RADIOLOGICAL LUMBAR SPINE ANATOMICAL CHANGES IN CHRONIC LOW BACK PAIN AND ITS SOCIAL IMPACT IN WESTERN KENYA

BY

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DECLARATION

This research thesis is my original work and has not been presented for award of degree in any university.

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DEDICATION

To my parents Mr. and Mrs. Bernard Papa whose life experience for the girl child education, their encouragement and sacrifice towards the provision of my education gave me a foundation and a vision that has enabled my academic achievements. To my loving husband; Dr. Stephen Buluma for his motivation and boundless support towards this nobble task and my lovely children; Brian, Violet, Joy and Patience for their unrelenting support during many demanding and challenging moments.

ABSTRACT

Chronic low back pain (CLBP) is defined as pain that lasts for a period of twelve weeks or more and can develop later even after the associated cause of the acute low back pain has been managed and remarkably resolved. It is the commonest musculoskeletal complaint that most patients present with in the outpatient department accounting for 77-85% of the cases globally and the leading cause of disability with both adverse psychosocial and economic implications. Diagnostic techniques with low specificity in various health institutions have created many gaps in understanding the nature and anatomical structures implicated in chronic low back pain. Proper understanding of the anatomical structures associated with chronic low back pain can lead to early diagnosis and proper management of the condition. Therefore, the aim of this study was to establish radiological lumbar spine anatomical changes in chronic low back pain of adult patients and its social impact at Kakamega County General and Referral Hospital which had the largest number of patients presenting with chronic low back pain. The study specifically ;(i) determined radiological changes in the lumbar spine of adults presenting with chronic low back pain, (ii) assessed the social impact of chronic low back pain in adult patients at Kakamega and (iii) determined the association between the severity of chronic low back pain with the socio demographic profiles of these patients. A target case group of patients with CLBP in the outpatient and emergency departments including those on follow up for pain management clinic was used with a sample size of 144 patients as per Yamane Taro formula. Purposive sampling of lumbar spine Magnetic resonance imaging scans was used to obtain data. Personal and societal impact of patients with chronic low back pain was assessed using Oswetry modified questionnaire. Data analysis was done using SPSS version 22.0. and descriptive data such as frequencies, mean, mode and median were presented into tables and graphs. It was established that females were more prone to chronic low back pain as compared to males. Patients with weight above 75kg were more likely to develop chronic low back pain. Osteophytes were the most pathological changes affecting both casual laborers, professionals and business people while fractures were the least common. Most of the social activities were affected with moderate pain. It can be concluded that osteophytic changes of vertebra, desiccation and spinal narrowing can predispose one to chronic low back pain. Pain impacts the emotional wellbeing and work productivity of an individual. Individuals weighing >75kg are more predisposed to lumbar spine changes that cause chronic low back pain. The study therefore recommends early screening and treatment to avert pain and weight reduction to lessen the mechanical damage on the lumbar column.

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LIST OF ABREVIATIONS

AF **:** Annulus fibrosus

CLBP **:** Chronic low back pain

GBDS **:** Global burden for disease studies

IVD : Intervertebral discs

IASP **:** International Association for the study of pain

KCGRH **:** Kakamega County General Referral hospital

L1 **:** 1st Lumbar vertebra

L2 : 2nd Lumbar vertebra

L3 : 3rd lumbar vertebrae

L4 **:**4th lumbar vertebra

L5 **:** 5th lumbar vertebra

MRI : Magnetic Resonance Imaging

MUERC : Maseno university ethical and review committee

NACOSTI : National commission of science technology and innovation

NP **:** Nucleus pulposus

S1 **:**1st Sacral vertebra

T12 **:**12th Thoracic vertebra

WHO **:** World health organization

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CHAPTER ONE

INTRODUCTION

1.1 Background information of the study

Lower back also referred to as the lumbar region or spine is described as the area of the spine that is located inferior to the twelfth thoracic vertebrae (T12) ending at the superior part of the first sacral vertebrae (S1) (Munsif, 2016). There are several structures that make up the lumbar spine namely the soft tissue, five movable vertebrae (L1- L5), intervertebral discs, zygapophyseal joint and neurovascular structures (Gray, 2000). The lumbar vertebrae (L1 –L5) are usually stacked together to form part of the spinal canal. The spinal canal acts as a tunnel housing the spinal cord and its respective nerves therefore preventing it from injury. The lumbar vertebra provides strong structural support to the upper part of the spine and is also connected to the pelvis(Netter, 2018). It bears most of the body's weight, stresses of lifting and carrying items. The lumbar spine is designed to bend inward in order to create a C- lordotic curve shape.

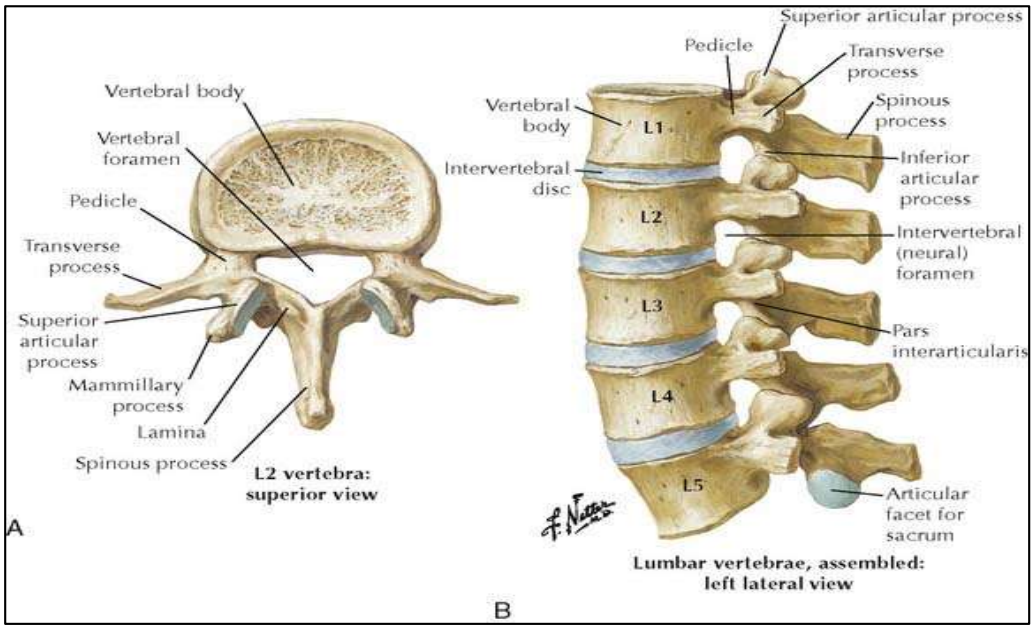

Figure 1.1: Illustrating the Lumbar vertebrae. Where A is the Superior view of a typical lumbar vertebra and B is the Lateral view of articulated lumbar vertebrae. (Netter, 2018)

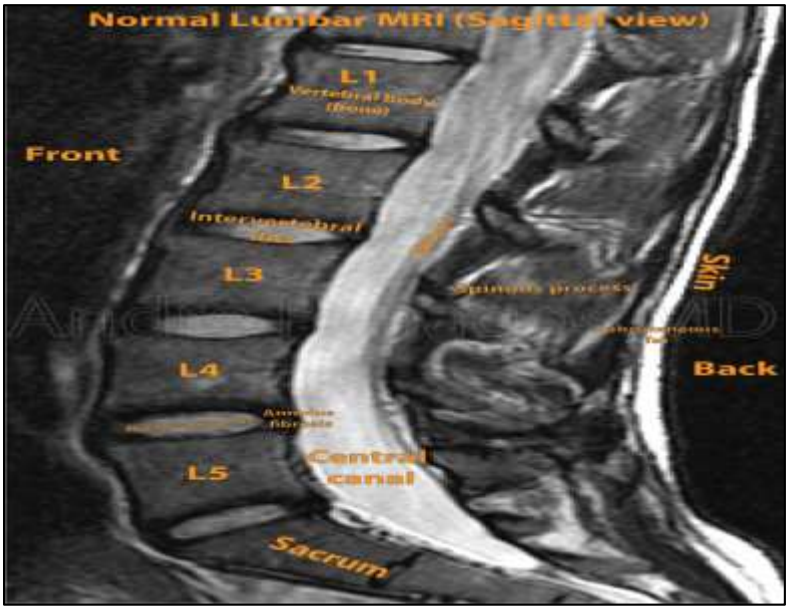

Figure1.2: illustrating sagittal view of the normal lumbar spine (adopted from Andre panagos 2015)

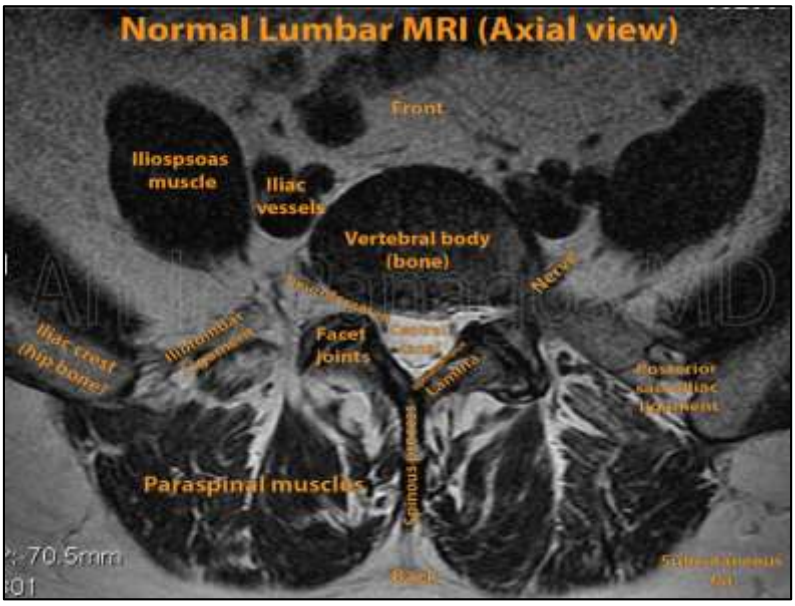

Figure 1.3: Illustrating the axial view of the normal lumbar MRI (adopted from Andre Panagos 2015).

This complex anatomy of the lumbar spine (Figures 1.2 and 1.3) above is as a result of strong combination of vertebrae, multiple joint elements with capsules, soft tissues, highly sensitive

nerves with complicated innervation and blood supply(Nelson *et al*., 2014). Therefore, the lumbar spine has been designed to be incredibly strong, to support body weight and provide movement while lifting and carrying items(Hayashi *et al.,* 2019). These structures are usually prone to several stressors and injuries leading to chronic low back pain(Verbrugghe *et al.,* 2019).

Chronic low back pain (CLBP) is one of the common musculoskeletal symptoms that affect the lower part of the spine (El-Tallawy *et al.,* 2021). It is described as pain and discomfort around the lumbar region lasting for more than twelve weeks (Traeger *et al.,* 2019). The global burden of disease studies (GBDS) defines chronic low back pain as "Pain in the area around the posterior aspect of the body from the lower margin of the twelfth rib to the lower gluteal folds with or without pain referred to one or both lower limbs that lasts for a period more than twelve weeks". Generally pain in the lower back can be associated with skin covering the lower back, muscles, lumbar vertebrae, intervertebral discs, spinal cord, neurovascular structures as well as internal organs of the pelvis and abdomen(Nelson *et al.,* 2014). Several anatomical structures are associated with chronic low back pain, thus the pain can either be nociceptive, nosiplastic, neuropathic or non-specific pain(Knezevic *et al.,* 2017). Each of these pains can occur solely or overlap with each other based on the severity of pain or illness. The symptoms of chronic low back pain might range from dull ache to a stubbing or shooting sensation. This nature of pain may be localized around the axial region or radiate to the lower limbs affecting the patients' daily activities(Seminowicz *et al.,* 2011).

The effects of chronic low back pain can be very devastating in severity resulting into physical disability(Geurts *et al.,* 2018). Severe low back pain after injury may be felt during coughing or micturition and can also be associated with loss of bowel or bladder control, weakness of the lower limbs and even fever(Dutmer *et al.,* 2019). The severity of pain is dependent on the anatomical

structure of the low back affected or injured (Cedraschi *et al.,* 2016). Due to the severity and chronicity of pain, it has led to persistent absence from work and the commonest reason for seeking medical treatment in primary health care settings(Wu *et al.,* 2020). The combination of these effects has resulted into social, psychological and economic problems in the society globally.

Chronic low back pain affects persons of all age groups, same sex, different ethnic groups globally with equal severity but its prevalence varies with age (Hurwitz *et al.,* 2018; Maher & Ferreira, 2022). The bio psychosocial model on chronic low back pain alludes that there is a dynamic and a direct relationship between biological, psychological and social factors that both influence and aggravates chronic low back pain(Hartvigsen *et al.*, 2018).These bio psychosocial factors are very critical and therefore a multidisciplinary approach should be adopted as it relates to its management and rehabilitation strategies.

The management of chronic low back pain is basically dependent on the type and severity of pain(Middleton & Fish, 2009). It usually starts with self-care and pharmacotherapy. Sometimes based on the assessment of the health care provider, non-pharmacological methods like physical therapy can also be helpful to the patient (Tousignant-Laflamme *et al.*, 2017). Most treatment options for chronic low back pain are costly and only address one attributable cause(Seminowicz *et al.,* 2011). This has resulted into persistency and chronicity of pain leading to costly hospital frequent visits, absentia from work places and psychosocial disturbances(Wu *et al.,* 2020).

