

**FUNCTIONAL OUTCOME OF RESISTED ACTIVE EXERCISES  
ON OLDER ADULTS WITH KNEE OSTEOARTHRITIS**

**BY**

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**(BMS2001284)**

**A PROJECT SUBMITTED TO THE DEPARTMENT OF  
PHYSIOTHERAPY, SCHOOL OF BASIC MEDICAL SCIENCES,  
COLLEGE OF MEDICAL SCIENCES UNIVERSITY OF BENIN  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
THE AWARD OF BACHELOR OF PHYSIOTHERAPY DEGREE**

**OCTOBER 2025**

## **CERTIFICATION**

This dissertation by Ochuko-Obodoeke Vwearhe is accepted in its presented form as satisfying the dissertation requirement of the degree of Bachelor of Physiotherapy of the School of Basic Medical Sciences, College of Medical Sciences of the University of Benin

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## **DEDICATION**

This dissertation is dedicated to God and my mom who made this work a reality.

## ABSTRACT

**Background:** Knee osteoarthritis is a long-term condition that tends to get worse gradually, and the symptoms can differ in how serious they are from one person to another. It mostly affects people who are over the age of 50 and has a major impact on their quality of life. One of the most effective ways to manage it is through exercise therapy, which helps reduce pain and improves how the joints work. Strength exercises focus on building weak muscles, while aerobic workouts can help lessen discomfort. Recently, more attention has been given to non-surgical approaches like resisted active exercises (RAEs). These exercises help stabilize the joint, make the muscles stronger, and improve how well older adults can move around and stay independent.

**Methods:** 19 participants with knee osteoarthritis 60 years and above were recruited using a purposive sampling technique. Data was collected using the Functional independence measure (FIM) and patient specific functional scale (PSFS) before and after the intervention was given. Resistance exercises were given to the participants 2-3 times a week for the next 6 weeks. Descriptive statistics summarized the data, while Paired T test was used to determine the correlation between variables. Significance was set at an alpha level of 0.05.

**Result:** The mean FIM (functional independence measure) score improved from  $114.68 \pm 7.72$  to  $118.26 \pm 5.85$ , and PSFS(patient specific functional scale) score from  $5.21 \pm 1.99$  to  $7.47 \pm 1.26$  post-intervention. Paired t-test showed significant improvement in functional status (FIM:  $p = 0.001$ ; PSFS:  $p = 0.001$ ) following six weeks of resisted active exercises.

**Conclusion:** The findings demonstrated significant improvements in both general, functional status functional independence and task-specific abilities, as evidenced by statistically significant increases in FIM and PSFS scores. These results support the effectiveness of resisted active exercises as a simple, low-cost, and non-pharmacological intervention for improving functional status in older adults with knee OA.

**Keyword:** Functional status, Quality of life, Activities of daily living, functional ability.

## ACKNOWLEDGEMENT

I am grateful to God for the successful completion of this work and for His protection and guidance throughout my stay on this campus.

Special thanks to my supervisor Dr (Mrs) Oluwaseun S. Kubeyinje for her assistance, support and guidance during the course of the research study. Despite the busy schedule, she devoted her time to listen to me, answer my questions, read through my work and also make corrections. May the good Lord reward you in hundred folds.

I also appreciate the Head of the Department, Dr (Mrs) C. Obaseki, pioneer Head of the Department, Prof Kayode Oke and all the lecturers of the Department of Physiotherapy, University of Benin, Dr. Nicholas Oghumu, Prof Joseph Umunnah, Prof Obinna Ezeukwu, Dr. Nelson Ezekwu, and Rev Sister Fawole who isn't here with us but I learnt greatly from her and all those who imparted knowledge on me during my stay in school. A special thanks to the Head of Department, Mr Taiwo Oyewumi, the directors, Mr. R.E. Okhuaehesuyi, Mrs. C. Obaseki and Mrs. S. Kubenje and also to the chiefs, interns and other clinicians in the Department of Physiotherapy, University of Benin Teaching Hospital, I appreciate the knowledge and skills imparted on me during my studentship in the University of Benin Teaching Hospital. I also appreciate the non-academic staffs, especially Mr Nosa, of the Department of Physiotherapy University of Benin.

I also give a special thanks to my Mom, Mrs Rita ochuko-obodoeke , Mr and Mrs aminu, and all my siblings, relatives for their words of advice, encouragement, prayers and financial support and help throughout my stay as a student of University of Benin. I will also like to appreciate my

friends my friends and special thanks to Godwin for his assistant during the period of my data collection. My special thanks and gratitude to others which the confines of this page will not permit me to state.

Finally, I want to acknowledge myself for the commitment, perseverance, and countless hours I put into bringing this work to life. Without my determination and resilience, this project would not have been completed. I am proud of how far I've come. Thank you all.

# TABLE OF CONTENTS

TITLE PAGE	i
CERTIFICATION	ii
DEDICATION	iv
ABSTRACT	v
ACKNOWLEDGEMENT	vi
TABLE OF CONTENTS	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
<b>CHAPTER ONE: INTRODUCTION</b>	<b>1</b>
1.1 Background of the Study	1
1.2 Statement of the Problem	3
1. 3 Research Questions	3
1.4 Aim of Study	4
1.4.1 Specific Objectives	4
1.5 Hypothesis	4
1.6 Significance of the Study	4
1.7 Scope and Delimitation	5
1.8. Limitations of the study	6
1.9 Definition of Terms	6
1.10List of Abbreviations	6
<b>CHAPTER TWO: LITERATURE REVIEW</b>	<b>Error! Bookmark not defined.</b>
2.1 Definition	7
2.2 Epidemiology	7

2.3 Risk Factors	8
2.3.1 Non-Modifiable Risk Factors:	8
2.3.2 Modifiable Risk Factors:	9
2.4 The Anatomy of the Knee Joint	10
2.4.1 The knee	10
2.4.2 Ligaments of the knee	<b>Error! Bookmark not defined.</b>
2.4.3 The Menisci of the Knee Joint	14
2.4.4 Bursa around the Knee	15
2.4.5 Blood Supply	19
2.4.6 Nerve supply	19
2.4.7 Movement at the Knee Joint	19
2.4.8 Muscles involved in the Movement of the Knee	20
2.5 Pathophysiology of Osteoarthritis	23
2.6 Clinical Signs and Symptoms of Osteoarthritis	24
2.7 Stages of Osteoarthritis	24
2.8 Radiological Investigation	<b>Error! Bookmark not defined.</b>
2.9 Management	27
2.9.1 Conservative Management	28
2.9.2 Surgical Management	29
2.10 Resisted Exercises	29
2.11 Functional Outcome	31
2.11.1 Functional Outcome Measures	32
2.12 Table of Empirical Review	36

<b>CHAPTER THREE: MATERIALS AND METHOD</b>	<b>40</b>
3.1 Materials	40
3.1.1 Population	40
3.1.2 Selection Criteria	40
3.1.2.1 Inclusion Criteria	40
3.1.2.2 Exclusion Criteria	40
3.1.3 List of Instrument:	41
3.1.4 Description of Instruments	41
3.2 Methods	45
3.2.1 Research Design	45
3.2.2 Sampling Technique	45
3.2.3 Sample Size	45
3.2.4 Ethical Consideration	46
3.2.5 Procedure for Data Collection	46
3.2.6 Resisted Exercises Procedure	47
3.2.7 Data Analysis	47
<b>.CHAPTER FOUR: RESULTS</b>	<b>Error! Bookmark not defined.</b>
4.1 Introduction	<b>Error! Bookmark not defined.</b>
4.1.1 Sociodemographic variable of the participants	<b>Error! Bookmark not defined.</b>
4.1.2 Descriptive statistics of the participants	<b>Error! Bookmark not defined.</b>
4.1.3 Effects of resisted active exercises on the function status of the participants	<b>Error! Bookmark not defined.</b>
4.2 Hypothesis testing	<b>Error! Bookmark not defined.</b>

<b>CHAPTER FIVE</b>	<b>55</b>
<b>DISCUSSION, CONCLUSION AND RECOMMENDATIONS</b>	<b>55</b>
5.1 DISCUSSION	55
5.1.2 Descriptive statistics of the participants	56
5.1.3 Effects of resisted active exercises on the function status of the participants	58
5.2 Conclusion	59
5.3 Recommendations	<b>Error! Bookmark not defined.</b>
5.4 Implications for Further Study	59
<b>REFERENCES</b>	<b>67</b>
<b>APPENDICES</b>	<b>69</b>
APPENDIX 1	70
APPENDIX 2	71
APPENDIX 3	75
APPENDIX 4	77
APPENDIX 5	78

## LIST OF TABLES

<b>Tables</b>	<b>Pages</b>
Table 4.1: Sociodemographic variable of the participants	51
Table 4.2: Descriptive statistics of the participants	55
Table 4.3: Effects of resisted active exercises on the functional status of the respondents	57

## LIST OF FIGURES

<b>Figures</b>	<b>Pages</b>
Figure 1: Bones of the knee joint (anterior and posterior view)	13
Figure 2: Anterior view of the Ligaments/menisci of the knee joint	18
Figure 3: Posterior view of the Ligaments/menisci of the knee joint	19
Figure 4: Presentation of Knee Osteoarthritis	27

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

As people grow older, their bodies go through natural physical changes that can affect their overall health and well-being. Some of the most noticeable changes include reduced bone strength, loss of muscle mass, and weaker joints. These shifts can lead to a decline in physical ability and raise the risk of falls, fractures, and disability (Majeed et al., 2024). Aging also brings a higher chance of developing health issues such as diabetes, back and neck pain, and joint conditions like osteoarthritis, which are common among older adults (WHO, 2024).

