of the Chung et al., study, which looked at the effect of age on joint range of motion in 1134 workers ranging in age from 16 to 64 years old (132).

Reduction in the extension of the range of motion was linked to getting older, and it was more noticeable in women. Because so many daily activities and work-related activities involve flexed postures, it's likely that this helps to maintain range of motion when compared to extension, and it's possible that this effect is stronger in females for unknown reasons (133). Merkus et al. discovered the same thing when they examined age-related differences in physical capacity, occupational physical demands, and relative physical strain at a group level, as well as the balance between capacity and demands at an individual level, in construction and healthcare workers. older workers (≥ 45 years) had lower mean back strength than younger workers (≤ 44 years) (134). It's reasonable to believe that core strength training could help older adults improve trunk muscle strength, postural alignment, balance, and functional mobility (135). The physical variables for grip strength were by age group and were in favor of the older age group. While Wang et al., (136) and Kim et al., (137) conducted two studies on age groups ranging (10-80) to determine the extent to which age influences grip strength. It was discovered that as they grew old, their grip strength weakened. Our finding showed a significant difference in physical activities by age group, the 35–40 age groups had a higher mean of total Physical Activity Metabolic Equivalent Task than the 41–46 age groups. On the contrary, in Wanner et al., the study showed that the older age groups made a higher physical effort than the younger age groups (131). Physical activity is also positively related to fat-burning control of body mass in office workers (138).

In our research on physical parameters and the extent to which they are related to exercise habits, we found that office workers who exercise three or more days a week have significantly higher mean values in range of motion, muscular strength, grip strength, and intensity of physical activity than those who exercise less than three times per week or who are constantly interrupted about doing exercises. A study done by Cho et al., (139) aimed to identify the effects of exercise and range of motion in patients with chronic low back pain, and the result showed an exercise program is effective in increasing active range of motion. In a study related to strengthening exercises for the spine and the extent of their response to increasing strength, Handa et al., showed was confirmed that trunk muscle strengthening exercises are useful for increasing muscle strength (140) . Exercise levels are positively correlated with grip strength, indicated in

a study by Unyó et al., (141) . According to studies by Arslan et al., (142) and Papathanasiou et al., (143) which found a link between physical activity and exercise, regular physical activity could improve the quality of life for office workers.

When it comes to range, males were most affected by lumbar extension, and females were most affected by trunk flexion ($p < 0.05$). In a study adopted by Kramer et al., 62 office workers did in an American University Hospital, was to investigate the differences in the electromyographic signals of patients with chronic low back pain and healthy subjects, showed poorer performance on both the lumbar and trunk range of motion compared with healthy controls (144).

The results of the Oswestry low back pain disability questionnaire analysis were used in our study. More than 85 percent of office workers in both genders who used desktop computers had a minimal disability. And for them, they can handle most daily activities. No severe disabilities were found in either gender. But in previous study done by kaya et al., (145) aimed to investigate the individual and work-related risk factors linked to musculoskeletal pain and pain-related disability among office workers, N= 150 workers were included, and the results showed moderate disability. This could be due to our participants' having a few years of experience compared to other studies with participants with many years of experience. According to Hicks et al., (146) Hicks and Manal., (147) and others (148, 149) suggest that low back pain and loss of functional abilities are common in people who have worked for long hours in prolonged static work posture without regular exercises. Based on the OSWESTRY scale, similar to our findings, Mark et al., (150) referring to the total score of the ODI functional scale by gender and age categories, with p-values less than 0.05, found that males had a significantly higher mean compared to females, in terms of age groups, respondents aged 41–46 had a significantly higher mean than those aged 35–40.

According to our outcomes, there were a significant difference between the age groups in the postural disability scores (in favor of the younger age group). As a result, workplace awareness of the importance of getting enough exercise, achieving the ideal posture, and avoiding ergonomic risk factors must be provided and implemented (151).

According to our findings, there was statistical significance between women and men in the trunk-lumbar postural disability (in favor of men) and lower part scores (in favor of women) of the posture scores. Males and females had small differences in angles around the head and neck, but larger differences in angles in the trunk (152). Dankaerts et al., did it in an adult study that looked at the sitting postures of asymptomatic people and nonspecific chronic low back pain patients to see how important subclassification is. Females have more differences between looking straight ahead and slumped postures than males due to their sitting posture. In sitting, females have more lumbopelvic extension than males (153).

According to our findings, for degrees of pain in movements, there was statistical significance in lumbar extension, lumbar right lateral flexion, and lumbar left lateral flexion between men and women (in favor of men). A total of 53 people with chronic low back pain were randomly assigned to one of two groups: the CORE group or the control group. The purpose of this study was to look into the effects of the CORE program on pain at rest, movement-induced pain, secondary pain, active range of motion, and proprioception deficits in female office workers suffering from chronic low back pain. Kim et al., discovered that one of the movements accompanied by pain was trunk flexion in a study (154). But in some of the studies on risk factors for MSDs, it was found that females have more pain in their lower back compared to males (155). Depending on the age group and pain in the movements, the 41–46 year old respondents had a significantly higher mean spine degree with pain compared to the 35–40 year old respondents, ($p < 0.05$). The findings made by Oha et al., found a strong relationship between pain and motion score and age among computer users (156). It depends on the exercise and pain in movements, the respondents who did exercise less than 3 days a week had a significantly lower mean degree of pain compared to those who never did any exercise, ($p < 0.05$). Kim et al., (157) showed participants' pain levels were lower after the exercise program than before it, with significant differences in pain levels noted in the low back. And their findings are relative to ours, as those who never do any exercise have a higher level of pain compared to those who do exercise. The measure of pain intensity was used among office workers in our study, and it turned out that the older age group experiences more pain than the younger age group in the rest and

movement positions. Additionally, there was no significant relationship between age and the severity of pain in the back pain ($p > 0.05$) the same result as with Shariat et al., (158) ($p > 0.05$) between age and pain severity in the back region. His objective was to examine the occurrence of the lower back, with the pain severity among office workers.

