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BURSA ULUDAG UNIVERSITY

INSTITUTE OF EDUCATION SCIENCES

DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS

CHIROPRACTIC & THERAPEUTIC EXERCISES AND MASSAGE EFFICIENCY FOR THE LUMBAR DISC HERNIATION IN YEMEN

DOCTORAL THESIS

Amer Ahmed Ali ALWASEL

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Danışman

Prof. Dr. Erkut TUTKUN

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COMPLIANCE WITH SCIENTIFIC ETHICS

I declare that all information in this study has been obtained in accordance with academic and ethical rules.

Amer Ahmed Ali ALWASEL

2023

APPROVAL OF CONFORMITY TO THE THESIS WRITING GUIDE

The Ph.D. thesis titled “Chiropractic & Therapeutic Exercises and Massage Efficiency for The Lumbar Disc Herniation in Yemen” has been prepared in accordance with the thesis writing rules of Bursa Uludağ University Institute of Educational Sciences.

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SIMILARITY REPORT

INSTITUTE OF EDUCATIONAL SCIENCES
DOCTORAL SIMILARITY REPORT

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Date: 20/06/2023

"Chiropractic & Therapeutic Exercises and Massage Efficiency for The Lumbar Disc Herniation in Yemen"

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Thesis defense exam for the doctoral study on “Chiropractic & Therapeutic Exercises and Massage Efficiency for The Lumbar Disc Herniation in Yemen” prepared by Amer Ahmed Ali ALWASEL, registered with the number 811570501 in the Department of Physical Education and Sports, on 20/06./2023 12.30 AM at the end of the answers to the questions asked, it was decided (unanimously/majority of votes) that the thesis of the candidate was (successful/unsuccessful).

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PREFACE

In contemporary society, physical activity has ceased to be an intrinsic component of everyday life for many individuals. Walking and engaging in sports have become imperative for leading a healthy lifestyle, as our current way of living is incompatible with the regular practice of physical exercise. Consequently, our sedentary lifestyles have shaped our physiques and are often defined by a marked absence of physical movement. However, we are exposed to the risk of injury with several diseases and physical inactivity, which negatively affect our bodies not only physically and physiologically, but also the nervous system. There is only one thing that is non-drug, inexpensive, and readily available that can reverse these health problems, and that is regular physical exercise.

Nowadays, the problem of spinal diseases is escalating to the point where it has become a disease of the annoying age, prompting many countries to investigate this disease in order to preserve their citizens and the recovery of their productive and economic energies, as many working days are lost due to back problems caused by herniated discs, as well as the exorbitant cost of attempting to cure this disease. Scientific studies indicate that back pain is one of the problems faced by many individuals in the modern era, which affects the individual's production and limits their daily activities. Tendons connected to the lumbar region of the spine or lower back pain may occur as a result of pressure on the long or peripheral nerves of the spinal cord in the lumbar region. sides of the spine.

According to Gashi and Azemi (2022), the spine is the axis of the body and the protector of the spinal cord inside it. The nerve that runs from the leg down the back and contributes to leg pain, or the nerve that runs near the swollen disc, may make contact with the patient's disc and push it, causing back discomfort.

The spine serves as a foundational structure for the body, supporting its weight and facilitating movement. Between each vertebra, there is a cushioning cartilaginous disc that helps absorb shocks from physical activity such as walking and jumping while also facilitating movement and flexibility between each vertebra. These discs are composed of a gel-like substance called the nucleus pulposus, which is surrounded by a tough outer layer known as the annulus fibrosus. Together, these components work to maintain the spine's integrity and provide crucial support to the body.

The cartilaginous disc is of significant importance, as its degeneration is a primary cause of spine-related pain. This degeneration may manifest as a loss of softness, the ossification of the gelatinous substance, fibrosis, shrinkage in size, or protrusion of the nucleus pulposus. Disc

protrusion, which is characterized by erosion of the spine, can also result from sudden, strenuous movements, falls, or impact with hard objects.

ACKNOWLEDGMENT

In this section, I should sincerely thank the people whose names would take pages if I wrote them one by one. First of all, I would like to special thank my advisor Prof. Dr. Erkut TUTKUN, and Head of Physical Education and Sports Department, Prof. Dr. Nimet Haşıl KORKMAZ, and Prof. Dr. Ş. Ümit ZEYBEK, who made valuable contributions to the thesis control committee. I would like to thank all my dear friends who have been with me in this process as well as in every moment of my life. Also, I would like to thank all the faculty members working at Bursa Uludağ University Faculty of Sports Sciences. Unfaltering affection and deep appreciation for our second home, Turkey. A never-ending thank you to my wife, Wadha Al-FERASI, and my children Malak, Aseel, Parveen, Ahmed, Moayyed, and Almuhaib, who spared no effort in their support.

Amer Ahmed Ali ALWASEL

ABSTRACT

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CHIROPRACTIC, THERAPEUTIC EXERCISES AND MASSAGE EFFICIENCY FOR THE LUMBAR DISC HERNIATION IN YEMEN

This study aimed to investigate the Chiropractic & Therapeutic Exercises and Massage Efficiency for Lumbar Disc Herniation Injuries in Yemen. In this thesis, the researcher utilized an experimental program on 40 patients with lumbar disc herniation of the spine. Thirty patients were chosen as participants or experimental groups, while 10 were selected as control groups. The proposed program was employed by the researcher, who has been working in this field with various professionals for years. Since the researcher discovered a considerable number of such cases of this type of pain, he devised a proposed program and presented it to certain specialists. Some points were modified and then applied to the experimental sample for 12 weeks, while the control sample was arranged in the hospital's regular program for 12 weeks. It was noticed that the two groups were relatively consistent in the program, with six sessions each week for a total of 72 sessions. The experimental group treatment had three components: first, chiropractic spinal straightening and adjustment to treat the slipped discs. Second, massage was employed to restore activity and blood circulation to the organs impacted by disc pressure. Finally, therapeutic activities were applied to strengthen the muscles, ligaments, and tissues around the herniated disc, particularly the back and abdomen. In the control group, the researcher applied the program simultaneously through the hospital's standard program of experts, where they used massage, spinal traction, ultrasound, tennis, and Infrared. Various variables were assessed before and after the two groups underwent the two programs, using the same conditions and instruments, as follows: Variable pain level, with the experimental group showed 71.029 % improvement and the control group showed 18.760 % improvement,variable

range of motion for the front spine, with the experimental group improving at a rate of 60.65 % and the control group improving at a rate of 5.23 %, variable range of motion for the back spine, the experimental group improved at a rate of 62.73 %, while the control group improved at a rate of 7.455 %, in terms of the experimental group's variable range of motion of the spine on the right side, the percentage of improvement was 41.64 %, whereas the rate of improvement for the control group was 2.45 %, variable range of motion of the spine on the left side, with the experimental group improving at a rate of 41.16 % and the control group improving at a rate of 4.56 %, the percentage of improvement in variable back muscular strength for the experimental group was 71.029 %, whereas the rate of improvement for the control group was 16 %. In this thesis, the researcher used an SP-based program via the arithmetic mean, standard deviation, skew coefficient, percentage improvement rate, and Wilcoxon test.

***Keywords*:** Chiropractic, Injuries, Lumbar Disc Herniation, Therapeutic Exercises.

ÖZET

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YEMEN'DE LOMBER DİSK FITIK HASTALARIMDA KAYROPRAKTİK, TERAPÖTİK EGZERSİZLER VE MASAJ ETKİNLİĞİ

Bu çalışma, Yemen'deki Lomber Disk Fıtık Yaralanmalarında Kayropraktik & Terapötik Egzersizler ve Masaj Etkinliğini araştırmayı amaçlamıştır. Bu tezde araştırmacı, omurgada lomber disk herniasyonu olan 40 hasta üzerinde deneysel bir program kullanmıştır. Otuz hasta deney grubu, 10 hasta ise kontrol grubu olarak seçilmiştir. Önerilen program, yıllardır bu alanda çeşitli profesyonellerle çalışan araştırmacı tarafından kullanılmıştır. Araştırmacı, bu tür ağrıların önemli sayıda vakasını keşfettiğinden, önerilen bir program tasarlayarak uzmanlara sunmuştur. Bu programın içinde yer alan bazı noktalar değiştirilmiş ve daha sonra 12 hafta boyunca deney grubuna uygulanmıştır, kontrol grubu ise 12 hafta boyunca hastanenin normal programına katılmıştır. Her hafta altı oturum olmak üzere toplam 72 oturumda iki grubun programda nispeten tutarlı olduğu fark edilmiştir. Deney grubu tedavisinin üç bileşeni bulunmaktadır: birincisi, kayropraktik yöntemle omurga düzeltme, kaymış diskleri tedavi etmek, İkincisi disk basıncından etkilenen organlara aktivite ve kan dolaşımını yeniden sağlamak için masaj uygulamasıdır. Son olarak sırt ve karın başta olmak üzere fıtıklaşmış disk çevresindeki kasları, bağları ve dokuları güçlendirmek için terapötik aktiviteler uygulanmıştır. Kontrol grubunda, araştırmacı hastanenin standart programına göre uzmanlarında kullandığı masaj, spinal traksiyon, ultrason, tenis ve kızılötesi gibi programlar eş zamanlı olarak uygulamıştır. Program uygulanmadan önce ve sonra çeşitli değişkenler aynı koşullar ve araçlar kullanılarak iki gruba aşağıdaki gibi değerlendirildi: Ağrı düzeyi, deney grubunda % 71.029, kontrol grubunda ise % 18.760 iyileşme göstermiştir. Hareket açıklığı ön omurga için deney grubunda % 60,65 iken, kontrol grubunda % 5,23 olarak saptanmıştır. Arka omurga için hareket açıklığı deney grubunda % 62,73 oranında iyileşirken, deney grubunun sağ taraftaki omurga

hareket açıklığı değişkenine göre kontrol grubunda % 7.455 oranında düzelme göstermiştir. İyileşme oranına bakıldığında deney grubunda % 41.64, kontrol grubunda ise % 2.45 olarak saptanmıştır. Omurganın sol tarafındaki hareket açıklığı, deney grubunda % 41.16 oranında düzelme gösterirken, kontrol grubunda bu oran % 4.56 olarak belirlenmiştir. Sırt kas kuvveti ise, deney grubunda % 71.029 gelişme gösterirken, kontrol grubu için gelişme oranı %16 saptanmıştır. Bu araştırmada, aritmetik ortalama, standart sapma, çarpıklık katsayısı, yüzdelik gelişme oranı ve Wilcoxon testi yoluyla SP tabanlı bir program kullanılmıştır.

***Anahtar Sözcükler*:** Kayropraktik, Lomber Disk Fıtıklaşması, Terapötik Egzersizler, Yaralanmalar.

INGREDIENTS

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LIST OF ABBREVIATIONS

ALL	**:**Anterior Longitudinal Ligament
AM	**:**Arithmetic Mean
BMI	**:**Body mass index
BMS	**:**Back Muscular Strength
BROM	**:**Backward Range of motion
CLB	**:**Chronic Low Back Pain
EMS	**:**Electrical muscle stimulation
ET	**:**Exercise therapy
FROM	**:**Forward Range of motion
LBP	**:**Low Back Pain
LLP	**:**Longitudinal Ligament Posterior
Lt.L A ROM	**:**Left side range of motion
M	**:**Muscle
MT	**:**Massage therapy
P	**:**Statistical indication
Rt.L A ROM	**:**Right side range of motion
S	**:**Skewness
SD	**:**Standard deviation

CHAPTER 1
INTRODUCTION

Spinal diseases have recently become a chronic ailment of the annoying age, with employees upset by back problems caused by herniated discs, urging governments to investigate this disease to maintain their citizens and restore their economic productivity. Scientific studies indicate that back pain is one of the problems faced by many individuals in the modern era, which affects the individual's production and limits his daily activity, tendons connected to the lumbar region of the spine or lower back pain may occur as result of pressure on the long or peripheral nerves of the spinal cord in the lumbar region, sides of the spine. So, according to Gashi and Azemi (2022), the spine serves as the body's axis and as a defender of the spinal cord inside it.

The nerve that extends down the back from the leg, explaining the sensation of pain in the leg, or the nerve that passes close to the swollen disc could well touch the patient's disc and press it due to contact, causing pain in the spine, where the spine maintains the body's consistency and helps to carry it. A disc exists between each vertebra and helps absorb shocks during movement and jumping and facilitates movement between one vertebra and another. The nucleus pulpous and the task of the cartilaginous pillow is most of the pain that affects the spine due to its erosion (degeneration), which causes a reduction in its softness and ossification of the gelatinous substance, fibrosis, and shrinkage in size or as a result (disc protrusion). All these affect the column due to erosion due to a sudden difficult movement, fall, or impact with something solid.

1.1. Introduction

The spine is made up of bony vertebrae that are joined together and separated by intervertebral discs, which allow the vertebrae to move slightly and allow the human spine to move freely. Furthermore, they can act as shock absorbers for the spine and shape the vertebral arches in different spinal areas, which is the main point by which we can determine the individual's physical strength, whether they are healthy or injured. The spine is affected by changes in different parts of the body because of the multiplicity of its parts, and the arches of the spine vary depending on the nature of the muscles (Andersen et al., 2017).

The function of the spine is dependent on the cooperation of the related muscles weakness in these muscles causes imbalances and changes in the natural arches and makes you more vulnerable. The spine can be thought of as the sum of all functional units that are linked together to keep the body moving against gravity (Akamine et al., 2015).

1.2. Purpose of the Research

The researcher's visits to several hospitals and treatment centers in Yemen, he found that there are a number of patients with lumbar disc herniation whose rehabilitation process varies, as a number of electrical therapeutic devices are used with the stability of motor therapy, the researcher concluded the necessity of knowing the effect of therapeutic exercises, chiropractic and therapeutic massage on patients with lumbar disc herniation.

The researcher noticed through his various practical experiences in the field of sports and in the field of physical therapy that lower back pain, also known as lumbar pain, affects four out of five individuals at separate times in their lives. In most cases, the pain lasts from days to weeks, but in some cases, the pain may last more than that and at frequent intervals, and this pain may occur suddenly and quickly, and it may be dangerous, and it may develop gradually over a period of time and cause long-term problems. As the researcher noted while reviewing the literature of previous studies, some programs and methods have been used to treat and relieve lower back pain.

1.3. Sub-Aims of the Research

The program of Chiropractic and therapeutic exercises, and massage effectively relieved discomfort caused by lumbar disc herniation and increased the spine's range of motion.

1.4. Importance of Research

This study is one of the scientific attempts to study the effect of the Chiropractic program, therapeutic exercises, and massage on some cases of lumbar disc herniation that do not require surgical intervention in terms of the range of motion, strength of back muscles and level of pain in the lumbar region.

The practical importance of the study stems from the importance of this study in identifying the effectiveness of chiropractic, therapeutic exercises, and massage on the lumbar vertebrae and the sensitive location these vertebrae occupy, affecting the motor ability of the lower extremities and the limited activity and life in general.

A. This study searched for the development of appropriate solutions to control the pain caused by lumbar disc herniation and the patient's return to their normal life and activities as they were prior to the injury.

B. It was important to improve the information for Yemeni libraries using the data provided in this study.

C. Explaining the importance of chiropractic treatment, therapeutic exercises, and massage, and the changes that result from them, and linking them to the means of physiotherapy in

hospitals and the physiotherapy centers in Yemen.

D. This study may help scientists and researchers in determining the best therapeutic methods for controlling pain caused by herniated disc injuries in the lumbar region, as well as avoiding injuries that lead to herniated discs in their working lives.

1.5. Assumptions of the Study

Chiropractic exercises and therapeutic massage have a positive effect in alleviating the pain caused by lumbar disc herniation, increasing the kinetic range of the spine and increasing the muscular strength of the back muscles.

1.5.1. Research Questions and Hypotheses:

1. Do exercises have a positive effect in relieving the pain caused by the lumbar herniated disc, increasing the kinetic span of the spine and increasing the muscular strength of the back muscles?
2. Does therapeutic chiropractic have a positive effect in relieving the pain caused by the lumbar herniated disc, increasing the kinetic range of the spine and increasing the muscular strength of the back muscles?
3. Does therapeutic massage have a positive effect in relieving the pain caused by the lumbar herniated disc, increasing the kinetic range of the spine and increasing the muscular strength of the back muscles?

1.6. Limitations of the Research

The study included 45 patients diagnosed with lumbar disc herniation at Limbs Center Hospital in Sana'a, Yemen's capital. These patients were divided into an experimental group, consisting of 30 patients, and a control group, consisting of 10 patients. Five patients were excluded from the study due to failure to meet the inclusion criteria.

1.6.1. The Survey: The researcher conducted an exploratory study on 3 patients from 12.08.2019 to 12.09.2019 to ensure the validity of the tests in the study variables.

1.6.2. Primary Study: The researcher conducted the basic experiment from 01.03.2021 to 01.06.2021.

1.6.3. Geographical Area: Physiotherapy unit, Limb Center Hospital in, Sana'a this is for the following reasons:

A. Availability of the capabilities used in the research experience.
B. Availability of measuring devices for research.
C. Availability of private fitness rooms.
D. Availability of Chiropractic tools and devices.
E. Availability of private massage rooms.

F. Availability of assistants in measurements.

1.6.4. Administrative Procedures: The researcher carried out the following administrative procedures to facilitate the measurement procedures for the research:

A. Obtaining the approval of the Physiotherapy Unit Center Limb Center hospital in the capital of Sana'a. to implement the proposed programme.
B. Obtaining the consent of the injured to conduct research on them.
C. Determining the time of the required measurement procedures for the research sample and agreeing on the dates for implementing the program.
D. Designing data registration forms for the sample members to be recorded in the case of the injured and the tribal and remote measurements.

CHAPTER 2
GENERAL INFORMATION

2.1. The Significance of Spine: The spine, which connects the top part of the body to the lower part through the shoulder belt and pelvis, is one of the most crucial components of the skeleton and is regarded as the center of the human body. The spine controls the movement of the skull, neck, and back while also being supported by a large number of muscles. It is the main part of the body that connects to the skeleton and is made up of 33 vertebrae that can move freely or are fixed. As a result, the spine is an excellent illustration of the different types of joints in the human body. Additionally, it facilitates rib movements (Altınel et al., 2008).