Osteoarthritis is one of the most common health problems that comes with aging. It usually causes joint pain, stiffness, and limited movement, especially in weight-bearing joints like the knees and hips (Rouhin et al., 2023). The knee is often the most affected because it carries most of the body's weight and is more prone to wear and injury over time (Ji et al., 2023). While the symptoms and progression of osteoarthritis can vary from person to person, they generally become worse over time and more painful. Each person may experience the condition differently and at different stages (Ryan et al., 2023). It is a long-term condition that can't be cured, so it requires ongoing attention and proper management from healthcare professionals (Rouhin et al., 2023). Knee osteoarthritis (KOA) happens due to the gradual breakdown of the knee joint, mostly from years of use. It's more common in older adults. There are two main types of KOA: primary, which develops without a known cause, and secondary, which results from other issues like joint injuries, bone deformities, or diseases like rheumatoid arthritis (Hsu, 2023). Several

factors increase the risk of developing KOA. Some of these, like obesity, muscle weakness, or jobs that involve a lot of standing or bending, can be controlled. Others, like age, gender, genetics, and race, are fixed (Ryan et al., 2023). KOA usually starts showing up in people over the age of 50. It's ranked as the 11th leading cause of disability and then 38th condition linked to reduced life expectancy, making it a major global health concern (Ruizhi et al., 2023). People with KOA often have weak thigh muscles especially the quadriceps which affects their balance and movement. This makes it harder to stay independent and increases their chances of falling. They also deal with pain and struggle with simple daily activities, which lowers their overall quality of life (Liu et al., 2025; Segal & Glass, 2011).

Treatment for KOA usually falls into two categories: non-surgical and surgical. Most patients start with non-surgical options, while surgery is only considered if those don't help anymore (Hunter Hsu et al., 2023). Non-surgical treatments include things like wearing knee braces, using topical anti-inflammatory medications, or getting joint injections (Sidhu et al., 2024). Patients are also encouraged to stay informed about their condition, manage their weight, make dietary adjustments, and engage in physical therapy or regular exercise to strengthen their muscles and reduce stress on the joints (Yue et al., 2022). Overall, the main goals of KOA treatment are to relieve pain, improve daily movement, and reduce the chances of becoming disabled (Carlos, 2024). Exercise therapy is considered the best non-surgical method to help reduce pain and improve joint movement. It is usually the first treatment doctors recommend. This therapy often includes aerobic exercises, which help with moving better and easing pain. Ruizhi et al. (2023) explain that strength training focuses on building weak muscles. Resisted active exercises, which use body weight or added resistance, can improve strength, endurance, and movement.

Given all of this, the purpose of this study is to investigate how resisted active exercises affect the functional outcome of older adults with knee osteoarthritis, which includes their capacity to perform ADLs and participate in social activities.

## **1.2 Statement of the Problem**

Osteoarthritis (OA) is one of the most common joint problems, especially among older adults, and it's a major reason for musculoskeletal disability. It greatly affects the quality of life of those who have it. In OA, the knee joint slowly wears down, causing pain, stiffness, and reduced movement. As the symptoms get worse, people tend to avoid using the affected knee, which can lead to muscle weakness, less joint stability, and a higher chance of falling. These challenges make everyday life harder simple activities like walking, working, socializing, and even staying mentally healthy can become difficult. Although medications can help ease the pain, there's a growing need for more effective and non-invasive treatment options for knee osteoarthritis, especially in older adults. The main goal isn't just pain relief but also helping people move better, climb stairs, and stay socially active, which supports independence. One such method is resisted active exercises (RAEs), which focus on strengthening the muscles around the knee while controlling movement. This kind of exercise might help improve joint stability and function in older adults with OA. However, more research is needed to fully understand how effective RAEs are in improving day-to-day function.

This study looks into how resisted active exercises affect the functional abilities of older adults living with knee osteoarthritis.

## **1.3 Research Questions**

To guide this investigation, we will explore the following questions:

- 1) What is the functional status of older adults diagnosed with KOA?
- 2) What is the effect of resisted active exercises on functional status of older adults KOA?

## **1.4 Aim of Study**

The aim of this study was to evaluate the functional outcome of performing resisted active exercises for six weeks on older adults with knee osteoarthritis.

### **1.4.1 Specific Objectives**

- 1) To determine the functional status of older adults diagnosed with knee osteoarthritis
- 2) To examine the effect of resisted active exercises on the functional status of older adults with knee osteoarthritis.

## **1.5 Hypotheses**

There would be no significant difference in the functional status of older adults with knee osteoarthritis following six weeks of resistance exercise training.

## **1.6 Significance of the Study**

Physiotherapists, medical professionals, researchers in the fields of orthopedics, rheumatology, geriatrics, and physiotherapy, as well as older adults with OA, may all greatly benefit from the study's findings when they are disseminated and implemented.

1] To the Patients:

This study may determine whether resisted active exercises can improve the functional abilities of older adults who have osteoarthritis in their knees. By engaging in resisted active exercises,

patients may experience reduced pain, increased mobility, and an overall improved quality of life. Patients may be able to better manage their condition and maintain their independence as a result of this study.

2] To the Physiotherapists:

The result findings of this study may offer important evidence regarding the effectiveness of resisted active exercises for older adults with osteoarthritis in the knee as well as insights into creating tailored treatment plans that prioritize functional outcomes.

3)To other health care providers:

The purpose of this study is to highlight the use of non-pharmacological treatment options for older adults with osteoarthritis in their knees. Incorporating resisted active exercises into patient care may lessen the need for invasive procedures or medications, encouraging a more comprehensive approach to patient care and improving health outcomes.

4] To Researchers:

For researchers in the fields of gerontology and rehabilitation science, this study could contribute to the growing body of literature focused on exercise interventions for older populations.

## **1.7 Scope and Delimitation**

In this study, the independent variable is resisted active exercises while the dependent variable is functional status. This study was delimited to Individuals of 60 years and above, who have been diagnosed of KOA and attending clinic at the University of Benin Teaching Hospital (UBTH), Benin city, Edo state during the period of the study.

## **1.8. Limitations of the study**

The limitations of the study includes:

1. Lack of Willing Participants: Some older adults approached for the study were unwilling to participate, making it difficult to reach a larger sample size.
2. Poor Consistency: A few participants struggled with maintaining consistency in performing the resisted active exercises, which may have affected the overall outcome of the intervention.
3. Short Duration: The timeframe for conducting the study was relatively short, limiting the opportunity to observe long-term effects and making it difficult to recruit more participants.

## **1.9 Definition of Terms**

- 1) Prevalence: This refers to the proportion of people in a given population who have a specific disease or health condition at any given time (Merriam-Webster Dictionary).
- 2) Functional mobility: This is a person's ability to move around, whether at home, at work, or in public, in order to perform daily tasks (Mário & Joaquim, 2020).
- 3) Quality of life: This refers to how a person perceives their life in light of their culture, values, goals, expectations, and personal concerns (Teoli & Bhardwaj, 2023).
- 4) Functional ability: This is a person's current or potential ability to perform the routine tasks and activities expected of them in daily life (WHO, 2020).

## **1.10 List of Abbreviations**

- 1) QOL - Quality of life
- 2) ADL - Activity of daily living

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Definition**

Osteoarthritis (OA) is a joint disease that causes problems with movement and pain, leading to a lower quality of life (Takashi, 2020). It mostly affects joints such as the knees, hips, hands, spine, and feet. The knee is the most common joint affected because it supports a lot of weight and is more vulnerable to injuries, both direct and indirect (Ji et al., 2023). The main cause of Osteoarthritis ( OA) is the gradual wearing down of the cartilage in the joints over time, especially in older adults. According to Hunter Hsu et al. (2023), OA can be divided into two types: primary OA, where joint damage happens without a known cause, and secondary OA, which occurs because of uneven forces on the joint due to past injuries or problems with the cartilage, like in rheumatoid arthritis (RA).

#### **2.2 Epidemiology**

Osteoarthritis (OA) ranks as the fourth most common cause of disability worldwide. Most of this disability comes from issues in the knees and hips (Fransen et al., 2011). In 2019, the WHO reported that 528 million people globally were affected by OA. Women make up 60% of those with the condition, and 73% are over the age of 55. The knee is the commonly affected, with 365 million cases, followed by the hand and hip (Long et al., 2019). Rehabilitation could help about 344 million people living with mild to severe osteoarthritis (Ceiza et al., 2019).

## **2.3 Risk Factors**

### **2.3.1 Non-Modifiable Risk Factors:**

#### 1) Age

Age is the most common risk factor for osteoarthritis, but it's important to know that OA isn't just a normal part of aging (Loeser, 2023). Actually, OA is showing up more often in younger adults. In 2018, 57% of adults in the US who said they had OA were under 65, and this group made up more than half of those who said OA limited their daily activities (Various, 2016).

#### 2) Sexuality

OA is almost twice as common in women than men. Hip OA happens about equally in both men and women, but knee and hand OA are more common in women.

#### 3) Nationality/Ethnicity:

Some ethnic groups get OA more often than others. Older African-American, Native American, and non-white Hispanic women tend to have higher rates of OA than white women (Wright et al., 2008; Eustice, 2018). Also, African-Americans are more likely to have painful knee and hip OA compared to other groups. For example, older African-American men have hip OA 33% more often than white men.