According to our outcomes employees who work 6 daily hours have more range of motion than those who work 8-9 daily hours, according to the table of ergonomic analysis among employees who work fewer daily hours, furthermore, those who work 7 daily hours have less pain intensity than those who work 8-9 daily hours. When compared to those who work a total of 1500–1800 hours per year, office workers who work 1,200 hours per year have less pain during rest and movement and a higher range of motion in all degrees of lumbar spine movement. The difference in daily working hours did not show any differences, but the total annual hours did. There was a significant difference in favor of the group that worked fewer hours, meaning everything that happened was more work fatigue, all of which resulted in a reduction in range of motion and an increase in pain intensity. Another study was conducted by O’Sullivan et al., (159) The difference in the number of working hours works on different degrees of pain intensity, the degree of pain intensity is related to the daily working hours. Long work hours were linked to an increase in back pain among employees, according to Krause et al., study (160). Another study found a link between reported back symptoms and a combination of extended shifts and long working hours (161). Working more than 45 hours per week was found to be a risk factor for lower back pain by Shin et al., (162) and Lee (163) discovered in their cohort study that workers who consistently worked more than 48 hours per week had a higher risk of lower back pain, and the prevalence of lower back pain was reduced when working hours were reduced.

The relationships between the study variables were determined using Spearman’s correlation coefficient, and all variables had a significant difference ($p < 0.05$). While stretching and exercise habits are moderately positive (Increasing exercise duration per week is will lead increase stretching activity), another study by Buckworth and Nigg (164) found a stronger correlation between measures of higher physical activity of high intensity and exercise. A weak positive correlation exists between BMI categories and

OSWESTRY classification. Furthermore, a study by Hong et al., (165) revealed the same correlation result. It was also shown that exercise habits and stretching had an inverse relationship with BMI. Also, Holzgreve et al., (166), Gasibat et al., (167), proved there is a significant positive association between exercise habits and stretching, as shown in our results among office workers. In addition, there is an inverse relationship between the total score of posture and stretching. Because stretching exercises can help to promote proper alignment. This, in turn, may aid in the improvement of your posture. Our findings showed that there is a link between exercise duration and stretching. According to Zakas et al., (168) and Peres et al., (169) increasing the exercise time increases the range of motion.

By evaluating the hours worked in terms of continuous variables by using Pearson correlation. In our study, there is a positive correlation between daily working hours and posture. Mork and Westgaard (170) showed Increasing the daily working hours made the employee go into positions of forward or backward rotation of the pelvis and trunk. Also, in our research, there is a positive link between annual working hours and physical activity. According to Angrave et al., (171), there isn't a lot of evidence of statistically significant links between levels of physical activity and the length of workdays. The findings of the analyses presented here call into question the widely held belief that people who work long hours on a regular basis are inevitably more likely to be inactive.

There are some limitations to this study; the study group will be stronger if the number of participants is increased, and the variety of exercises among genders can improve statistical power.

6. CONCLUSION

Finally, there were significant differences in risk factors for their office ergonomics based on hours worked, gender, age category, and exercise habits. There was a significant difference in favor of the group that worked fewer hours, they had more range of motion and less pain intensity. When it comes to the posture findings, the trunk and lumbar postural disabilities are in favor of men. Furthermore, there were significant differences in physical activity levels between men and women when comparing the results, with men having a higher level of physical activity than women. Regarding their functional findings, there were significant differences between men and women when comparing the results, men have a higher rate of functional disability than women.

As a result, based on our findings, the daily working hours and the posture alignment have a direct relationship. And the annual working hours and physical activities are inextricably linked. Stretching and exercise habits have a positive correlation. There is also a positive correlation between BMI categories and OSWESTRY classification. Furthermore, there is a negative correlation between BMI categories and exercise habits. In addition, BMI categories and stretching have an inverse relationship. Lastly, stretching and New York classification have an inverse relationship.

According to our results, poor ergonomic analysis and awareness have a negative impact on postural, physical, and functional parameters of spine health among office workers.

Recommendation based on the previous findings, according to results of our study we recommend the following: Working hours are reduced in order to maintain a greater range of motion and a lower intensity of pain, as well as to improve active performance. More training, rehabilitation, and self-care are required for older workers. In order to stay healthy, women needed more corrective exercise, physical training, and personal exercise.

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8. APPENDIX

Appendix A: Ethical Committee Approval

Evrak Tarih ve Sayısı: 09.07.2021-23357



T.C.
BEZMİALEM VAKIF ÜNİVERSİTESİ REKTÖRLÜĞÜ
Girişimsel Olmayan Araştırmalar Etik Kurulu

Sayı : E-54022451-050.05.04-23357
Konu : Etik Kurul Kararı - Şule DEMİRBAŞ

09.07.2021

Sayın Yrd. Doç Dr. Şule DEMİRBAŞ
Yeditepe Üniversitesi - Fizyoterapi ve Rehabilitasyon

2021/277 numaralı "Ofis çalışmalarında ergonomik analiz, farkındalık ve omurga sağlığının postüral, fiziksel ve fonksiyonel parametreler üzerindeki etkisi" başlıklı başvurunuz Üniversitemiz Etik Kurullar Birimi' nin 08.07.2021 tarihli, 15 sayılı Girişimsel Olmayan Araştırmalar Etik Kurul toplantısında değerlendirilmiş olup, mevcudun oybirliğiyle onaylanmasına karar verilmiştir.