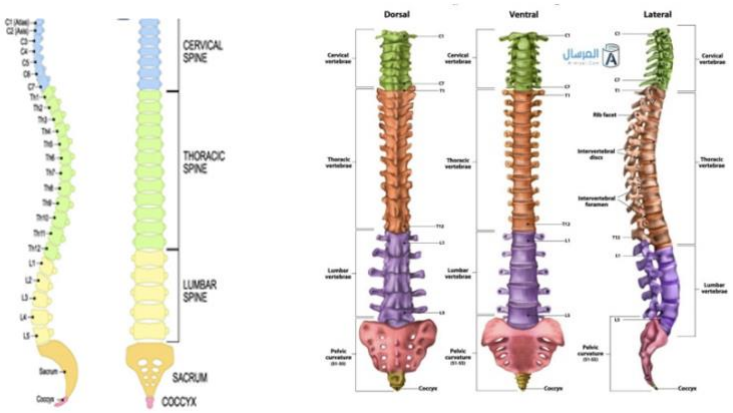

Figure 1
Anatomy of spine (Chan et al., 2013).

2.1.1. Anatomy of spine: The human spine consists of bone vertebrae, joined together and separated by intervertebral discs, which allow slight movement of the vertebrae so that the human spine can move easily, in addition, it does the function of a shock absorber for the spine and prevent friction between vertebrae. The spine extends from within the skull to the pelvic cavity and contains the spinal canal, which encloses and protects the spinal cord. Its typical length is 85 cm, with cervical vertebrae measuring 12 cm, thoracic vertebrae measuring 38 cm, and lumber vertebrae measuring 18 cm. Both the sacral and coccygeal vertebrae are roughly 12 cm long, and cartilage is a major factor in the length of the spine, accounting for 20: 25% of spinal length, which has a significant influence on the length of the body as you age (Clare et al., 2004).

In a human's spine, there are normally thirty-three vertebrae as follows (Woldendorp et al., 2018).

1. Cervical vertebrae 7

2. Thoracic vertebrae 12
3. Lumber vertebrae 5
4. Sacrum vertebrae 5
5. Coccyx vertebrae 4

Movements between two adjacent vertebrae are small and limited, but the sum of movements in vertebral joints allows the spine to move. The most moving vertebrae are the cervical and lumbar.

2.2. Anatomy of Vertebral: The vertebral body extends from the side of the vertebra into the front, it is a short bone mass whose upper and lower surface is covered by a fibrous cartilaginous disc, this disc connects the vertebrae to each other from the top and bottom, which gives the spine flexibility in freedom of movement and prevents the vertebrae from rubbing against each other (Last & Hulbert, 2009).

2.2.1. Vertebral arch: It is in the back of the upper vertebra and is connected with the tendon on the side and with the body of the vertebra (Beattie, 2008).

2.2.2. Spinal process: This protrusion is located at the back of the vertebra in the form of a protrusion and is the point of connection of the vertebrae to each other through fibrous ligaments (Bohinski & Mule, 2016).

2.2.3. Transverse process: It is a single protrusion on each side of the vertebra at the attachment of the tendon to the arch (Atchison et al., 2021).

2.2.4. Vertebral foramen: It is a cavity in the middle of the vertebra through which the spinal cord, its blood vessels and cerebrospinal fluid pass (Jung et al., 2022).

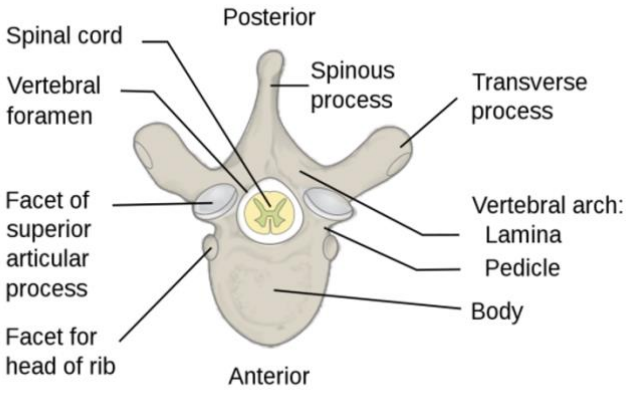

Figure 2
Foramen vertebral (Bohinski & Mule*, 2016).*

2.2.5. Articular Process: It is a projection of a vertebra that fits with an adjacent vertebra (Bohinski & Mule 2016).

Figure 3
Part of bone vertebra (Spahn, 2015).

2.3. Types of Vertebrae in Different Areas of Spine:

2.3.1. Cervical vertebral: It is a group of bony vertebrae seven vertebrae in the apex of the spine. They are distinguished by the presence of a foramen hole in each transverse process, through which the vertebral artery and vertebral veins pass. Furthermore, a transverse process fixes muscles on it (Bellido- Fernández et al., 2022).

2.3.2. Atlas vertebral: This vertebra is called the carrier because it carries the skull. It differs from other vertebrae by lack of vertebral body, which leads to expanding the spinal canal. Also, it allows the skull to move up and down through a small spinal process. It is ring-like and consists of an anterior arch, posterior arch, and two lateral masses, the superior surface

of the two lateral masses is called the articulator superior surface, concave in shape, and joints with the occipital bone of the skull that help with the movement of the head up and down and the inferior articular surface is associated with the second cervical vertebra (Celenay et al., 2021).

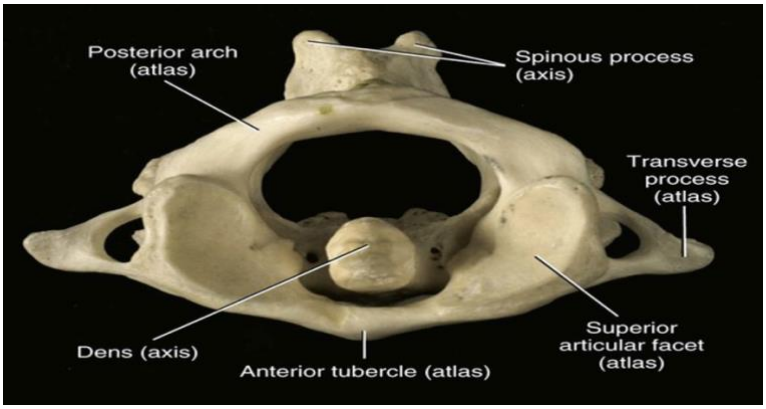

Figure 4
The atlas vertebral (Árnason et al., 2018).

2.3.3. The axis vertebral: This vertebra contains an odontoid process, which rises from the anterior part of the vertebra this process forms a pivot in which head and atlas vertebra rotate. As a result, head can move in all sides easily (Bakhtiary et al., 2005).

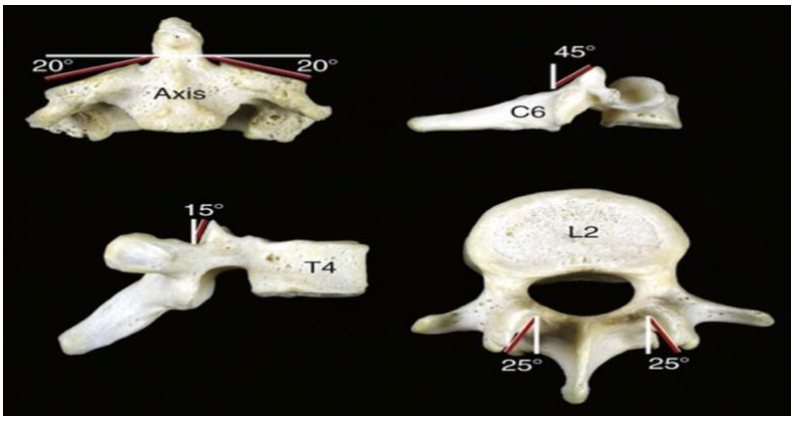

Figure 5
The axis vertebral (Stephens, 2005).

2.3.4. The five cervical vertebrae (from the third until the seventh): Those vertebrae have no specific name, but they are numbered from three to seven. This area is the most flexible of the spine and is similar to the thoracic vertebrae in shape. The foramen of those vertebrae, in which the artery passes, is narrow compared with other vertebrae (Celenay et al., 2021).

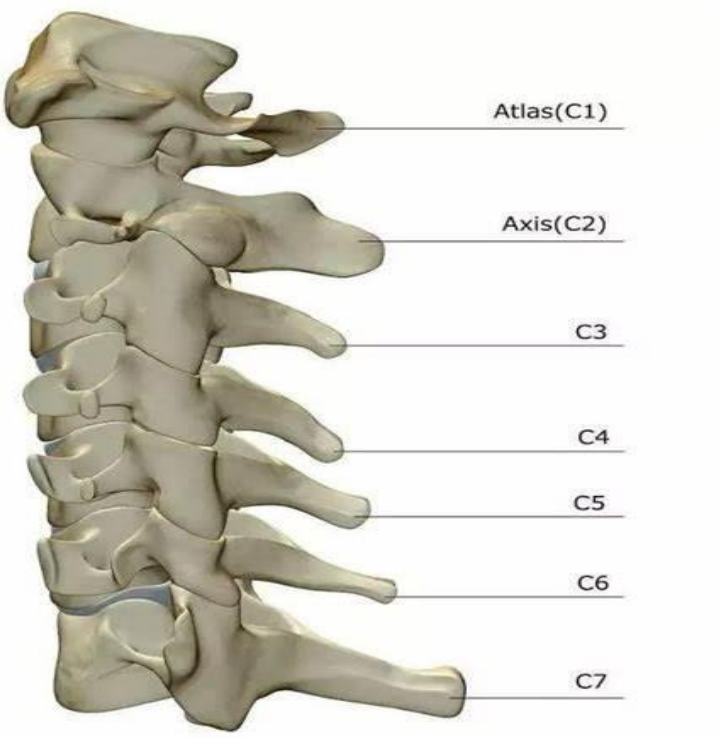

Figure 6
Vertebral cervical (Woldendorp et al., 2018).

2.3.5. Thoracic vertebral: It is the second area after the cervical vertebrae, twelve vertebrae, and they are called the thoracic vertebrae because they are in the chest area and connected with the rib cage. The body vertebra of the thoracic area is similar to the heart muscle, while the spinal canal is round, the posterior lamina is long with a backward direction and the transverse process is long and strong. Also, they are distinguished by the presence of facets on the sides of the bodies for articulation with the heads of the ribs, where the rib articulates with the two adjacent surfaces of two vertebrae with the exception the first and the last three vertebrae, the last three vertebrae are large in size and more similar to the lumbar vertebrae (Brenner, 2005).

2.3.6. Lumber vertebra: The five lumbar vertebrae are the largest of the vertebrae in terms of shape and size. They are characterized by the large body of the vertebra, where the spinal canal is small and triangular. While the posterior pedicles are broad and the transverse processes are short and broad and have no articulating surfaces as in the other vertebrae. Furthermore, the upper articular processes are connected to the medial and backward sides that enhance the movement of rotation, while the lower articular processes are connected to the lateral and forward sides. The transverse processes are flat and appear on the lateral and

backward sides, and there is an additional tuber behind the root of the transverse process. Also, there is a rounded and mammillary process in the backward of the upper articulator process, while the laminae of lumbar vertebrae are separated from each other and have a space between them filled by a ligamentum flavum. The large lumbar muscle is found between the vertebral bodies and their transverse processes, while the erector spinal muscle is located between the transverse and spinous processes of the lumbar vertebrae (Burton et al., 2000).

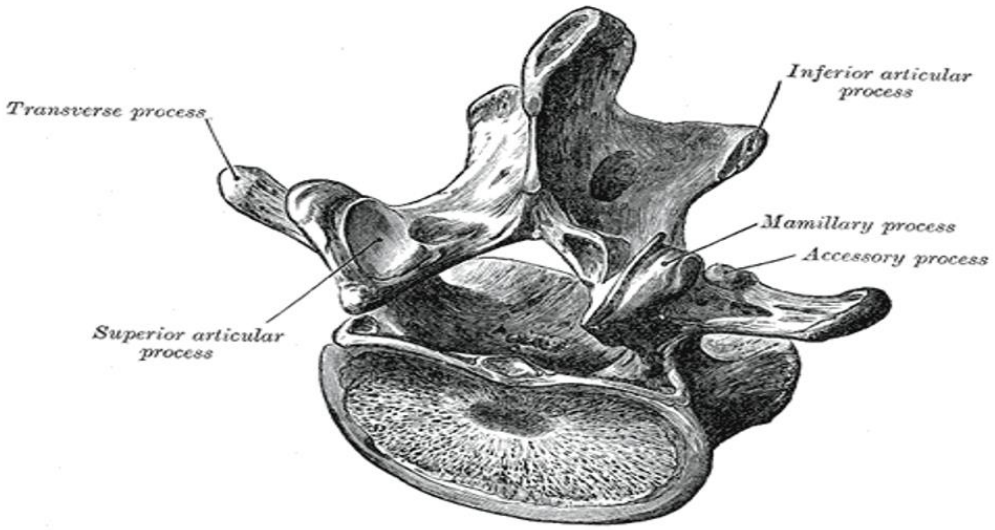

Figure 7
Lumber vertebral (Cruder et al., 2018).

2.4. Some Features of Lumber Vertebral (Caine & Maffulli, 2005):

- It is the largest and strongest vertebrae in the spine.
- The transverse process is small and broad and has no articulating surfaces.
- The laminae are broad, short, and strong.
- The spinal canal is small and triangular, with a large kidney shaped vertebral body

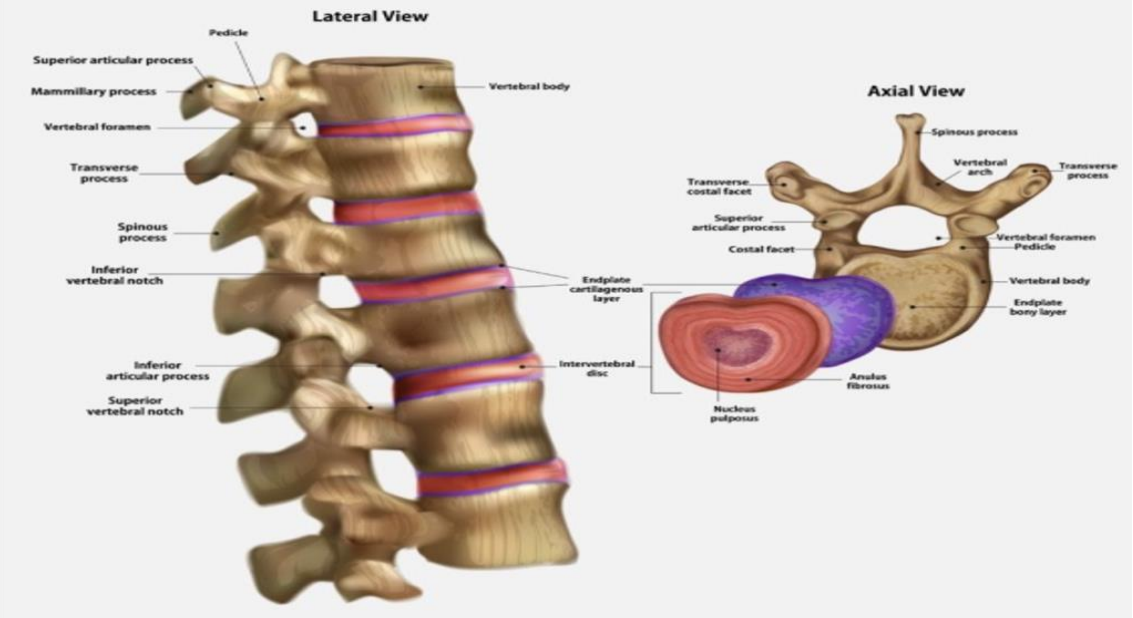

Figure 8
Lumbar vertebral (Woldendorp et al., 2018).

2.4.1. Functions of lumber vertebral: The lumbar vertebrae are the main point in the spine and are among the most mobile areas in the spine, moderating stature and maintaining balance. They are the closest to the center of the body's weight and they are the largest and most powerful with different functions, including (Beattie, 2008):

a. They connect with the lower part/limp by the sacroiliac articulator.
b. They act as shock-absorbers in the entire spine due to their thick cartilage.
c. They provide protection for the spinal cord that passes through the spinal canal to the lumbar vertebrae.
d. They enable the body to move easily.

2.5. Sacrum Vertebral: They are curved triangles in shape and consisting of fused five vertebrae, the upper part of the sacrum connects with the last lumbar vertebra and its lower part with the coccyx vertebrae connects with the pelvic bones on both sides. The sacrum vertebra is formed by the fusing of the sacral vertebrae between ages 18 and 30, and the sacrum has a base, an apex, two anterior and posterior surfaces, and two lateral surfaces. The base of the sacrum is the upper surface of the first vertebra and articulates with the fifth lumbar vertebra to form a large projection known as sacrum. These vertebrae have less strength and size than the lumbar vertebrae (Casazza, 2012).

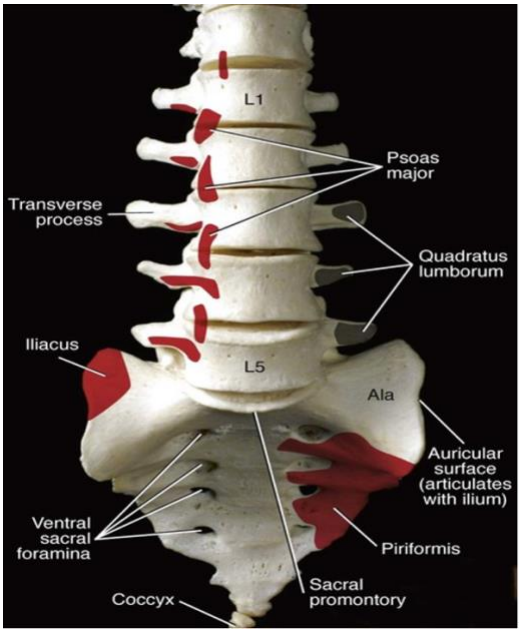

Figure 9
Vertebral coccygeal and sacrum (Klein et al., 2014).

2.6. Vertebral Coccygeal: These vertebrae are the last segment of the spine, consisting of four vertebrae fused together and these vertebrae do not contain peripheral nerves or spinal cord. This reduces the feeling of pain during the sit of the human body (Cherkin et al., 2011).

2.7. Intervertebral Discs: An intervertebral disc lies between adjacent vertebrae in the spine. Each disc forms a fibrocartilaginous joint to allow slight movement of the vertebrae, to act as a ligament to hold the vertebrae together, and to function as a shock absorber for the spine. Also, they allow the spine to move easily on all sides. Intervertebral discs differ from each other in size and in shape and consist of an outer fibrous ring and contain a nucleus inside, which is a gelatinous substance, proteins, and water and has the ability to stretch between the body of each vertebra (Tsai et al., 2021).

2.7.1. Anatomy of intervertebral discs (Anulus Fibrosus): The anulus fibrosus consists of several layers of laminae fibrocartilage made up of collagen that helps absorb the outer shocks of the spine. These fibers can stretch in various directions (Clare, et al., 2004).