In regards to the complex nature, causes and costly management of chronic low back pain with its related social, psychosocial and economic effects; this research will specifically focuses on improving the accuracy and objectivity of assessing anatomical structural changes of the lower spine on MRI implicated in causing chronic low back pain .This will help to generate a scientific

radiological and diagnostic knowledge on the anatomical structures associated with the development of chronic low back pain phenomena to the dynamic medical World . This will greatly help the health care professionals in making proper diagnosis in order to give appropriate management to patients with chronic low back pain. Therefore, improving patients' health and activity as well as prolonging pain free life.

1.2 Statement of the problem

Chronic low back pain (CLBP) is the commonest musculoskeletal complaint that most patients present with in the outpatient department accounting for 77-85% of the cases globally (Nieminen *et al.,* 2021). The point prevalence rate of CLBP by the International Association for the study of pain (IASP) in 2017 was estimated to be about 7.5 % of the total global population. In Africa , the mean prevalence rate of CLBP is approximated to be 33% in a adolescents and 50% in adults (Downing & Elias, 2016). However, in Kenya there is paucity of data regarding common spinal anatomical changes implicated in chronic low back pain and its related personal and societal impact. In addition, chronic low back pain prevalence, its main spinal lumbar anatomical causes identified through Magnetic resonance Imaging and socio-demographic patterns of chronic low back pain at KCGRH is still largely unknown or not well documented. The proper diagnostic methods of CLBP also remain a subject of controversy and have been greatly influenced negatively by low specificity of imaging and other intervention.In this regard, this research will help to improve on scientific knowledge on the anatomical structures that relate to chronic low back pain which shall be guided diagnostically by radiology. This will be beneficial to health care providers offering therapeutic management, counseling and meaningful health education to patients with chronic low back pain thus improving their quality of life.

1.3 Objectives of the study

1.3.1 Broad objective

To evaluate radiological changes in the lumbar spine of adults presenting with chronic low back pain and its social impact.

1.3.2 Specific Objectives

i. To determine radiological changes in the lumbar spine of adults presenting with chronic low back pain at Kakamega County General and Referral Hospital.
ii. To assess the social impact of chronic low back pain in adult patients at Kakamega County General and Referral Hospital.
iii. To determine the association between the severity of chronic low back pain with the socio demographic profiles of these patients.

1.4 Research Questions

The following questions have been formulated to guide the study:

i. What are the radiological changes seen in patients with chronic low back pain?
ii. What is the social impact of chronic low back pain in these patients?
iii. What is the association between the severity of chronic low back pain and the socio demographic characteristics these patients?

1.5 Justification of the study

CLBP is the commonest disorders encountered by physical therapist (Edward Shipton, 2018). The approximated health related costs to chronic low back pain globally account for 75-90% (Geurts

et al., 2018). Moreover, a significant group of population with CLBP has greatly been associated with reduction in quality of life resulting from poor health, comorbidities and increasing health related costs (Romanenko, 2016) . Diagnostic techniques with low specificity in various health institutions have also created many gaps in understanding the nature and anatomical structures implicated in chronic low back pain(Knezevic *et al.,* 2017). The proper knowledge on the prevalence of CLBP locally, its main radiological spinal lumbar anatomical causes, socio-demographics and clinical profiles of these patients at KCGRH would be very useful in providing additional information to the limited body of knowledge that already exists. This baseline information is useful as guides future research in regards to epidemiology of chronic low back pain. The accurate information on the breadth, and spectrum of chronic low back pain is beneficial to the patients in terms of timely diagnosis and management, KCGRH health care providers and all the health care system an understanding of lumbar spine anatomical structures and related changes associated with chronic low back pain is important in health care provision because it leads to better resource planning, proper allocation and patient centered health care delivery.

1.6 Significance of the study

Proper understanding of lumbar spine structural changes diagnostically proven through MRI associated with CLBP is essential to patients as well as health care providers. This will greatly help the health care professionals in making timely proper diagnosis in order to give appropriate management to patients with chronic low back pain. Therefore, improving patients' health and activity through drastic reduction of patients' medical costs and frequent hospital visits thus prolonging pain free life. The knowledge obtained from this study will also be disseminated to the medical training institutions and all health care providers. The ministry of health benefits from

the study since the study may help in the formulation of policies in regards to prevention, care and management of chronic low back pain.

1.8 Limitations and Delimitations

High cost of MRI examination which made the examination inaccessible to some study subjects.

1.9 Delimitations

Patients were advised to enroll into national health insurance fund (NHIF).

CHAPTER TWO

LITERATURE REVIEW

2.1 Functional Anatomy and the biomechanics of the lower spine

2.1.1 Vertebrae

The lower spine is basically composed of the five lumbar vertebrae (Figure 2.1), which are bony elements usually cylindrical in shape(Netter, 2018). These vertebrae increase in size from L1- L5 (Figure 2.2) in order to accommodate the load that usually increases progressively. Between these vertebrae are the intervertebral discs as illustrated in figure five below with nucleus pulpous (NP) located in the central part and annulus fibrosus forming a peripheral ring(Kasai *et al.,* 2009).The MRI of the lumbar spine can either be highlighted in length wise sagittal view(Figure2.1) to show the lumbar vertebrae and the spinal cord .

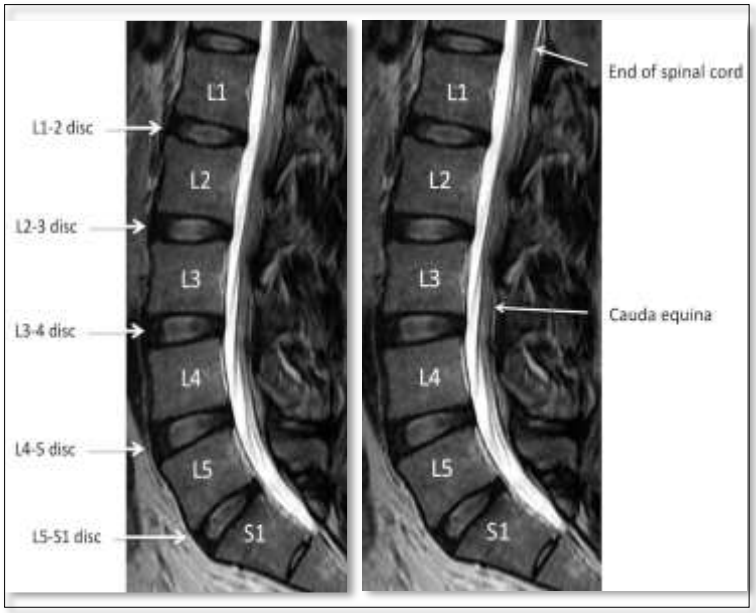

Figure 2.1: Illustrating the sagittal view of the normal lumbar spine MRI adopted from (Ibrahim et al., 2015)

The vertebral body

This is the anterior part of the vertebra (Kasai *et al.,* 2009). Each vertebral body consist of pedicles that project posteriorly from the vertebral body. These pedicles form the only connection linking the posterior joints of the segment with the vertebral bodies both providing tensile and bending forces respectively(Standring *et al.,* 2005). The muscles of the back that are attached to the lumbar vertebra usually pull downwards hence directly transmitting the muscular force to the vertebral body. This muscular force being transferred via the pedicles which serve the purpose of a lever; subjects the vertebrae to bend at a certain degree(Pérez *et al.,* 2003). For instance, in circumstances that the vertebral body slides forward, then the inferior articular processes usually lean on against the superior articular processes of the next lower vertebra hence providing strong resistance against the slide produced. Therefore, the resistive forces in general are usually transmitted to the vertebral body via the pedicles.

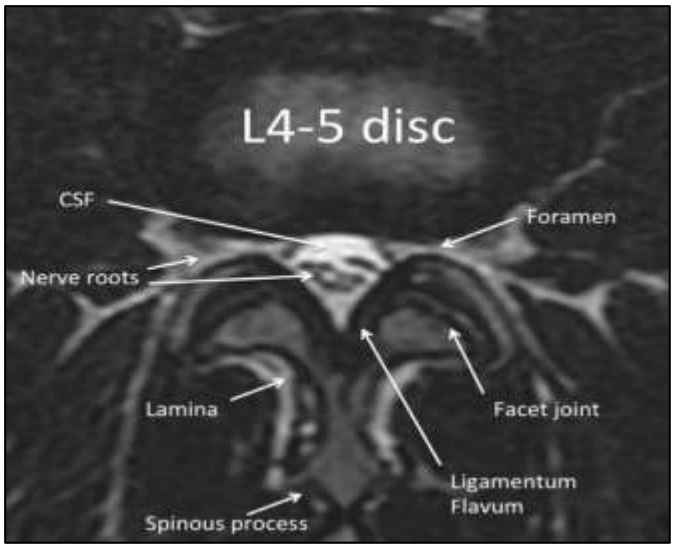

Figure 2.2: Illustrating the Axial view of MRI Lumbar spine Anatomy adopted from (Dunn, 2020)

The laminae (Figures2.2) are generally strong, short and broad forming the posterior part of the vertebral arch. Their function is to take up the various forces transferred through the spinous and articular processes respectively(Goleman *et al.,* 2016). The pars interarticularis serves as a link between the vertically oriented lamina and pedicle which runs horizontally thereby leading to withstanding of the bending forces. The two laminae usually connect and unite with one another, to form an arch called the vertebral or neural arch. This neural arch acts as a bony channel for the passage of spinal cord. The transverse and the spinous processes of the vertebral body both serve as important areas or points for attachment of lumbar muscles(Levy *et al.,* 2010; Snell, 2018).

2.1.2 Intervertebral Disk

Annulus Fibrosus (AF)

Generally, the upper and lower surfaces of the lumbar spine vertebral bodies are relatively wider, sizeable and evenly flat which reflects their function to transfer the heavy load of the body. The disc of the lumbar vertebrae has a relatively cylindrical shape , which is usually ascertained by the unity ,stability and strength of the annulus fibrosus (AF)(Netter, 2018). The AF contains nearly 10–12 and sometimes as much as 15–25 coordinated sheets that are made up of majorly type I collagen fibers. These fibrous materials are connected together by proteoglycan gel. Normally, the layers of annular numerically decreases with advancing age, although, there is continuous increase in size layers that remain(Seminowicz *et al.,* 2011). These fibers are directed about 65 degrees coming from vertical direction. The fibers of every sheet sequentially or lamella usually maintain constant the leaning of 65 degrees, even so, inversely directed to the adjacent lamella. This ensures that each subsequent fibrous sheet is directed towards the same inclination. Therefore, considerably a half of the fibers of the total sum is always experiencing stressful forces accompanied by at least rotational forces within any stipulated period of time. This variation in the

direction of fibers in every lamella is crucial in necessitating the ability of the disk to withstand the forces created through torsion or twisting.

The appearance of the disc which is wedge-shaped produced by the configuration and arrangement of the lamellae gives the lumbar spine the normal lordotic appearance or shape(Heetun, 2006).

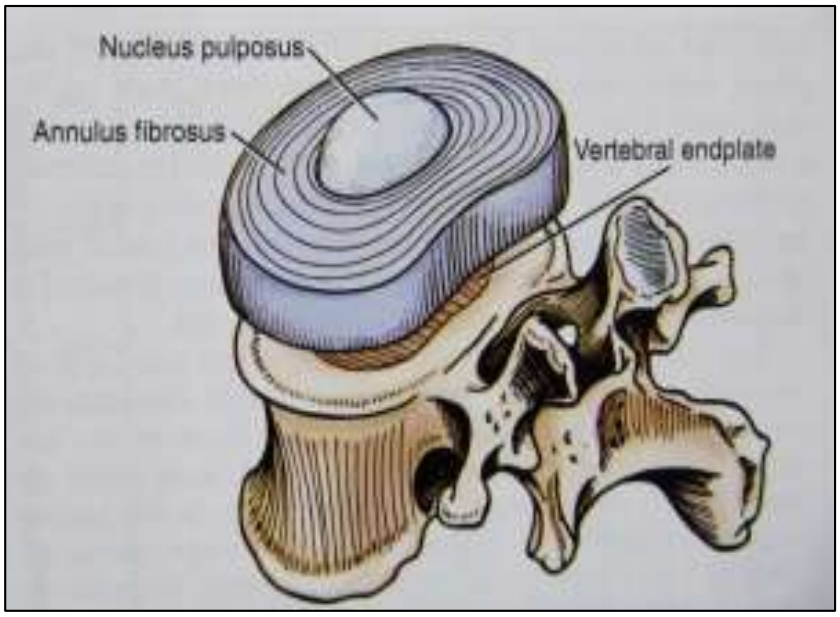

Figure 2.3: showing the interverbal disc lifted up to reveal the vertebral endplate, (Hegewald *et al.,* 2011)

The intervertebral discs (IVDs) of the lumbar spine of a young healthy adult are made up of a nucleus pulposus (figure 2.4 and 2.5) above, containing a mass of fluid which is semi mucoid. The fluid is generally clear, gelatinous and firm appearance. It is worthy to note that the general stability of the NP normally interchanges with advancing age. This is a result of gradually subsequent reduction in the volume of water inside the NP hence subsequently becomes drier(Goode *et al.,* 2013). The IVDs have the capability of distributing full scale stress equally

between the two adjacent vertebrae. This is for the reason that the NP and inner AF act as fluid under pressure that does not change alongside location or direction. However, studies on the movement of the IVD has generally shown that the disk has a considerable function to be flexibility to both low loads and as well as firmness at heavy loads(Sullivan *et al.*, 2012).