Gereğini ve bilgilerinizi arz/rica ederim.

Prof.Dr. İsmail MERAL
Başkan

Bu belge, güvenli elektronik imza ile imzalanmıştır.

Doğrulama Kodu :BSM447UCT2 Pin Kodu :29062 Belge Takip Adresi : <https://turkiye.gov.tr/ebd?eK=5394&eD=BSM447UCT2&eS=23357>
Bezmialem Vakıf Üniversitesi Adnan Menderes Bulvarı (Vatan Caddesi) Fatih /
İstanbul Bilgi için: Zübeyde ÖZDEMİR
Telefon No:0 (212) 523 22 88 Faks No:0 (212) 533 23 26 Unvan: Memur
e-Posta:info@bezmialem.edu.tr İnternet Adresi:www.bezmialem.edu.tr



Appendix B: Participant constant from (English)



Consent to Participate in a Research

Title of Study: Ergonomic analysis and culture in office work and it's impact on Postural, physical and functional parameters of spine health

Investigator: Name: Hamza Taleb Alzeer **Dept** Physiotherapy **phone** 05524621469

Introduction

- You are being asked to be in a research study of assessment of ergonomic analysis and culture and its impact on postural, physical and functional parameters of spine.
- We ask that you read this form and ask any questions that you may have before agreeing to be in the study.

Purpose of Study

- To quantify the level of common parameters in ergonomic analysis and ergonomic culture in office work, then to characterize the postural, physical, and functional impact of office work on spine health, Postural parameters of spine curve.
- Arrive to general declarative variables, occupational identification variables, clinical ergonomic variable and variables related to the health problem of the owner of this profession.
- Ultimately, this research will be used for Master degree thesis

Description of the Study Procedures

- This research is targeting office workers aged between 35-46 years and male and female participants, data will be collected from 70 participants between 1 Apr 2021 and 1 June 2021.
- You will take one group in this study according to your criteria.
- Weight, height, sitting height, head circumference, waist circumference, waist-hip ratio and arm span will be noted by Tape measure.
- We will start with Digital dynamometer used for Muscle Strength Testing, Grip dynamometer for measuring the maximum isometric strength of the hand and forearm muscles its used for testing handgrip strength And Goniometer is a device used to measure joint angles or range-of-motion.
- After that will be asked about ergonomic analysis and ergonomic culture.
- Then start fill with questionnaires such as Functional parameters were examined with Modified Oswestry Disability, Spine Postural parameters by New York Posture Rating (NYPR), International Physical Activity Questionnaire - Short Form.
- The procedure will be conducted by a physical therapist in the physiotherapy laboratory.
- The procedure time will be approximately 35/40 minutes.

Risks/Discomforts of Being in this Study

- There are no reasonable foreseeable (or expected) risks. There may be unknown risks.
- Due to the nature of the approach that works on muscles a slight discomfort might occur.

Confidentiality

- This study is anonymous. We will not be collecting or retaining any information about your identity.
- The records of this study will be kept strictly confidential. Research records will be kept in a locked file, and all electronic information will be coded and secured using a password protected file. We will not include any information in any report we may publish that would make it possible to identify you.

Right to Refuse or Withdraw

- The decision to participate in this study is entirely up to you. You may refuse to take part in the study at any time without affecting your relationship with the investigators of this study or the institution. You have the right not to answer any single question, as well as to withdraw completely from the interview at any point during the process; additionally, you have the right to request that the interviewer not use any of your interview material.

Right to Ask Questions and Report Concerns

- You have the right to ask questions about this research study and to have those questions answered by me before, during or after the research. If you have any further questions about the study, at any time feel free to contact me (Hamza Taleb Alzeer) at htz96.htz96@gmail.com .or by telephone at 05524621469 If you like, a summary of the results of the study will be sent to you. If you have any problems or concerns that occur as a result of your participation, you can report them to the investigator at the number above.

Consent

- Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the study investigators

Subjects name _____

Signature _____

Investigators name _____

Signature _____

Appendix C: Participant constant form (Turkish)



Araştırmaya Katılma Onayı

Çalışmanın adı: Ofis çalışmalarında ergonomik analiz , farkındalık ve omurga sağlığının postüral, fiziksel ve fonksiyonel parametreler üzerindeki etkisi

Investigator: Name: Hamza Taleb Alzeer **Dept** Fizyoterapi **phone** 05524621469

Giriş

- Ergonomik analiz ve kültürün değerlendirilmesi ve bunun omurganın postural, fiziksel ve fonksiyonel parametreleri üzerindeki etkisine ilişkin bir araştırma çalışmasına katılmanız isteniyor.
- Bu formu okumanızı ve çalışmaya katılmayı kabul etmeden önce aklınıza gelebilecek tüm soruları sormanızı rica ediyoruz.

Çalışmanın amacı:

- Ofis çalışmasında ergonomik analiz ve ergonomik kültürde ortak parametrelerin düzeyini ölçmek, ardından ofis çalışmasının omurga sağlığı üzerindeki postural, fiziksel ve fonksiyonel etkisini karakterize etmek, Omurga eğrisinin postural parametreleri.
- Genel bildirim değişkenlerine, mesleki kimlik değişkenlerine, klinik ergonomik değişkenlere ve bu mesleğin sahibinin sağlık sorunuyla ilgili değişkenlere ulaşın.
- Sonuç olarak, bu araştırma yüksek lisans tezi için kullanılacaktır.