2.7.2. The anatomical structure of the herniated disc (Anulus Fibrosus): It is the outer covering of what is inside the cartilage. Outer annulus consists of genetic cola fibers, it is

formed in a way that allows the absorption of external influences on the spine these fibers can stretch in various directions equal to half of their number (Garcia et al., 2015).

2.8. Nucleus Pulposus: This nucleus is located inside the fibrous cover and consists of a multi-molecular glycolytic tissue, which holds out the backbone of shocks, pressures, and external influences on it (Dunn & Iversen, 2003).

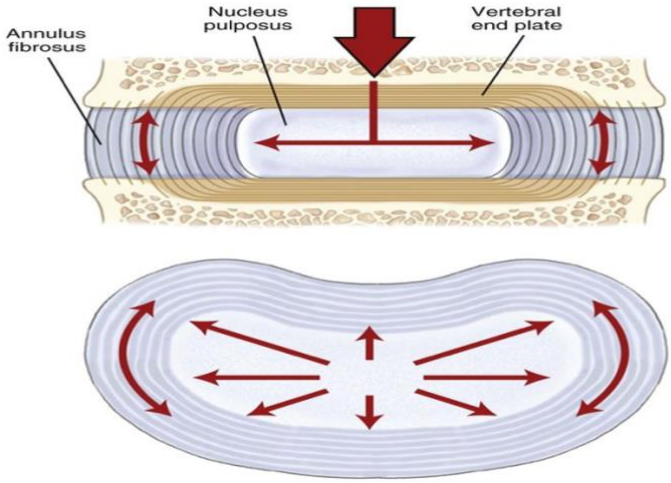

Figure 10
Nucleus pulposus (Roos & Roy, 2018).

2.9. The Functions of The Cartilage (Sisko et al., 2011) :

- It makes the spine gains more flexibility, which helps to perform various movements due to the strong and flexible fibers.
- It works to absorb shocks that may be exposed to the spine during jumping or falling.
- It prevents friction between the vertebrae and each other.
- It gives the spine a suitable length that makes it suitable for the shape of the body.
- It works to carry the vertebrae and protect the spinal cord.
- It gives the spine the normal secondary curvature by the difference in the size and thickness of the cartilage in the region's backbones.

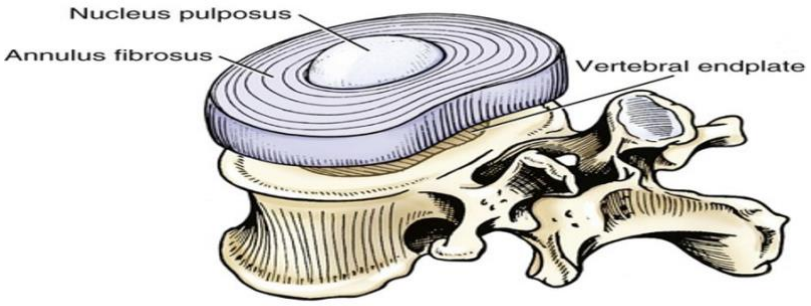

Figure 11
The disc (Sisko et al., 2011).

2.9.1. The cartilaginous mechanical movement: The movement of cartilage varies from one area to another, we may note that the movement between the vertebrae may be limited, but we find that the total movements in the joints of the vertebrae give the spine a flexible shape and freedom of movement. synovial joints of the articular surfaces and the most mobile areas of the spine are the cervical spine, followed by the lumbar spine (De Souza & Frank, 2001).

2.9.2. The effect of aging on cartilage: As a person ages or accidents and damage to the spine accumulate, several biochemical changes occur in the cartilage, affecting its ability to absorb water from the body. That plays a significant part in the integrity of the cartilage and the execution of its functions, as cartilage contains 70% to 80% of water. When water is ingested during activities involving large weights or sports, the pulpous nucleus works to nourish the cartilage. As we age, the amount of water in cartilage reduces to 65%, and the length of cartilage diminishes progressively owing to cartilage atrophy and a decrease in the degree of biochemical activity, leaving us vulnerable to issues and accidents. Thus, they become more vulnerable to harm and injuries due to their low level of endurance to stresses and shocks (Gregory et al., 2008).

2.10. The Spinal Nerves

The spinal nerves consist of thirty-one nerves that exit the spinal cord on each side, through the foramina between the two vertebrae, The spinal nerve is formed by the union of the anterior root of the nerve, the motor root with the posterior root of the nerve and the sensitive root, as each root penetrates the dura mater of the spinal cord before its union with the other (Hinkeldey et al., 2020).

2.10.1. The Spinal Nerves are Divided into Groups, and Each Group is Named After The Area it Follows: Cervical spinal nerves include the eight nerves that exit from the spinal canal above the bearing vertebra reaching above the first dorsal vertebra, dorsal spinal nerves: these include the twelve nerves following the cervical nerves lumbar spinal nerves: these five nerves follow the dorsal nerves (Itz, 2016).

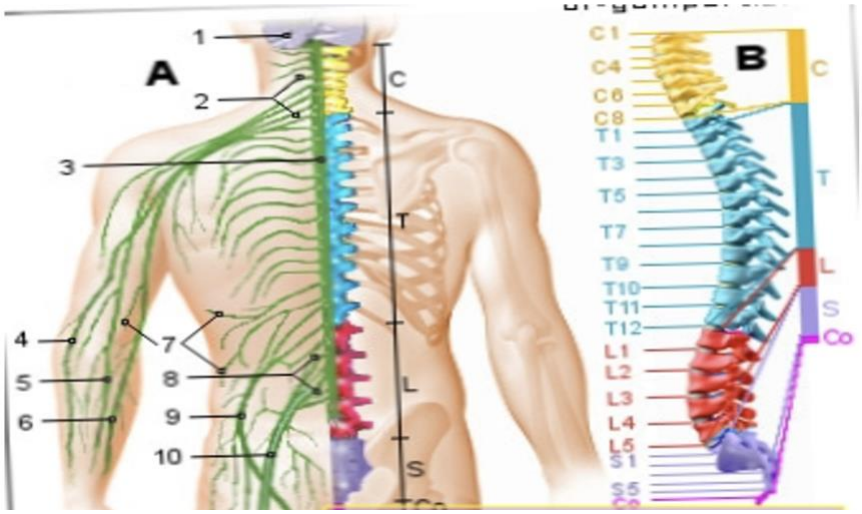

Figure 12
The spinal nerves (Engen et al., 2012).

2.10.1.1. The plexus nerves: It is a group of nerves named after the area that feeds it. It originally consists of the union of the primary anterior branches and the spinal nerves, forming with each other these plexuses, the posterior branches have absolutely nothing to do with it (Iversen et al., 2003). The primary anterior branches of the spinal nerves supply the extremities and the anterior and lateral parts of the trunk and are larger than the posterior branches, the nerve plexuses (Tchorowska et al., 2021) include the following:

2.10.1.2. The lumbar plexus: It is located in front of the transverse processes of the lumbar vertebrae in the posterior part of the Ipsospasm major muscle (Wang et al., 2021).

2.10.1.3. The lumbar plexus consists of: The primary anterior branches of the three upper lumbar nerves and the greater part of the fourth nerve, as well as the first branch of the last dorsal nerve (Joseph et al., 2018).

2.10.1.4. Lumbar plexus branches (Choi et al., 2010):

- It nourishes the lumbosacral muscle, the ipsilateral major, the minor muscle, and the iliac muscle.

- The nerve supplies the extrinsic, intrinsic, and transverse abdominal muscles, and the nerve feeds the skin of the anterior part of the seat.
- The western iliac nerve also supplies the internal oblique abdominal muscle, the upper and medial skin of the thigh, the upper part of the scrotal skin in the male, and the skin around the labia majora in the female.
- The femoral genital nerve, which supplies the testis-bearing muscle in the leg, the skin of the scrotum, and the ligament in the female, the skin around the labia majora, as well as the skin of the femoral triangle.
- The lateral femoral cutaneous nerve supplies the skin in the anterior and lateral parts of the thigh up to the knee.
- The femoral nerve is the largest posterior branch of the plexus.
- The cataract nerve supplies the thigh joint, the long connective muscles, the short connective muscles, the large and beautiful connective tissues, and the external ligaments, and ends in the knee joint.
- The cataract auxiliary nerve supplies the pubic muscle and the thigh joint.

2.10.1.5. The sacrum plexus consists of the anterior branches of the fourth and fifth lumbar nerves and the first to fourth sacral nerves, the largest nerve branching from this plexus, the sciatic nerve. The ischial nerve in the human body innervates the muscles of the leg and the whole body (Kolt & McEvoy, 2003).

2.10.1.6. Branches of the sacral plexus (Engen et al., 2012).

- The plexus is covered by nerves that supply the quadriceps femoris, intrinsic, and piriformis muscles.
- The upper gluteal nerve supplies the small and medium gluteus muscles.
- The lower gluteal nerve feeds the gluteus maximus muscle.
- The posterior femoral cutaneous nerve of the buttock region, perineum, thigh, and back leg.
- The sciatic nerve is the largest branch of the plexus.
- The vital nerve supplies the rectal nerve or the lower hemorrhoidal nerve, the levator ani muscle, the coccyx and the sphincter of the external anus, and the skin of this area.

It also covers the posterior nerve of the penis or clitoris, as well as the perineal nerve. It also supplies the skin of the scrotum in the male, the labia majora in the female, the muscles of the urogenital diaphragm, the pubic muscle, and the thigh joint (Chiarelli & Moore, 2008).

2.10.1.7. The coccygeal plexus consists of a small branch of the anterior branch of the fourth sacral nerve, the anterior branch of the fifth sacral nerve, and the coccygeal nerves. The stem is formed on the pelvic surface of the coccygeal muscle and nourishes the skin in the coccygeal region (Lehmann et al., 1990).

2.10.2. The Femoral Nerve: Briefly, it consists of the posterior branches of the lumbar nerves 4.3.2. It covers the lumbosacral and iliac muscles in the abdomen and then goes down behind the inguinal ligament and enters the thigh, and covers many branches (Liebig et al., 2000).

- Motor branches of the muscles: the pubic, suture, and quadriceps femoris muscle.
- Branches of the hip joint and knee joint.
- Branches of Sensitive skin from the front and to the side.
- Branch for the main side of the thigh and leg.

2.10.3 The Sciatic Nerve: It is the largest and longest nerve in the human body, with a width of 2 cm. It is an extension of a flattened fiber from the sacral plexus and consists of the anterior and posterior branches of the fifth lumbar nerve and part of the fourth. In addition to the three upper sacral nerves, the nerve exits the pelvis through the great sciatic passage under the piriformis muscle and then runs in the posterior thigh, passing between the greater trochanter of the femur and the sciatic tuberosity. The gluteus maximus covers the nerve's upper part and is posteriorly in the middle of the thigh or in the last third. It is divided into two large branches, the medial and lateral popliteal nerves (Kim et al., 2022).

2.10.3.1. Branches of the sciatic nerve (Moffett & McLean, 2006):

- The thigh joint.
- The branches feed the two and a half tendon quadriceps femoris muscles, the semimembranous and the sciatic part of the long adductor muscle.
- The medial popliteal nerve, which is the largest of the two branches. It consists of all the anterior branches of the sciatic nerve. It starts from the middle of the thigh at the

back or in the last third of it and goes down through the middle of the popliteal fossa to the lower edge of the popliteal muscle in the leg, where it is called the posterior bronchial nerve.

- The posterior bronchial nerve continues downward to the medial malleolus, where it divides in the space between it and the Achilles tendon into two branches, the medial and lateral plantar nerves.

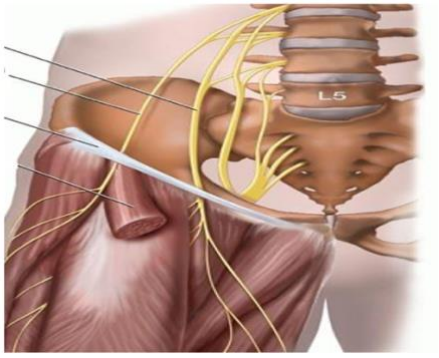

Figure 13
The sciatic nerve (Terry Longmani et al., 2015).

2.10.3.2. Vertebral column ligament: Ligaments are fibrous tissues that connect the vertebrae to each other, and their functional work varies from one ligament to the other. However, the main function of the spinal ligaments is to hold together between those vertebrae by means of flexible and durable ligaments, which are a rectangular ligament in front and another behind the bodies of the vertebrae and a strong, flexible ligament known as the yellow ligament. In addition, a ligament between each protrusion of two thorns and each transverse, and the ligament represents a strong means of communication with the vertebrae. Its function lies in its connection with the vertebrae, and it is poor in blood supply if compared to the various nerves and ligaments, including the longitudinal, anterior and posterior longitudinal, and internal ligaments (Phillips et al., 2013).

2.10.3.3. A.L.L. Anterior longitudinal ligament: This ligament extends along the length of the spine, starting from the cervical vertebrae to the sacral vertebrae, and is externally lateral to the spine. It protects the vertebrae when carrying heavy objects through adhesion to the vertebrae (Rattanatharn et al., 2004).

2.10.3.4. L.L.P. Longitudinal ligament posterior: The posterior longitudinal ligament differs from the anterior one, as the posterior ligament starts from the third cervical vertebra and ends in the sacral vertebrae from the internal medial side (Rubin, 2007).

2.10.3.5. Flavum ligament: It is a rubber tendon that holds the vertebrae functioning to protect the spinal canal from pressure on it from what is around it during the flexion movement in the spine because it is solid and there is one on each side (Nie et al., 2005).

2.10.3.6. Interspinouc ligament: This ligament is not a rubber band, but it is flexible and helps to allow the complete flexion movement of the spine and is located between the protrusions of the vertebrae in it (Solberg et al., 2021).

2.10.3.7. Supraspinous ligament: It is an extension of the descending ligament of the cervical vertebrae, and it is not rubber functioning to limit flexion in the spine. It is located near the spurs of the vertebrae and is considered the most superficial ligament and the most vulnerable to rupture (Solberg et al., 2021).

2.10.3.8. Ligaments of the lumbar vertebrae

Table 1 ***Ligaments of the lumbar vertebrae:***

Inguinal Lig	Capsular Ligament
Ligamentum sacrotu berale	Annulus Fibrosus posterior longitudihal ligament of vertebral bodies
Ligamentum Flavum	Anterior longitudinal ligament
Supras pinous Ligament	Inferior longitudinal ligament
Inter spinous Ligament	

(Swain, 2020).

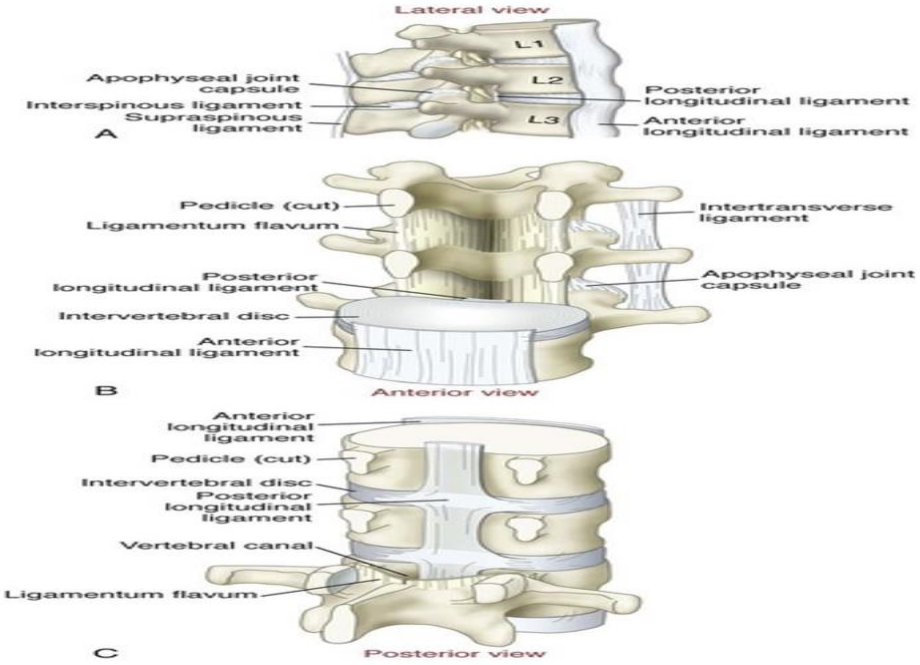

Figure 14
Lumbar ligaments (Rocha et al., 2014).

2.10.4. Membranes of the Spinal Cord: Three membranes surround the spinal cord, and each membrane is separated from the other by spaces containing cerebrospinal fluid called the space under the dura mater and under the arachnoid mater, the pia mater: It covers the spinal cord from the inside and extends to it from the brain (Sherman et al., 2001).

- Dura mater: It consists of the extension of the inner layer of the brain and ends in the spinal cord at the second sacral vertebra.
- Spider mother is also an extension of its counterpart in the brain.

2.10.4.1. The importance of the spinal cord: It directs the muscular work of the muscles of the body other than the muscles of the face. It works to create a state of compatibility between the different muscle groups through motor reflexes. Responsible for transmitting nerve signals to and from the brain. It is responsible for reflexive actions of all kinds. It controls voluntary movements by determining the precise design of the movement when performing the expected movements in cooperation with the higher nervous centers (Sherman et al., 2009).

2.11. Muscular Tone

This term means involuntary muscle tension, in which the muscle is always in a state of readiness to work and contract. In the event of an increase in it beyond the acceptable limit, it will constitute a burden on the athletes' muscles and can be shown in the case of learning new

skills, which prompts the trainers to get rid of the muscular tone, the muscle tone occurs because of the central nervous system receiving various stimuli, which are some reflex actions by working continuously, which leads to the muscle tone (Twain, 2021).

2.11.1. The Vertebral Column Muscles: Muscles are the first line of defense against shocks or injuries and are of paramount importance in achieving balance, so the spinal muscles in the human body are one of the most complex areas in terms of overlapping the work of each of the muscles and other tissues. as it requires this area to perform its functions well to prevent the occurrence of excessive load on the joints of the spine. In addition to performing movements with a high degree of fluidity and coordination (Triano et al., 1997).

Figure 15
The vertebral column muscles (Van Selms et al., 2017).

The true cause of movement is the contraction of the muscles connected to the bones, and these muscles are the inherent force in the human body, the bones connected to it in a specific direction, and the number of these muscles, there are approximately 80 muscles, varying in size, shape, length, and strength, and distributed in three layers in the area extending between the skull and the bones of the pelvis, the function of each muscle varies, the muscles are usually thick in the middle and become thinner in the extremities, and the point where they meet with bones is known by tendons (Shi et al., 2022).

2.11.1.1. Basic motor: They are the primary muscles or group of muscles responsible for making the desired movements (Park et al., 2011).