Other studies have also shown that inability to distribute the load equally to the IVD is a vital influence and contributes in the radial tear of the AF(Shojaei, 2018). This tearing may be influenced by the effect of torsional stress of the vertebra above that keeps on rotating in constant direction in relation to sagittal movements(Moseley et al., 2004). Usually, the posterolateral part of the AF tends to weaken first. It should be noted that whenever the innermost layers of the posterior AF pull apart in the presence of the NP with the necessary ability to bulge into the space created by the tear; therefore the disk disease symptoms are more probable to be experienced(Middleton & Fish, 2009). The area within the spinal canal that the disk trespasses usually determines the class as well as level and degree of neuronal effect ,classical patterns of pain , as well as its prognosis(Geurts *et al.*, 2018). It is also evident that the characteristic nature of neuronal effect and severity of pain can't be judged accurately using the size and disk material type involved thus big and loose fragments often can cause no neurological impairment or strain(Hancock *et al.*, 2011).

2.1.3 Nerve Root Canal

This canal is usually found laterally to the spinal canal (Figure 2.3) above. The medial wall of the canal is formed by the dural sac, the lateral wall and the inner part of the pedicle. The dorsal boundary of the nerve root canal is basically formed by the following structures namely; Lamina, ligamentum flavum, and superior articular process. Its ventral border is formed by the body of

the vertebrae and intervertebral discs(Pandey *et al.*). A reduction in the size of this canal leads to a syndrome known as lateral stenotic syndrome(Moseley *et al.,* 2004).

2.1.4 Zygapophyseal Joints

It is formed by the articulation of two successive lumbar vertebrae. These articulations lead to the formation of three joints namely, one joint which if formed in between two consecutive vertebral bodies and the intervertebral disc while the remaining two joints are developed as a result of the articulation of the upper articular process of one vertebra together with the lower articular processes of the vertebrae just superior to it. They are commonly known as zygapophyseal joints. The primary function of the zygapophyseal joint in the normal vertebral column is to protect the mobile part from excessive stress that arise from rotation ,anteriorly shearing forces, and flexion(Diaz-Collado *et al.,* 2018).

2.1.5 Ligamentum Flavum

The ligamentum flavum is a bilateral ligament that connects two consecutive laminae. It is made up primarily of (80%) elastin, and collagen contributing to (20%). Therefore, this is one of the elastic ligaments which is capable of stretching during flexion and basically retains its neutral and normal length within the neutral position or extension. It plays a key role in terms providing resistance to separation of the lamina while flexing and prevention of the anterior capsule from flogging in between the articular edges as the fibers recoil back as in extension(Snell, 2018).

Ligamentum flavum hypertrophy (Figure 2.8) is a condition in which the ligamentum flavum (LF) thickens due to stresses placed on the spine. With hypertrophy, ligamentum flavum (LF) increases in thickness (size). The thicker it becomes, the higher the risks of compressing the spinal cord or

spinal nerves. In short, a thicker than average ligamentum flavum (LF) decreases the room or available areas a nerve root or the spinal cord has. Compression of spinal nerves or spinal cord can produce varying degrees of pain and even disability

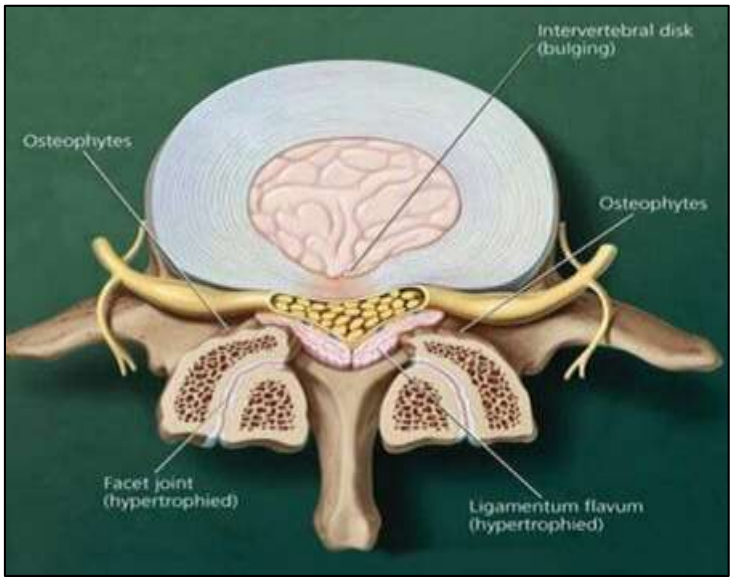

Figure 2.4: Illustrating the hypertrophied ligamentum flavum adopted from Dr Yama Zafer, D.C,2018.

2.2 Anatomical structural changes in patients with chronic low back pain

2.2 .1 Herniation of intervertebral disc.

Herniation of intervertebral discs that results into degenerative disease can be triggered by physical stress such as rising from flexion to extension and torsion movement at the level of the lumbar spine(Geurts *et al.*, 2018). This occurs when the softer part of annulus polposus pushes against its covering i.e. annulus fibrosus hence causing annulus polposus to herniate (Figure 2.10). Once the nucleus is pulled out, it moves to directly compress to the nearby nerve therefore causing pain, weakness of one or both lower limbs and reduced sensitivity.

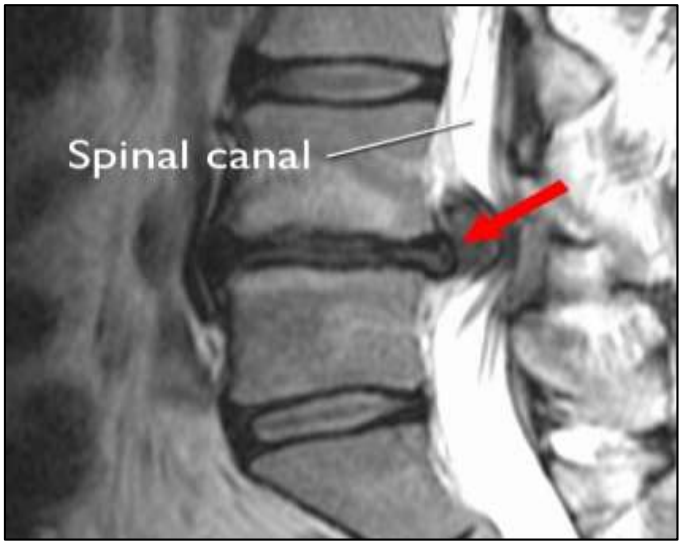

Figure 2.5: Saggital T2 weighted MRI scan shows a herniated disk in the lower back (arrow). The disk is bulging out toward the spinal canal, putting pressure on the spinal cord and nerve roots(Deuk spine institute)

2.2.2 Degenerated disc

The intervertebral discs are made up of spongy pads that act as shock absorbers between the two lumbar vertebrae. When dehydration occurs in a degenerated disc (Figure 2.12) it results into loss of its normal height thus reducing the disc space(Husky *et al.,* 2018). This results into compression of the surrounding spinal nerves causing pain. The causes of chronic low back pain in the lumbar spine have been associated with disc degeneration occurring in the lumbar spinal nerve L4 and /or L5 (Husky *et al.,* 2018) . A study in Germany by H M Mayer in 2017, on discogenic low back pain and degenerative lumbar spinal stenosis showed that pain generators for chronic low back pain are usually nociceptors at the cartilaginous end plates, the outer fibrous annulus and the periosteum of the vertebrae. Discogenic pain that results from degeneration of the intervertebral discs has been estimated to the major cause of chronic low back pain in about 39%

of the patients whereas lumbar zygapophyseal pain was estimated to be 30% of CLBP patients (Alschuler,2010) .

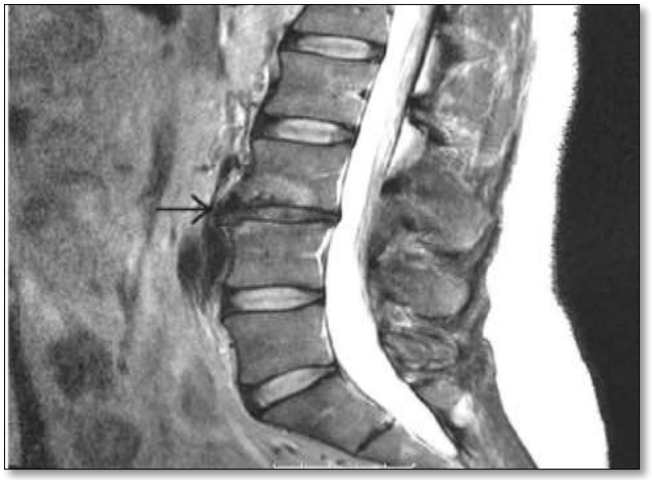

Figure 2.6: Disc space narrowing and degenerative changes at the L3-L4 level (arrow) on sagittal T2-weighted MRI(spine universe,2020)

2.3 Social impact of chronic low back pain

2.3.1 Impact of CLBP to an individual

There has been a drastic impact of chronic low back pain to the individual, family, society as well as employment sectors in general. Most people with chronic low back pain present with complaints that CLBP restricts their social life, relationships with family members and friends. A study done by (Robins *et al.*, 2019) on physical, emotional and social impact of CLBP on individual assessed and analyzed that in majority of patients , CLBP restricted their personal social life as well as family relationships. There was a considerable concern that most patients could not participate in various social activities e.g. wedding and in several occasions, pain has restrained them from attending certain settings and activities, therefore causing them to miss out

on very important social functions. This has resulted in emotional concerns such as lack of support, stigma and discrimination, hopelessness and sadness.

Health policy institute also alludes that globally, there are common downhearted feelings among adults living with CLBP compared to those without back pain and a substantial group of adults with CLBP reported some significant levels of psychological distress such as anger and depression.(Linton *et al.,* 2018) found out that Patients with severe CLBP had a remarkable substantial level of interference with all social activities performed and associated increasing negative emotions.

In Kenya little has been researched on the impact of CLBP but a study on western Kenya by (Mwangi et al., 2019) titled " Low back pain among primary school teachers; prevalence and contributing factors" low back pain prevalence of 64.98% and there were also associated work related psychosocial factors that needed comprehensive approach in terms of evaluation and management. (Mwawingwa, 2017) study titled 'the quality of life of patients with chronic low back pain at Kenyatta national hospital" found out that 34% of patients with CLBP were in the formal sector and lumbar spine changes associated with CLBP accounted for 64% on MRI and 26% of participants had severe pain (7 out of 10) as recorded in pain rating scale.

2.3.2 Societal impact of CLBP

The impact of chronic low back pain can either be direct or indirect. Direct healthcare costs are usually caused by patients seeking pain treatment and management while indirect or societal costs result from secondary consequences of disability and morbidity due CLBP. This has led to work absenteeism and informal care given to people living with CLBP. Also, direct health care costs for medical care are considerably high leading to public health burden. Generally, in patients with CLBP, healthcare resources are mainly utilized for pain treatment and management and despite all

these efforts; the patients still suffer from severe pain with physical disability and have serious loss of quality of life(Ariza-Mateos et al., 2021).

There has been a global socioeconomic inequalities especially in older patients with chronic low back pain(Husky et al., 2018).

A study by (Kipruto, 2018) titled " The impact of low back pain on a adult women attending Moi teaching and referral hospital, Eldoret , Kenya" showed that low back pain was prevalent and a non-communicable disease that negatively affects the patients' daily physical activities and drastically reduces the quality of life. Therefore, there is need to diagnostically evaluate patients with chronic low back pains in order to provide meaningful intervention and proper health education. (Mwangi et al., 2019) in his study "The quality of life in patients with chronic low back pain as seen at Kenyatta National Hospital" allude that 70% of patients could not accomplish what they would wish to do because of severity of pain. This has a direct attribute to low work output both individually and at their places of work. Thus, there was need to further investigate the causes of CLBP with specific management modalities. A study by Philip Gituri at Kenyatta national hospital in 2017 on the quality of life of patients with CLBP, Showed that serious anatomical pathologies on the lower spine that were diagnosed on MRI accounted for 89 % while non-specific cause for CLBP patients was found to be 11%. Therefore , there is need to accurately carry out diagnostic guided imaging and management on patients with CLBP in order to prolong and improve their quality of life (Romanenko, 2016) . Most studies on chronic low back pain have attributed it to several structural changes that have significantly changed the quality of life of patients(Oduah, 2018).This study therefore, will be able to evaluate the severity of pain and the quality of life of patients suffering from CLBP which will be guided radiologically through MRI to ascertain the morphological changes of the lumbar spine predisposing patients to CLPB.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter outlined the methods that were used in the study to obtain the data. It comprised the study area, study design, study population, Sample size determination, Sampling method, Selection criteria, instruments for data collection and methods of data analysis.

3.2 Study area

The study was carried out in Kakamega County General and teaching Hospital, Kakamega County in Western Kenya. This is a level five government health teaching referral facility in western Kenya. The institution has bed capacity of 448, and provides the following services including surgery, obstetrics and gynecology, medicine, pediatrics, intensive care unit, pharmacy, a well-established laboratory department and radiology departments including advanced MRI laboratory with quality MRI machines as well as professional and qualified staff. Averagely, a total of 400 patients are seen daily as outpatients in all departments

3.3 Study Design

This was a cross sectional quantitative descriptive study whereby, patients' data was collected during patients' presentation at orthopedic outpatient clinic and MRI department. These Patients were only enrolled once into the study but were included in subsequent follow-up clinic. This study design enabled the researcher to assess severity of pain how the chronicity was associated with

changes in anatomical structures of the lower spine in patients that presented with chronic low back pain and its personal and societal effect.