Çalışma Prosedürlerinin Tanımı

- 35-46 yaş arası ofis çalışanları ile kadın ve erkek katılımcıları hedefleyen bu araştırma, 1 Nisan 2021 ile 1 Haziran 2021 tarihleri arasında 70 katılımcıdan veri toplanacaktır.
- Bu çalışmada kriterlerinize göre bir grup alacaksınız.
- Kilo, boy, oturma yüksekliği, baş çevresi, bel çevresi, bel-kalça oranı ve kol açıklığı Mezura ile not edilecektir.
- Kas Gücü Testi için kullanılan bir Dijital dinamometre, elin maksimum izometrik gücünü ölçmek için bir Kavrama dinamometresi ve el kavrama gücünü test etmek için kullanılan ön kol kasları ve bir Gonyometre, eklem açılarını veya hareket aralığını ölçmek için kullanılan bir cihazdır.
- Daha sonra ergonomik analiz ve ergonomik kültür hakkında sorular sorulacak.
- Daha sonra Modifiye Oswestry Disability ile Fonksiyonel parametreler, New York Posture Rating (NYPR) ile Omurga Postural parametreler, Uluslararası Fiziksel Aktivite Anketi - Kısa Form gibi anketlerle doldurmaya başlayın.
- İşlem fizyoterapi laboratuvarında fizyoterapist tarafından yapılacaktır.
- İşlem süresi yaklaşık 35/40 dakika olacaktır.

Bu Çalışmada Olmanın Riskleri / Rahatsızlıklar:

- Makul öngörülebilir (veya beklenen) risk yoktur. Bilinmeyen riskler olabilir.
- Kaslar üzerinde çalışan yaklaşımın doğası gereği hafif bir rahatsızlık olabilir.

Gizlilik:

- Bu çalışma anonimdir. Kimliğiniz hakkında herhangi bir bilgi toplamayacağız veya saklamayacağız.
- Bu çalışmanın kayıtları kesinlikle gizli tutulacaktır. Araştırma kayıtları kilitli bir dosyada tutulacak ve tüm elektronik bilgiler şifreli bir dosya kullanılarak kodlanacak ve güvence altına alınacaktır. Yayınlayabileceğimiz hiçbir rapora, kimliğinizi belirlemeyi mümkün kılacak hiçbir bilgiyi dahil etmeyeceğiz.

Reddetme veya Geri Çekme Hakkı:

- Bu çalışmaya katılma kararı tamamen size kalmıştır. Bu çalışmanın araştırmacıları veya kurumla olan ilişkinizi etkilemeden, istediğiniz zaman araştırmaya katılmayı reddedebilirsiniz. Tek bir soruya cevap vermeme, sürecin herhangi bir noktasında görüşmeden tamamen çekilme hakkınız vardır; ayrıca, görüşmeciden görüşme materyalinizin hiçbirini kullanmamasını talep etme hakkınız vardır.

Soru Sorma ve Endişeleri Bildirme Hakkı:

- Bu araştırma çalışması hakkında soru sorma ve bu soruların araştırma öncesinde, sırasında veya sonrasında tarafımdan yanıtlanmasını isteme hakkına sahipsiniz. Çalışmayla ilgili başka sorularınız varsa, istediğiniz zaman htz96.htz96@gmail.com adresinden veya 05524621469 numaralı telefondan benimle (Hamza Taleb Alzeer) iletişime geçebilirsiniz. sana gönderilecek. Katılımınız sonucunda ortaya çıkan herhangi bir sorun veya endişeniz varsa, bunları yukarıdaki numaradan araştırmacıya bildirebilirsiniz.

Razı olmak:

- Aşağıdaki imzanız, bu çalışmaya gönüllü olarak katılmaya karar verdiğiniz ve yukarıda verilen bilgileri okuyup anladığınızı gösterir. Çalışma araştırmacıları tarafından gerekli görülen diğer basılı materyallerle birlikte saklamanız için bu formun imzalı ve tarihli bir kopyası size verilecektir.

Konu adı _____

İmza _____

Araştırmacı adı _____

İmza _____

Appendix D: Data collection form (English)



1-Sociodemographic Features

Name Surname

Age [Years]

Height [Cm]

Weight [Kg]

BMI [Kg/m²]

Gender [M/F]

Academic level

Marital status [Single/Married]

Dominant side [Right/left]

Smoking habit: ☐ Never ☐ Quit ☐ Yes

Alcohol Consumption Habit: ☐ Never ☐ Only Special Days ☐ Several times a month ☐ Few times a week ☐ regularly every day.

Do you have any disease? ☐ No ☐ Rheumatismal ☐ Vestibular ☐ Traumatic ☐ Orthopaedic ☐ Neurologic ☐ Different type.

Is there any medication using regularly? ☐ Yes ☐ No .

Did you get any surgery [except circumcision] ? ☐ Yes ☐ No .

Exercise habit: ☐ Never ☐ Less than 3 days ☐ 3 days or more 14] .

Exercise Type: ☐ Never ☐ Fitness ☐ Pilates ☐ Swimming ☐ Strength ☐ Football ☐ Running ☐ Walking ☐ Volleyball ☐ Basketball.

Exercise frequency: I do:..... Monthly-Weekly I do not.....