2.11.1.2. The opposite or the contradictory: They are the muscles located on the other side of the motor and basic muscles and their function is the opposite of what the main motor muscles do, their work is resistant to the work of the motor muscles (Wang, 2020).

2.11.1.3. Stabilizer muscles: They are the muscles that stabilize the skeletal system when the motor muscles are working or performing a specific activity (Livak et al., 2022).

2.11.1.4. The physiological mechanical work of the muscles on the spinal column: The muscle consists mainly of the muscle cell and the group of muscle cells that make up the muscle fiber, the medium-sized muscle contains about 10 million muscle fibers. An external tissue that is the so-called motor unit covers each group of muscle fibers and is a solid tissue with the endurance to generate and reduce the energy that allows them to work during certain periods without depending on the muscular skin. It also enables it to stretch horizontally as well as contract, as it enables it to contract in varying degrees. Massage also restores muscle tone, which is the permanent partial contraction of the body's muscles, which is a true contraction of the fibers alternately with each other and this helps to keep the body in a state of alert and permanent readiness to work. Muscle tone is also of great importance in maintaining the proper mechanical position of the muscles, which helps to increase the efficiency of the muscle in the performance of its work (Swartz, 2020).

2.11.1.5. Vertebral column muscles: The equilibrium of the spine is affected by a group of muscles that extend from the posterior tuberosity to the thigh and pelvis, which keep the back straight and reduce pressure on the lumbar vertebrae in the lower back area. When the back extensor muscles contract, the spine becomes aligned with the pelvis (Sheets et al., 2012).
In the lumbar region, the back extensor muscles are the thickest and most powerful. The spine in this part is also more mobile, which leads to increased stress in that area. In the bending movement to the side, the axis is in a sagittal direction through the body, and the twisting movement is on the vertical axis where during these movements on the three axes, the movement of the spine is formed (Rydeard et al., 2006). The iliopsoas muscle is the most powerful holding muscle for the thigh joint, while the gluteus maximus muscle is one of the key muscles that straighten the thigh and is the strongest and largest in the human body, helping to straighten the stature.

Strong ligaments that connect the vertebrae to one another and other ligaments connected to the pelvis also share importance with the muscles that affect the pelvis and spine. For instance, the abdominal muscles and the extensors of the thigh joint contract when bending moderately behind the pelvis. The pelvic ligaments work to moderate and erect the spine on the pelvic bones so as not to impair the spine's ability to slide forward, while the iliac-femoral

ligament secures strength against every increase in the backward bending movement (Chu, 2022).

Accordingly, the position of the spine, the natural curves, imbalance and balance depend on the interrelationship of the function of the ligaments with the muscles connected to the spine, which affects the different areas that make up the spine, especially the lower back. It is characterized as being better than others in performing the motor movements of that area; therefore, the harmonious body is due to the protection of the spine and the compatibility of the muscles working on it and the muscles that move it. It shows the importance of the spine in performing daily movements such as walking and performing sports activities (Liao et al., 2022).

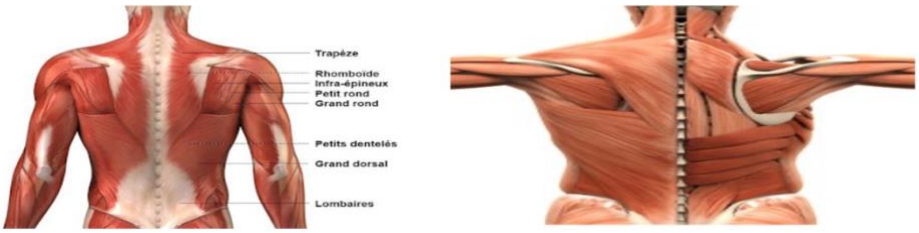

Figure 16
Shows the muscles of the lumbar region and back muscles (Ying et al., 2015: Pelfort et al., 2015).

Table 2 Muscle and type of movement.

Trunk Flexion:	Trunk Extension:	Trunk Rotation:
The rectus abdominis muscle	Spinal muscle	External descending oblique muscle
Anterior dentate muscle	Dorsal iliac muscle	Ascending medial oblique muscle
Transverse muscle	Long dorsal muscle	
Medial oblique muscle	Dorsal spinal muscle	
Suture muscle	Lumbosacral dorsal muscle	
Fascia efferent muscle	Quadriceps muscle	

(Porter, 2013).

2.12. The Anatomical Structure of The Pelvis

The pelvis consists of the connection of the sacrum bone from the back with a pair of bones known as the innominatum on the two sides that articulate from the front by cartilage in the pubic bone, the pelvis can be described as a strong bony ring, each half of these two halves connects to the two sides of the coccyx bone and heads forward to connect one to the other. The coccyx bones connect the upper parts to the lower limbs that articulate on one side. the pelvic movements depend on the movements of the lumbar region (Özcan, 2004).

Each symphysis is made up of three bones, the iliac bone, the ischium, and the pubic bone, and all three are united into one bone at the pubic bone (Nelson & Kokkonen, 2020).

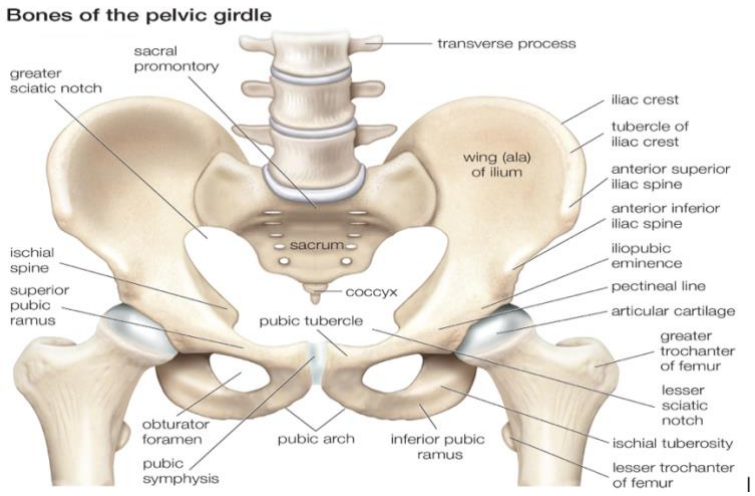

Figure 17

Shows the anatomy of the pelvis (Engen et al., 2010).

2.12.1. Movements Associated With The Pelvis: Mention that there are only four movements that can occur in the pelvic area and that pelvic movements facilitate the movement of the spine and thigh, and these four movements are (Roggio et al., 2022);

- *Increasing the degree of inclination,* where the sacrum is moved up and the pubic bone is moved down.
- *In decreased inclination,* the sacrum is moved downward while the pubic bone moves upward and forward.
- *Rotation or lateral twist,* where the pelvis rotates around the vertical axis to the right or left side.
- *Inclination to the side;* vertical axis, in this movement, one of the two edges of the mechanism rises up and the other edge of the machine goes down the other side.

2.12.1.1. The hip joint: Multiple hip joints are among a group of joints known as the ball and Socket joint, where the oval head of the femur is articulated with the fossa formed by the bones of the pubic, iliac, and ischium (Nasir et al., 2021).

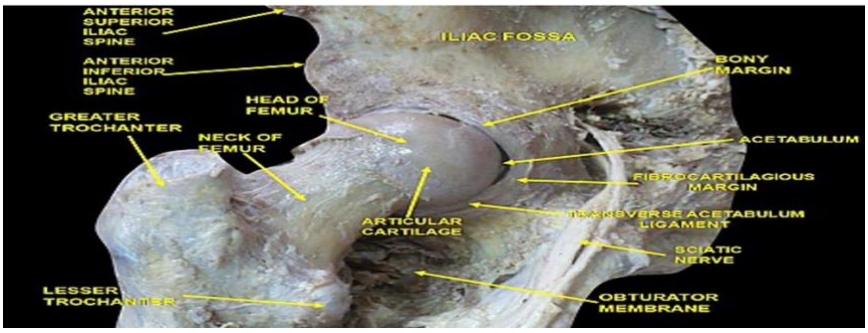

Figure 18
Show the right of the articulation of the head of the femur (Hubley-Kozey, 2002).

The head of the femur is responsible for absorbing many of the shocks that the joint is exposed to because of jumping, running, or various sports practices, however, with age, the bones become brittle and are prone to fracture, when looking at the femur from the front, we find that the base of the bone is directed inward compared to the head, and we find that the larger the pelvis, the greater this deviation increases. It may be noted that this is the main reason for the negative impact on the efficiency of running in women compared to men due to the presence of the pelvic widening they have, as this leads to the difficulty of maintaining the thrust in a straight line forward, which results in the production of a rotating vehicle of the force (Mostofi, 2015).

2.12.1.2. Elevation of pelvis

Table 3 Pelvis movement muscles:

"Elevation of Pelvis"	**Hip Flexion abduction and lateral rotation with knee Flexion**	**Hipextension**	**"Hipabdetion"**	**Hip adduction"**	**"Hip lateral Ratation"**	**"The muscles that rotate the pelvis at an average angle between (0-45) degrees.**	**Hip Flexion"**	**Knee Flexion"**	**The muscles that connect the lower limb with the torso**
Quadratus Lumborum Muscle	Sartorlun Muscle	Gluteus maximus Muscle	Muscle Middle gluteus muscle	Adductor Magnus Muscle	Obturator Externus Muscle	Gluteus minimus Muscle	Posas major	Biceps Femorisc (Long head)	The Gluteus Maximus Muscle
Additional Postion Muscle		Semitendinuosum Muscle		Adductor Brevis Muscle	Obturator in ternus Muscle	Tensor fasciaeleatae Muscle	lliacus muscle	Biceps Femorisc (Short head)	The Gluteus medius Muscle
Iliocostalis Lumborum Muscle		Semimembranosus Muscle		Gracilis Muscle	Piriformis Muscle			Seimtendinosus Muscle	The G luteus minimus Muscle
Obliauus Externus abdominus Muscle		Biceps Femorisc (Long head)		Pectineus Muscle	Gluteus maximus Muscle				The Piriformis Muscle
Obliauus lnternus abdominus Muscle					Gemellus superior Muscle				The Obturaror lnternus Muscle
					Gemellus inferior Muscle				The Quadratus femoris Muscle
					Quadratus femoris Muscle				The obturator externus Muscle

(Miller et al., 2005).

2.13. Low Back Pain

In recent times, lower back discomfort has become increasingly common among people of all age groups. This is due to a variety of factors, such as the reduced levels of physical and motor activities in daily life, the rise of sedentary lifestyles facilitated by technological advancements, and the prevalence of industrial interventions that minimize the need for physical exertion. As a result, individuals engage in fewer movements, leading to a decline in their physical well-being (Mckenzie, 1990).

90% of all spinal injuries involve damage to the lumbar region, making it a common occurrence in various sports, such as combat sports, athletics, gymnastics, and diving. The fourth and fifth vertebrae in the lumbar region are particularly prone to injury due to their proximity to the body's center of gravity and distribution line. Consequently, this region serves as the foundation of endurance for many sports and is also one of the most mobile parts of the spine, rendering it more susceptible to injury (Klein et al., 2014).

80% of lower back pain instances result from muscular weakness surrounding the afflicted area, and the primary reason for treating these symptoms is to increase muscle strength and flexibility of muscles, particularly the muscles of the trunk and legs (Šiško et al., 2011).

2.13.1. Causes of Low Back Pain: When we look at lower-back pain, we find that it is common among people; thus, there are many reasons leading to this injury, whether it is related to wrong practices in daily life, such as sitting in the wrong way, standing for long periods of time, or practicing hard crafts, or there may be another aspect related to this pain from an organic perspective, which has a negative impact and causes lower back pain (Liang et al., 2021).

Figure 19
Low back pain (Machado et al., 2005).

The injury may occur because of a sudden change in the position of the body, especially activities associated with carrying things in the wrong way, bending the trunk, or rolling. We find that the most important causes of lower back pain are due to the weakness of the muscles of the back, legs, and buttocks with the inflexibility of the spine. One of these reasons is an increase in daily training load, which exposes the spine to stature deviations such as increased back concavity or lumbar concavity, and the five large vertebrae in the lumbar region carrying the vast bulk of the body weight and serve as the axis of movement for the upper part of the body on the lower part. Increased body weight puts a significant amount of stress on this area, resulting in lower back discomfort and weak ligaments and muscles on both sides of the lumbar vertebrae. Several sports and non-sports activities rely heavily on lumbar muscle work for extended periods of time, such as weightlifting, gymnastics, and strong games (Machado et al., 2005).

2.13.1.1. Some mechanical causes of lumbar and sacral pain: The spine is responsible for bearing the weight of the body in all motions or fixed positions, such as standing, sitting, sleeping, and performing sports movements, but with different degrees of endurance. Therefore, we discover that sitting on a chair without a back cushion places significant stress on the lumbar and sacral regions, resulting in weakness in this area. If this situation persists for a prolonged period of time due to the stress that occurs to the muscles in this area, the reason for this is that every kilo of increase in the abdomen corresponds to ten kilos of stress on the lower back, resulting in an unusual increase in the lumbar region's forward curvature from the normal position, muscle length and weakness, and loss of back muscle contraction in the lumbar region. This results in the individual being unable to maintain the natural priority of the pelvic angle, which causes the pelvis to tilt forward and the afflicted bone to lower, increasing pain in the lumbar, sacral, and coccygeal regions and causing the back muscles to be unable to maintain the mechanics of the body (Leach, 2020).

2.13.1.2. Mechanical pain in the lower back: Mechanical pain in the lower back region occurs because of repeated loads on the skeletal system, especially the muscles on the spine and the lower extremity, through several factors, including the strength of the muscles of the trunk, the nature of texture, the strength and flexibility of the muscles of the pelvic region and the lower extremity, and the mechanics of muscular work, the spine works to adapt to high loads by increasing the muscular strength of the working muscles. ın the event of the inability to adapt to these loads, the injury occurs cumulatively or suddenly, and the problems associated with

the strength of the lower extremity affect the emergence of some cases of lower back pain (Kuligowski et al., 2021).

Furthermore, injuries to the lower extremity can contribute to the development of lower back pain by impacting the flexibility and strength of the muscles in this limb. This may result in a mechanical defect in the limb's movement, which leads to an adjustment in the position of the spine to compensate for this defect. Consequently, lower back pain commonly arises in such cases, and clinically healthy individuals often experience mechanical pain in the lower back. This may occur due to a direct injury to the lower extremity in the past (Khorami et al., 2021).

2.13.1.3. The mechanics of posture and its relationship with lower back pain: Posture refers to the state of muscular and nervous equilibrium that enables the various organs of the body to perform their functions during periods of stability and movement. It exerts either a positive or negative influence on the mechanical and functional interdependence of the body's diverse parts. Adequate posture enables athletes to engage in sports activities with minimal risk of injury. Hence, there is a negative relationship between strength and lower back pain (Field et al., 2007).

If an individual loses the ability to maintain strength and balance between the muscle groups working on the spine, the lower back area, and the corresponding muscles, this has a negative impact on the individual and makes them highly vulnerable to injury. This applies to athletes and others, but individuals participating in sports activities are more vulnerable to injury, especially because each sport depends heavily on specific muscle groups more than others. For example, as the front abdominal muscles weaken, the lower back muscles weaken, causing the pelvis to rotate forward and down, increasing discomfort in the lumbar and sacral regions (Kolt, 2003).

2.13.1.4. Reasons for lower back pain: Wang et al., (2021), explain that lower back pain is one of the most widespread illnesses and injuries, costing money to treat the wounded, and the causes of lower back pain are attributable to various variables, including:

- Doing business that needs to be bent forward for a long time.
- Overweight.
- Exposure to too many vibrations.
- Carrying heavy things.
- Lack of elasticity in the posterior thigh muscles.

- An imbalance in the trunk muscles.
- Doing wide and fast movements in the torso area.
- Osteoporosis.
- Aging.
- The high number of pregnancies in women.

In athletes who engage in sports such as gymnastics, weightlifting, dolphin swimming, javelin throwing, rowing, and wrestling, inadequate strengthening of the trunk muscles may result in low back pain. Such athletes often focus on these muscles without ensuring that they are sufficiently strengthened to facilitate exercise and competition (Postmus, 2001).

2.13.1.5. The most significant causes that lead to lower back pain: *Not practicing sports activities*; some studies conducted by Katz indicated that one of the causes of lower back pain is the lack of exercise, which leads to weakness of the muscles of the back, abdomen, and legs, which are unable to do the appropriate muscle work and their inability to support and protect the vertebrae and bone joints, which leads to injury (Katz, 2006).

*Abdominal muscle weakness; a*bdominal muscles are a key factor in the prevention of lower back pain. in case of weakness of these muscles, they cannot maintain the correct position of the pelvis, which negatively affects the vertebrae in the lower back, and this may be accompanied by an increase in lumbar concavity and cause the convergence of the back edges of the vertebrae, which works to narrow the space from which the nerves extend, causing a kind of pain as a result of pressure on the nerves (Iwamoto et al., 2011).

Anxiety and depression decrease morale and lead to intense pain and an excessive sense of it. Some questionnaires conducted in a psychiatric clinic in the united states of America with depressed patients indicated that more than half of the patients suffer from back pain as if there is a close relationship between depression and feeling this pain (Haslett et al., 2002). The researcher believes that this type of reason leads to the occurrence of lower back pain as a result of the poor psychological state of people, which makes them isolate from others and take some wrong positions in sitting and sleeping, many may prefer to escape from reality, or the problems that led to this depression leads to excessive sleep, which limits movement and activity. As a result, it leads to muscle weakness and the inability to do the appropriate muscle work (Hartigan et al., 2000).

Joint sprain and muscle strain rotation, bending, lifting heavy objects in the wrong way, or sudden movements may lead to sprains in the joints, tightening of muscle ligaments, and the occurrence of lower back pain players may be exposed to these pains when performing some skills suddenly (Griffin et al., 2009).

Muscular work in some sports activities can enhance vital and physiological functions, as well as muscular strength and size. However, certain sports that extensively utilize the lower back muscles and involve prolonged training sessions may lead to initial mild pain, requiring athletes to attend to the imbalance and strive to avoid potential injuries during competitions. Examples of such sports include wrestling, which heavily relies on lower back skills, and gymnastics, which demands spinal flexibility during movements (Garcia et al., 2011).

Mechanical causes account for over 90% of lower back pain cases. This refers to the incorrect use of the back during daily activities, which exposes the lower back to significant stress that can lead to chronic or acute contraction of the muscles surrounding the spine or herniation of the disc nucleus. This, in turn, can cause compression of the nerve roots supplying the lower extremity, resulting in severe pain and numbness in one or both legs. Herniated discs account for less than 5% of lower back pain cases, and only a small percentage of cases (less than 10%) require surgical intervention. The majority of cases (over 90%) can be managed without surgery. It can be treated with specialized treatment and rest and without surgical intervention. It also falls under mechanical causes, the narrowing of the medullary canal or the nerve root canal, as well as the roughness of the synovial joints between every two vertebrae or the roughness of the cartilage disc in old age, which leads to the inability of the cartilage disc to bear the stress that falls (Rocha et al., 2014).