3.4 Study population/subject

Kakamega County General Hospital had an annual catchment population of 70,995 patients in 2021.The total number of adult patients who presented to the health facility with CLBP and were referred for lumbar spine MRI scan within three months were 227 (KCGRH Health records and information section, 2022). This study therefore targeted a case group of adult patients with CLBP in the outpatient and emergency departments including those on follow for pain management in orthopedic clinic.

3.5 Sample size determination

A sample is a group of respondents that will be selected from the proposed target population of study. Since the catchment population of Patients with CLBP in KCGRH was less than 10,000, therefore, sample size was calculated using Yamane Taro formula (1967) because its accuracy had been shown in cross-sectional studies.

$$n = \frac{N}{1+ Ne^2}$$

Where: *n* =sample size required

N = study population

e =maximum acceptable margin of error/ allowable error 5 %

In this case, the desired sample size was 227 patients

Thus:

$$n = \frac{227}{1+227(0.05)^2}$$

$$= 144$$

Therefore, the target population was 144 respondents.

3.6 Sampling method

The researcher used purposive sampling method to obtain data. Any patient who presented with CLBP within the facility, consented and met the inclusion criteria was subjected to the study to avoid bias.

3.7 Selection criteria

3.7.1 Inclusion criteria

The study population included all adult patients who presented with history of CLBP more than 12 weeks and referred to presenting to radiology department for lumbar spine MRI scan and consented to the study.

3.7.2 Exclusion criteria

These included Patients with congenital anomalies and tumors of the lumbar spine, cardiac pacemakers, cochlea implants, metallic implants, aneurysm clips, claustrophobia and previous back surgery.

3.8 Study variables

3.8 .1 Independent variable

Age

Sex

Occupation

3.8.2 Dependent variable

Morphological changes in lumber vertebrae, Intervertebral discs, facet joints, ligamentum flavum, spinal canal and roots. Social activities such as patient's daily activities, emotional well-being, number of hospital visits and chronic low back pain.

3.8.3 Intervening variable

Availability and ability of patients to undergo MRI examination.

3.9 Data collection instrument/Tools

The tools used for data collection in this study included data collection forms and structured pretested self-administered questionnaire. The following information was captured in the data form namely demographic profile, Pain features, pain rating scale adopted from universal pain assessment tool, point pain location adapted from lumbar spine MRI features. Psychosocial and disability score sheet adapted from Modified Oswetry questionnaire. Attached in appendix 2

3.10 Data collection procedure

The permission to carry out research in Kakamega County General and Referral hospital was granted by the Hospital research and ethics committee, Medical super tenant and the hospital administrator. The researcher made pre visits to the hospital to seek consent, plan and made arrangements that enabled her to conduct the study. Once the consent was granted, the researcher met the radiologist in charge seeking permission to collect data from the department. The Type of the MRI machine used was Magsense 360, Mindray brand with 0.5 Tesla strength. The lumbar spine MRI scan was done as per the hospital's SOP (protocol). Axial, sagittal and coronal T1, T2 and T2 STIR weighted MRI scans of the lumbar spine were reviewed by the principal investigator

to identify and document changes within the lumbar spine. The findings were corroborated by two board certified consultant radiologist. In cases where the two consultant radiologists differed, a third radiologist's opinion was sought as a tiebreaker. The Oswetry modified questionnaires was hand delivered by the researcher to the participants each accompanied by a cover letter to explain the purpose and significance of study and gave assurance to confidentiality.

3.11 Data analysis

The data collected was entered in to excel sheet and analyzed using the Statistical Package for Social Scientists (SPSS) version 22(2020). An observational descriptive statistic was used to evaluate the anatomical changes associated with CLBP in order to find the mean, frequencies and percentages. These results were presented in form of tables, pie charts and graphs. A chi square test was used to determine the association between the severities of CLBP with the socio demographic characteristics of these patients.

3.12 Ethical consideration

Once the research topic and proposal were approved by the school of medicine, Maseno University, it was forwarded to the school of graduate studies for approval. Request to conduct the study was sent to scientific ethics and review committee University of eastern Africa; Baraton. Ethical approval from NACOSTI and other relevant bodies was obtained to enable the researcher collect data (Appendices 111,1V, V and V1). Before collecting the data, patients' autonomy was highly respected and taken into consideration as well their confidentiality strictly observed. Patients were not coerced to enroll to this study. A written informed consent was used for each patient participating in the study (Appendix 1). The aim of this study was well explained to the

participants in a language they understand better. No harm of any nature was imposed to the study participants concerned. The participants were informed that they were free to withdraw from the study as long as they wished to do so. They were also informed that the findings from this research shall be compiled into a thesis and be submitted in partial fulfillment of the MSc Human Anatomy. While compiling the research findings, there was no misconduct e.g., plagiarism fabrication and falsification as well as other deviant practices that took place.

The consenting process was carried out by the principal investigator together with trained research assistant. This took place after completion of the consultation process, which enabled the patient to be identified as a potential participant. Only after obtaining informed consent was the participant's data recorded in the designed data collection form (Appendix 11).

3.13 Dissemination of study results

Results from the study were disseminated through seminars, conferences and later published in reputed journals

CHAPTER FOUR

RESULTS

4.1 Introduction

This quantitative cross-sectional descriptive study was carried out at KCGRH. The study aimed to determine radiological lumbar spine anatomical changes of patients presenting with CLBP with its social impact and to assess the association between the severities of chronic low back pain with the socio demographic profiles of these patients at KCGRH. A sample size of 128 respondents had previously been calculated, however, the number of patients who presented with chronic low back pain and participated in this study was 144.This study was carried out within a period of three (3) months from March, 2023 to May 2023. None of the study participants opted out or refused to actively participate within the study period.

4.2 Socio demographic profile

The dataset comprised of 144 individuals, and the variables analyzed include gender, age, weight, and occupation. It was observed that the sample was predominantly female, representing 66.7% (n=96) of the study participants. The most represented age groups are the 45-54- and 55–64-year-olds constituting 62.6% (n=90) of the sample. The most represented weight group was 'Above 88' kg, constituting 31.3% (n=45) respectively. The participants' occupation was categorized into three groups. A significant majority of the participants are Professionals, comprising 64.6% (n=93) of the sample (Table 4.2).

Table 4.1: Socio demographic characteristics of study participants

Socio demographic characteristics		N	%
Gender	Female	96	66.7%
	Male	48	33.3%
Age Cohort	34-44	24	16.7%
	45-54	45	31.3%
	55-64	45	31.3%
	65-74	18	12.5%
	75-84	12	8.3%
	Above 85	0	0.0%
Weight cohort	48-58	15	10.4%
	59-68	18	12.5%
	69-78	27	18.8%
	79-88	39	27.1%
	Above 88	45	31.3%
Occupation	Casual laborer	42	29.2%
	Professionals	93	64.6%
	Business people	9	6.3%

4.3 Radiological changes in the lumbar spine anatomical structures associated with chronic low back pain

Lumbar spine anatomical structures associated with chronic low back pain

Of the total respondents, 43.8% (n=63) had abnormal vertebral changes that included osteophytes, fractures and modic type 1 changes. The most common pathology observed was presence of osteophytes at 31.3% (n=45) whilst the least common was fractures at 4.2 %(n=6) (Table 4.2)

Table 4.2: lumbar vertebral changes of patients with CLBP

Lumbar spine anatomical structures		n	%
Vertebrae changes	Osteophytes	45	31.3%
	Fracture	6	4.2%
	Modic changes 1	12	8.3%
	Modic changes 2	0	0.0%
	Modic changes 3	0	0.0%
	Normal	81	56.2%

Concerning the intervertebral discs, the most common abnormality was desiccation observed in 27.1% (n=39) of participants and the least common abnormality was present in only 2.1% (n=3) of participants (Table 4.2).

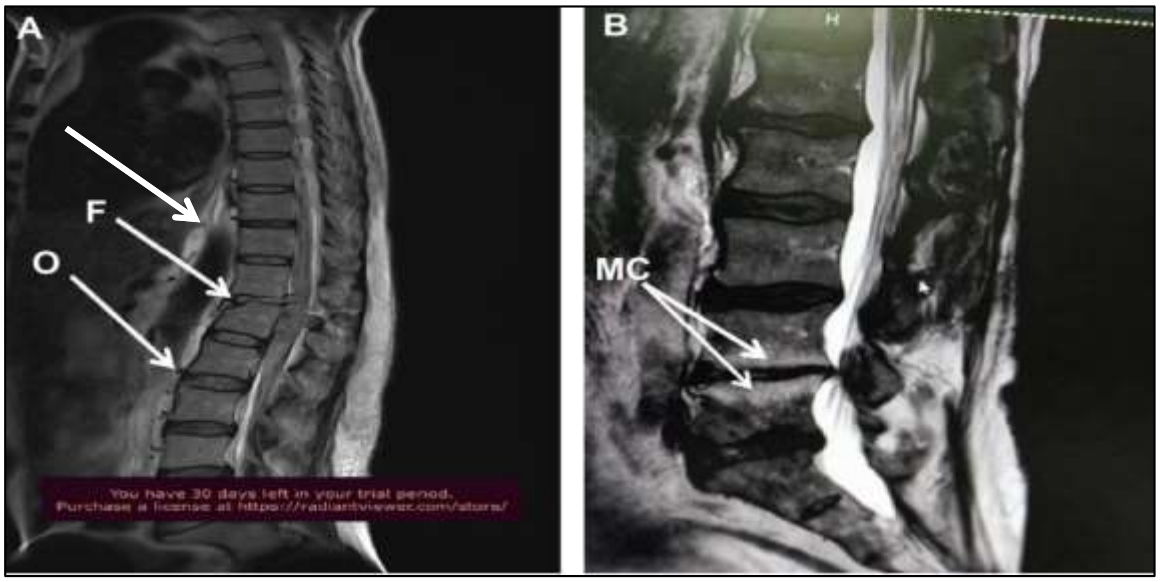

Figure 4.1: MRI sagittal view of the lumbar spine illustrating fracture at L1, Osteophytes at L2 and modic changes at end plates of L4 and L5.

KEY: *F- fracture, O- Osteophytes, MRI- Magnetic resonance imaging, MC-Modic changes L3-Lumbar vertebra three, L2-Lumbar vertebra two.*

Anatomical vertebral changes of the lumbar spine may predispose one to chronic low back pain. These vertebral changes may present as a fracture of the vertebral end plate, osteophytes or modic changes (Figure 4.1a and b). A broken vertebral bone may predispose one to obvious deformity of the spine, severe pain and disability. Osteophytic changes of the vertebrae are usually smooth bone spurs that form between two adjacent bones. They have severe effects to tendons therefore resulting into joint damage. Modic changes are end plate sclerotic changes that result into ischemia of the vertebrae (Figure 4.1).

Table 4.3 Intervertebral discs of patients with CLBP

Lumbar spine anatomical structures

Intervertebral discs	Desiccation	39	27.1%
	Diffuse	30	20.8%
	Right paracentral discs bulge/prolapse	21	14.6%
	Left paracentral discs bulge/prolapse	3	2.1%
	Normal	51	35.4%

The total abnormal facet joint changes were observed in 29.2% of patients. Bilateral facet joint erosion was the most common abnormality present in 18.8% (n=27) of the participants. Out of 144 participants, 18.8% (n=27) had spinal canal narrowing, while the majority, 81.3% (n=117), showed no signs of this condition (Table 4.3).

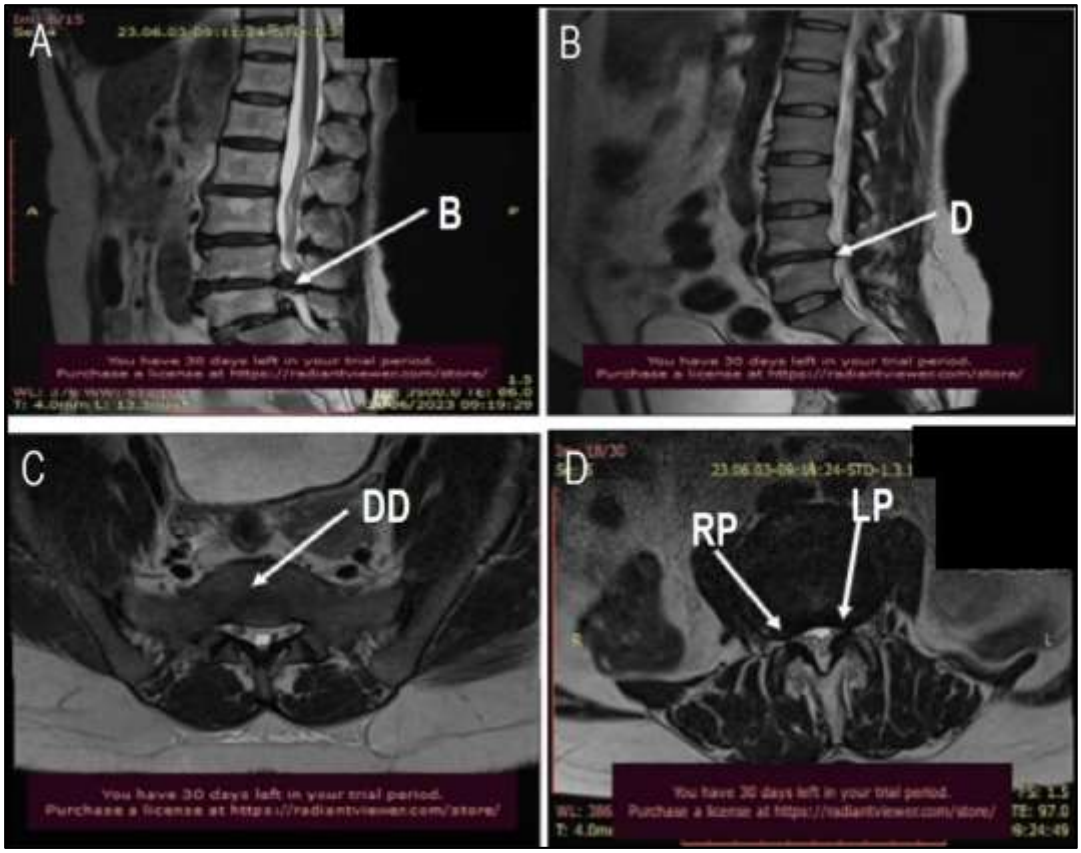

Figure 4.2: MRI sagittal view of the lumbar spine showing disc desiccation, bulge/prolapse, diffuse disc bulge, right and left paracentral disc bulges.