#### 4) Genetics

Genetics play a big role in OA. Different genetic variations affect the risk, but none are very strong on their own (Warner and Valdes, 2017). Twin studies show that OA can run in families, with heritability rates of around 60% for hip OA, over 40% for knee OA, 65% for hand OA, and

70% for spinal OA. These genetic effects probably come from how different genes work together to affect bones, cartilage, and collagen (Spector et al., 2004).

#### 5) Previous Joint Damage:

Around 12% of osteoarthritis cases happen because of post-traumatic arthritis, which can come from injuries like car accidents, military activities, falls, or sports (Punzi et al., 2016). Driban et al. (2014) say that people with past knee injuries are three to six times more likely to get OA. Vina and Kwok (2016) add that having an ACL or meniscus tear raises the chance of knee OA by 2.5 times and the chance of needing a total knee replacement by 4 times. No matter how the injury is treated, about one in three people with an ACL injury will show signs of OA on X-rays within ten years (Luc et al., 2014; Harris et al., 2017).

### **2.3.2 Modifiable Risk Factors:**

#### 1) Being overweight

Men who are obese are about 2.8 times more likely to get knee osteoarthritis, and for women, the risk is even higher at 4.4 times (Garstang and Stitik, 2006). Every extra ten pounds of weight can add about sixty pounds of pressure on the knee with each step (Hopkins, 2018). Besides the mechanical stress, metabolic factors also play a role because even though not all obese people get OA, being heavier is linked to a higher chance of getting hand OA too (Loeser, 2023).

#### 2) Sports and Occupation

Jobs that require a lot of standing, squatting, lifting, kneeling, or repeated movements like construction, healthcare, farming, law enforcement, first responders, and military are linked to a higher risk of OA and can make symptoms worse (Yucesoy et al., 2015; Driban et al., 2016). In

the military, OA and back pain are the main reasons people leave due to disability, whether during peace or war (Patzkowski et al., 2012). High-impact sports like football, hockey, and soccer also increase the risk of joint injuries and ongoing stress, and even amateur soccer players can get OA (Amoako et al., 2014).

### 3) Joint Strength and Alignment

If someone has knee malalignment being knock-kneed (valgus) or bowlegged (varus) their chance of developing knee OA goes up. People with more severe misalignment tend to have worse physical function (Sharma et al., 2019).

## **2.4 The Anatomy of the Knee Joint**

### **2.4.1 The knee**

The knee is the biggest and most visible joint in the body. As explained by Moore et al. (2019), it's mainly a hinge-type synovial joint, meaning it allows bending (flexion) and straightening (extension). The joint is formed where the condyles of the femur, tibia, and the patella come together. The patella sits in front of the femoral condyles, while the tibial condyles are positioned behind and below them (Chaurasia, 2023). There are three main parts that make up the knee joint: one is the femoropatellar joint between the patella and femur, and the other two are the medial and lateral femorotibial joints between the femoral and tibial condyles. The structure of the joint is not naturally stable its surfaces don't match up perfectly, and it has been described as two balls sitting on a bent tabletop. Because of this, the stability of the knee depends mostly on the muscles around it, the tendons, and the ligaments that connect the tibia to the femur (Moore et al., 2019).

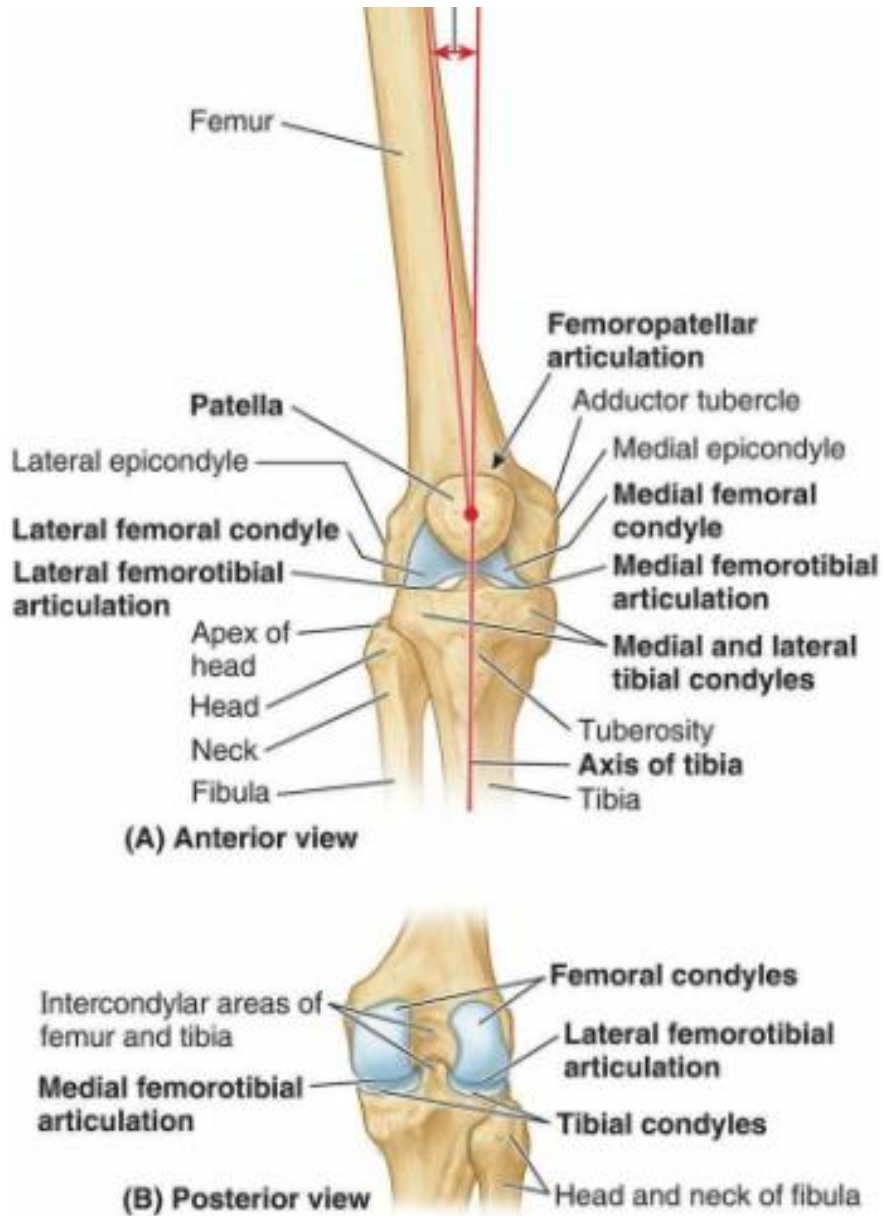


Figure 1: Bones of the knee joint (Moore et al, 2019)

## 2.4.2 Ligaments of the knee

The following ligaments support the knee joint:

### 1) A fibrous capsule

The thin, fibrous sac that surrounds the knee joint is called the fibrous capsular ligament. The attachments includes:

The femoral (thigh bone) has unique characteristics such as the suprapatellar bursa and is attached beyond the articular margins.

The tibia (shin bone) is connected beyond the margins at certain points for the popliteus tendon and ligamentum patellae.

The inner capsule and bones are lined with synovial membrane, which ends at the menisci and articular cartilages. It extends into the suprapatellar bursa (above the patella), the infrapatellar pad of fat (below the patella), the alar and infrapatellar folds, and a cul-de-sac surrounding the cruciate ligaments (Moore et al., 2019).

### 2) Patellae Ligamentum:

It is actually the quadriceps femoris tendon of insertion, which runs from the patella's apex to the upper portion of the tibial tuberosity. The ligamentum patellae measures 2.5 cm in width and 7.5 cm in length. It is joined below to the smooth upper portion of the tibial tuberosity and above to the edges and rough posterior surface of the patella's apex. It is associated with the infrapatellar pad of fat and the subcutaneous and deep infrapatellar bursae (Singh, 2020).

### **3) The Medial (Tibial Collateral) Ligament:**

A long, wide band with attachments: superiorly, the femur's medial epicondyle and Inferiorly: splits into two sections Anterior (superficial): covers nerves and vessels and is attached to the medial tibia. Posterior (deep): attaches to the medial tibial condyle, merging with the capsule and medial meniscus, supports the knee joint functionally and is morphologically connected to the adductor magnus muscle's degenerated tendon (Moore et al., 2019; Charusia, 2022).

### **4) The Lateral Fibular Collateral Ligament:**

a large, roughly 5-cm-long ligament that resembles a cord. It is embraced by the biceps femoris tendon and attached superiorly to the lateral epicondyle of the femur and inferiorly to the head of the fibula. Additionally, the popliteus tendon and inferior lateral genicular vessels and nerve separate the capsule from the lateral meniscus, morphologically connected to the femoral attachment of the peroneus longus muscle (Charusia, 2022).

### **5) The Popliteal Ligament Oblique**

It comes from the tendon of the semimembranosus and then runs laterally and upward, merging with the posterior capsule. It fastens to the femur's lateral condyle and intercondylar line. The middle genicular vessels and nerve, as well as the terminal portion of the posterior division of the obturator nerve, pierce it, and it is closely associated with the popliteal artery (Charusia, 2022).

### **6) The Popliteal Arcuate Ligament**

It runs over the popliteus tendon after emerging from the head of the fibula. It is attached to the tibia's intercondylar region's posterior border (Charusia, 2022).