Rheumatic causes stiffness of the spine that affects young males more than in females, at an age ranging from 25-40 years, and results from chronic pain for more than 3 months in the lower back that increases very much in the morning when waking up from sleep accompanied by stiffness in movement. These symptoms improve with movement or practicing any therapeutic exercise and are accompanied by many other symptoms and signs only known by a specialist rheumatologist. Also, among the rheumatic causes are psoriatic arthritis and rheumatoid disease. Similarly, there are many causes, such as intestinal arthritis accompanied by intestinal diseases and fibromyalgia, which is accompanied by poor sleep or restless sleep (French et al., 2006).

2.13.2. Rehabilitation of Lower Back Pain Injuries: There are many methods and programs in the rehabilitation of pain associated with the lower back area in general, this philosophy is based on three basic principles that give the general form of the rehabilitation

steps from injury, and they are using the philosophy of rehabilitating lower back pain in general with the method used in the treatment and rehabilitation of other joints in general.

Guiding the injured, teaching the basic rules, and motivating them towards restoring basic functions, despite the healing of the body's muscular tissues after the injury, most of these tissues recover their condition in terms of structure and mechanical properties. The patient must be taught how to control pain and good self-management of injury.

Healing rates of muscle tissues of different types differ in terms of the type of tissue or the degree of injury. The biomechanics of the work of the affected area requires identifying certain types of rehabilitative exercises that do not negatively affect the healing processes of muscle tissue, whether in terms of size, intensity, or duration of exercises, the relationship of the movements that lead in daily activity to the mechanics of the injury (Fritz et al., 2007).

2.13.2.1. Ways to avoid lower back pain (Cooperstein et al., 2001):

- Avoid standing for long periods during work, and if it is necessary, you must walk and move every half hour at least.
- Maintain a healthy body weight and avoid obesity.
- Try to stay away from everything that causes anxiety and depression in daily life, as well as physical exhaustion.
- Try to participate in sports activities continuously and in a correct manner.
- Avoid sitting for long periods during work and maintain sitting properly, and it is preferable that the chair has a backrest.
- Avoid carrying things incorrectly, especially while lifting them off the ground.
- Avoid sleeping on a spongy or hard surface.
- Avoid using high-heeled shoes, which leads to a mechanical defect in the lower back.
- Avoid sleeping on your stomach. It increases the mechanical pressure on the back, and if necessary, put a pillow under your stomach to help straighten the lumbar vertebrae while sleeping on the stomach.
- Regular walking for 15-20 minutes two or three times a day is very useful for improving blood circulation to the back tissues, improving cartilage nutrition, and increasing the endurance of the back muscles.
- Avoid reading or watching TV in a lying position on the bed, as most of the time, the back is in a bad position.

- Avoid exposure of the back to air currents, and try to avoid sudden changes in the atmosphere, such as moving from the air heated to air conditioning.

2.13.2.2. The physical rehabilitation program: The contents of the rehabilitation program vary according to several factors, including age, degree of pain and gender, males and females, and the goals of the rehabilitation program they differ from athlete to non-athlete, and the content of the rehabilitation program is also developed according to the type of injured muscle and its function and muscle work in order to work on rebuilding this function again. In order to know the type of exercises used in the program, the number of repetitions and the time period from one stage to another (Chou et al., 2017).

2.13.2.3. Objectives of the physical rehabilitation program (Büyükturan et al., 2021):

- Re-development and improvement of the elements of physical fitness in line with the nature of the activity being practiced.
- Elimination of the negative rest period resulting from the occurrence of the injury, so the rehabilitation program begins at the earliest stage of treatment.
- Avoiding the negative effects of losing components of physical fitness and complications resulting from surgical intervention.
- Helping the injured individual to restore and develop muscle and joint flexibility and range of motion for the part injured.
- Reaching the injured individual to the best physical and psychological level in the least possible period to practice all the requirements of motor performance according to the type of activity practiced and daily life.
- Ensure the injured reaches his normal state before the injury occurs by performing all functional tests specified for the activity being practiced

2.13.3. Therapeutic Exercise: Therapeutic exercises are considered the main focus in getting rid of many injuries because they aim to get rid of the cases of dysfunction of the affected part. This is because it takes care of the manifestations of weak muscle growth, ligament and joints, and when forming therapeutic exercises, three basic factors must be present (Lim et al., 2018).

- *Reformal building exercises:* to develop muscle strength and twitch between different muscle groups and improve muscle tone.

- *Flexibility and stretching exercises:* They should include the flexibility of all joints, in addition to muscle lengthening exercises.
- *Balance exercises:* they include muscular and muscular coordination exercises for the body in a state of stability and movement, and taking care of distributing the body's tone in an appropriate manner to avoid disturbing the muscular balance that causes pain.

States that treatment with controlled and purposeful movement is one of the natural and basic means in the integrated treatment of injuries. Rehabilitation depends on various exercises in all their forms and types (Van Selms et al., 2017):

- Passive exercises
- Active Exercises
- Resistance exercises
- Assistive exercises.

2.13.3.1. Objectives and effects of motion therapeutic exercises: This type of therapeutic exercise aims to restore the basic functions of the muscles and joints in the affected area and get rid of the feeling of pain. We can put these objectives in several points (Roos & Roy, 2018);

- Removing muscle pain and getting rid of muscle spasms that cause these pains.
- Working on restoring the full range of motion of the various bony joints.
- Restoring the speed of the latent voluntary relaxation reaction of the affected area.
- Developing and strengthening the different muscle groups in the area of injury and the surrounding muscles.
- Restoring the flexibility of the affected part to its normal level.
- Returning the injured person to the level of activity she/he was at before the injury or better.
- Preventing complications from the injury.
- Restoring the speed of the latent systolic reaction to the affected area.
- Developing a person's sense of the right situation.
- Increasing the person's interest in knowing the mechanical information of the body and her/his eagerness to perform the treatment program with a sensory-motor concept.

2.13.3.2. The effect of therapeutic exercises on some physiological organs: According to Moseley (2002) therapeutic exercises have a variety of positive effects on various body systems, and these effects include.

2.13.3.3. The effect on the heart and circulatory system: Therapeutic exercises increase the thickness and strength of the heart muscle, increase its functional efficiency, and the amount of blood flowing from the heart to the arteries heading to the muscles. It also widens the blood vessels and strengthens the valves in the arteries and veins (Roy & Anap, 2015).

2.13.3.4. The effect on the muscular system: Therapeutic exercises help in supplying the muscles with oxygen-laden blood and work to nourish them because of the expansion of blood vessels, and increases the elasticity of the muscle fibers. The exercises also improve the efficiency of the force of contraction and relaxation of the muscles and improve muscle tone (Gupta et al., 2022).

2.13.3.5. The effect on the skeletal system: Therapeutic exercises increase the flexibility of the bony joints and increase the nutrition of the bones so that they grow properly, and increase the strength of the ligaments. Therapeutic exercise helps hold the joints strong and protect them from dislocation and improves the mechanics of the bones to increase their size. Moreover, exercises work on improving and restoring the joints properly through reproducing the fluids of the joints, which nourish and facilitate the movement of cartilage. Furthermore, they affect the restoration of the natural state of areas of deviations in strength and some cases of paralysis (Al-Jazzazi, 2021).

2.13.3.6. The effect on the nervous system: Rehabilitation exercises develop the nervous reaction and improve the functions of the nervous system, especially when using strength and speed exercises. The exercises also affect the autonomic nervous system, which is responsible for various emotional states (Twomey & Taylor, 2006).

2.13.3.7. The effect on the digestive system: Therapeutic exercises affect the strength of the digestive system and work to activate and strengthen it. They also work to increase the various secretions, improve the digestion process, increase the absorption of various nutrients, activate the periodic movement of the intestines and treat some cases of constipation. They work to produce the amount of insulin in appropriate quantities that are used to burn excess sugar from the state of the body, which produces energy and maintains the level of sugar in the blood (Farber & Wieland, 2016).

2.13.3.8. The effect on the respiratory system: Exercise enhances the respiratory system, particularly the oxygen-carrying process. This enhancement results from increased oxygen-rich blood pumped from the heart and its subsequent delivery to the active muscles via

blood vessels. Furthermore, exercise improves the efficiency of gas exchange in the lungs and enhances an individual's respiratory capacity. Physical activities also increase muscles' ability to consume oxygen and eliminate carbon dioxide via the exchange of gases between the blood and lungs while enhancing the blood flow through the alveoli. These combined effects lead to deeper breathing and the strengthening of the muscles in the rib cage (Farber & Wieland, 2016).

2.13.3.9. The effect on the immune system: The immune system in the human body consists of small cells called lymphocytes, which are in the form of white balls, while the rest of the cells are based in the lymph nodes, spleen, liver, and red bone marrow. Exercising leads to changes in the blood's defensive ability, as all vital systems adapt to meet the need for effort and modify their functions, which leads to an increase in the number of white blood cells. Results of some studies have indicated that aerobic exercise increases white blood cells; in addition, walking leads to an increase in immune bodies (Burton et al., 2000).

2.13.4. Standards for Developing Therapeutic Exercise Programs (Bigos et al., 1994):

- Ensure the diagnosis and degree of injury and make a decision regarding it (refer to a doctor).
- Determine the appropriate type of exercise.
- Determine the number of sets and repetitions in each group and the rest periods between them.
- Determine the intensity of performance timing, weights, and tools used.
- Install the program before upgrading it or changing the quality of the exercises in the expected duration of the program.
- Train other parts of the body comprehensively without harming the affected area.

2.13.5. Basic Concepts of Rehabilitation: Before starting the rehabilitation program, it is necessary to identify some of the basic factors and principles of the rehabilitation process in order to get rid of the injury correctly and quickly, especially since lower back pain greatly hinders motion in the practice of daily activities. These principles include (Roy & Anap, 2015).

- Identifying the causes of this injury to treat it directly.
- Clarifying the injury status of the injured person and giving him/her the necessary advice to get rid of the injury.

- Working on speeding up the start of the rehabilitation program to avoid any complications.
- Restricting the rehabilitation program to avoid overloading the affected tissues, which leads to increased pain.
- Identifying the motive abilities and the degree of pain of the injured person and implementing the rehabilitation program in a way that suits the ability of the injured person.

2.14. Massage

Massage is utilized as a part of physical therapy to assist individuals in enhancing the functioning of their organs and their overall physical health. Massage has a particular function in curing some injuries, diseases, and the muscular condition of sportsmen before contests, therefore the wounded person should pay close attention to it. Massage has been utilized from the beginning of time. It is recognized to be one of the ancient remedies used in the treatment of various diseases and accidents, enhancing physical ability performance and regaining physical efficiency rapidly, and sustaining it for extended periods of time (Aslan, 2016).

The success of the massage is dependent on numerous factors; consequently, understanding the massage method is insufficient for the masseur’s success. Rather, he or she must be familiar with the physiology and anatomical structure of the body's organs. To achieve the desired outcomes, the masseur must understand the effects of massage on these various organs as well as the effects of the same massage motions on the parts that comprise the body (Kim & Lee, 2013).

2.14.1. The Concept of Massage: Massage is used as one of the important means in the treatment of sports and non-sports injuries, massage is one of the important aspects that are relied upon in preparing athletes and improving the general efficiency of the body. It is easy to apply this type of treatment because of its efficient goals in the quick restoration of injuries through various methods used, which make the selection of the appropriate method for the type of muscle work and the objective of this massage (Ernst, 2003).

The massage process seeks to increase skin function, accelerate and improve blood and lymph circulation, pull blood from the internal organs of the body, stimulate nerves, get rid of waste and sediments in the soft areas of the body, and improve the nutrition process (Bogduk, 2005).

Massage is defined as the practice of directly manipulating the body's soft tissues with the hands or other tools in a scientifically-recognized manner to improve the body's systems and organs and relieve the effects of fatigue, injuries, and certain diseases in athletes and non-athletes alike (Hernandez-reif et al., 2009).

2.14.2. Effect of Massage on Muscles: Physiological investigations have shown that massage that leads to inactive muscles boosts their ability to operate and eliminates weariness (Farber & Wieland, 2016). Massage promotes blood flow to the muscles, which serves to nourish the muscular tissue and restore muscle tone and strength, especially if it is weak due to a lack of physical activity.

If massage movements are used regularly, the massed organ will increase in size, strength, and stability. As a result, blood circulation will improve, and the organ will return to its size and nature. It is obvious that massage can be a good alternative to exercises in case of inability to perform these exercises for any reason (Singla & Veqar, 2017).

Massage helps to secrete acetylcholine, which stimulates the muscle fibers under the influence of nerve signals that pass from the central nervous system to the nerve endings, which positively affects the completion of the process of nervous stimulation. It also creates the appropriate conditions to increase the ability of muscle work (Moayedi & Davis, 2013).

Massaging the stressed muscles for a period of 10 minutes restores not only their ability to work but also increases this ability. Experiments have confirmed that the ability of muscular work increases from 5 to 7 times after performing the massage. The increase in the sensitivity of muscle fibers to stimulation after the massage makes the muscles expand. This can be explained by special attention to the fine muscle fibers inherent in the thickness of the muscle fiber (Stanhope et al., 2019).

Massage improves blood circulation and the process of re-oxidation in the muscles, and it also helps to increase blood flow to the massaged muscle. It also helps to get rid of cases of pain, muscle contraction, swelling, and muscle stress after exercising, and it speeds up the isolation of metabolic results (Al Obaidi & Mahmoud, 2014).

2.14.2.1. The most important effects of massage on the muscles are the following (Brenner, 2005):

- Increasing blood flow in the muscles, which works to nourish the muscle tissue well.
- Getting rid of carbonates and wastes in muscle tissue because of metabolism.
- Regulating muscle tone.

- Getting rid of tension, stress, and muscle pain that may be caused by wrong daily habits or sports activity.
- Relaxing the muscles and improving the state of muscular work.
- Regulating and improving the speed of the voluntary systolic and diastolic reactions of the muscles.
- Regulating and improving the process of regulating energy between muscles and cells.
- Improving the bioelectrical activity of the muscles.

2.14.3. The Importance of Manual Massage for the Back Area: Back is one of the most important parts during massaging, especially if the massage is applied as therapeutic because of the spinal cord within the spine, in which several nerve branches emerge in the form of nerve plexuses that serve to nourish the various areas of the body, the cervical, thoracic, lumbar and sacral, spreading gradually along the body parts and its extremities. As a result, since the brain coordinates all bodily motions, it is able to feel the skin and so receive all bodily feelings. The network of neuronal connections in the skin, which is around 65 kilometers long, is how the brain receives feelings like cold or heat (Engen et al., 2012).

It is crucial to deal thoroughly with the back area during a massage session since it has a significant skin surface area on average; an adult has a body surface area of one to two square meters. This body part is said to be crucial for assessing the masseuse’s response and level of relaxation before the targeted session, which will benefit both the masseur and the masseuse (Spahn et al., 2017).

As much as the person receiving the massage relaxes, releases tension, and benefits from the different massage techniques by working through the entire body, including the nervous system and the various bodily systems, the masseuse's procedures become sequential and simple, and there is significantly less effort required than if the patient is tense. The masseuse may therefore save time and effort as a consequence (Chan et al., 2014).

2.14.4. Effect of Massage on Blood Circulation: Massage helps to secrete many chemicals that affect the capillaries and increase their flexibility, such as histamine and atropine. the blood is emptied after pressing on it with the hands and then filled again when the pressure of the hands is removed. In this way, it is possible to increase the amount of arterial blood heading to the parts under the influence of the massage range, which increases the functional efficiency of those parts. A number of studies confirm that massage removes more

lactic acid from muscles than short waves or ultrasonic frequencies. Some researchers, however, did not come to any conclusions from their experiments that point to an increase in blood or a faster rate of lactic acid removal (Stanek et al., 2017).

At the beginning of the message, the rate of blood flow may significantly rise, but as the massage continues, this increase progressively declines, and the total volume of blood does not increase—instead, there is more blood emptying followed by more blood flow. Accordingly, several brief massage sessions are favored because the massage motions help to stimulate the blood flow in the arteries and the metabolism, secretion, and absorption processes, resulting in increased functional activity in the part or parts susceptible to massage (Singh, 2021).

2.14.5. Physiological Effects of Massage on the Human Body: The reflexive neuro-mechanical nature of the massage is indicated by the excitation of the many-branched nerve terminals found inside the skin's external receptors, tendons, ligaments, muscles original receptors, blood vessels, and internal organs. When nerve impulses flow in response to the stimulation of those receptors, a general reaction occurs in the body, manifesting as functional motions in diverse organs and systems (Cabak et al., 2017).

The characteristics and structures of these physical reactions are determined by the functional state of the upper parts of the central nervous system, the functional state of the receptors being massaged, the methods and types of massage used, and the existence of clinical illness (Field et al., 2007).

Massage also impacts the motion of all fluid media in the body, such as blood, lymph, and inter-tissue fluid, and twists and displaces tissues. The mechanical factor influences metabolic process activation, removes residual phenomena and elevates body temperature in massaged areas (Farasyn et al., 2006).

2.14.6. The Most Important Functions that Massage has on the Circulatory System (Stokes et al., 2007):

- Increasing the attraction of white and red blood cells in the direction of the blood flow.
- Activating hemoglobin in red blood cells.
- Improving the access of nutrients from the blood to cells.
- Reducing blood pressure.

- Improving blood circulation and improving the function of the heart muscle without additional burdens.
- Massage directly affects the dynamic and compressive effect on the vessels, which leads to the emptying of their contents, which generally leads to stimulating blood circulation and improving its functions, the most important of which are.
- Gaseous exchange between tissues and blood, where CO2 moves from cells to venous blood to return to arterial blood to use it in the process of metabolism and release the necessary energies.
- Gaseous exchange between tissues in the body that frees the blood of CO2 and receives O2 from the atmosphere through the lungs.

2.14.7. Effect of Massage on the Lymphatic System (Arnason et al., 2014)**:**

- Massage helps the lymphatic system to function very efficiently.
- Massage helps to activate the lymphatic system, especially if there are dissolved residues.
- Massage increases the absorption property of the lymphatic vessels. It helps absorb large particles and harmful substances that are difficult to permeate the blood through the walls of blood vessels due to the presence of Endothelium cells lining the lymphatic vessels.