KEY: *D- Disc desiccation, B- Bulge, DD– Diffuse disc, RP-Right paracentral, LP-Left paracentral Changes and MRI - Magnetic resonance imaging.*

Pathological Intervertebral disc changes may predispose one to chronic lower back pain and may present as a disc bulge which is protrusion of inner part of the intervertebral disc into the spinal canal causing narrowing of the spinal canal and compression of the spinal nerves. (Figure 4.2a). Desiccation of the disc (Figure 4.2b) is basically dehydration of the disc which leads to rigidity and shortening of the disc space causing to chronic low back pain. Diffuse disc bulge is generalized protrusion of the disc which causes compression of bilateral foramina and their respective nerves thus resulting into pain (Figure 4.2c). Right and left paracentral disc bulge is protrusion of the disc

on either side causing bilateral neural foramina narrowing and subsequent compression of the nerve roots (Figure 4.2d)

Table 4.4: Facet joint erosion/effusion of patients with CLBP

Lumbar spine anatomical structures		frequency	Percentage
Facet joints	Right facet joint erosion/effusion,	15	10.4%
	Left facet joint erosion/effusion.	0	0.0%
	Bilateral erosion	27	18.8%
	Normal	102	70.8%
Spinal canal	Narrowing	27	18.8%
	Normal	117	81.3%

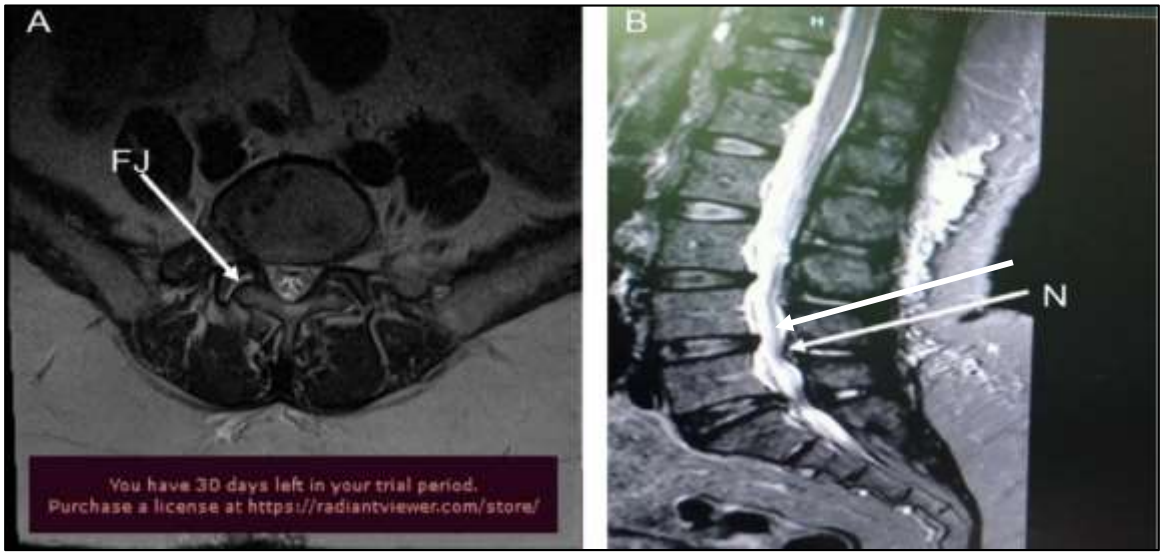

Figure 4.3: MRI sagittal view of the lumbar spine showing facet joint effusion and Spinal canal narrowing.

***KEY*:** *FJ- facet joint effusion NS- Spinal canal narrowing and MRI - Magnetic resonance imaging*

Effusion of the articular surfaces may predispose one to chronic low back pain. Articular surfaces of the joints contain hyaline cartilage which can easily be compressed due to its elasticity, therefore accommodating enormous compressional and shear forces during weight bearing. Accumulation of fluid within this articular surface is referred to as facet joint effusion (Figure4.3a). This is caused by inflammation and break down of cartilage triggering pain sensations within spinal nerve endings. Spinal canal narrowing is basically stenosis of the canal causing compression of the cauda equina leading to severe pain and interfering with innervation of the lower back and lower limbs. (Figure4.3b)

Table 4.5 Ligamentum flavum hypertrophy of patients with CLBP

Lumbar spine anatomical structures			
Ligamentum flavum	Right sided hypertrophy	18	12.5%
	Left sided hypertrophy	3	2.1%
	Bilateral hypertrophy	21	14.6%
	Absent	102	70.8%

Ligamentum flavum changes were observed in 29.2% (n= 42) of the study participants out of the total, bilateral hypertrophy was present in 14.6% (n=21) whilst left-sided hypertrophy was only present in 2.1% (n=3) of participants (Table 4.5).

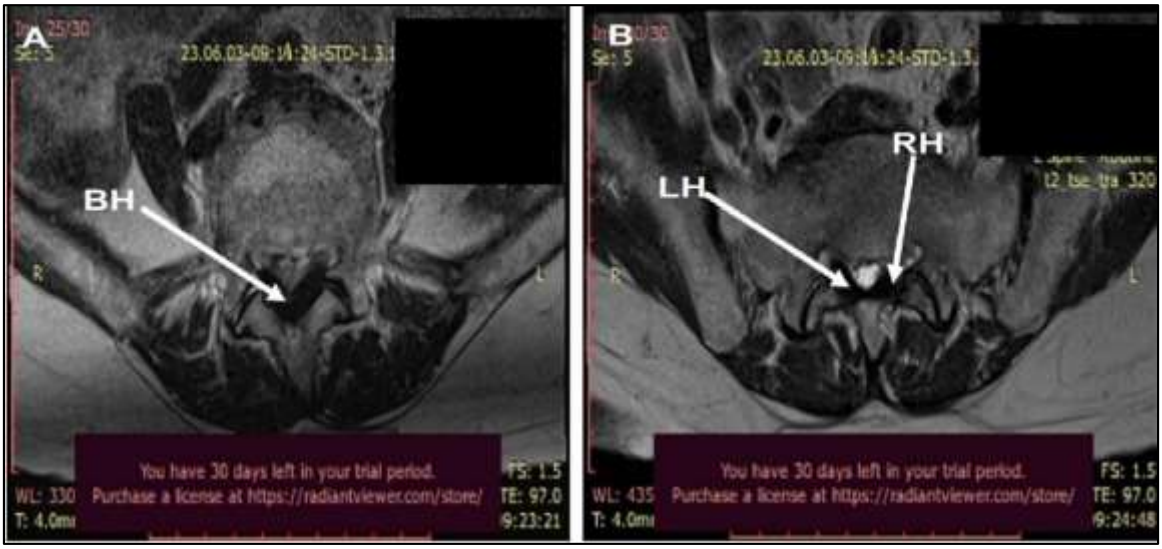

Figure 4.4: MRI axial view of the lumbar spine showing ligamentum flavum hypertrophy causing compression of bilateral nerve roots.

KEY: *BH- Bilateral ligamentum flavum hypertrophy, RH-Right sided hypertrophy, LH-Left sided hypertrophy and MRI - Magnetic resonance imaging*

Hypertrophy of the ligamentum flavum is the thickening of the flavum due to increased pressure on the lumbar spine. This causes compression of the spinal canal, neural foramina and spinal nerves leading to chronic low back pain (Figure 4.4a and b)

4.4 Social *impact* of chronic low back pain

Psychosocial and disability score sheet derived from Oswetry modified questionnaire was used to assess the social impact of chronic low back pain, specifically addressing its effects on overall quality of life, social activities, emotional well-being, personal and work productivity. Table 4.6 below illustrates effects on social activities. Out of 144 respondents, 50% (n=72) reported moderate pain that affected their social activities, while 4.2%(n=6) of respondents reported that they had normal social activities despite their chronic pain (Table 4.6).

Table 4.6 Effect of chronic low back pain on social activities

Effect on social activities	Normal with pain	6	4.2%
	Mild with pain	12	8.3%
	Moderate with pain	72	50.0%
	Severe with pain	24	16.7%
	Restricts social activities	30	20.8%

In terms of emotional well-being, a significant majority of respondents (60.4%) reported that their chronic low back pain affected their emotions, while 39.6% reported it did not affect their emotions. The largest proportion of participants 45.8%(n=66) reported mild effects on their work productivity (Table 4.7).

Table 4.7: Effects of chronic low back pain on emotional wellbeing and work productivity

Effect on emotional wellbeing	Affects emotions	87	60.4%
	Does not affect emotions	57	39.6%
Effect on work productivity	Mild	66	45.8%
	Moderate	36	25.0%
	Severe	42	29.2%

4.5 Association between sociodemographic and severity of chronic low back pain

The analysis was conducted using the Chi-square test, and results were interpreted based on the p-value, with a level of significance set at $p<0.05$.

In terms of the vertebrae changes, the Chi-square test revealed no significant association between gender and osteophytes ($\chi2=2.525$, $p=0.471$), with 22.9% (n=33) of females and 8.3% (n=12) of males presenting this condition. There was an equal distribution of fracture and Modic changes type 1 between both genders. A significant association was found between gender and disc desiccation ($\chi2=20.37$, $p<0.00042$*), with this condition more prevalent among females (20.8%, n=30) than males (6.3%, n=9). Diffuse disc changes were also more prevalent in females (18.8%,

n=27) than males (2.1%, n=3). There was no significant difference in the prevalence of right paracentral disc bulge/ prolapse between females (8.3%, n=12) and males (6.3%, n=9). However, left paracentral disc bulge/prolapse was only observed in males. Right facet joint erosion/effusion was more prevalent in females (8.3%, n=12) than males (2.1%, n=3), while bilateral erosion was almost equally distributed between females (10.4%, n=15) and males (8.3%, n=12). Although our study found differing rates of spinal canal narrowing between genders, these differences were not statistically significant ($\chi 2$=1.846, p=0.174249). A slightly higher incidence of bilateral hypertrophy was observed in females (8.3%, n=12) compared to males (6.3%, n=9). In summary, disc desiccation was the only anatomical change significantly linked to gender and predominantly observed in females. This observation indicates a higher susceptibility to disc desiccation among female participants in this study (Table 4.8)

Table 4.8 Association between lumbar spine anatomical changes causing chronic low back pain with gender

Lumbar spine anatomical structures		Gender				Chi-square & p value
		Female		Male		
		n	%	n	%	
Vertebrae changes	Osteophytes	33	22.9	12	8.3	Chi =2.525
	Fracture	3	2.1	3	2.1	df=3
	Modic changes 1	9	6.3	3	2.1	p= 0.471
	Modic changes 2	0	0.0	0	0.0	
	Modic changes 3	0	0.0	0	0.0	
	Normal	51	35.4	30	20.8	
Intervertebral discs	Desiccation	**30**	20.8	9	6.3	Chi=20.37
	Diffuse	27	18.8	3	2.1	df=4
	Right paracentral discs bulge/prolapse	12	8.3	9	6.3	**P=.00042***
	Left paracentral discs bulge/prolapse	0	0.0	3	2.1	
	Normal	27	18.8	24	16.7	
Facet joints	Right facet joint erosion/effusion,	12	8.3	3	2.1	Chi =2.744
	Left facet joint erosion/effusion.	0	0.0	0	0.0	df=2
	Bilateral erosion	15	10.4	12	8.3	P= .254
	Normal	69	47.9	33	22.9	
Spinal canal narrowing	Narrowing	21	14.6	6	4.2	Chi =1.846
	Normal	75	52.1	42	29.2	df=1
						P= .174249
Ligamentum flavum	Right sided hypertrophy	9	6.3	9	6.3	Chi=5.313
	Left sided hypertrophy	3	2.1	0	0.0	df=3
	Bilateral hypertrophy	12	8.3	9	6.3	P= 0.150
	Absent	72	50.0	30	20.8	

*Note. * p value is statistically significant*

Table 4.9 below presents the association between lumbar spine anatomical changes causing chronic low back pain with different age groups. For the vertebral changes, there was a statistically significant association with age (Chi-square=34.878, p<0.0001). Osteophytes were most prevalent in the 55-64 age group (14.6%). Fractures and Modic changes 1 seemed to be unrelated to age, as they occurred sporadically across the age groups. Desiccation and diffuse changes seemed to peak in the 55-64 age group (10.4% and 8.3%), respectively. Facet joint changes exhibited a significant association with age (Chi-square=20.374, p=0.009). Spinal canal narrowing demonstrated a

significant association with age (Chi-square=14.523, p=0.006) and its prevalence increased with age, peaking in the 55-64 age group (8.3%). The changes in the ligamentum flavum were significantly associated with age (Chi-square=49.148, p<0.00001). Bilateral hypertrophy was evenly distributed among the 45-54, 55-64, and 75-84 age groups (4.2% each). Right and left sided hypertrophy was common in 34-44 age group with 6.3% and 2.1% respectively.