### **7) ACL, or anterior cruciate ligament:**

It is connected above to the posterior portion of the medial surface of the lateral femoral condyle and below to the anterior intercondylar region of the tibia. The purpose Both anterior and posterior dislocations of the tibia on the femur are prevented by taut knee extension (Singh, 2020).

### **8) The PCL, or posterior cruciate ligament:**

It is connected to the anterior portion of the lateral surface of the medial femoral condyle above and the posterior intercondylar region of the tibia below. Its purpose is to prevent anterior dislocation of the femur on the tibia and posterior dislocation of the tibia on the femur by being taut during knee flexion (Singh, 2020).

### **2.4.3 The Menisci of the Knee Joint**

These are fibrocartilage crescentic plates, or wafers, that deepen the tibia's articular surface and aid in shock absorption. These are the functions:

1. To improve congruence with the femoral condyles, the menisci increase the tibial condyles' concavities.
2. They lubricate the joint cavity by serving as swabs.
3. During weight transfer, they serve as shock absorbers to shield the articular cartilage.
4. They adjust to the different femoral condyle components' different curvatures.

A semilunar shape that is connected to the tibia's intercondylar region (anterior and posterior horns) and is wider behind than in front of the tibial plateau and the deep portion of the tibial

collateral ligament (via coronary ligaments). The tendon of the popliteus, the medial condyle of the femur (Humphrey and Wrisberg), and the intercondylar region of the tibia (anterior and posterior horns) are all connected to this nearly circular, uniformly wide structure (Singh, 2020 and Moore et al., 2019).

#### **2.4.4 Bursa around the Knee**

The knee is surrounded by about 12 bursae, four of which are anterior, four of which are lateral, and four of which are medial. These bursae consist of:

1) The subcutaneous prepatellar bursa, subcutaneous infrapatellar bursa, deep infrapatellar bursa, and suprapatellar bursa are examples of anterior bursae.

2) Lateral Bursae: these include the bursa beneath the lateral head of the gastrocnemius muscle, the bursa between the biceps femoris muscle and the fibular collateral ligament, the bursa between the popliteus tendon and the lateral condyle of the tibia, and the bursa between the fibular collateral ligament and the popliteus tendon.

3) Medial bursae include the bursa beneath the medial head of the gastrocnemius muscle, the bursa deep to the tibial collateral ligament, the bursa beneath the semimembranosus muscle, and the Anserine bursa, a complex bursa that divides the tendons of the sartorius, gracilis, and semitendinosus from one another, the tibia, and the tibial collateral ligament (Singh, 2020 and Moore et al., 2019).

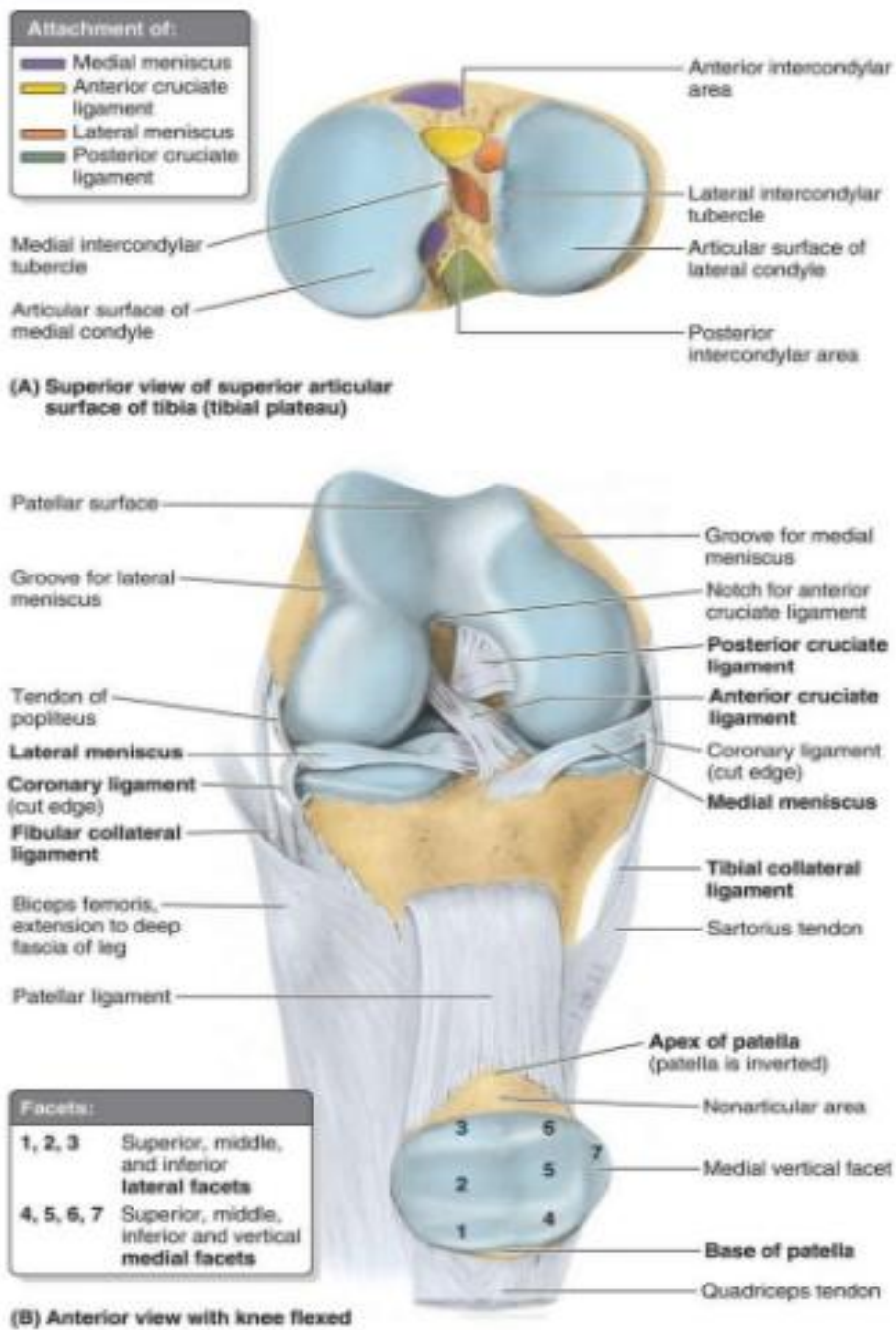


Figure 2: Ligaments/menisci of the knee joint, (Moore et al, 2019)

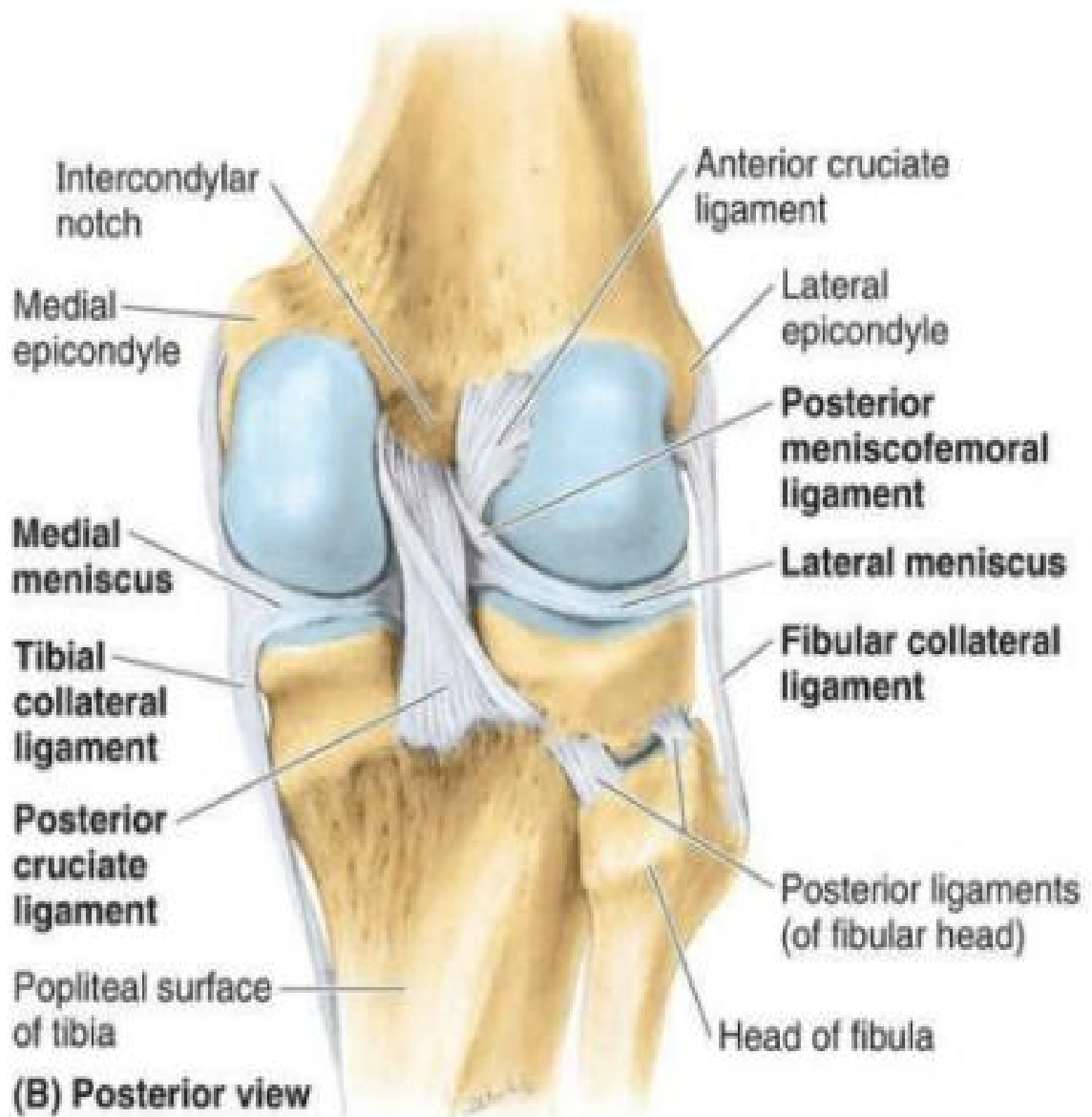


Figure 3: Ligaments/menisci of the knee joint, (Moore et al, 2019)