Exercise duration: ☐ 20 minutes less ☐ 20-30 minutes ☐ 30 - 60 minutes ☐ 60 minutes.

Pain intensity: Rest Position 1-10: In movement 1-10:

2- Anthropometric measurement of the participants such as:

Sitting Height ☐

Head circumference ☐

Waist circumference ☐

Waist-hip ratio ☐

Arm Span ☐



3- Ergonomic analysis of office work:

Work age []
 Daily hours []
 Weekly days []
 Annual hours []

4- Ergonomic awareness:

Correct posture [Yes / No]

Break times [Yes, How many times / No]

Stretching [Yes, How many times / No]

5- Spine Physical parameters: Muscle strength, endurance and ROM (Physical Examination)

5.1-Range of motion via Goniometer

Spine Motion	Normal ROM	Trail 1	Trail 2	Trail 3	Average	Free pain ROM
Flexion	0°-80°					
Extension	Thoracic spine: 0°-10°					
Extension	Lumbar spine: 0°-25°					
Rotation	0°-45°					
Lateral Flexion	0°-80°					

5.2- Muscle strength Via Hand held dynamometer

Spine Strength	Trail 1	Trail 2	Trail 3	Average
Flexion				
Extension				
Rotation				
Lateral Flexion				

5.3- Grip dynamometer:

Palm pinch	Trail 1	Trail 2	Trail 3	Average
Right hand				
Left hand				



6- Questionnaires:

6.1- Functional parameters were examined with Modified Oswestry Disability scale

MODIFIED OSWESTRY DISABILITY SCALE – INITIAL VISIT

1. Pain Intensity

- (0) I can tolerate the pain I have without having to use pain medication.
- (1) The pain is bad, but I can manage without having to take pain medication.
- (2) Pain medication provides me with complete relief from pain.
- (3) Pain medication provides me with moderate relief from pain.
- (4) Pain medication provides me with little relief from pain.
- (5) Pain medication has no effect on my pain.

2. Personal Care (washing, dressing, etc.)

- (0) I can take care of myself normally without causing increased pain.
- (1) I can take care of myself normally, but it increases my pain.
- (2) It is painful to take care of myself, and I am slow and careful.
- (3) I need help, but I am able to manage most of my personal care.
- (4) I need help every day in most aspects of my care.
- (5) I do not get dressed, wash with difficulty, and stay in bed.

3. Lifting

- (0) I can lift heavy weights without increased pain.
- (1) I can lift heavy weights, but it causes increased pain.
- (2) Pain prevents me from lifting heavy weights off the floor, but I can manage if the weights are conveniently positioned (eg, on a table).
- (3) Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- (4) I can lift only very light weights.
- (5) I cannot lift or carry anything at all.

4. Walking

- (0) Pain does not prevent me from walking any distance.
- (1) Pain prevents me from walking more than 1 mile.
- (2) Pain prevents me from walking more than ½ mile.
- (3) Pain prevents me from walking more than ¼ mile.
- (4) I can only walk with crutches or a cane.
- (5) I am in bed most of the time and have to crawl to the toilet.

5. Sitting

- (0) I can sit in any chair as long as I like.
- (1) I can only sit in my favorite chair as long as I like.
- (2) Pain prevents me from sitting more than 1 hour.
- (3) Pain prevents me from sitting more than ½ hour.
- (4) Pain prevents me from sitting more than 10 minutes.
- (5) Pain prevents me from sitting at all.

6. Standing

- (0) I can stand as long as I want without increased pain.
- (1) I can stand as long as I want but, it increases my pain.
- (2) Pain prevents me from standing more than 1 hour.
- (3) Pain prevents me from standing more than 1/2 hour.
- (4) Pain prevents me from standing more than 10 minutes.
- (5) Pain prevents me from standing at all.

7. Sleeping

- (0) Pain does not prevent me from sleeping well.
- (1) I can sleep well only by using pain medication.
- (2) Even when I take pain medication, I sleep less than 6 hours.
- (3) Even when I take pain medication, I sleep less than 4 hours.
- (4) Even when I take pain medication, I sleep less than 2 hour
- (5) Pain prevents me from sleeping at all.

8. Social Life

- (0) My social life is normal and does not increase my pain.
- (1) My social life is normal, but it increases my level of pain.
- (2) Pain prevents me from participating in more energetic activities (eg. sports, dancing).
- (3) Pain prevents me from going out very often.
- (4) Pain has restricted my social life to my home.
- (5) I have hardly any social life because of my pain.

9. Traveling

- (0) I can travel anywhere without increased pain.
- (1) I can travel anywhere, but it increases my pain.
- (2) My pain restricts my travel over 2 hours.
- (3) My pain restricts my travel over 1 hour.
- (4) My pain restricts my travel to short necessary journeys under 1/2 hour.
- (5) My pain prevents all travel except for visits to the physician/therapist or hospital.

10. Employment / Homemaking

- (0) My normal homemaking/job activities do not cause pain.
- (1) My normal homemaking/job activities increase my pain, but I can still perform all that is required of me.
- (2) I can perform most of my homemaking/job duties, but pain prevents me from performing more physically stressful activities (eg. lifting, vacuuming).
- (3) Pain prevents me from doing anything but light duties.
- (4) Pain prevents me from doing even light duties.
- (5) Pain prevents me from performing any job or homemaking chores.