Table 4.9. Association between lumbar spine anatomical changes causing chronic low back pain with age group.

Lumbar spine anatomical structures		Age group						Chi-square & p value
		34-44	**45-54**	**55-64**	**65-74**	**75-84**	**85>**	
		%	%	%	%	%	%	
Vertebrae changes	Osteophytes	4.2	8.3	**14.6**	2.1	2.1	0.0	Chi = 34.878 df=12 **P=0.0001***
	Fracture	0.0	2.1	0.0	0.0	2.1	0.0	
	Modic changes 1	2.1	2.1	0.0	2.1	2.1	0.0	
	Modic changes 2	0.0	0.0	0.0	0.0	0.0	0.0	
	Modic changes 3	0.0	0.0	0.0	0.0	0.0	0.0	
	Normal	10.4	18.8	16.7	8.3	2.1	0.0	
Intervertebral discs	Desiccation	2.1	8.3	**10.4**	4.2	2.1	0.0	Chi = 25.736 Df=16 p=0.058
	Diffuse	2.1	6.3	**8.3**	2.1	2.1	0.0	
	Right paracentral discs bulge/prolapse	2.1	4.2	2.1	4.2	2.1	0.0	
	Left paracentral discs bulge/prolapse	0.0	2.1	0.0	0.0	0.0	0.0	
	Normal	10.4	10.4	10.4	2.1	2.1	0.0	
Facet joints	Right facet joint erosion/effusion,	4.2	4.2	2.1	0.0	0.0	0.0	Chi = 20.374 Df=8 **p=0.009***
	Left facet joint erosion/effusion.	0.0	0.0	0.0	0.0	0.0	0.0	
	Bilateral erosion	**4.2**	**4.2**	**4.2**	**2.1**	**4.2**	0.0	
	Normal	8.3	22.9	25.0	10.4	4.2	0.0	
Spinal canal narrowing	Narrowing	2.1	2.1	**8.3**	2.1	4.2	0.0	Chi= 14.523 Df=4 **p=0.006***
	Normal	14.6	29.2	22.9	10.4	4.2	0.0	
Ligamentum flavum	Right sided hypertrophy	**6.3**	2.1	4.2	0.0	0.0	0.0	Chi = 49.148 Df=12 P=.00001*
	Left sided hypertrophy	2.1	0.0	0.0	0.0	0.0	0.0	
	Bilateral hypertrophy	0.0	**4.2**	**4.2**	**2.1**	**4.2**	0.0	
	Absent	18.3	25.0	22.9	10.4	4.2	0.0	

Table 4.10 provides an overview of the association between lumbar spine anatomical causing chronic low back pain and weight categories. The vertebral changes showed a statistically significant association with weight (Chi-square=30.151, p=0.00265). Osteophytes were most prevalent in the 79-88 weight category (10.4%), whereas fractures and Modic changes 1 were observed mainly in higher weight categories (69-78 and above). For intervertebral discs, the association with weight was borderline significant (Chi-square=33.636, p=0.006). Desiccation was most common in the 79-88 weight category (10.4%), while diffuse changes were relatively evenly distributed across all weight categories. The instances of right paracentral disc bulge/prolapse increased with weight, peaking in the above 88 weight category (6.3%). Facet joint changes also demonstrated a significant association with weight (Chi-square=17.831, p=0.023). Right facet joint erosion/effusion was only observed in higher weight category of 79-88 at (6.3%). Spinal canal narrowing showed a significant association with weight (Chi-square=10.513, p=0.033) and was most common in the above 88 weight category (8.3%). Ligamentum flavum changes were significantly associated with weight (Chi-square=27.433, p=0.007). Right-sided hypertrophy was most common in the 79-88 weight category (6.3%), and bilateral hypertrophy increased with weight, peaking in the above 88 weight category (6.3%).

Table 4.10 Association between lumbar spine anatomical changes causing chronic low back pain with weight categories

		Weight categories					
Lumbar spine anatomical structures		48-58	59-68	69-78	79-88	88>	Chi square
		%	%	%	%	%	
Vertebrae changes	Osteophytes	6.3	2.1	6.3	**10.4**	6.3	Chi= 30.151
	Fracture	0.0	0.0	2.1	0.0	2.1	Df=12
	Modic changes 1	0.0	0.0	**4.2**	2.1	2.1	**p=0.00265***
	Modic changes 2	0.0	0.0	0.0	0.0	0.0	
	Modic changes 3	0.0	0.0	0.0	0.0	0.0	
	Normal	4.2	10.4	6.3	14.6	20.8	
Intervertebral discs	Desiccation	2.1	2.1	4.2	**10.4**	8.3	Chi= 33.636
	Diffuse	4.2	**6.3**	2.1	2.1	6.3	Df=16
	Right paracentral discs bulge/prolapse	2.1	0.0	4.2	2.1	**6.3**	p=0.006*
	Left paracentral discs bulge/prolapse	0.0	0.0	0.0	2.1	0.0	
	Normal	2.1	4.2	8.3	10.4	10.4	
Facet joints	Right facet joint erosion/effusion,	0.0	0.0	0.0	**6.3**	4.2	Chi= 17.831
	Left facet joint erosion/effusion.	0.0	0.0	0.0	0.0	0.0	Df=8
	Bilateral erosion	2.1	2.1	**6.3**	4.2	4.2	**p=0.023***
	Normal	8.3	10.4	12.5	16.7	22.9	
Spinal canal narrowing	Narrowing	4.2	2.1	2.1	2.1	8.3	Chi= 10.513
	Normal	6.3	10.4	16.7	25.0	**22.9**	Df=4
							p=0.033*
Ligamentum flavum	Right sided hypertrophy	0.0	2.1	0.0	**6.3**	4.2	Chi= 27.433
	Left sided hypertrophy	0.0	0.0	2.1	0.0	0.0	Df=12
	Bilateral hypertrophy	2.1	0.0	2.1	4.2	**6.3**	p=0.007*
	Absent	8.3	10.4	14.6	16.7	20.8	

Table 4.11 presents the association between lumbar spine anatomical causing chronic low back pain and occupation. The occupations included are casual laborers, professionals and business people. Vertebrae changes showed a statistically significant association with occupation (Chi-square=26.061, p<0.000217). Osteophytes were most prevalent among professionals (14.6%), Modic changes 1 were present only in professionals and business people, with professionals having the highest prevalence (6.3%). For intervertebral discs, the association with occupation was also statistically significant (Chi-square=35.169, p<0.000025). Desiccation was most common among

casual laborers (16.7%), while diffuse changes and right paracentral disc bulge/prolapse were most prevalent among professionals (16.7% and 12.5% respectively).

Facet joint changes demonstrated a significant association with occupation (Chi-square=37.848, $p<0.0001$). Right facet joint erosion/effusion was observed in professionals and business people, with professionals having the highest prevalence (6.3%). Bilateral erosion was most common in professionals (14.6%). Spinal canal narrowing showed a significant association with occupation (Chi-square=12.098, $p=0.002$). Narrowing was most common among casual laborers (10.4%). Changes in the ligamentum flavum did not demonstrate a significant association with occupation (Chi-square=6.962, $p=0.324$). Right-sided hypertrophy and bilateral hypertrophy were observed in all three occupations, with professionals having the highest prevalence for both (6.3% and 10.4% respectively).

Table 4.11: Association between lumbar spine anatomical changes causing chronic low back pain with occupation

Lumbar spine anatomical structures		Occupation						Chi-square & p value
		Casual laborer		Professionals		Business people		
		n	%	n	%	n	%	
Vertebrae changes	Osteophytes	18	12.5	21	**14.6**	6	4.2	Chi-square= 26.061 Df=6 **P=000217***
	Fracture	3	2.1	3	2.1	0	0.0	
	Modic changes 1	0	0.0	9	6.3	3	2.1	
	Modic changes 2	0	0.0	0	0.0	0	0.0	
	Modic changes 3	0	0.0	0	0.0	0	0.0	
	Normal	21	14.6	60	41.7	0	0.0	
Intervertebral discs	Desiccation	24	**16.7**	15	10.4	0	0.0	Chi-square= 35.169 Df=8 **P= .000025***
	Diffuse	3	2.1	24	16.7	3	2.1	
	Right paracentral discs bulge/prolapse	3	2.1	18	12.5	0	0.0	
	Left paracentral discs bulge/prolapse	0	0.0	3	2.1	0	0.0	
	Normal	12	8.3	33	22.9	6	4.2	
Facet joints	Right facet joint erosion/effusion,	0	0.0	9	**6.3**	6	**4.2**	Chi-square= 37.848 Df=4 **P<0.0001***
	Left facet joint erosion/effusion.	0	0.0	0	0.0	0	0.0	
	Bilateral erosion	6	4.2	21	**14.6**	0	0.0	
	Normal	36	25.0	63	43.8	3	2.1	
Spinal canal narrowing	Narrowing	15	**10.4**	12	8.3	0	0.0	Chi-square= 12.098 Df=2 **p=0.002***
	Normal	27	18.8	81	56.3	9	6.3	
Ligamentum flavum	Right sided hypertrophy	6	4.2	9	6.3	3	2.1	Chi-square= 6.962 Df=6 p=0.324
	Left sided hypertrophy	0	0.0	3	2.1	0	0.0	
	Bilateral hypertrophy	6	4.2	15	10.4	0	0.0	
	Absent	30	20.8	66	45.8	6	4.2	

CHAPTER FIVE

DISCUSSION, CONCLUSSION AND RECOMMENDATION

5.1 Introduction

The main objective of this study was to evaluate the anatomical changes as shown in an MRI in the lumbar spine of adult patients presenting with chronic low back pain and its social impact. This would be beneficial to health care providers offering therapeutic management, counseling and meaningful health education to patients with chronic low back pain thus improving their quality of life.

5.2 Socio demographic profile

In the current study, 66.7% (n=96) of the respondents were females while the remaining 33.3%(n=48) were males. The respondents were selected purposively where any patient who presented with CLBP was included in the study. Therefore, more female presented with CLBP than males. Other studies (Watiti, 2015; Mwawingwa, 2017) in Kenya also reported that more females suffered chronic low back pain than males while cross examining the magnetic resonance imaging and radiographic findings. The high incidence of CLBP may be attributed to fluctuating hormonal levels among women especially in their post-menopausal stages.

It was noted that the age cohorts 45-54years and 54-64 year were more prone to CLBP at 31.3% (n=90) respectively. In this study the mean age was 55.76 years (Table 4.1). This findings are in tandem with (Hoy *et al*., 2012) when estimating global burden of CLBP and found out that age 40-80 years were presenting more with chronic low back pain. Similar findings were reported by (Galukande *et al.,* 2005) in Mulango hospital in Uganda. Based on these findings it is postulated

that most of cases of CLBP are found in fourth and fifth decades of life. This is mainly because of the slow progression of anatomical defects specifically affecting the vertebral column. These worsening features may be associated with vertebral column anatomical shape changes and disc herniations. The advance in severity of low back pain with age is more likely to interfere with the economic status of an individual or a family (Hoy *et al*., 2014).

With regard to work and profession of the respondents, most of the respondents were in formal professional sector such civil servants accounting for 64.6% (n=93) of the study participants, while casual labors and business people constituted 29.2% (n=42) and 6.3% (n=9) respectively. In summary, the common participants were predominantly female professionals aged between 45 and 64 years who had similar findings of the study population. The findings in this study are similar with other studies (Kipruto, 2018; Wekesa, 2022) in which participants were predominantly female professionals aged between 45 and 64 years of age. However, these findings are in contrast to a study (Richard Monthsiwa,2017) in Eldoret which showed that 53.9% of patients that presented with low back pain included occupations that usually involved slightly intense amounts of manual labour on daily basis, like farming, business and housewives.

Most people with CLBP in this study weighed above 79kg which constituted 58.4%(n=84) of the study participants (Table 4.1). All the body weight is majorly beared by the lumbar segment of the vertebral column therefore, the heavier you are, the higher the possibility of developing CLBP due to the intense pressure exerted to the vertebral column. Most sprains, intervertebral disc degeneration, bulge or prolapse, ligamentum tears and hypertrophy are generally caused by heavy weight. These findings are in agreement with the findings of (Melissas *et al.,* 2003; Mugga, 2014) in which patients who were obese suffered from chronic low back pain. Apart from the body

weight, excessive and occupational weight lift might also be a leading attributing factor to developing CLBP.

5.3 Radiological changes in the lumbar spine anatomical structures associated with chronic low back pain

During Radiological examination of the lumbar spine, several anatomical changes can be seen in the vertebral bone, intervertebral discs, facet joints, spinal canal and ligamentum flavum. These anatomical changes can predispose one to CLBP. In the lumbar vertebral bone, anatomical changes such as osteophytes, fractures and sclerotic end plate changes are likely to occur in patients with CLBP as observed in radiological studies.

In the current study, osteophytes were the most common pathological change observed at 31.3% whilst the fractures were less prevalent at 4.2 % (Table 4.2).Osteophytes are growths that usually occur on joints of the lumbar vertebral region due to degenerative changes of the spine. It is mostly caused by poor postures, nutritional deficiencies and structural anomalies. This can cause disc breakdown thus causing increased movements of the spine. This could potentially cause pain due to injuries to the nerves, ligamental strains and sprains. The findings of this study correlate with (Goode *et al.*, 2013) in which individuals who had radiographic vertebral changes and osteophytes were likely to present with low back pain due to nerve injury, intervertebral disc anomaly , muscle dystrophy and ligament strains. However; another study (Wong *et al.*, 2016) reported that although osteophytic changes of vertebral column were observed in 60% of women and 80% men above 50 years, it was not sufficient enough to correlate with low back pain.