### **2.4.5 Blood Supply**

The knee joint receives a great amount of blood supply from an arterial network around it, consisting of: (a) five genicular branches of the popliteal artery, (b) the descending genicular branch from the femoral artery, (c) the descending branch of the lateral circumflex femoral artery, (d) two recurrent branches of the anterior tibial artery, and (e) the circumflex fibular branch of the posterior tibial artery (Singh, 2020)

### **2.4.6 Nerve supply**

The knee joint is richly innervated by:

- (a) The femoral nerve, this primarily through its branches supplies the vasti muscles, particularly the vastus medialis.
- (b) The tibial and common peroneal nerves via their genicular branches.
- (c) The obturator nerve through its posterior division ( Singh, 2020).

### **2.4.7 Movement at the Knee Joint**

The knee joint allows for the following movements:

Main movements

- i. Flexion (bending)
- ii. Extension (straightening)

Accessory/other movements

- i. Medial rotation (rotation inward)

ii. Lateral rotation (rotation outward)

## **2.4.8 Muscles involved in the Movement of the Knee**

### 1) Quadriceps femoris

The quadriceps femoris is a powerful muscle group located at the front of the thigh. It includes four muscles: rectus femoris, vastus lateralis, vastus medialis, and vastus intermedius. All four muscles are responsible for extending the knee joint and are supplied by the femoral nerve. Except for the rectus femoris, which crosses both the hip and knee joints, the others only act on the knee.

#### Rectus Femoris

This muscle is long, with a fusiform (spindle-shaped) belly in its upper part and a flat tendon in its lower part. It starts from the ilium using two heads: the straight head from the upper part of the anterior inferior iliac spine, and the reflected head from a groove just above the acetabulum. These two heads come together to form a single muscle belly that attaches to the base of the patella through a flat tendon. It gets its nerve supply from the posterior division of the femoral nerve. Since it helps to flex the hip and extend the knee, it's often called the “kicking muscle.”

#### Vastus Lateralis

It starts from several areas, including the intertrochanteric line, greater trochanter, gluteal tuberosity, linea aspera, and the lateral intermuscular septum. It attaches into the common tendon shared with rectus femoris and also connects to the side of the patella's base. Some of its fibers (retinacular fibers) go down to the lateral condyle of the tibia. Like the others, it gets its nerve

supply from the posterior division of the femoral nerve and plays a key role in extending the knee joint.

### Vastus Medialis

It starts from the lower intertrochanteric line, spiral line, medial lip of the linea aspera, and the medial supracondylar line and inserts into the tendon of the rectus femoris and the medial base of the patella, with a fibrous expansion (medial patellar retinaculum) to the medial condyle of the tibia. The posterior division supplies this muscle.

### Vastus Intermedius

It starts from the anterior and lateral surfaces of the upper three-fourths of the femur shaft and it inserts into the base of the patella, located beneath the tendon of the rectus femoris. It is innervated by the posterior division of the femoral nerve. Its main function is to extend the knee joint.

## 2) Hamstrings

The hamstrings consist of three long muscles which begins from the ischial tuberosity and connect below the knee joint.

Semimembranosus: it inserts into the posterior medial condyle of the tibia.

Semitendinosus: it inserts along the medial surface of the proximal tibia.

Biceps Femoris; This muscle has two heads short and long. Both heads insert into the fibula, but they originate differently; the long head arises from the ischial tuberosity, while the short head originates from the posterior femur.

### Sartorius

This muscle begins at the pelvis and runs in an S-shaped curve down to the area just below the knee. It sits behind the inner part of the quadriceps and joins with the gracilis and semitendinosus at the front inner side of the tibia in a spot called the pes anserinus, or goose foot.

### Gracilis

The gracilis is a thin, long muscle on the inner side of the thigh. It starts from the inner part of the ischiopubic ramus and, like the sartorius and semitendinosus, connects at the pes anserinus area on the tibia.

### Gastrocnemius

This large calf muscle is found at the back of the lower leg. It has two heads one comes from the outer side of the femur (lateral epicondyle), and the other from the inner side (medial epicondyle). Both heads come together and insert into the heel bone (calcaneus) through the Achilles tendon.

### Popliteus

The popliteus helps begin bending at the knee and "unlocks" the joint when moving from a straight position. It starts from the outer condyle of the femur and attaches to the upper back part of the tibia.

## **2.5 Pathophysiology of Osteoarthritis**

Osteoarthritis (OA) is a condition where the cartilage in the joints starts to wear out, the bones may change shape, and some inflammation can occur. It mainly affects the smooth cartilage that helps the bones move easily at the joint. OA can happen for a bunch of reasons like everyday wear and tear, carrying extra body weight, old injuries, or even joint issues that someone might be born with. Aging and family history can also make someone more likely to develop it (Sissons, 2023). Inside the joint, OA leads to the breakdown of cartilage, damage to support structures like ligaments and menisci, and thickening of the joint capsule (Martel-Pelletier et al., 2008). Normally, hyaline cartilage covers the ends of bones and lets them move smoothly against each other while absorbing impact. But with OA, that cartilage gets damaged, causing pain, swelling, and stiffness. It usually starts at the cartilage covering the bone ends at the joint. Over time, the cartilage can crack, wear down, or become rough, and if the damage gets worse, it can go deep enough to affect the bone underneath (Sissons, 2023).

In the early stages of osteoarthritis, the cartilage cells (chondrocytes) try to fix the damage by making more proteoglycans and releasing substances that block enzymes responsible for breaking down the joint's structure. But these repair efforts don't fully keep up with the damage, causing an imbalance. Because of this, the cartilage starts to lose its normal proteoglycan levels and takes in too much water. The collagen becomes disorganized, and the tissue loses its

flexibility. These changes lead to visible damage like cracks in the cartilage and worn-out joint surfaces (Kisand et al., 2018).

As osteoarthritis gets worse, the joint can break down even more, and bony growths called bone spurs can form. Small pieces of bone or cartilage might also break off and float around in the joint space. The body responds with inflammation, releasing certain chemicals like cytokines and enzymes that speed up the damage to the cartilage. Over time, the cartilage wears away so much that the bones rub directly against each other, causing more pain and damage (Sissons, 2023). While knee osteoarthritis is often linked to aging, it's actually its own disease not just something that happens because someone is getting older. The way cartilage changes in OA is different from what happens during normal aging (Hsu et al., 2023).

## **2.6 Clinical Signs and Symptoms of Osteoarthritis**

Knee osteoarthritis tends to develop slowly over time. Some of the usual symptoms people notice are knee pain that comes and goes or sticks around, often starting off mild and getting worse with movement. There's also morning stiffness, usually lasting under 30 minutes, and the knee might feel like it's locking or giving out. A cracking or popping sound (crepitus) might be heard when moving the joint. Pain can also show up after sitting or resting for a while. Everyday activities like walking, climbing stairs, or doing chores can become harder (Lespasio, 2017). Other signs include swelling around the joint, the knee looking slightly bigger, and the area feeling tender when touched (Arya and Jain, 2013).