2.14.8. Effect of Massage on the Respiratory System: According to recent studies, the percussive and rubbing massage method on the chest muscles and between the ribs increases the depth of breathing. This is especially true when applying energetic motions in the percussive, kneading, and scrubbing massage in the space between the ribs, which deepen the inhale and exhale (Ballenberger et al., 2018).

In sporting applications, the reflex association of the lungs with other devices requires special attention. Massage causes a moderate increase in the gas exchange of 10-20% before physical exertion and a higher increase of 95-130% after physical exercise (Tortora & Nielsen, 2017).

Harmer (1984) indicates that there are different effects of massage on the respiratory system, including:

- Removing congestion from the lungs through percussive and pressure massage movements.

- Massage helps blood flow to and from the heart, allowing blood to reach the lungs at a high level.
- Helping to deepen the respiratory pattern by relaxing and relieving tension in the respiratory structure in the thoracic cavity and the muscles involved in breathing.

2.14.9. Effect of Massage on Joints, Ligaments and Tendons: Massage has a positive effect on the articular system's ligaments, enhances blood flow to the joints and surrounding tissues, stimulates the diffusion of synovial fluid to the inner layer, and makes the bonds more flexible. It enhances the flexibility and durability of ligaments and joint movement, particularly in the elderly and those who have been wounded, as well as joint diseases in the case of loss of movement (Ernst, 1999).

With massage, it is possible to increase the range of motion of the joint and to strengthen the joints and tendons through special massage sessions. Massage also improves joint nutrition and is considered a way to avoid cartilage tissue damage that leads to arthritis for athletes. Massage also acts as an effective means to restore these organs to their natural functions. It also reduces the incidence of joint stiffness and non-elasticity of the ligaments by releasing the attached muscles and ligaments and increases the ease and effectiveness of the movement. It also helps to retain nitrogen, phosphorous, and sulfur in the bones (Kochem & Silva, 2017).

Massage always prevents injuries and has the most significant benefits when sports and training are held in cold weather, and the ligaments apparatus becomes more vulnerable to injury, and it is used, at this time, as a preventive and warm-up for the muscles, ligaments and joints (Ajidahun et al., 2017).

2.14.9.1. Importance is summarized (Sridhar & Vimala, 2012):

- Increasing the smoothness and effectiveness of the motion of the joints.
- Stimulating blood circulation, which leads to the nutrition of the joints.
- Reducing the roughness of the joints and the lack of elasticity of the ligaments by releasing the contracted muscles and ligaments.
- Increasing the range of motion in the joints and preventing the occurrence of articular stiffness.
- Retaining sulfur, phosphorous and nitrogen in the bones, which makes it an important factor in the fast recovery from fractures

2.14.10. The Effect of Massage on the Digestive System and the Process of Food Absorption: The effect of massage on the process of food absorption in the stomach is very important as the movements of massage help to increase the secretions of the glands of the alimentary canal which helps in digestion and increase the metabolism process. Because of the increase in the activity of the blood circulation and the lymphatic system, there is improvement in the digestive process represented in the following (Blanco-Piñeiro et al., 2015) :

- Improving the absorption process.
- Increasing the improvement of the diffusion of digestive juices.
- Improving the activity of the liver's portal cycle.
- Retaining the normal movement of the digestive canal because of many dysfunctions of the movement of the stomach and intestines.
- Increasing kidney excretion of fluids and protein wastes for metabolism, inorganic phosphorous, and salt for normal individuals.
- Facilitating the involuntary contraction that occurs in the walls of the large intestine.
- Helping to get rid of involuntary contraction or colic in the digestive area.

2.14.11. Effect of Massage on the Circulatory System: There are many important effects of massage on the physiological organs of the body, as they improve their functional states and raise their practical efficiency such as (Nishiyama & Tsuchida, 2016):

- Increasing fiber nutrition through the exchange of fluids and energy-producing substances.
- Increasing blood flow in the veins and arteries, which helps to stimulate blood circulation.
- Speeding recovery of the affected tissues because of improving the efficiency in the blood circulation through massage.
- Improving heart rate and decreasing blood pressure.
- Helping to get rid of waste products resulting from the metabolism process.
- Reducing pain caused by irritation of the nerves that control the work of the circulatory system through pressure and excitation.
- Helping the flow of blood loaded with food to the various muscles.
- Reducing swelling and bruising associated with muscles.
- Expanding blood vessels improves the speed of blood flow.

2.14.12. The Effect of Massage on Metabolism: It indicates that some studies confirmed the effects of massage on the metabolism inside the human body. Massage leads to an increase in diuresis and oxygen consumption by (%10-15), and affects the increase in sweat secretions, knowing that sweat comes out of the body with various salts, some nitrogenous substances, and lactic acid. The studies investigating the link between massage and the rate of lactic acid excretion from the body after exercise found that when massage is conducted in large muscles that do not participate in physical activity, lactic acid oxidizes at an increasing rate (Blanco-Pineiro et al., 2017).

2.14.13. The Effect of Massage on the Functional States of the Body: In addition to the mechanical and physiological effects of massage on various body systems, it is possible to confirm that massage contributes to changing the functional state of the body. Some factors are related to the effect of massage on the body, including the length and continuity of performance, the nature and style of sessions in terms of speed and strength, and also related to the number of sensory organ receptors that receive alerts and the extent of the massage. The functional state of massage's influence on the body may be divided into three fundamental directions (Stanhope et al., 2019).

2.14.14. Refreshing Effect: This is related to the intense currents of nerve impulses generated by massaged muscles and sent to the neurological system in the brain. Massage is used to compensate for the lack of stimulation of the sensory organs. The refreshing impact of massage on the body is obtained by utilizing powerful types of massage, kneading, beating, and rocking to stimulate nervous system activity, provided that these types are utilized in a short period of time and in a quick manner to produce the desired effect (Sagar et al., 2007).

2.14.15. The Sedative Effect: The sedative effect of massage is connected to the rhythm, moderation, and constant alertness of the body’s sensory organs. This sedative effect on the body is achieved by performing a continuous rhythmic scanning massage for lengthy periods of time, which, unlike a refreshing massage, includes large surfaces of the body muscles, back, buttocks, and thigh. In other words, short movements and constant and gradual scrub massage reduce nervous system activity (Bogduk, 2005).

In sports applications, we often resort to the sedative effect when necessity requires reducing the nervous system alert process that appears within players, known as initiating anxiety or nervous tension (Stanek et al., 2017).

2.14.16. Nutritional Effect: The effect of massage appears in strengthening and improving the supply of tissues and organs with the necessary oxygen and nutrients and this is the result of stimulating the metabolic process. As the nutritional effect has a very significant role in restoring muscle capacity, we find that the stimulating effect of the message appears in the functional changes that lead to an increase in the functioning of the nervous system, as summarized in the following (Cygańska, et al., 2017):

- It improves regeneration processes in cells.
- It forms effective acetylcholine, which works to increase the speed of nerve signal delivery to the muscles.
- It activates the biological energy of the muscles.
- It helps to increase the temperature of the tissues, which results in the activation of the metabolism process.
- It improves muscle contraction performance.
- It forms histamine, which dilates the blood vessels.

2.14.17. Functions Organizational Effect: There are numerous important effects of massage on the dynamics of nervous processes in the brain. It is well known that the effect of massage on regulating the dynamics of nervous processes is significantly important in the sports field, particularly during training periods when the processes of excitement and disability in the nervous system are fully controlled. Massage's influence on functional regulation may be seen in the strengthening and regeneration of tissues, as well as the elimination of atrophy, which is important in treating injuries and disorders (Aparicio et al., 2016).

2.15. The Importance of Manual Massage

Massage has long been used to cure injuries and ailments due to its various methods. Numerous scholars are interested in manual massage treatment, not only in sports medicine but also in other domains such as sports biology and physiology, sports injuries, and so on. Some pharmacological treatment methods have used manual massage therapy as an extra or alternative method. It has been merged with physiotherapy sessions in various treatment facilities as well as in the sports sector, where it has become frequently employed throughout hospitalization procedures, and some of its results are detailed below (Árnason et al., 2014):

- Manual massage helps relieve pain.

- Manual massage has an effective effect in cases of nerve injuries, especially paralysis, muscle tears, strain, dislocation and fracture. It is more effective if combined with therapeutic exercises.
- It restores and excites protein.
- It alerts the secretion of cortisone in the blood.
- It restores the natural state of many components of metabolism affecting royamin and acetylcholine.
- It restores the normal levels of triglyceride and phosphate concentration and reduces the level of cholesterol in the blood.
- It helps reduce the level of uric acid in the blood.
- It restores the normal state of carbohydrate metabolism.
- Stimulates and alerts the blood circulation in the skin.
- It stimulates blood circulation in the various organs and systems of the body.
- It improves the state of arterial and venous blood pressure.
- It helps absorb infiltrates into tissues and joints and reduces pain.
- It restores the normal state of some mixed nervous substances.
- It improves the levels of immunity and does not make the body susceptible to infection. In addition to reducing appetite barriers and eliminating stress and anxiety.
- It activates the movements of red and white blood cells and hemoglobin.

2.15.1. Cases in Which Using Manual Massage is Not Acceptable (Ballenberger et al., 2018):

- In cases of fever and severe high temperature.
- In cases of acute (miscellaneous) infections.
- In cases of impaired blood circulation.
- In cases of bleeding.
- In cases of neurological and mental diseases.
- In cases of cancer and tuberculosis.
- In cases of gallstones or stones in the bladder, and some bladder diseases.
- In cases of various skin diseases and burns.
- In cases of recent fractures that have not yet healed and open wounds.
- In recent cases of tearing or cutting that occur in muscle fibers.

2.16. Physical Therapy

Physical therapy is defined as the use of natural means such as heat, water, and electricity after legalizing them on scientific grounds in treatment. Physiotherapy is a science and art that contributes to developing health and preventing disease by understanding the movement of the body. It works to correct and achieve the effects of disease and injury, and its means of treatment include evaluation and treatment of patients, management, and supervision of physiotherapy services and their workers. It is distinguished by the following characteristics: consultation with other health systems, preparation of records, reporting, participation, community planning, projects and future plans, and evaluation of educational programs. Physiotherapy is also one of the branches of modern medicine that appeared in Western countries first and then famed in the East, which stresses its significance and usefulness in treating many injuries. It also refers to physiotherapy centers in various government hospitals and their effective contribution to this type of treatment, its significance for paralysis arteriosclerosis, and others (Lee et al., 2012).

Recent years have witnessed great development and diversity in the means and techniques used in physical therapy. Physiotherapy treatment does not cause any side effects. It can be used and applied for all ages and stages of life and for various types of injuries, diseases and disabilities, as well as for all parts of the body. Therefore, many means and techniques have been developed. The old one was also developed based on the same principle. However, it was developed in order to increase the therapeutic effect, shorten the time, or in order to double the effect of more than one factor. All aim to reach the maximum level in the rehabilitation of the injured and the back to sports activities or the rehabilitation of non-athletes (Kochem & Silva, 2017).

2.17. Chiropractic

Chiropractic is the art, science, and philosophy of maintaining health in the body. The chiropractor's objective is to ensure proper cell communication by way of preserving optimal nerve function. Furthermore, chiropractors are trained to find misaligned vertebrae that cause nerve pressure; the chiropractor then relieves the nerve pressure by restoring appropriate joint alignment and mobility (Baadjou et al., 2014).

2.17.1. Benefits of Chiropractic (Kok et al., 2016):

- Restore proper nerve signals and mind/body connection by removing any interference.
- Restore proper joint motion.

- Restore proper joint alignment.
- Restore proper body biomechanics.
- Restore proper muscle tone and strength.
- Prevent degenerative joint/disc disease.
- Ensure optimal immune response.
- Pain relief is a beneficial side effect.

CHAPTER 3

METHOD

The researcher utilized an experimental method to achieve the study's objectives and hypothesis because it is appropriate to the nature of the study and its objectives in the way of pre and post-measurements for two groups; an experimental group and a control group.

3.1. Participants

The participants were chosen intentionally from male patients. They were 45 who suffered from lumbar disc herniation. They were aged between 30 and 50 years old. The irregular patients were not selected. The study population is patients who suffer from lumbar disc herniation and who visit Prosthetic Limbs Center Hospital in Sana'a and It was approved by the Ethics Committee in 25/02 /2022 with No 61351342 February 2022 - 49.

Ten patients were selected as the control sample and five patients who did not meet the conditions were excluded to ensure the authentication of the study. The patients were selected according to the following criteria:

- A positive diagnosis of lumbar disc herniation.
- Transferred patients to the physiotherapy unit by the specialist physician.
- Not being treated by other treatment methods during the implementation of the program.
- Volunteered to be treated by the proposed program.

3.1.1. The Experimental Group: It is the group that is subject to the proposed rehabilitation program, which includes chiropractic, therapeutic exercises and massage in a systematic and organized method. The experimental group consists of 30 patients who suffer from lumbar disc herniation. The total period of the program was 12 weeks, and the total number of sessions in the program was 72 sessions divided into 6 sessions every week. The time of the session varies from one stage to another, starting from 45-60 min. to 120-135 min. divided between therapeutic exercises, chiropractic, and massage.

3.1.2.The Control Group: It is the group that used the traditional program, which includes rehabilitation exercises not similar to the exercises of the experimental group, ultrasound devices, tennis devices, and tension devices, which were developed by a physiotherapist. The control group consists of 10 patients who suffer from lumbar disc herniation. The total period of the program was 12 weeks, and the total number of sessions in

the program was 72, divided into 6 sessions every week. The period of the session was 30-50 min..

3.2. Experimental Procedures

After defining the study problem, hypotheses, sample and the tools used in data collection, the study steps were implemented as follows.

3.2.1. Exploratory Study: The researcher conducted an exploratory study from 11/08/2019 to 12/09/2019 in the Physiotherapy Unit - Prosthetic Limbs Center Hospital in Sana'a on a sample of 3 patients who met the conditions of sample selection and they were not from the research sample.

3.2.2. The Exploratory Study Aims To*:*

- Identify the appropriateness of the proposed program using chiropractic, therapeutic exercises and massage for those who suffer from lumbar disc herniation for the participants of the study sample.
- Determine the different stages of the rehabilitation.
- Test the validity and safety of the devices and tools used in the rehabilitation program.
- Determine the time of the appropriate rehabilitation exercise session of the experiment.
- Determine the appropriate massage session time for the experiment.
- Determine the necessary rest periods of each patient between each exercise.
- Identify the challenges that may occur during the experiment.

3.2.3. Results of the Exploratory Study*:*

- Suitable location for the experiment.
- Training in conducting study measurements.
- Determining the type and time of massage on the body at each stage of the program.
- Determining the format of the form of recording the research data and measurements.
- Discovering and avoiding the challenges that may occur during the implementation.

3.2.4. The Fundamental Study: The researcher implemented the fundamental study from 01/03/2021 to 01/06/2021 for 30 patients who met the conditions and specifications of the sample. They were divided into two groups as follows.

3.2.4.1. Experimental group: They are the participants to whom the proposed rehabilitation program is applied so that the patient is given the following: Chiropractic, therapeutic exercises, and massage to those who suffer from lumbar disc herniation in 6 sessions every week.

3.2.4.2. Program's protocol: The researcher conducted a comprehensive survey through references, research, and rehabilitation programs, which were set by physical therapy and rehabilitation centers. Also, he obtained information and references from different universities, the internet, previous studies, and translations of foreign books in order to get the latest studies from international institutions that implemented programs in chiropractic, therapeutic exercises, and massage. It was found that the latest and best methods of treatment and which have the most important roles are chiropractic, massage, and therapeutic exercises, as well as their effect on the rehabilitation and treatment of people who suffer from lumbar disc herniation.

The rehabilitation program was presented to experts to find out their points of view during the stages of the program, the exercises used in each stage and their suitability to the nature of the study as well as the achievement of the objectives set for each stage, this was done depending on experts' points of view, which were designed by the researcher, after collecting experts' points of view and analyzing the results; some exercises were deleted and added until the program was in its final form, which the researcher identified in the following points.

- The treatment method used in the proposed rehabilitation program includes chiropractic, massage, and therapeutic exercises.
- The total period for the proposed rehabilitation program is 12 weeks.
- The proposed rehabilitation program was divided into three stages. The duration of each stage is 4 weeks.
- The number of sessions every week during the implementation of the program stage is six every week.
- The session time for the implementation stages of the proposed rehabilitation program is as follows:
- The session time in the first stage is 45-60 min..
- The session time in the second stage is 90-105 min.
- The session time in the third stage is 120-135 min.

3.2.4.3. Conditions of selecting experts: The areas of expertise of the experts have varied due to the variety of areas of the investigation on which the expert would express his point of view and also assist the researcher by offering information, advice, and guidance.

- In general, the researcher took into account the following conditions during the selection of the experts.

- Consultant spine surgeon.
- Professor of orthopedic surgery or physical medicine in one of the specialized colleges.
- Have a Ph.D. in sports health sciences and sports rehabilitation.
- A physiotherapist has been working in this field for no less than ten years.
- Have a Ph.D. degree in tests and measurements.

3.2.4.5. The proposed rehabilitation program: *(the objectives of the proposed rehabilitation program).*

- Reducing the intensity of pain and making it cured completely.
- Increasing the size of back muscles.
- Increasing the strength of the abdominal muscles.
- Increasing the range of motion of the back muscles.

3.2.4.6. Conditions that must be followed during the implementation of the proposed program:

- Exercises should be performed within the limits of pain.
- The proposed rehabilitation program should be applied individually for each stage.
- The rehabilitation unit begins with general warm-up exercises for the body as a whole, then exercises for the injury, and finally, relaxing exercises.
- Paying attention to the rehabilitation exercises that affect the muscle strength, the range of motion, and the balance in the proposed rehabilitation program.
- Paying attention to training the undamaged limb during the implementation of the rehabilitation program in order to apply the principle of balance between the limbs, which is common in physical therapy as one of the foundations of its application.
- Starting with static passive exercises, then positive move exercises.
- Gradual training loads, taking into account the rest periods.
- Paying Attention to therapeutic massage and exercises.
- Taking into account the patient's psychological state and working to make the patient trust himself/herself and the treating specialist.

3.2.4.7. Control group: These are the participants on whom the conventional program is implemented, providing the patient with the following:

- Hospital treatment sessions.

- Rehabilitation exercises that are not similar to the exercises of the experimental group.
- Not using chiropractic.
- Not using therapeutic massage.
- The program was implemented inside the Prosthetic Limbs Center Hospital in Sana'a after obtaining the approval of the head of the center.

3.3. Data Collection Tools

- Many foreign references and recent research that studied this issue before.
- Previous research related to the study topic.
- The World Wide Web.
- Points of view of experts and specialists in the study topic and the proposed rehabilitation program.
- The researcher's previous experiences in the scientific and practical field.
- Multiple forms, such as forms of each patient to register the following:

The measurements of (the range of forward, backward, right and left side motion of the spine, back muscles strength, and pain degree.