With regards to intervertebral discs, anatomical changes such as desiccation, prolapse or disc bulge may predispose one to CLBP. The intervertebral discs are made up of spongy pads that act as

shock absorbers between the two lumbar vertebrae. When dehydration occurs, it causes degenerated disc or desiccation resulting into loss of its normal height thus reducing the disc space. This results into compression of the surrounding spinal nerves causing pain. Desiccation of intervertebral disc is mostly caused by genetic factors affecting shape of the disc hence causing bulging due to reduced disc signal intensity. In this study, desiccation of the disc was the most common abnormality at 27.1%. Diffuse disc bulge was observed at 20.8% while left paracentral disc prolapse was the least at 2.1% in Table 4.3. These changes are more critical in helping radiologists achieve a high diagnostic power and indexes affecting the spinal column. The findings of this study are in tandem with (Lambrechts *et al.,* 2021; Sundarsingh & Kesavan, 2020; Videman *et al.,* 2009) in which patients who have intervertebral disc desiccation were more predisposed to CLBP which might be associated with muscle dystrophy and ligamental strains. In the current study, disc prolapse was also attributed to causing CLBP. Disc prolapse is a biomechanics contributor to CLBP (Adams, 2004). These findings are similar to (Van Der Windt *et al.,* 2010) in which disc herniation causes radiculopathy and lumbar low back pain, as it was linked to sciatica.

Lumbar spine facet joint erosion or effusion is also another anatomical change that can predispose one to CLBP. Facet joints are formed by two successive lumbar vertebrae. The primary function of the facet joint in the normal vertebral column is to protect the mobile part from excessive stress that arise from rotation, anteriorly shearing forces, and flexion (Buchowski & Kelly, 2018). Facet joint effusion is basically accumulation of fluid in a joint as a result of degenerative changes within the joint in between the spine. The cartilage within the joints can easily break and later on cause inflammation of the tissue thereby causing pain signals within the nerve ending (Geurts *et al.,* 2018).

Facet joint erosion occurs as a result of chondral loss in a joint. Facet joint changes are known to cause joint osteoarthritis and low back pain. In this study, a total of 29.2% of patients had abnormal facet changes, 18.8% had bilateral facet joint erosion (Table4.4). These findings are similar to (Kalichman *et al.,* 2008; Pneumaticos *et al.*, 2006) who noted that most patients who suffered from CLBP had abnormal facet joint changes that might have caused osteoarthritis of spine and lumbar joint changes. At advanced stages, worse end facet changes can cause joint erosion thus predisposing one to CLBP.

Spinal canal changes are another anatomical structure that can predispose one to CLBP. The lumbar vertebrae (L1 –L5) are usually stacked together to form part of the spinal canal. The spinal canal acts as a tunnel housing the spinal cord and its respective nerves therefore preventing it from injury (Netter Frank, 2018). More often, the spinal canal can be compressed by either vertebral bone or prolapsed intervertebral disc causing spinal canal narrowing which exerts a considerable pressure to the spinal cord and its respective nerves causing CLBP. In the current study,18.8% had spinal canal narrowing. These findings are in agreement with (Goode *et al*., 2013; Raastad *et al.*, 2015) in which most patients with spinal canal narrowing presented with CLBP. The authors argue that spinal canal narrowing could have been caused by osteophytes, facet changes, intervertebral disc desiccation and spinal necrosis.

With regards to ligamentum flavum hypertrophy, a total of 29.2% of the participants had ligamentum flavum hypertrophy, 14.5% had bilateral hypertrophy while only 2.1% had left sided hypertrophy (Table 4.5). ligamentum hypertrophy is among those pathophysiological changes postulated to cause canal narrowing. Its hypertrophy is associated with spinal stenosis and advanced stages of spondylitis which might generally cause CLBP. These findings are similar to reports of (Munns *et al*., 2015; Sairyo *et al*., 2007) in which most of the patients with CLBP had

ligamentum flavum hypertrophy on radiological examination of the vertebral column. The ligamentum flavum hypertrophy can either be bilateral or unilateral affecting one side.

5.4 Social impact of chronic low back pain

Chronic low back pain has multiple effects majorly affecting the quality of life, social activities, emotional well- being, work productivity and personal productivity. In the current study, it was observed that 50% of the respondent with moderate pain reported that their social activities were affected while 20.8% attributed CLBP to restricted social activities (Table 4.6). These findings were in tandem with other previous (Childs *et al.*, 2005; Mannion *et al.*, 2007) which observed that levels of social activities and engagements are highly affected with pain. Pain limited the range of movements at different points of the spinal column. Therefore, the study postulates that these restrictions might have been caused by reduced range of movements at different joints that limit self-engagements, muscle strains and ligamental sprains that interferes with various range of movements.

Emotional wellbeing and work productivity of patients was highly affected with CLBP. Out of 144 participants, a total of 60.4% of respondents reported that their CLBP had affected their emotional well-being while 45.8% of respondents had reduced work productivity. This study ruminates that emotional well-being and work productivity might have been affected by different levels of pain, as moderate and severe pain will interfere with carrying out tasks and sometimes it can lead to patients' withdrawal from the general public. The findings of this study are in agreement with (Bean *et al.*, 2014; Mattila-Rautiainen *et al.*, 2023) who describes emotional well-being as mental stability and therefore records that CLBP may interfere with mental stability and in turn cause emotional instability. (Sadosky *et al.*, 2015; Waongenngarm *et al.*, 2018) in their

studies also argue that patients with moderate to severe CLBP will have reduced work output which relates to the present findings.

5.5 Association between ssocio demographics and severity of chronic low back pain

Lumbar spine anatomical changes are the major factors causing chronic low back pain among most respondents in reference to age groups. In the current study, it was observed that vertebral changes; osteophytes, fractures and modic changes were the major contributing factors to CLBP. Osteophytes were the leading cause of CLBP within the ages between 45-64 years. These findings are similar to (Goode *et al.,* 2013) when describing the osteophytic changes on vertebral column. Osteophytes are degenerative changes that progress with age, its severity worsening within the ages between 40-70 years. Modic changes also largely contributed to CLBP by causing spinal narrowing, facet changes among other components. Modic changes are sclerotic end plate changes that generally interfere with the alignment of the lumbar spine. A study in India (Ahdhi *et al.*, 2016; Farin *et al.,* 2013) deduced that there was high association of chronic low back pain and sociodemographic factors where by most women with CLBP had anatomical changes of vertebral column as seen on radiographical images.

In the current study, desiccation and diffuse changes were common in the age group 55-64 years (10.4% and 8.3%) respectively. These anatomical changes mostly worsen with age and are more common in the said age group. (Raja'S *et al*., 2009) found out that most intervertebral desiccation were seen in elderly patients on radiological examination.(Videman *et al.*, 2009) in an Indian based study used men of age group35-70 years to evaluate the intervertebral disc desiccation, herniation and prolapse. Advanced age had these features on radiological examinations. Therefore, this study

postulates that with advancing age spinal biomechanics do occur and this can be a leading cause to CLBP.

It was observed that spinal canal narrowing was more prevalent with increased age as seen in 55-64 age group at 8.3% while right and left ligamentum hypertrophy was common in 34-44 age group at 6.3% and 2.1% respectively. These changes are degenerative based and are characterized with increased osteophytes production, muscle dystrophy and ligamental hypertrophy which can complicate to spinal canal narrowing and disc prolapse. Other studies (Goto *et al.*, 2010; Kim *et al.*, 2013) in Japan observed this changes among elderly patients as compared to the young cohorts. These degenerative changes normally progress with age and are more severe in elderly patients as at this point in life there is reduced regenerative capability, muscle disuse and atrophy among other physiological changes.

The present study noted that right paracentral disc bulge/prolapse increased with weight and was peak at 88kg (6.3%), this was similar to right and left ligamentum flavum hypertrophy. These findings are similar to (Wahby & Edward, 2013; Wang *et al.*, 2014) in which patient with weight within the normal ranges were less likely to have a disc prolapse. The study postulates that disc prolapse might have been more common among patients weighing more than 75kg because the heavier the trunk the more weight the lumbar vertebral body has to bear as all this weight is usually projected to the lumbar segment. This might cause obvious degeneration, reduced movement, muscle dystrophy and hypertrophy so as to sustain this level of weight. This might also cause anatomical anomalies on the spine.

It was observed that, there was a significant correlation between vertebral changes and weight of the respondents ($p=0.00265$). Among the changes, the presence of osteophytes was the most

common change among patients weighing 79 to 88kg. This findings are similar to (Wolfe *et al.*, 2002) in which patients with weight above 74kg had osteophytes as examined on MRI. Osteophytic changes have multiple effect on the vertebral column and thus would more likely cause pain. Therefore, the study accords that overweight and obesity could probably interfere with anatomical structure of the vertebral column, causing disc prolapses, herniation, muscle dystrophy and hypertrophy thus leading to CLBP.

5.6 Conclusion.

In this study, osteophytic changes within the vertebra, desiccations of intervertebral disc, spinal canal narrowing, and bilateral facet joint erosion were the most common lumbar spine anatomical changes that may predispose one to chronic low back pain. On the social impact of chronic low back, the current study concludes that the pain impacts the emotional wellbeing of the respondents followed by their work productivity.

Respondents with increased age above 55 years were mostly predisposed to CLBP. In addition, respondents weighing more than 75kg were also predisposed to anatomical changes of the lumbar spine hence causing CLBP.

5.7 Recommendations.

1. Early screening and treatment to avert the pain.
2. Weight reduction to lessen the mechanical stress on the vertebral column.
3. More attention needs to be given to the social well-being of patients suffering from chronic low back pain.
4. Opportunity for future interventional research on anatomical structures predisposing patients to CLBP.

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APPENDINCES

APPENDIX I: INFORMED PATIENT CONSCENT FORM IN ENGLISH

TITLE: LUMBAR SPINE ANATOMICAL CHANGES IN CHRONIC LOW BACK PAIN AND ITS SOCIAL IMPACT: A RADIOLOGICAL STUDY AT KAKAMEGA COUNTY GENERAL HOSPITAL.

INVESTIGATOR: STELLAH IMADE PAPA

SUPERVISORS : DR. ADERO, DR OTIENO, DR MASONI

INVESTIGATORS' REMARKS: Thank you so much for accepting to read this form. This form contains information about my study thus will aid you in making decisions whether to participate on the study or not. Kindly, proper translation will be done in the language you are well familiar with.

INTRODUCTION: Chronic low back pain is a very common problem. Patients suffering from chronic low back pain always experience prolonged period of severe pain, reduced physical activity, social and mental problems and more so reduced quality of life due to prolonged pain and suffering, absence from work, increased cost of treatment as well as daily dependence to pain medication. The aim of my research is to determine the anatomical changes of the lumbar spine that cause chronic low back pain through MRI and the social impact of these changes. This will greatly improve health care provision, potentially reduce high medical costs and promote pain free life of patients with chronic low back pain.

PROCEDURE: If you accept to participate in this study, kindly, I will ask you some personal questions regarding your daily life and activities in order to find out the effect of severity of chronic low back pain to your lifestyle.

BENEFITS: The research findings from this study will be appropriately interpreted you, Maseno university, Kakamega county General and referral hospital. This will greatly improve health care provision and policy formulation in regards to care and management of chronic low back pain.

CONFIDENTIALITY: Please, if you accept to be part of this study, then the responses you will give will be kept strictly in confidence and will only be used for the purpose of this study.

REASSURANCE: kindly, note that the information that will be obtained from you will only be used by the investigator and/or the supervisors for the purposes of analyzing this information. Please if you don't wish to continue participating in this study, then you are voluntarily allowed to withdraw from the study at any time without any penalty.

ETHICAL CONSIDERATION: I have been granted permission by all the relevant research and ethical committees to carry out this study.

I verify that I have clearly given explanation of this study to my participant and responded to all questions and concerns.

Name of investigator…….Date……..Signature…..

Kindly, you can make inquiries on the ethical consideration through

DR NYUMBILE – MEDICAL SUPERINTENDAT

KAKAMEGA COUNTY GENERAL AND REFFERAL HOSPITAL,

P.O BOX 15-50100, KAKAMEGA

TEL:05030050

MOBILE NO; 0720295739/0758721989

To show that that you have voluntarily accepted and given consent to participate in this study, kindly sign or put your thumb print in the line below.

I agree that this study has been fully explained to me and I willingly consent to participate in this study.

Participants' name…….

Signature/Thumbprint…

APPENDIX 11: DATA COLLECTION FORM

SECTION A (To be filled by the doctor examining you)

1) Socio demographic profile.