6.2- Spine Postural parameters by New York Posture Rating (NYPR)

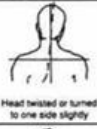
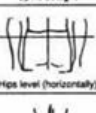
Posture score sheet	Name _____			Scoring dates			
	Good—10	Fair—5	Poor—0				
Head Left Right	 Head erect, gravity line passes directly through center	 Head twisted or turned to one side slightly	 Head twisted or turned to one side markedly				
Shoulders Left Right	 Shoulder level (horizontally)	 One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

Figure 10.12 New York Posture Rating Chart. Note. From *The New York Physical Fitness Test: A Manual for Teachers of P.E.*, New York State Education Dept. (Division of HPER) 1958. Reprinted by permission.



6.3- International Physical Activity Questionnaire - Short Form

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?
____ **days per week**
☐ No vigorous physical activities → **Skip to question 3**
2. How much time did you usually spend doing **vigorous** physical activities on one of those days?
____ **hours per day**
____ **minutes per day**
☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
____ **days per week**
☐ No moderate physical activities → **Skip to question 5**



4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ hours per day

_____ minutes per day

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ days per week

☐ No walking → **Skip to question 7**

6. How much time did you usually spend **walking** on one of those days?

_____ hours per day

_____ minutes per day

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ hours per day

_____ minutes per day

☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.

Appendix E: Data collection form (Turkish)



YEDİTEPE ÜNİVERSİTESİ

YEDİTEPE ÜNİVERSİTESİ
SAĞLIK BİLİMLERİ ENSTİTÜSÜ
SPOR FİZYOTERAPİSİ ANABİLİM DALI

Veri Formu

1-Sosyo Demografik Özellikler

Ad Soyad

Yaş

boy (Cm)

Ağırlık (kg)

BMI (Kg / m ^ 2)

Cinsiyet (E / K)

Akademik seviye

Medeni durum [Bekar / Evli]

Dominant taraf [Sağ / sol]

Sigara alışkanlığı: [] Asla [] bıraktım [] Evet

Alkol Tüketimi Alışkanlığı:

[] Asla [] Sadece Özel Günler [] Ayda birkaç kez [] Haftada birkaç kez [] düzenli olarak her gün.

Herhangi bir hastalığınız var mı?

[] Hayır [] Romatizmal [] Vestibüler [] Travmatik [] Ortopedik [] Nörolojik [] Farklı tip.

Düzenli olarak kullanılan herhangi bir ilaç var mı? [] Evet [] Hayır

herhangi bir ameliyat oldunuz mu? [] Evet [] Hayır.....

Egzersiz alışkanlığı: [] yapmıyorum [] 3 günden az [] 3 gün veya dahafazla].

Egzersiz Türü: [] yapmıyorum [] Fitness [] Pilates [] Yüzme [] Güç [] Futbol [] Koşu [] Yürüyüş [] Voleybol [] Basketbol.

Egzersiz sıklığı: Yaparım:.....Yapmıyorum..... Aylık-Haftalık.....

Egzersiz süresi: [] 20 dakika daha az [] 20-30 dakika [] 30-60 dakika [] 60 dakikadan fazla.

Ağrı şiddeti: Dinlenme Pozisyonu (1-10):..... harekette (1-10):.....(1 en az , 10 en çok)

2- Katılımcıların antropometrik ölçümü, örneğin:

Otururkenki Boyu []

Baş çevresi []

Bel çevresi []

Bel-kalça oranı []

Kol Açıklığı []

3- Büro işinin ergonomik analizi:

Çalışma yılı []

Günlük saatler []

Haftalık günler []

Yıllık saatler []

4- Ergonomik farkındalık:

Doğru duruş [Evet / Hayır]

Mola zamanları [Evet, Kaç kez / Hayır]

Esname [Evet, Kaç kere / Hayır]

5- Omurga Fiziksel parametreleri: Kas gücü, dayanıklılık ve ROM (Fiziksel Muayene)

5.1-Gonyometre ile hareket aralığı

Omurga Hareketi	Normal ROM	1 ölçüm	2. ölçüm	3.ölçüm	Ortalama	ağrısız ROM'u
Fleksiyon	0°-80°					
Ekstansiyon	0°-10°					
Rotasyon	0°-45°					
Yanal fleksiyon	0°-80°					

5.2- El dinamometresi ile kas gücü

Omurga hareketi	1.ölçüm	2.ölçüm	3.ölçüm	Ortalama
Fleksiyon				
Ekstansiyon				
Rotasyon				
Yanal fleksiyon				

5.3- Kavrama dinamometresi

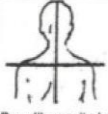
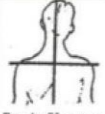
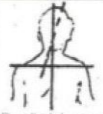
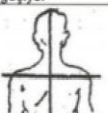
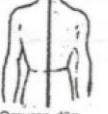
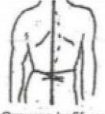
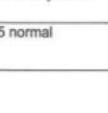
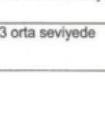
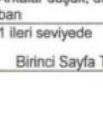
Palmar grasp (palmar yakalama)	1.ölçüm	2.ölçüm	3.ölçüm	Ortalama
Sağ el				
Sol el				

New York Postür Değerlendirme Formu

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Spor ve Egzersizde Vücut Biyomekaniği

Tablo-3.8. New York Duruş Değerlendirme Yöntemi Standartları [Magee-19897]