3.3.1. Anthropometric Measurements: The researcher studied some scientific references, studies, and previous scientific research related to the topic of this study, which dealt with the main axes of this study in terms of the effect of chiropractic, therapeutic exercises, and massage on patients suffering from lumbar disc herniation in Yemen. He did so based on the results of the theoretical reading related to the study and according to its requirements. The researcher then employed the following data-gathering methods and instruments.

- Morris Pain Scale to measure pain degree.
- Kinematic range meter goniometer 'Goniometer.'
- Muscle strength measuring device 'Dynamometer.'
- Chiropractic Chair.
- Height measuring device 'Restameter.'
- Medical scale for measuring weight.
- Assistant tools to implement the program, such as the following:
- Plastic balls in different sizes.
- Cones and sticks.
- Massage table.

- Massage oil.
- Measuring tape.
- Stopwatch.

3.3.2. Personal Interviews: The researcher conducted some personal interviews with massage, tests, and measurement experts of the faculty members and workers in the field of sports injuries and sports medicine to discuss and know their experience and also to take benefit from their points of view. Then he conducted personal interviews with the study sample to know how the injuries happened and when they were injured and to explain the performance and application of study variables.

3.3.3. Height Measurement: The Restameter Device was used to measure the height. The participant stands on the wooden stage and must consider the body's tension and look forward. Then the holder is lowered until it touches the upper edge of the skull. The number facing the holder expresses the height of the participant (Maiers & Salsbury, 2021).

3.3.4. Weight Measurement: A medical scale was used to measure the weight in kilograms. The patient stands vertically in the middle of the scale with both feet without looking down when measuring and was taken the body weight for patients (Sefton et al., 2010).

3.3.4.1. Pre-measurements: Pre-measurements are made before starting the implementation of the proposed program in order to know the condition of the patient since the beginning of the measurements. Then the measurements are recorded and written down with the precision of the range of motion, the strength of the back muscles, and the pain degree.

- Measuring the motion range of the spine forward using a Goniometer.
- Measuring the motion range of the spine backward using a Goniometer.
- Measurement of the range of right side motion of the spine using a Goniometer.
- Measuring the motion range of the spine's left side using Goniometer.
- Measuring the strength of the back muscles using a Dynamometer.
- Measuring pain degree by using Morris Pain Scale. The patient was given a pre-prepared Roland-Morris Disability Questionnaire and answered the questions that were most relevant to their pain. Their score was determined according to the Roland-Morris Disability Scale.

3.3.4.2. Post-measurements: The post-measurements are made with the same procedures carried out in the pre-measurements, which was after the completion of the proposed program to know the extent of progress and improvement of the patient's condition from the beginning of the pre-measurements until the end of the program.

3.4. Data Analysis

After applying study measurements and recording data, the researcher wrote down those data and then put them in special tables in order to make it easy to apply the statistical procedures.

In the light of the objectives and their procedures and after applying the program of the study, the researcher recorded the data, wrote them down, and put them in tables in order to make it easy to do the statistical procedures by using the SPSS program in order to measure the following:

- Descriptive statistics arithmetic mean, standard deviation, skew coefficient, improvement percentage.
- Wilcoxon Z Test for the indication of differences between the two groups in each of pre and post measurements.
- The indication P was accepted in the morale level of 0.05 and approximated the numbers to three decimal numbers.

CHAPTER 4

RESULTS AND COMMENTS

The results of our current study, with regard to improving the strength of the back muscles, are in agreement with the study of Lorimer Moseley (2002) that the use of therapeutic and rehabilitative exercises leads to a significant improvement in decreasing the level of pain for the sample participants suffering from lower back pain and regaining the flexibility of the trunk strengthening the abdominal and back muscles.

Table 4

Describe the expemimental group and control group in the variables of age, height, weight for the study sample.

Variables	**Experimental Group (N=30)**		**Control Grup (N=10)**	
	$\bar{x}$ ± SD	Skewness	$\bar{x}$ ± SD	Skewness
Age (Year)	*36.200±3.75*	*0.524*	*38.80±3.61*	*0.398*
Height (cm)	*166.26±6.20*	*0.439*	*166.60±6.22*	*0.059*
Body weight (kg)	*70.06±10.76*	*0.114*	*74.30±4.64*	*1.245*

p<0.05

Table 4 indicates the arithmetic mean and normative deviation to the variables of age, height, and body weight for the control study sample. It also explains that skew coefficient was confined between ±3 for the variables of age, height, and weight of the study, which indicates the homogeneity of the sample members in those variables.

Also in table 4 indicates the arithmetic mean and standard deviation to the variables of age, height and weight for the experimental study sample. It also explains that the skew coefficient was confined between ±3 for the variables of age, height and body weight of the study which indicates that the study samples are identical in those variables.

Table 5

Descriptive statistics and the indication differences between the two groups.

Variables	**Experimental Group (N=30)**		**Control Grup (N=10)**		
	$\bar{x}$ ± SD	Skewness	$\bar{x}$ ± SD	Skewness	**p**
Age (Year)	*36.20±3.75*	*0.524*	*38.80±3.61*	*0.398*	***0.809***
Height (cm)	*166.26±6.20*	*0.439*	*166.60±6.22*	*0.059*	***0.574***
Body weight (kg)	*70.06±10.76*	*0.114*	*74.30±4.64*	*1.245*	***0.100***
BMI (kg/m^2)	*25.43±4.20*	*0.668*	*26.84±2.72*	*0.301*	***0.921***

p<0.05

Table 5 presents an analysis of the descriptive characteristics of the two groups and shows no significant statistical difference between them, indicating that the groups were

homogeneous in those categories prior to the implementation of the program. Table 6 provides information on the arithmetic means and standard deviations of the BMI variables for the experimental and control groups. Additionally, the skew coefficient values for the BMI variables under investigation were within the range of ±3, indicating homogeneity among the sample participants in these variables. The results below show the differences between the pre-and-post measurements between an experimental and control group for all the variables under consideration.

Table 6

Descriptive statistics and significance for anthropometric variables in pre-measurements of the experimental and control groups.

Variables	Experimental Group (N=30)			Control Group (N=10)			
	Mean	**SD**	**Skw.**	**Mean**	**SD**	**Skw.**	**p**
Range of motion of the spine forward (cm)	*38.90*	*11.43*	*0.02*	*42.80*	*8.90*	*0.94*	***0.548***
Range of motion of the spine backward (cm)	*39.10*	*15.05*	*0.78*	*38.90*	*11.0*	*0.96*	***0.377***
Range of motion of the spine right side(cm)	*44.03*	*11.77*	*0.562*	*40.70*	*8.26*	*0.13*	***0.687***
Range of motion of the spine left side(cm)	*44.13*	*12.59*	*0.379*	*43.80*	*11.1*	*0.07*	***0.427***
Back muscle strength(kg)	*3.45*	*1.41*	*0.846*	*4.70*	*1.29*	*0.62*	***0.687***
Level of Pain (v.a.s)	*59.36*	*16.58*	*0.016*	*59.70*	*16.90*	*0.38*	***0.687***

$p<0.05$ **SD:** Standard Deviation **Skw:** Skewness

Table 6 indicates the arithmetic mean and standard deviation of the anthropometric variables in pre-measurements of the experimental and control groups. And was measurement for the range of motion of the spine forward, range of motion of the spine backward, range of motion of the spine right side, range of motion of the spine left side, and rack muscle strength .The spine coefficients' values of the physical variables were limited to ±3, which indicates the homogeneity of the two groups in those variables.

Table 7

The significance of differences between pre- and post-measurements of each study variable within the experimental group usin the Wilcoxon test (Z).

Variables	Direction of ranks	Mean rank	Sum of ranks	Z	p
Range of motion of the spine forward	-	*0.00*	*0.00*	**4.783*	***0.000***
	+	*15.50*	*465.00*		
Range of motion of the spine backward	-	*0.00*	*0.00*	**4.787*	***0.000***
	+	*15.50*	*465.00*		
Range of motion of the spine right side	-	*0.00*	*0.00*	**4.787*	***0.000***
	+	*15.50*	*465.00*		
Range of motion of the spine left side	-	*0.00*	*0.00*	**4.787*	***0.000***
	+	*15.50*	*465.00*		
Back muscle strength	-	*0.00*	*0.00*	**4.782*	***0.000***
	+	*15.50*	*465.00*		
Level of Pain	-	*15.50*	*465.00*	**4.793*	***0.000***
	+	*0.00*	*0.00*		

$p<0.05$ Experimental group N=30

Table 7 indicates that there is a statistical and significant difference between pre-and post-measurement in favor of post-measurement of the experimental group in all the variables under study.

Table 8

The arithmetic mean and the ratio of change in the pre- and post- measurements of the variables under study within the experimental group.

Variables	Pre-measurement Mean	Post-measurement Mean	Rate of improvement %
Range of motion of the spine forward	*38.900*	62.5333	60.65
Range of motion of the spine backward	*39.1000*	63.6333	*62.73*
Range of motion of the spine right side	*44.0333*	62.3667	41.64
Range of motion of the spine left side	*44.1333*	62.3000	41.16
Back muscle strength	*3.4553*	11.9260	71.029
Level of pain	*59.3667*	16.7333	71.18

Experimental group N=30

Table 8 manifests the ratios of change in pre-and-post-measurements of the experimental group arithmetic mean, which shows an improvement throughout the variables of the study, indicating the great impact of the training program used. The rate of improvement for all variables was categorized from highest to lowest and estimated at 71.18 % in reducing the level of pain, 71.029 % in back muscle strength, 62.73 % in back spine range of motion,

60.65 % in range of motion of the spine forward, 41.64 % in right side spine range of motion, and 41.16 % in left side spine range of motion.

Table 5

The significance of differences between pre- and post- measurements of each study variable in the control group using the Wilcoxon test (Z).

Variables	Direction of ranks	Mean rank	Sum of ranks	Z	p
Range of motion of the spine forward	-	*0.00*	*0.00*	*2.539	***0.011***
	+	*4.50*	*36.00*		
Range of motion of the spine backward	-	*0.00*	*0.00*	*2.816	***0.005***
	+	*5.50*	*55.00*		
Range of motion of the spine right side	-	*0.00*	*0.00*	*2.816	***0.035***
	+	*5.50*	*55.00*		
Range of motion of the spine left side	-	*0.00*	*0.00*	*2.060	***0.039***
	+	*3.00*	*15.00*		
Back muscle strength	-	*0.00*	*0.00*	*2.803	***0.005***
	+	*5.50*	*55.00*		
Level of Pain	-	*5.50*	*55.00*	*2.812	***0.005***
	+	*0.00*	*0.00*		

p<0.05 Control Group N=10

Table 9 indicates that there is a statistical and significant difference between pre-and post-measurement in favor of post-measurement of the control group in all the variables under study.

Table 6

The arithmetic mean and the ratio of change in pre- and post- measurements of the variables under study within the control group.

Variables	Pre-measurement mean	Post-measurement mean	Rate of improvement %
Range of motion of the spine forward	*.428000*	*45.000*	*5.23*
Range of motion of the spine backward	*38.9000*	*41.8000*	*7.455*
Range of motion of the spine right side	*40.7000*	*41.7000*	*2.45*
Range of motion of the spine left side	*43.8000*	*45.8000*	*4.566*
Back muscle strength	*4.7060*	*5.4810*	*16.468*
Level of pain	*59.7000*	*48.5000*	*18.760*

Control Group N=10

Table 10 manifests the ratios of change in pre-and-post measurements of the control group arithmetic mean, which shows an improvement throughout the variables of the study,

indicating the great impact of the training program used. The rate of improvement for all variables was categorized from highest to lowest and estimated at 18.76 % in reducing the level of pain, 16.468 % in back muscle strength, 7.455 % in back spine range of motion, 4.566 % in left side spine range of motion, and 2.45 % in right side spine range of motion and, 5.23 % in range of motion of the spine forward.

CHAPTER 5
CONCLUSION, DİSCUSSİON AND SUGGESTİONS

5.1. Discussion

The study employed two programs for two distinct groups of 40 individuals diagnosed with lumbar disc herniation. The first group comprised 30 patients and was designated as the experimental group, while the second group consisted of 10 patients and served as the control group. Chiropractic treatments, massage, and therapeutic activities were recommended as part of the experimental group's program. First, the chiropractic program showed its practical effect on patients by measuring them before and after using it, and the findings favored measuring after the program. Second, the therapeutic massage program positively affected the experimental group's patients, and these findings were obtained in favor of the measurement following the program, making the patients experience a considerable improvement. Third, the therapeutic exercise program had a positive effect, as the measurement results after the program differed much from the measurement findings before the program.

This program was combined into a single program for patients in the experimental group; the control group was measured before conducting the hospital program, which included various activities such as ultrasound, tennis, and traction, as well as therapeutic exercises and regular massage. We found the program results were weak compared to the program for the thesis since the differences were visible and detailed in this chapter.

The program included various variables on various organs and muscles, the most essential of which measured pain levels before and after running the program. The findings of the measurement were precise in favor of the post-measurements in significantly reducing the level of pain from the initial days, and the varied range of motion of the spine in the front was also weak. The post-measurement outcomes were favorable, with patients recovering quickly and effectively.

In terms of the kinetic range variable of the posterior spine, the patients' movement level before and after the program was outstanding in both measurements. Simultaneously, the participants' kinetic range variable on the right side of the spine was extremely low, and after applying the program, the range of motion on the left side of the spine improved significantly. The results demonstrated an improvement in the participants' spinal range of motion before and after the training.

As for the kinetic range variable of the posterior spine, the movement level of the patients in the measurement before and after the program was excellent. At the same time, the kinetic range variable of the left side of the spine was very weak for the participants. after

applying for the program, the range of motion became much better, and the variable range of motion of the spine on the left side showed an improvement in the range of motion of the participants, clearly before and after the program.

The findings of the back muscle strength variable in the measurements after the program's application showed that the back muscles have become stronger than they were before the program, indicating the validity and efficiency of the proposed program.

A experimental group comprising 30 patients who underwent the hospital's program was randomly selected from a total population of individuals aged between 30 and 50 years, with weights ranging from 60 to 80 kg and heights ranging from 158 to 177 cm. The selection was based on referrals by a specialist doctor in the hospital, considering their X-ray results and medical examinations of lumbar herniated discs.

A control group comprising 10 patients who underwent the hospital's program was randomly selected from a total population of individuals aged between 30 and 50 years, with weights ranging from 60 to 80 kg and heights ranging from 158 to 177 cm. The selection was based on referrals by a specialist doctor in the hospital, considering their X-ray results and medical examinations of lumbar herniated discs. Notably, the participants' results differed from the expected program outcomes, and the pre-and post-measurement findings were notable.

5.1.1 Discussion of the Variable Range of Motion of the Spine Forward: The experimental and control groups showed statistically significant differences in the range of motion variable of the spine forward between pre-measurement and post-measurement. The improvement in tables 9 and 11 suggests that the experimental group's improvement rate for the post-measurement in the range of motion variable forward was higher. The percentage of improvement for the experimental group was 60.65%. On the other hand, the percentage of improvement for the control group was 5.23% .

5.1.2 Discussion of the Variable Range of Motion of the Spine Backward: There were statistically significant differences between the pre-measurement and the post-measurement in the range of motion variable of the spine backward for the research sample for the post-measurement group. There are also statistically significant differences between the experimental group and the control group. Tables 9 and 11 indicate that the experimental group exhibited a 62.73% improvement in the range of motion variable of the spine backward, while the control group exhibited only a 7.455% improvement. These findings suggest a significant and superior improvement in the experimental group compared to the control group (Aure Urits et al., 2006).

5.1.3. Discussion of the Range of Motion Variable for the Spine Right Side: There were statistically significant differences between the pre-measurement and the post-measurement in the range of motion variable of the spine right side for the research sample for the two groups. Furthermore, there are statistically significant differences between the pre-measurements and the post-measurements in favor of the post-measurement. According to Tables 9 and 11, the post-measurement improvement percentage of the range of motion variable for the spine's right side favored the experimental group by 41.64%, while the control group showed only a 2.45% improvement. These findings suggest that the experimental group demonstrated a significantly superior improvement in the range of motion variable for the spine's right side compared to the control group (Fahmy et al., 2019).

5.1.4. Discussion of the Range of Motion Variable for the Spine Left Side: There were statistically significant differences between the pre-measurement and the post-measurement in the range of motion variable of the spine’s left side for the research sample for the two groups. Furthermore, there are statistically significant differences between the pre-measurements and the post-measurements in favor of the post-measurements. Tables 9 and 11 demonstrate that the post-measurement improvement percentage of the range of motion variable for the spine's left side favored the experimental group by 41.16%, while the control group showed only a 2.56% improvement.

The researcher attributed the difference in the level of improvement in the motion range variables forward, backward, right side, and left side between the two groups experimental and control in the pre-measurement and post-measurement in favor of the post-measurement to the effect of chiropractic, therapeutic exercises, and massage that were applied to the research sample of the experimental group, which included flexibility exercises that were positively applicable without aiding in performance. These exercises have a significant effective impact on improving the degree of motion range and the elasticity of tendons, ligaments, and muscles, and the use of manual massage in various ways increases the flexibility and durability of ligaments and joint movement, which also leads to an increase in motion range.

This is consistent with the study of Urits et al., (2019) that performing various rehabilitation activities and receiving manual massage improves the range of motion for those with lower back pain and helps them regain their trunk flexibility. While according to the study of Atchison et al., (2021), in addition to reducing discomfort, the use of a rehabilitation program that includes central manual massage and rehabilitation exercises helped to strengthen the muscles in the lower back and lower abdomen. The rehabilitation exercises assisted in

increasing trunk flexibility, achieving a healthy range of motion, and regaining muscle strength in the injured area and the muscles around it.

The results of this study in table 9 of the present study corroborate the findings of Twomey and Taylor's (2006) investigation, which indicated that rehabilitation exercises could rapidly and effectively promote the recovery of the spine's normal functions, and enhance the lumbar region's range of motion and flexibility. Thus, the study results were similar to the results of this study regarding the motion variable. Similarly, the results of the study of Malkia and Ljunggren (1996) indicated that the application of a rehabilitation program that includes rehabilitation exercises together for people with lower back pain works to strengthen the muscles in the lower back as well as reduce pain and develop the motion range in the trunk area. It also indicates, quoting from Joseph et al., (2018), that practicing a physical-motion program strengthens the muscle group and supports the lumbar region while increasing the flexibility of the spine in various directions in general and the lumbar region in particular, which helps relieve lower back pain.