## **2.7 Stages of Osteoarthritis**

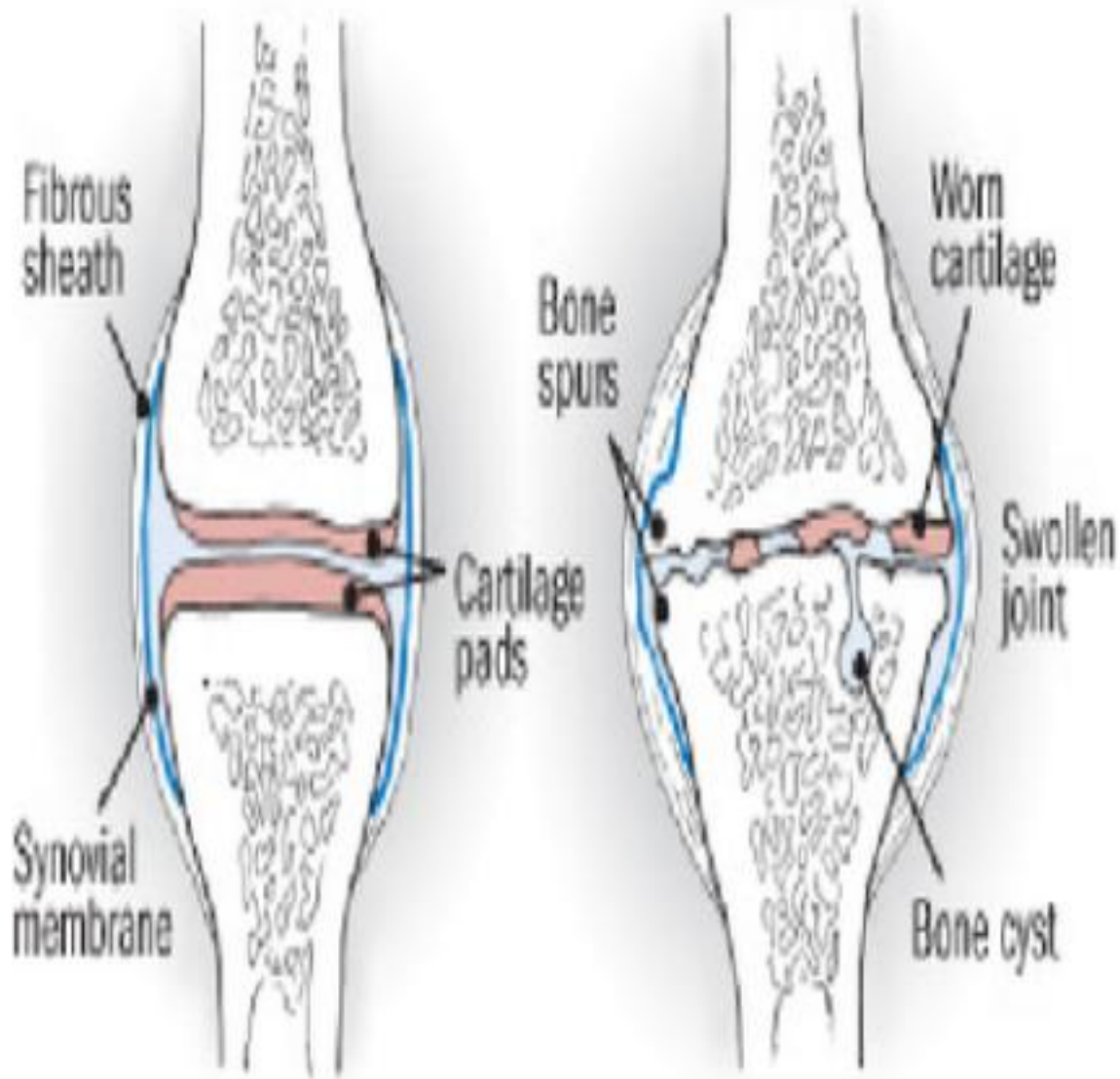
Osteoarthritis is usually divided into four stages, depending on how much the cartilage and joint have been damaged and how serious the symptoms are.

Stage 1 (Mild): At this point, the cartilage is still mostly healthy, and symptoms might be very mild or not even noticeable.

Stage 2 (Moderate): The person may start feeling sharper pain or discomfort, and there's visible wear on the cartilage.

Stage 3 (Advanced): Most of the cartilage is worn down, and symptoms like pain during movement or when putting weight on the joint become more noticeable.

Stage 4 (Severe): This is the most serious stage. People might experience strong pain, stiffness, swelling, and trouble moving the joint. The knee might feel unstable or give out, and things like bone spurs, joint deformities, or muscle weakness can also show up (Whelan et al., 2024).



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Figure 4: Presentation of knee osteoarthritis, Image source: [physiopedia.com](http://physiopedia.com)

## **2.8 Radiological Investigation**

According to Lloyd-Jones (2020), the radiographic characteristics of knee OA include:

1) Joint space narrowing: The gap between the femur and tibia has become very tight, especially on the inner (medial) side of the knee, causing the bones to touch. The tibia is angled abnormally inward (varus deformity), and the outer (lateral) side of the joint appears widened. The denser appearance suggests thickening of the joint surface (sclerosis).

2) Osteophytes: These are bone spurs that commonly form in osteoarthritis. In this front-facing knee X-ray, you can see bony growths on both the tibia and femur. The space in the knee joint looks uneven and narrowed, with small spurs forming near the top of the tibia.

3) Articular irregularity and/or sclerosis: The joint surface looks more dense than normal, showing that it's thickened (sclerosis). The space between the joints is reduced, the bone surface is uneven, and there are small cyst-like changes under the surface.

4) Deformity: This refers to a change in the usual alignment or shape of the bone or joint.

## **2.9 Management**

Knee osteoarthritis can be managed either without surgery or through surgery. As explained by Collins et al. (2019), doctors usually begin with non-surgical options, and if those stop working, then they consider surgery as the next step.

### **2.9.1 Conservative Management**

Knee osteoarthritis can be managed using several physical methods like physiotherapy, exercise, losing weight, and wearing knee braces. Jamtvedt et al. (2008) stated that exercise and weight loss help reduce pain and improve how the body functions. Exercise is one of the key treatments recommended for knee OA. Both high-intensity and low-intensity aerobic workouts help people with knee OA by improving how they walk, lowering pain, and boosting fitness. Exercises like walking, strengthening the quadriceps, and resistance training are helpful in lowering pain and making daily activities easier. Doing exercises in water or on land can reduce knee pain and improve physical ability (Roddy et al., 2005). Strengthening the quadriceps muscles helps manage pain and decrease disability (Devita et al., 2018). It's also important to focus on hip muscles. Strengthening the hip abductor muscles has been shown to reduce pain and improve how people with knee OA move and function (Praphaka et al., 2022). Stretching exercises are also necessary, especially for the hamstring muscles, since knee OA often reduces their flexibility. Adding hamstring stretching to strengthening routines can help with pain and movement (MA et al., 2023). Schlenk and Xiaojun (2019) noted that exercise not only helps the joints move better but also improves overall life quality and reduces depression in knee OA patients.

**Weight loss:** Losing weight plays a key role in managing knee osteoarthritis, no matter what stage it's at. It's especially recommended for people with a BMI over 25 who are showing symptoms. The best way to lose weight is through a mix of low-impact cardio exercises and proper diet control. Studies have shown that even a small amount of weight loss can make a big difference. In fact, dropping just 1% of your body weight can lower the chances of needing knee replacement by 2% (Collins et al., 2019).

Knee braces are also used as part of OA treatment. Braces that shift weight away from the painful part of the knee, known as offloading braces, are really helpful for people who have knee alignment issues like valgus or varus (Saliz et al., 2022).

Other treatments include electrotherapy methods like ultrasound, infrared radiation, and TENS (transcutaneous electrical nerve stimulation), which are also used to manage pain and symptoms in knee OA (Nicolaskis et al., 2002).

### **2.9.2 Surgical Management**

Here, Healthcare professionals might suggest surgery if non-surgical treatments stop working, the joint is badly damaged, the pain becomes too much, or if daily tasks get really hard to do. Some surgical options for knee osteoarthritis include osteotomy, where the bone is cut and realigned to take pressure off the damaged part; arthroscopy, which is a less invasive way to look inside the joint and treat issues; and joint replacement surgery, where the damaged joint is taken out and replaced with an artificial one.

### **2.10 Resisted Exercises**

Resistance exercises are workouts that use your body weight or added resistance like weights or bands to build muscle strength, power, and endurance. They are a form of exercise therapy that helps improve a person's ability to move around, function independently, and stay mobile (Loveless and Ihm, 2015). For people with knee osteoarthritis, resistance training can help reduce pain and stiffness and improve how well they move (Li et al., 2016). It also helps boost energy, mood, and overall quality of life in older adults. This type of training strengthens key muscles like the quadriceps, hamstrings, and the muscles around the hips. Resistance training means doing exercises against something that pushes back, like dumbbells, sandbags, resistance

bands, barbells, or even your own body weight (Kisner and Colby, 2012). There are certain key points to keep in mind when designing a resistance training program. The following are important guidelines for creating a resistance training program:

1) Overload Principle: This means that to make muscles stronger or better, you need to push them harder than they're used to. If the muscle isn't challenged with more resistance, it won't grow or improve. So, you have to increase the effort for the muscle to get better (McArdle et al., 2009).

2) SAID Principle (Specific Adaptation to Imposed Demands): This principle explains that your body gets used to whatever kind of stress or activity you put it through. If you train a certain way, your body will adapt specifically to that. It's based on Wolff's law, which says bones and body structures change depending on how much pressure or load they deal with (ACSMs, 2010).

3) Reversibility Principle: This one says that if you stop exercising or don't keep up your training, the strength and endurance you gained will slowly go away. To keep the benefits, you have to keep doing the exercises regularly or stay active in other ways (ACSMs, 2010).

4) Individuality: Everyone responds differently to exercise, so training programs should be made to fit each person's specific needs, abilities, and goals (ACSMs, 2010).

The way a resistance training program is designed affects how safe, effective, and appropriate it is. This is especially important when resistance training is used as part of regular fitness routines for healthy people or as part of rehab for those with actual or possible problems in muscle performance (Kisner and Colby, 2012). All of these elements must be shaped around each

person's own goals, following the SAID principle. Important components of resistance training include:

Body alignment; Making sure body parts are properly lined up during exercise so the movements are done right. joint stabilization; Keeping nearby joints stable during exercise to avoid unwanted or wrong movements. Intensity; Refers to how much resistance or weight is being used. Volume; Means the total number of sets and reps done during a session. Exercise order; The specific sequence in which muscle groups are trained during a workout. Frequency; How often the workouts happen daily or weekly. Rest intervals ; The time taken for breaks between sets and between training sessions. Duration; The total length of the training program over days, weeks, or months. \*Exercise mode\* – Includes the type of muscle contraction used (like concentric or eccentric), body position during the exercise, what kind of resistance is applied (like bands or weights), the range of motion, and the energy system used.