NEW YORK POSTÜR DEĞERLEME TESTİ						
Adı:		Soyadı:		Yaş:	Cinsiyet:	
5		3		1	1. 2. 3.	
A						
	Baş dik gravite hattı direk merkezden geçiyor	Baş hafifçe yana eğilmiş veya dönmüş	Baş ileri derecede yana eğilmiş veya dönmüş			
B						
	Omuzlar yere paralel	Bir omuz diğerinden hafifçe yukarıda	Bir omuz diğerinden ileri derecede yukarıda			
C						
	Omurga düz	Omurga hafif yana eğilmiş	Omurga ileri derecede eğilmiş			
D						
	Kalçalar yere paralel	Bir kalça diğerinden hafifçe yukarıda	Bir kalça diğerinden ileri derecede yukarıda			
E						
	Ayaklar düz	Ayaklar dışa dönük	Ayaklar pronasyonda			
F						
	Arkalar yüksek	Arkalar hafif düşük	Arkalar düşük, düz ta- ban			
	5 normal	3 orta seviyede	1 ileri seviyede	Birinci Sayfa Toplamı		

Papatya Yayıncılık Eğitim

Postür-Duruş

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Birinci Sayfa Toplamı

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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 yukarıda sternum vücut önünde ileride	 Göğüs hafif derecede çökmüş	 Göğüs ileri derecede çökmüş (düz)			
I	 Omuzlar merkezde	 Omuzlar hafif ileride	 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 protrake	 Karın protrake ve sarkmış			
M	 Alt sırt normal	 Alt sırt hafif çukur	 Alt sırt ileri derecede çukur			
	5 normal	3 orta seviyede	1 ileri seviyede			
			TOPLAM SKOR			

1. Eğer sol kolondaki açıklamaya uygun ise 5 puan
2. Eğer orta kolondaki açıklamaya uygun ise 3 puan
3. Eğer sağ kolondaki açıklamaya uygun ise 1 puan

Bölüm 3

OSWESTRY SKALASI

Aşağıdaki sorular, bel ağrınızın günlük aktivitelerinizi ne kadar etkilediğini anlamak için planlanmıştır. Size en uygun yanıtı işaretleyiniz. Lütfen her soruya tek bir yanıt veriniz!

1-Ağrınızın şiddeti nasıl?

- 1)Gelip geçici ve çok hafif bir ağrı
- 2)Sürekli, fakat hafif bir ağrı
- 3)Gelip geçici ve orta şiddette bir ağrı
- 4)Sürekli ve orta şiddette bir ağrı
- 5)Gelip geçici ve şiddetli bir ağrı
- 6)Şiddetli ve çok değişmeyen bir ağrı

2-Kişisel bakım

- 1)Ağrıdan kaçınmak için günlük yaşamımda (yıkama, giyinme şekli vb) değişiklik yapmadım
- 2)Biraz ağrı yapsa da yıkama ve giyinme şeklinde değişiklik yapmadım.
- 3)Yıkama ve giyinmem ağrımı arttırıyor, fakat bunları değiştirmeden idare ediyorum
- 4)Yıkama ve giyinmem ağrımı arttırıyor, bu yüzden bunları yapma şeklimde değişiklik yaptım.
- 5)Ağrı nedeniyle yıkama ve giyinmede bir miktar yardım alıyorum.
- 6)Ağrı nedeniyle yıkama ve giyinmeyi yarımsız yapamıyorum.

3-Yük Kaldırma

- 1)Ağır yükleri ağrı olmadan kaldırabiliyorum.
- 2)Ağır yükleri kaldırırken bir miktar ağrı oluyor.
- 3)Ağrı yüzünden ağır yükleri kaldıramıyorum.
- 4)Ağrı, ağır yükleri kaldırmamı önüyor, fakat uygun pozisyon varsa (örn. masa üzerinden) bunu başarabilirim.
- 5)Sadece çok hafif yükleri kaldırebiliyorum
- 6)Hiç yük kaldıramıyorum

4-Yürüme

- 1)Yürürken ağrı yok
- 2)Yürümeyle biraz ağrı var, fakat mesafeyle artmıyor
- 3)Ağrımda belirgin artma olmaksızın 2 km den fazla yürüyemiyorum
- 4)Ağrımda belirgin artma olmaksızın 500 m den fazla yürüyemiyorum
- 5)Ağrımda belirgin artma olmaksızın yürüyemiyorum
- 6)Hiç yürüyemiyorum

5-Oturma

- 1)Herhangi bir sandalyede istediğim kadar uzun oturabilirim
- 2)Sadece uygun bir sandalyede istediğim kadar uzun oturabilirim
- 3)Ağrı bir saatten uzun oturmamı önlüyor
- 4)Ağrı yarım saatten uzun oturmamı önlüyor
- 5)Ağrı 10 dakikadan fazla oturmamı önlüyor
- 6)Ağrımı arttırdığı için oturmaktan kaçınıyorum

6-Ayakta durma

- 1)Ağrı olmaksızın istediğim kadar uzun ayakta durabilirim
- 2)Ayakta durmakla biraz ağrı oluyor, fakat bu zamanla artmıyor.
- 3)Bir saatten uzun ayakta kaldığımda ağrı şiddetleniyor.
- 4)Yarım saatten uzun ayakta kaldığımda ağrı şiddetleniyor.
- 5)On dakikadan uzun ayakta kaldığımda ağrı şiddetleniyor.
- 6)Ağrımı arttırdığı için ayakta durmaktan kaçınıyorum

7-Uyuma

- 1)Yatakta ağrı yok
- 2)Yatakta ağrı var, fakat iyi uyuyorum
- 3)Ağrı nedeniyle normal uykumun 3/4 ünü uyuyorum

4)Ağrı nedeniyle normal uykumun yarısını uyuyorum

5)Ağrı nedeniyle normal uykumun 1/4 ünü uyuyorum

6)Ağrı nedeniyle hiç uyuyamıyorum

8-Sosyal yaşam

1)Sosyal yaşamım normal ve ağrı yaratmıyor.