The results of both studies were comparable, and they agreed with the outcomes highlighted in Table 9 and the current study concerning the variable of motion range in all directions. Particularly, the results of this study are consistent with the results of the study of Javaheri et al., (2011). The impact of the combined therapeutic protocol exercise therapy and massage on the quality of life in a cohort of male patients with chronic low back pain brought on by disc herniation. In his study, there were 15 male participants in the experimental group underwent an eight-week implementation of the combination regimen. It resulted in an improvement in life quality on both a physical and mental level for patients with herniated lumbar discs in the test group. This study is identical to our study in every way.

The findings of this current study also agree with the results of Burton et al., (2000), that the use of therapeutic exercises and therapeutic massage achieves a high percentage of improvement in the level of bending the trunk forward-down by up to (74-140%) and the level of bending the trunk right and left sides by up to (21-45%) as well as reducing the level of pain sensation by up to (4-32%). The results of our current study, with regard to improving the strength of the back muscles, are in agreement with the study of Moseley (2002) that the use of therapeutic and rehabilitative exercises leads to a significant improvement in decreasing the level of pain for the sample participants suffering from lower back pain and regaining the flexibility of the trunk strengthening the abdominal and back muscles. Its results support the effectiveness of combined physical therapy in bringing about symptomatic and functional change in moderately disabled chronic low back pain patients in this study.

The results of the current study, as in table 9, show that the improvement in the motion range variable is consistent with the findings of Romanowski & Grzekowiak (2012), who observed pain relief, increased mobility range in all directions, and improved balance after implementing a therapeutic exercise program on 26 individuals with lower back pain. Finally, the results of this study agree with the study of Burton et al., (2000) regarding the results of improving the level of pain, which aimed to identify the effect of the use of chemotherapy and manual therapy on the nucleus of the lumbar disc herniated disc, and its results indicate a decrease in the pain lower and back of the manually treated participants more than the chemically treated participants within three weeks.

5.1.5. Discussion of the Back Muscular Strength Variable: According to Wilcoxon Test (Z), there were statistically significant differences between the pre-measurements and post-measurements regarding the variable back muscle strength of the research sample participants for the experimental group and the control group. Furthermore, there are statistical differences between the pre and post-measurements in favor of the post-measurements. The improvement rates shown in tables 9 and 11 demonstrate that the post-measurement improvement percentage of the back muscle strength variable was 71.029% for the experimental group, while the control group showed an improvement rate of 16.468%.

The difference in the level of improvement in the muscular strength variables for the back between the two groups in pre and post-measurements is linked to the adoption of suitable therapeutic exercises for the injury in terms of muscle work direction and intensity in the rehabilitation units. This is also attributable to the intermittent rest periods applied to the study sample participants in the experimental group, as well as the application of manual massage with adequate ways of pain area and for sufficient durations of time.

Therapeutic exercises strengthen the muscles of the lumbar region and the muscles surrounding it, which has an effective effect on reducing muscle pain in the lower back. The use of exercises improves muscle strength and raises the level of efficiency and muscular work. Massage helps boost muscular function, stimulate and enhance blood and lymph circulation, pull blood from the body’s internal organs, stimulate nerves, remove waste and sediments from body parts, relieve muscle tension, and improve the nutrition process in the muscles (Hubley-Kozey, 2002).

We found in our study that chiropractic exercises and massages are based on strengthening the muscles of the lower back, which has an effective effect in reducing muscle pain in the lower back. The study’s conclusion is that chiropractic exercises and massages,

which aim to strengthen the lower back muscles, have a significant impact on reducing muscle pain in the lower back and aiding in the recovery from a herniated lumbar disc.

The findings of this study, as presented in all tables, are consistent with previous research. First, it concurs with the study of Liddle et al., (2004) that rehabilitative exercises strengthen the existing muscles and reduce muscle pain in the lower back and lower abdominal muscles. Second, it aligns with the results of the study by Russo et al., (2017) in the positive effect on increasing muscle strength in the lower back area, reducing pain, and increasing range of motion. The two researchers proved through their studies that rehabilitative exercises and manual massage have a positive effect on increasing muscle strength in the lower back area, reducing pain, and increasing the motion range. Third, it agrees with the study of Imamura et al., (2007) that the application of a program of standardized rehabilitation exercises to patients suffering from low back pain works to reduce the intensity of pain and strengthen muscle groups in the lumbar region, abdomen, and surrounding muscles and improve the flexibility of the trunk of the injured. Fourth, the study of Preyde (2000) also supports the findings of our recent study on pain relief. His research demonstrated that massage improves muscles capacity to perform and reduces weariness. It functions to stop muscle weariness. Additionally, massage improves the efficiency of muscular activity. Additionally, massage increases the passage of blood to the muscles, which nourishes the muscular tissue and improves its tone and strength, particularly if it has become weak due to a lack of casual exercise. Regular massage techniques will result in larger, stronger, and more stable muscles, as well as improved blood flow. Muscle weariness can be eliminated with massage as well because of normal movements and casual stress. It is obvious that massage can be a good alternative to exercises in case of inability to perform these exercises for any reason. Fifth, the current study agrees on the rate of pain reduction with the study of Aure et al., (2003). The study demonstrated that massage aids in the secretion of acetylcholine, which stimulates muscle fibers under the impact of nerve impulses that go from the central nervous system to nerve endings, favorably affecting the completion of the neurostimulation process. Massage also creates the appropriate conditions to increase the muscle's work capacity and increase its size, which helps to increase blood flow to the massaged muscle and reduce pain and muscle contraction. The results of the study by the researchers are consistent with the results of the current study on reducing pain.

5.1.6. Discussion of the Degree of Pain Variable : There were statistically significant differences between the pre-measurements and post-measurements regarding the degree of pain variable of the research sample participants for the experimental group. Furthermore, there are statistical differences between the pre and post-measurements in favor of the post-

measurements. The improvement rates in Table 9 and Table 11 indicated that the improvement percentage for the post-measurement in the degree of pain variable for the experimental group was 71.029%, while the control group's improvement was 18.760%.

The researcher attributes the contrasting level of improvement in the back muscle strength variables between the two groups during the pre-and post-measurements in favor of the post-measurement to the use of massage in the experimental group. The positive impact of massage therapy can be attributed to its ability to make injured individuals feel more comfortable before commencing rehabilitation exercises. Additionally, it has both psychological and physiological benefits for injured individuals during the practice.

The use of rehabilitative exercises according to the nature of the injury in terms of muscle work direction and intensity in rehabilitation units, with rest times in between, has a positive impact. Moreover, the use of manual massage with appropriate methods for sufficient periods has a positive effect. It significantly speeds up the work to relax the nerves, reduces the speed of adhesion formation and the sensation of pain, and improves the speed of nerve influence and the conduction of nerve signals. This is possible because of repeated massage operations to acquire the status of a conditional reflex alert. These results of the current study are in agreement with the study of Şahin et al., (2018), in which it is obvious that the use of rehabilitation exercises has a positive effect on reducing pain in the lower back area.

The results of the current study also agree with the study of Hosseinifar et al., (2013) in using rehabilitation exercises and movement programs that strengthen the muscles supporting the lumbar region in particular, which helps relieve lower back pain. Also, this is consistent with the study of Şahin et al., (2018) that the use of rehabilitative exercises and sports massage has a significant impact on the speed of relieving the pain associated with the lower back and regaining its basic functions. Additionally, rehabilitative exercises are one of the best and safe treatment and rehabilitation methods for relieving pain and increasing the range of motion of the affected area. The study of Brenner (2005) also confirms that the use of manual therapy and therapeutic exercises on lower back pain reduces the rate of pain. This is also consistent with Cherkin et al., (2011) study, which found that massage treatment may effectively cure chronic low back pain and provide benefits for at least six months. It also influences how quickly people can get rid of discomfort.

The researcher attributed the increase in the rate of improvement in the degree of pain variable for the first experimental group over the second experimental group and the control group is due to the use of massage in the first experimental group. Furthermore, massage has

an effect on relieving pain before starting the rehabilitation exercises and feeling physical and psychological comfort after completing the rehabilitation session.

The study of Herrera et al., (2010) agrees that the use of massage has an effect on decreasing pain sensation, as cooling numbs the sensation of pain. Hartigan et al., (2000) also agree that the use of therapeutic and sports exercises with people suffering from chronic low back pain has a positive and significantly effective effect on getting rid of such pain and that exercising does not have any adverse effect or pain on them from the foregoing.

The proposed rehabilitation program for the experimental group clearly achieved the best results for all research variables and fulfilled the hypothesis of our study, which states that chiropractic, therapeutic exercises, and massage have a positive effect in alleviating pain, improving back muscle strength, and increasing the motion range of the spine in favor of the experimental group and post-measurements.

According to Taimela et al.,'s (1999) study, lumbar disc herniation occurs when the lumbar discs become suddenly tense, rupturing the fibrous capsule that surrounds the joint. This causes the nucleus of the disc to protrude from the disc, putting pressure on the nearby nerves, muscles, back ligaments, blood vessels, and other tissues.

Injury can happen suddenly or gradually over the course of weeks and months and can be influenced by age, lifestyle, or improper spine positioning. These findings coincide with those of the training group in our earlier study. In the study by Burton et al., (2000), titled "A Controlled Trial Using Chemotherapy and Manual Therapy for the Treatment of Lumbar Herniated Disc," patients with lumbar herniated discs were divided into two groups, and manual therapy and chemotherapy were used to treat the patients.

The most significant findings were a greater reduction in pain severity for patients treated manually than for patients treated chemically within 3-2 weeks, and these findings are consistent with those of our current study in terms of reducing pain severity. In the study by Iwamoto et al., (2011) titled Return to Sports Activity after Rehabilitative Prosthetic Treatment for Lumbar Herniated an injured athlete group consisting of 72 male and 28 female athletes was treated using an experimental approach and a rehabilitative compensatory exercise program. The results of this study are consistent with our study on therapeutic exercise in that it showed that therapeutic exercise significantly reduced the symptoms of lumbar disc herniation by more than 80%.

In a study by Frih et al., (2009) titled "Efficacy and Treatment Compliance of a Home-based Rehabilitation Program for Chronic Low Back Pain (CLBP)," the researchers treated lower back pain brought on by lumbar disc herniation using an experimental approach. One

hundred and seven patients with lumbar disc herniation were included in this study. The experimental group significantly improved in the study's physical tests, and these findings were physically similar to those of our study.

5.2. Results

The following conclusions were reached in light of the researcher's findings, keeping in mind the limitations of the research's sample, its sample size, the means of all data, the statistical analysis methods employed, and the presentation and discussion of the results.

1. Using the proposed program, which includes chiropractic, therapeutic exercises and massage, to improve the variables of the following experimental group.
2. Rapidly reducing the degree of pain in the lumbar area.
3. Increasing muscle strength of the back muscles.
4. Increasing the range of motion of the spine forward.
5. Increasing the range of motion of the spine backward.
6. Increasing the motion range of the spine right side.
7. Increasing the motion range of the spine left side.
8. The use of therapeutic exercises for the experimental group led to an increase in muscle strength in the variable back muscle strength.
9. The use of chiropractic improved the level of pain and range of motion in a very short period.
10. The use of massage led to the loss of the feeling of pain, which had a positive effect on performing the therapeutic exercises and gaining the patients a sense of comfort and improving their psychological state.
11. The use of stretching exercises for the experimental group led to an increase in the range of motion of the trunk area in general and the spine.
12. The use of manual massage gave the patients in the experimental group a feeling of physical and psychological relaxation.
13. Chiropractic, therapeutic exercises, and massage helped to strengthen the muscles of the lumbar area, which led to a reduction in pain and an improvement in the range of motion of the spine.
14. The results showed that the program used, which includes chiropractic, therapeutic exercises, and massage, is the most effective in improving the pain variable. This was shown by increasing the rates of improvement of the rates of change of the post-measurements from the pre-measurements and the percentage of improvement between the experimental and control groups, especially the experimental group.

15. The use of manual massage at the beginning of the rehabilitation unit helped to lose the feeling of pain, which helped to improve the psychological state of the injured and prepare to perform chiropractic and therapeutic exercises in an active and lively manner.

5.2.1. Challenges

1. The study was put on hold for several months due to the Covid-19 outbreak.
2. Multiple measurements were made when applying the program.
3. Applying the proposed program to each patient individually.
4. The irregularity of some of the participants in the experiment led to the exclusion of five patients.
5. The preoccupation of many experts and their failure to empty the evaluation and express their opinion on the tools used and the proposed program prolonged the evaluation and opinion time.
6. The desire of the injured to go back rapidly to practicing daily life, even if it does not achieve a full recovery.
7. The civil war in Yemen made the study period longer, and it was difficult to travel from one city to another.

5.3 Suggestions

In light of the research objectives, hypothesis, statistical treatments used, and the proposed rehabilitation program through the research results and discussion, the following can be recommended:

1. Pursuing the rehabilitation program used to treat lower back pain, which consists of (chiropractic, therapeutic exercises, and massage).
2. Therapeutic exercises are used with gradual intensity and to the extent of pain.
3. Manual massage is used after rehabilitation exercises, which helps in physical relaxation.
4. The daily rehabilitation unit must be preceded by sufficient rest time after practicing daily activities.
5. Doing the massage after the rehabilitative exercises because of its ability to shrink the blood vessels. When the massage is finished, the blood vessels expand, the affected tissues expel the chemical remains, and the muscles are nourished with oxygen or sugar.
6. Using various rehabilitation exercises to improve the muscle strength of the muscles of the lower back and surrounding muscles.

7. Using manual massage on the affected muscles to get rid of carbonates and wastes in muscle tissue because of metabolism and increase their strength.
8. Using Chiropractic by a specialist to treat the affected areas of the spine.

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APPENDICES

Ethics Committee Approval

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ÜSKÜDAR ÜNİVERSİTESİ
GİRİŞİMSEL OLMAYAN ARAŞTIRMALAR
ETİK KURULU BAŞKANLIĞI

SAYI: 61351342/ŞUBAT 2022-49 **25/02//2022**

Sayın Prof.Dr.Erkut TUTKUN
(Amer Ahmed Ali ALWASEL)

Üsküdar Üniversitesi Girişimsel Olmayan Araştırmalar Etik Kurulunun **25/02/2022** tarihinde yapılan **03** No.lu toplantısında **"Yemen'de Lomber Disk Hernisi (Bel Ağrısı) Yaralanmalarında, Terapatik Egzersizler, Kayropraktik ve Masaj Etkinliği"** adlı araştırma projenizin etik açıdan uygun olduğuna karar verilmiştir.

Bilgilerinize rica ederim.

Prof. Dr. Cumhur TAŞ
Girişimsel Olmayan Araştırmalar Etik
Kurulu Başkanı

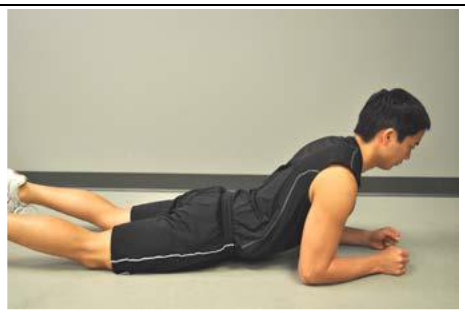
The Program

A. **Therapeutic Exercises Program** :

1: Lying on stomach
Lay on stomach with arms under your shoulders or down at your side.
Head facing down or turned to one side.
Take deep breath and relax.
Hold 5 min
Frequency: 6 times per day for 12 week

2: Lying on pillow
Take deep breath and relax. Hold 5 min.
Frequency: 6 times per day for 12 week

3: Prone on elbows
Lay on stomach, place your elbows under your shoulders so you are resting on your forearms.
Take deep breath and relax.
Hold 30 sec, repeat 10 times.
Frequency: 6 times per day for 12 week



4: Prone Press-ups

Lay on stomach, place your hands under your shoulders.

Slowly straighten elbows, keeping lower body relax while raising the back upwards as far as pain will allow.

Hold 10 sec, repeat 10 times.

Frequency: 6 times per day for 12 week

5- Finding Pelvic Neutral

Tighten AB muscles, draw belly button in, flatten your back.

Technique: Hiss like a snake / Say the letter “S”. ‘sssssss’

Try to pull out towel with your hand.

A proper core contraction should prevent the towel from moving.

This is your starting position for all core exercises!

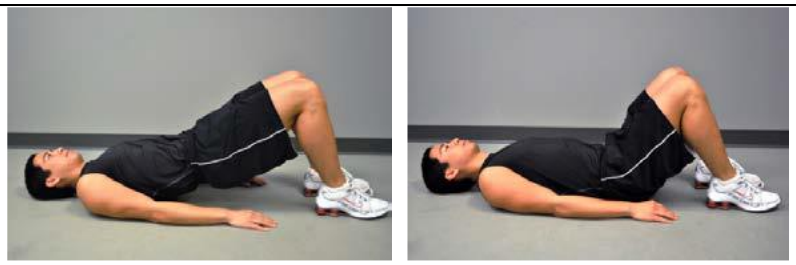
for 12 week

6- Quadruped
Find Pelvic Neutral.
Extend one arm, extend opposite leg.
Hold 10 sec. Change arms/legs.
Keep hips level, avoid back extension.
Frequency: 1 max set. Once a day. for 12 week
Rationale: Core control with movement.

7- Prone Plank
Find Pelvic Neutral.
Balance on Elbows. Squeeze Gluts.
Hold Position. Avoid Back Extension.
Frequency: 1 max set. Once a day. for 12 week
GOAL: *Good*: 2 m. *Great*: 3-5 m.
Rationale: Entire Core Muscles.

8- Superman
Lie on stomach with arm extended overhead
Extend arms and legs. Arms parallel to ears.
Hold Position 10sec. Avoid excessive back extension.
Frequency: 1 max set. Once a day. for 12 week

Rationale: Glut, Hamstring, Back Muscles.

9- Double Leg Bridge
Lie on back with both knees bent 90 degrees.
Slow raise hips up towards the ceiling
Hold 5 sec. for 12 week
Frequency: 1 max set. Once a day
Goal: Increase gluteal strength

B. Chiropractic Program:
Use the 6 time per week for 12 week
Benefits of Chiropractic :
Restore Proper Nerve Signals (Mind/Body Connection) by removing any interference
Restore Proper Joint Motion
Restore Proper Joint Alignment
Restore Proper Body Biomechanics
Restore Proper Muscle Tone and Strength
Prevent Degenerative Joint/Disc Disease
Insure Optimal Immune Response
Pain Relief is a Beneficial Side Effect
C. **Massage Program** Use the 6 times per week for 12 week.

We will do relaxing and stimulation massage for spine and lower limb
The researcher used traditional massage for 30 minutes for the purpose of calming down in a circular way for the trunk and the lower limb