Exercise velocity; The speed at which exercises are performed. Periodization; Changing the volume and intensity of the training depending on the phase of the training program. Integration of functions ; including resistance training that mimics the functional needs of day-to-day tasks (ACSMs, 2010). Resistance training helps to build muscle strength and tone while also maintaining flexibility, mobility, and balance. These all support a person's ability to stay independent as they age and can help improve overall wellbeing (Sundell, 2011).

## **2.11 Functional Outcome**

Functional outcomes mean how well someone can handle daily activities and take part in social or work life (Remington, 2010). It mainly focuses on tasks like dressing, bathing, walking, or using the stairs (Semin Lang, 1998). But it also includes whether a person can go to work, spend

time with others, or enjoy hobbies. These outcomes show how well a person can do tasks and stay involved in things that matter to them. They are usually checked using tests, questionnaires, or scales that look at things like pain, movement, strength, and balance (Remington, 2010).

How knee osteoarthritis affects functional outcomes:

Knee OA seriously affects how well a person can function because it brings pain, stiffness, and less movement, making daily tasks harder. Simple activities like walking or using stairs can become challenging. People with knee OA often feel stiff and sore, especially after sitting or resting, which makes it tougher to use their legs for daily routines. It also weakens the muscles around the knee, which affects movement, balance, and makes it harder to do things like squatting, climbing stairs, or doing chores at home (Faiq et al., 2018; WHO, 2023).

### **2.11.1 Functional Outcome Measures**

The following instruments are used to evaluate and measure an individual's ability for daily living, including activities related to daily routines.

#### **1) Functional Independence Measure (FIM):**

This tool is used to check disability levels in different types of people, not just those with one specific health issue. It looks at how well someone can take care of themselves, like using the bathroom, moving from place to place, walking, talking, and thinking socially (Cameron and Monroe, 2007). The FIM helps measure how dependent or independent a person is and keeps track of how much they improve after treatment or rehab. It mainly focuses on daily activities (Linacre et al., 1994). The FIM includes 18 tasks split into two parts: motor and cognitive. The motor part has scores ranging from 13 to 91, and the cognitive part ranges from 5 to 35. When

you add both, the total score can be anywhere from 18 to 126 (Gosman-Hedstrom et al., 2000). Each task is rated using a 7-point scale that shows how much help a person needs to do it.

#### Helper – Total Dependence

1) Complete Assistance or Not Testable: The person can do less than 25% of the task on their own.

2) Maximal Assistance: The person can perform at least 25% but needs major help.

#### Helper – Modified Dependence

3) Moderate Assistance: The person is able to complete at least 50% of the task.

4) Minimal Assistance: The person does 75% or more and just needs a bit of help.

#### No Helper Needed

5) Supervision: The person can do the task fully but needs someone around just in case.

6) Modified Independence: The person can do it alone but uses a tool or device.

7) Complete Independence: The person does everything alone, safely and efficiently. Linacre et al. (1994) mentioned that the total FIM score reflects a person's overall level of independence. This shows how independent a person is—18 means they are fully dependent, while 126 means they are completely independent. The FIM has been proven to be reliable, with inter-rater reliability scores (intraclass correlation coefficients) between 0.86 and 0.88, showing good consistency between different assessors. Also, when compared with the Barthel Index, the FIM

showed strong validity, meaning both tools measure similar things when it comes to functional limitations, with ICC scores higher than 0.83 (Gosman-Hedstrom et al., 2000).

## **2) Time up and go test (TUG):**

This test checks how long it takes someone to stand up from a chair, walk three meters at their normal speed using any walking aid if needed, turn around, walk back, and sit down again. It helps to assess how well the person moves, their balance while moving, and how likely they are to fall (Zasadzka and Borowicz, 2015). To do the test, you need a chair with armrests, a stopwatch, and a mark on the floor showing the three-meter distance. The person being tested should wear their regular shoes and use any walking aid they usually rely on. It's important to note if they use any support like a cane or hold onto something with their hands during the test (Cook et al., 2000).

## **3) The Western Ontario and McMaster Universities Arthritis Index (WOMAC)**

This questionnaire measures how someone manages daily living activities, their walking ability, general movement, overall health, and their quality of life. It's often used to assess hip and knee osteoarthritis, as supported by the American College of Rheumatology (2013). The form has 24 self-administered questions, split into three main parts. The pain section includes 5 items and looks at how much pain is felt during things like walking, climbing stairs, sleeping, sitting, lying down, and standing. The stiffness section has 2 questions that ask about how stiff the person feels in the morning and later in the day. The physical function section has 17 questions, and these involve different activities such as going up or down stairs, getting up from sitting,

standing, bending, walking, getting in or out of a car, shopping, putting on or taking off socks, getting out of bed, lying down, bathing, sitting, using the toilet, and doing both heavy and light housework. Each item is scored from 0 to 4, where 0 = none, 1 = mild, 2 = moderate, 3 = severe, and 4 = extreme. The total scores can go from 0–20 for pain, 0–8 for stiffness, and 0–68 for physical function. The higher the score, the more pain, stiffness, and difficulty the person has. Each of the WOMAC's subscales has different reliability. The physical function part tends to have good test-retest reliability and is more consistent. The pain section usually meets the minimum reliability standard, but results vary across different studies. The stiffness part has been found to have low reliability when tested more than once.

### **3) The Knee Outcome Survey (KOS):**

This questionnaire is filled out by patients to measure how much difficulty they have with daily tasks (using the daily living section) or during sports (using the sports activity section). It's used for different knee problems like ACL injuries, meniscus tears, and osteoarthritis. A lower score means the person has more disability. The questionnaire is divided into two parts: one for sports and one for daily activities. For each item, a score of 5 means "no difficulty" and 0 means "can't do it at all." The daily living part of the scale is known to be trustworthy and accurate for measuring knee-related problems, with a test-retest score of 0.97. It also shows a good connection with other functional tests like the Lysholm Knee Scale (ranging from 0.78 to 0.86) and a general function rating from 0 to 100 (with r values between 0.66 and 0.75) (Irrgang et al., 1998).

## 2.12 Table of Empirical Review

<b>AUTHOR/ YEAR</b>	<b>TITLE</b>	<b>SAMPLE SIZE</b>	<b>AIM OF STUDY</b>	<b>STUDY TYPE</b>	<b>OUTCOME MEASURES</b>	<b>FINDING</b>
Ciolac et al/ 2015	The resistance training's effects on older women with total knee replacement and osteoarthritis	23 women	To examine how resistance training affects balance, lower-limb loading distribution, and functional performance in older women who have osteoarthritis (OA) and total knee arthroplasty (TKA	Pre-post experimental design	Six MW tests, sitting to standing, getting off the ground, and climbing stairs.	Following resistance training the OKG demonstrated improvements in lower-limb loading distribution, unilateral balance, and functional performance that were higher than those seen Following in the younger and older women.
Hamid and Hafiz/2021	Impact of Progressive Resistance Strength Training on Functional Capacity, Quality of Life, and Body	56 patients	To examine the effects of the lower limb rehabilitation protocol's (LLRP) progressive resistance strength	A Randomized Controlled Trial.	The Western Ontario and McMaster Universities Osteoarthritis Index	LLRP's progressive resistance strength training is beneficial for lowering BMI and enhancing

	Mass Index in Knee Osteoarthritis		training on the functional capacity, quality of life, and body mass index (BMI) of overweight patients with knee osteoarthritis (OA)		(WOMAC), height and weight measurements, BMI computation, and Gait Speed Test were all carried out	functional ability and quality of life.
Jan et al/ 2008	Examining the Clinical effect of High- and Low-Resistance Exercise on Patients with Osteoarthritis of the Knee	102 subjects	To evaluate the effects of strength training with high and low resistance in older individuals with osteoarthritis of the knee	A Randomized controlled trial		For people with mild to moderate knee OA, the benefits of high-resistance strength training appear to be greater than those of low-resistance strength training, even though the differences between the HR and LR groups were not statistically significant.

Liao et al/ 2020	The Impact of Elastic Resistance Training on Mass and Physical Function in Older Women with Osteoarthritis Following Total Knee Replacement in the Knee	60 older women who received unilateral primary total knee replacement surgery	To determine how elastic resistance exercise training affects muscle mass and physical outcomes in older women with osteoarthritis in their knees following total knee replacement	A Randomized Controlled Trial	Appendicular lean mass, the Western Ontario and McMaster Universities Osteoarthritis Index, and physical function performance (such as Timed Up & Go, gait speed, forward reach, single-leg stance, and timed chair rise)	In older women with knee osteoarthritis, a twelve-weeks elastic resistance exercise training program following total knee replacement improved muscle mass, mobility, and functional outcomes as measured by the Western Ontario and McMaster Universities Osteoarthritis Index
Li et al/ 2016	Resistance training's effects on individuals with osteoarthritis in the knee	17 randomized clinical trials including 1705 patients were integrated	To evaluate the effect of resistance training on knee osteoarthritis pain, stiffness, and physical function.	A systematic review and meta-analysis		The meta-analysis results suggested that resistance exercise training reduced pain, stiffness, and improved physical

						function
Vincent et al/ 2020	Comparing cocentric and Eccentric Resistance Training on Functional Pain and Physical Function in Knee Osteoarthritis	88 older adults	To evaluate the effects of eccentrically and concentrically focused resistance training on knee osteoarthritis functional pain and physical function	A Randomized Controlled Trial	chair rise time, stair climb time, 6-minute walk test distance, community ambulation, functional pain, and temporal- spatial gait parameters	Leg strength was increased by both muscle action types, but functional performance was not improved in a different way. The only exercise that decreased ambulatory pain was concentric exercise

# CHAPTER THREE

## MATERIALS AND METHOD

### 3.1 Materials

#### 3.1.1 Population

The population includes participants for this study comprises of individuals aged from 60 years and above who resides in Benin city, Edo state and have been diagnosed with primary knee osteoarthritis and attending the University of Benin Teaching Hospital (UBTH), Benin City, Edo State.