2)Sosyal yaşamım normal, fakat ağrımı arttırıyor.

3)Ağrı, dansetmek, futbol oynamak gibi daha fazla enerji gerektiren ilgilerimi kısıtlamak dışında sosyal yaşamımda belirgin etki yaratmıyor.

4)Ağrı, sosyal yaşamımı kısıtlıyor, bu nedenle çok sık dışarıya çıkamıyorum.

5)Ağrı, aile içi yaşamımı da kısıtlıyor.

6)Ağrı nedeniyle hemen hemen tüm sosyal yaşamım kısıtlandı.

9-Seyahat

1)Seyahatte ağrım olmuyor.

2)Seyahatte biraz ağrım oluyor, fakat artmıyor.

3)Seyahatte ağrım artıyor, fakat bu ağrı seyahat şeklimi değiştirmede.

4)Seyahatte olan şiddetli ağrılarım nedeniyle başka seyahat şekilleri arıyorum.

5)Ancak yatarak seyahat edebiliyorum.

6)Ağrı nedeniyle seyahat edemiyorum.

10-Ağrının değişme derecesi

1)Ağrım hızla iyileşiyor.

2)Ağrım artıp azalıyor, fakat genelde iyiye gidiyor.

3)Ağrım iyileşiyor, fakat düzelme yavaş.

4)Ağrım ne kötüleşiyor, ne de iyileşiyor.

5)Ağrım yavaş yavaş kötüleşiyor.

6)Ağrım hızla kötüleşiyor.

Uluslararası Fiziksel Aktivite Anketi (Kısa Form)

İnsanların günlük hayatlarının bir parçası olarak yaptıkları fiziksel aktivite tiplerini bulmayla ilgileniyoruz. Sorular son 7 gün içerisinde fiziksel olarak harcanan zamanla ilgili olarak sorulacaktır. Lütfen yaptığınız aktiviteleri düşünün; işte, evde, bir yerden bir yere giderken, boş zamanlarınızda yaptığınız spor, egzersiz veya eğlence aktiviteleri.

Son 7 günde yaptığınız şiddetli aktiviteleri düşünün. Şiddetli fiziksel aktiviteler zor fiziksel efor yapıldığını ve nefes almanın normalden çok daha fazla olduğu aktiviteleri ifade eder. Sadece herhangi bir zamanda en az 10 dakika yaptığınız bu aktiviteleri düşünün.

1. Geçen 7 gün içerisinde kaç gün ağır kaldırma, kazma, aerobik, basketbol, futbol veya hızlı bisiklet çevirme gibi şiddetli fiziksel aktivitelerden yaptınız?

Haftada ___gün

✎ Şiddetli fiziksel aktivite yapmadım. 🗨️ (3.soruya gidin.)

2. Bu günlerin birinde şiddetli fiziksel aktivite yaparak genellikle ne kadar zaman harcadınız?

Günde ___ saat

Günde ___ dakika

✎ Bilmiyorum/Emin değilim

Geçen 7 günde yaptığınız orta dereceli fiziksel aktiviteleri düşünün. Orta dereceli aktivite orta derece fiziksel güç gerektiren ve normalden biraz sık nefes almaya neden olan aktivitelerdir. Yalnız bir seferde en az 10 dakika boyunca yaptığınız fiziksel aktiviteleri düşünün.

Geçen 7 gün içerisinde kaç gün hafif yük taşıma, normal hızda bisiklet çevirme, halk oyunları, dans, bowling veya çiftler tenis oyunu gibi orta dereceli fiziksel aktivitelerden yaptınız?Yürüme hariç.

Haftada ___gün

✎ Orta dereceli fiziksel aktivite yapmadım. 🗨️ (5.soruya gidin.)

4. Bu günlerin birinde orta dereceli fiziksel aktivite yaparak genellikle ne kadar zaman harcadınız?

Günde ____ saat

Günde ____ dakika

✎ Bilmiyorum/Emin değilim

Geçen 7 günde yürüyerek geçirdiğiniz zamanı düşünün. Bu işyerinde, evde, bir yerden bir yere ulaşım amacıyla veya sadece dinlenme, spor, egzersiz veya hobi amacıyla yaptığınız yürüyüş olabilir.

5. Geçen 7 gün içerisinde, bir seferde en az 10 dakika yürüdüğünüz gün sayısı kaçtır?

Haftada ____gün

✎ Yürümedim. 🗣️ (7.soruya gidin.)

6. Bu günlerden birinde yürüyerek genellikle ne kadar zaman geçirdiniz?

Günde ____ saat

Günde ____ dakika

✎ Bilmiyorum/Emin değilim

Son soru, geçen 7 günde hafta içinde oturarak geçirdiğiniz zamanlarla ilgilidir. İşte, evde, çalışırken ya da dinlenirken geçirdiğiniz zamanlar dahildir. Bu masanızda, arkadaşınızı ziyaret ederken, okurken, otururken veya yatarak televizyon seyrettiğinizde oturarak geçirdiğiniz zamanları kapsamaktadır.

7. Geçen 7 gün içerisinde,günde oturarak ne kadar zaman harcadınız?

Günde ____ saat

Günde ____ dakika

✎ Bilmiyorum/Emin değilim

APPENDIX F: CURRICULUM VITAE

Kişisel Bilgiler

Adı	Hamza	Soyadı	Alzeer
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