Age : _____

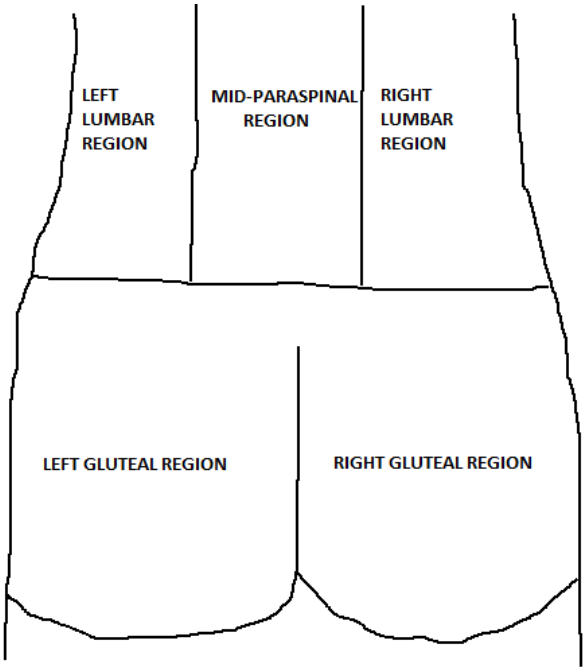
Sex : _____

Weight: _____

Occupation: _____

Location: _____

2) Pain Location (Please mark point location of pain)



In a scale of 1 – 10 below; please rate your back pain in terms of severity and activity tolerance by using the mark X

Scale	Severity	Activity tolerance	X
0 -1	No pain	can do all tasks	
2- 3	Mild pain	can be ignored	
4-6	Moderate pain	interferes with task / sleep)	
7- 8	Severe pain	Interferes with basic needs	
9-10	Worst pain possible	Bed rest required	

4) Anatomical changes of the lower spine as shown on MRI. (Kindly, this section will be filled by the doctor examining you)

Anatomical structure	Anatomical change	Present		Absent
Vertebrae	Osteophytes Fracture Modic changes		 Type 1 Type 2 Type 3	
Facet joints	Joint effusion/Erosion		Right facet Left facet	
Intervertebral discs	Dessication Diffuse Right Paracentral Left paracentral			

Spinal canal	Narrowing		
Ligamentum flavum	Hypertrophy	Right sided Left sided	

SECTION 2

5) Social impact of chronic low back pain.

Please read this: This specific questionnaire will be used by your doctor to get more information on how your chronic low back pain is affecting your ability to manage your everyday life. Kindly give responses in every section and mark in each box the best response that describes your condition. This information will be confidential and will only be shared with your doctor

Pain Intensity

- I can tolerate the pain I have without having to use pain medication.
- The pain is bad but I manage without having to take pain medication.
- Pain medication provides me complete relief from pain.
- Pain medication provides me moderate relief from pain.
- Pain medication provides me little relief from pain.
- Pain medication has no effect on the pain

Personal Care (Washing, Dressing, etc.)

- I can take care of myself normally without causing increased pain.

- I can take care of myself normally but it increases my pain.
- It is painful to take care of myself and I am slow and careful.
- I need help but I am able to manage most of my personal care.
- I need help every day in most aspects of my care.
- I do not get dressed, wash with difficulty and stay in bed.

Lifting

- I can lift heavy weights without increased pain.
- I can lift heavy weights but it causes increased pain.
- Pain prevents me from lifting heavy weights off the floor, but I can manage if weights are conveniently positioned, e.g. on a table.
- Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
- I can lift only very light weights.
- I cannot lift or carry anything at all.

Walking

- Pain does not prevent me walking any distance.
- Pain prevents me walking more than 1 KM.
- Pain prevents me walking more than ½ KM
- Pain prevents me walking more than ¼ KM
- I can only walk using crutches or a cane.
- I am in bed most of the time and have to crawl to the toilet.

Sitting

- I can sit in any chair as long as I like.
- I can only sit in my favorite chair as long as I like.
- Pain prevents me sitting more than 1 hour.
- Pain prevents me from sitting more than ½ hour.
- Pain prevents me from sitting more than 10 mins.
- Pain prevents me from sitting at all.

Sleeping

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

Social activities

- My social life is normal and does not increase my pain.
- My social life is normal, but it increases my level of pain.
- Pain prevents me from participating in more energetic activities (ex sports, dancing, etc.
- Pain prevents me from going out very often.
- Pain has restricted my social life to my home.

Traveling

- I can travel anywhere without increased pain.
- I can travel anywhere but it increases my pain.
- Pain restricts travel over 2 hours.
- Pain restricts travel over 1 hour.
- Pain restricts my travel to short necessary journeys under ½ hour.
- Pain prevents all travel except for visits to the doctor/therapist or hospital.

Employment/Homemaking

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

Patients' personal relationships.

(Please, give only one response to indicate how the pain has affected your personal relationship)

	YES	**NO**
I usually feel guilty about the impact of my back pain on my family, partner and friends		
I actually feel that my family, partner and friends do not understand my situation		
I always have arguments with my family/ partner because of my low back pain		
The pain has made me distant to my friends		
A partner has ended a relationship because of my back pain		
I feel stigmatized by my family/friends/partner		

Emotional well-being.

(Please indicate whether or not your chronic low back pain affects your emotional well-being)

	YES	NO
Sad		
Frustrated		
Stigmatized		
Calm		
Happy		
Anxious		
Desperate		
Hopeless		
Energetic		
Hopeful		
Determined		
Ashamed		
Ignored		

Supported		
Misunderstood		
Embarrassed		

(Adapted from Modified Oswetry questionnaire)

6. Work productivity activity Impairment (WPAI) Questionnaire

(Please answer the following questions on the effect of your chronic low back pain on your ability to work. Please fell in the blanks or circle the number as indicated)

1. Are currently employed -------NO----------YES

2. During the past seven days, how many hours did you miss from your work because of your pain?----------HOURS

3. During the past seven days, how many hours did you actually work?-------HOURS

4. During the past seven days ,did your pain affect your work productivity? …….YES……NO

5. Using a scale below from 0 - 10 consider how your pain affected your productivity while working. Kindly circle the number

(Pain had no effect on my work) 0 1 2 3 4 5 6 7 8 9 10 (Pain completely prevented me from working)

6. During the past one month, how many days you have been off duty because of our pain?.....DAYS

7. During the past three months, how WEEKS you have been off duty because of your pain?..... WEEKS

8. During the past twelve months, how many months have you been off duty because of your pain?.....MONTHS

8. Health care provider visits (kindly, indicate the number of times you have been visiting your health care provider for the last six months)……..TIMES

APPENDIX I11: PROPOSAL APPROVAL LETTER

MASENO UNIVERSITY

SCHOOL OF GRADUATE STUDIES

Office of the Dean

Our Ref: MSC/SM/00013/020

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 23rd September, 2022

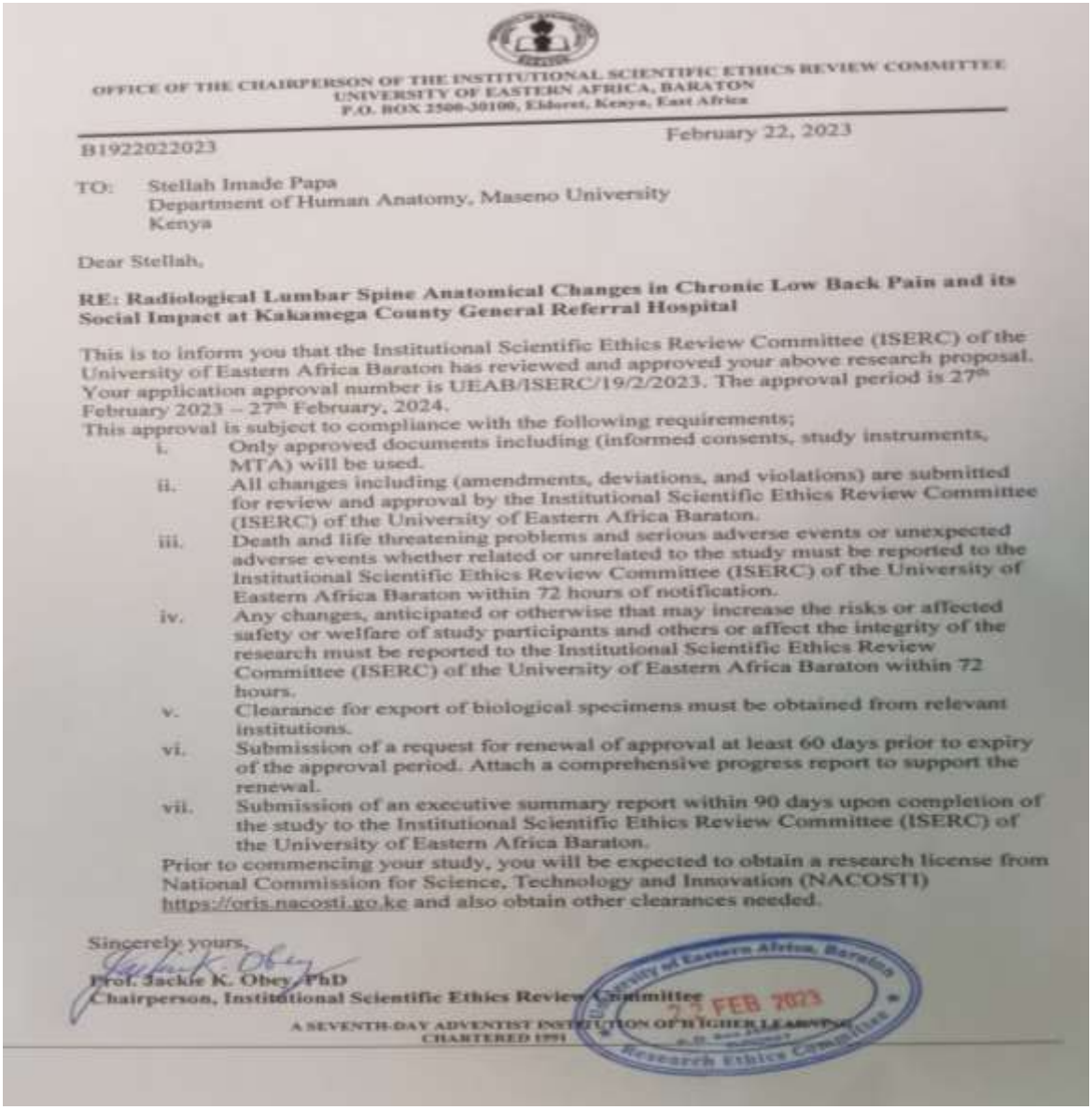
TO WHOM IT MAY CONCERN

RE: PROPOSAL APPROVAL FOR STELLAH IMADE PAPA — MSC/SM/00013/020

The above named is registered in the programme of Master of Science in Anatomy in in the School of Medicine, Maseno University. This is to confirm that her research proposal titled "**Radiological Lumbar Spine Anatomical Changes in Chronic low Back pain and its Social Impact at Kakamega County General Referral Hospital"** has been approved for conduct of research subject to obtaining all other permissions/clearances that may be required beforehand.

Prof. J.O. Agutu
DEAN, SCHOOL OF GRADUATE STUDIES

APPENDIX IV: ETHICAL APPROVAL LETTER



OFFICE OF THE CHAIRPERSON OF THE INSTITUTIONAL SCIENTIFIC ETHICS REVIEW COMMITTEE
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2500-30100, Eldoret, Kenya, East Africa

B1922022023

February 22, 2023

TO: Stellah Imade Papa
Department of Human Anatomy, Maseno University
Kenya

Dear Stellah,

RE: Radiological Lumbar Spine Anatomical Changes in Chronic Low Back Pain and its Social Impact at Kakamega County General Referral Hospital

This is to inform you that the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/ISERC/19/2/2023. The approval period is 27th February 2023 – 27th February, 2024.
This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely yours,

Prof. Jackie K. Obey, PhD
Chairperson, Institutional Scientific Ethics Review Committee

23 FEB 2023

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CHARTERED 1991

APPENDIX V : NACOSTI LICENSING AND APPROVAL

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **606947**

Date of Issue: **05/April/2023**

RESEARCH LICENSE

This is to Certify that Miss.. STELLAH IMADE PAPA of Maseno University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kakamega on the topic: RADIOLOGICAL LUMBAR SPINE ANATOMICAL CHANGES IN CHRONIC LOW BACK PAIN AND ITS SOCIAL IMPACT AT KAKAMEGA COUNTY GENERAL REFERRAL HOSPITAL for the period ending : 05/April/2024.

License No: **NACOSTI/P/23/24110**

606947

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

APPENDIX V1: RESEARCH AUTHORIZATION FOR DATA COLLECTION-NO.ERC/196-04/2023

COUNTY GOVERNMENT OF KAKAMEGA

E-mail: wpgh15@yahoo.com
Telephone: Kakamega 0702930346
When replying, please quote:

REF: CGH/KAK/ERC/VOL.1/205

COUNTY GENERAL HOSPITAL
P.O. Box 15-G.P.O-50100
KAKAMEGA

DATE: 5th April, 2023

MINISTRY OF HEALTH SERVICES

STELLAH IMADE PAPA
REF: NACOSTI/P/23/24110

RE: RESEARCH AUTHORIZATION FOR DATA COLLECTION – NO. ERC/196-04/2023

This is to inform you that Kakamega County General Hospital Ethics Review Committee (KCGH ERC) acting on behalf of the Kakamega County Department of Health, has reviewed and authorized your data collection for the protocol titled: ***"Radiological Lumbar Spine Anatomical Changes in Chronic Low Back Pain and its Social Impact at Kakamega County General Hospital."*** The approval period shall expire on 5th April 2024.

This authorization is subject to compliance with the following requirements:

i. Only approved documents including informed consent, study instruments, will be used.
ii. All changes including amendments, deviations and violations are submitted for review and approval by the **KCGH ERC.**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **KCGH ERC** within 24 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety of welfare of the study participants and others or affect the integrity of the research must be reported to **KCGH ERC** within 24 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to **KCGH ERC**.
viii. Submission of quarterly progress report to the **KCGH ERC** and dissemination of preliminary findings at the end of the study is expected from the researcher
ix. This authorization for data collection is for Kakamega County General Hospital only.

This authorization should be attached to your research license from National Commission for Science, Technology and Innovation (NACOSTI) and also other necessary clearances. Preliminary dissemination of your study findings to **KCGH ERC** is mandatory prior to publications.

COUNTY DIRECTOR HEALTH SERVICES
11 APR 2023

DR. AJEVI AUSTINE
CHAIRMAN; ETHICS AND RESEARCH COMMITTEE