#### 3.1.2 Selection Criteria

##### 3.1.2.1 Inclusion Criteria

- I. Individuals aged 60 years and above clinically diagnosed with knee osteoarthritis.
- II. Individuals attending Outpatient Clinic at the University of Benin Teaching Hospital (UBTH), Benin city, Edo state.
- III. Individuals willing to participate.

##### 3.1.2.2 Exclusion Criteria

This study excluded in:

- I. Individuals with severe comorbidities such as uncontrolled cardiovascular, pulmonary and metabolic disease.
- II. Individuals with cognitive impairment which can affect with their participation in the study.

III. Individuals with recent history of fracture and dislocation and major surgery

V. Individuals with heart disease that limits physical activity

### **3.1.3 List of Instrument:**

1) Functional Independence Measure (FIM)

2) Patient Specific Functional Scale (PSFS)

### **3.1.4 Description of Instruments**

#### **1) Functional independence measure (FIM):**

In rehabilitation, this tool is the most commonly used to check how well someone functions (Wright, 2011). It helps measure how much a patient is affected by their condition and how they improve after getting treatment or rehab. It's usually done through an interview and takes around 30 to 45 minutes to complete. Healthcare workers use the FIM to figure out and rank how independent someone is based on how much help they need. The FIM has 18 items and uses a scale to rate performance, and it works for many rehab conditions. A score of 1 means the person needs total help (they can only do less than 25% of the task), and a score of 7 means they can do it completely on their own. If someone scores below 6, it means they still need supervision or help. The 18 items are split into two main parts: cognitive and motor functions (Linacre et al., 1994; Wright, 2011).

The motor section of the scale covers:

Self-care (6 tasks):

- Eating

- Personal grooming
- Bathing
- Dressing the upper body
- Dressing the lower body
- Using the toilet

Sphincter control (2 tasks):

- Controlling bladder function
- Controlling bowel function

Transfers (3 tasks):

- Moving between bed, chair, or wheelchair
- Getting on and off the toilet
- Getting in and out of the bath or shower

Movement (2 tasks):

- Walking or using a wheelchair
- Going up and down stairs

The cognitive section includes:

Communication (2 tasks):

- Understanding what's said ( comprehension)
- Expressing thoughts and ideas

Social cognition (3 tasks):

- Interacting with others ( social interaction)
- Solving everyday problems (problem-solving)
- Remembering things(memory)

The total FIM score is calculated by adding up all the points, and it can be anywhere from 18 to 126. If someone scores between 18 and 54, it means they're more dependent and need a lot of help. A score between 55 and 90 shows they have some level of independence but still need help or supervision for certain tasks. If the score is between 91 and 126, it means they're mostly independent and can do most or all tasks on their own. The FIM has shown good reliability, with intraclass correlation scores between 0.86 and 0.88, and it also matches well with the Barthel Index, showing strong validity (ICC above 0.83).

## **2) Patient Specific Functional Scale:**

Stratford et al. (1995) developed this scale as a self-report tool to check how well someone can function, no matter their level of independence. Patients are told to list up to five important activities they struggle with or can't do because of their condition like putting on shoes or going shopping. Then, they rate how difficult each task feels on a scale from 0 to 10. After going through treatment, they're asked to rate those same tasks again, and they can also add any new

tasks they've started having trouble with. A score of 0 means they can't do the task at all, while 10 means they can do it like they used to before the problem started.

The PSFS is known to be reliable when it comes to conditions like general lower back pain and knee problems. It works well as a tool to measure progress in people dealing with back, neck, knee, or upper limb issues (Cleland et al., 2006). Patients pick tasks they struggle with because of their condition and rate how well they can do each one now. They use a scale from 0 to 10—0 means they can't do it at all, and 10 means they can do it just like they did before the problem started. The test has strong reliability, proven by an ICC of 0.82, meaning if the same patient is tested more than once, the scores are likely to stay consistent. The 95% confidence interval (0.54–0.93) also supports its trustworthiness. In cervical radiculopathy cases, the PSFS showed strong test-retest reliability compared to the Neck Disability Index. It worked best in people with upper limb problems, though results were a bit weaker for cervical radiculopathy (ICC = 0.713). Chatman et al. (1997) and Westway et al. (1998) also found PSFS valid ( $p < .001$ ) for detecting upper limb issues. In practice, patients pick up to three daily activities that matter to them but are hard to do. Then they rate each one from 0 to 10. After scoring, the average of all selected tasks is taken to get a final score. A lower score shows more limitations, while a higher one shows better function. Tracking these scores helps check if treatment is working or not over time.

#### PSFS Scoring Levels:

##### 0–2: Really Dependent

You can't do the activity at all or it's super hard.

##### 3–5: Somewhat Dependent

The activity is still hard, and you might need some help or have noticeable trouble doing it.

6–8: Kinda Independent

You can do it on your own, but it's not easy still takes effort or feels uncomfortable.

9–10: Fully Independent

You can do the activity just like you used to before the problem no help needed.

## **3.2 Methods**

### **3.2.1 Research Design**

This study adopted a pre-post quasi experimental research design.

### **3.2.2 Sampling Technique**

Participants for this study were recruited using a purposive sampling technique.

### **3.2.3 Sample Size**

The sample size for this study was calculated using the Slovin formula:

$$n = N / (1 + N(e)^2)$$

where:

n = sample size

N = population size (20)

e = margin of error (let's assume 0.05 for 95% confidence level)

Plugging in the numbers:

$$n = 20 / (1 + 20(0.05)^2)$$

$$n = 20 / (1 + 20(0.0025))$$

$$n = 20 / (1 + 0.05)$$

$$n = 20 / 1.05$$

$$n = 19.$$

### **3.2.4 Ethical Consideration**

Ethical approval for this study was obtained from the Ethics and Research Committee of the University of Benin Teaching Hospital, Benin city. A letter of introduction was submitted to the Department of Physiotherapy, UBTH and the researcher's supervisor. Written informed consent was obtained from all participants before their inclusion in the study. Confidentiality was upheld throughout the research, with all data anonymized and stored securely.

### **3.2.5 Procedure for Data Collection**

The eligible participants received an informed consent form that outlined the study's aims, procedures, potential risks, and benefits. The study was conducted at the orthopedic physiotherapy outpatient clinic. The participants' demographic information were documented using a proforma. Participants engaged in a six-week supervised program of resisted active exercises, which was conducted three times a week under the guidance of a qualified physiotherapist. A pre-assessment was conducted using the Functional Independence Measure (FIM) and Patient Specific Functional Scale (PSFS) to evaluate participants' functional status before starting the intervention and after six weeks a post-assessment was performed using the

FIM to assess participants' functional status again to evaluate for any changes in the participants functional status.

### **3.2.6 Resisted Exercises Procedure**

The participants took part in 2 to 3 sessions each week for the next six weeks. Each session lasted about 30 to 45 minutes. This included 3-5 sets of 8 to 12 repetitions of exercises like step up and down, squats, lunges, leg raises, leg extensions, and leg curls with the use of sandbag and theraband of different weight and resistance respectively. The intensity of the workouts was moderate to high, and as participants got stronger, the program was adjusted to meet their needs. For example, the weight was increased by 0.5 to 1 kg when someone can easily complete the reps. Repetitions were increased by 2 to 3 when participants could perform the repetitions easily. Additionally, sets were increased by 1 to 2 when participants could perform all sets easily.

### **3.2.7 Data Analysis**

All data was analysed using descriptive statistics of mean, frequency and standard deviation. Inferential statistics of paired T test was used to determine the correlation between variables. Data was analysed using Statistical Package for Social Sciences (IBM SPSS) version 27. The level of significance was set at  $p < 0.05$ .

# CHAPTER FOUR

## RESULTS

### 4.1 Introduction

The primary aim of this study was to evaluate the functional outcome of performing resisted active exercises for six weeks on older adults with knee osteoarthritis. A total of 19 patients who have been diagnosed with mild to severe knee osteoarthritis and attending the University of Benin Teaching Hospital (UBTH), Benin City, Edo State were recruited for this study.

#### 4.1.1 Sociodemographic variable of the participants

A total of 19 participants were recruited out of which 17(89.5%) were females while just 2(10.5%) were males. 13(68.4%) were married, 11(57.9%) had tertiary level of education. 7(36.8%) of the participants are retirees, 6(31.6%) are traders. 15(78.9%) of the participants have both knees affected with Osteoarthritis (OA) and 12(63.2%) of the participants have had OA for  $\leq 1$  year duration. The age of the participants ranged from 60 to 80 years with a mean age of 68.63 years ( $\pm 6.75$ ) as shown in table 1.

**Table 1: Sociodemographic variable of the participants**

<b>Variable</b>	<b>Frequency</b>	<b>Percentages</b>
<b>Gender</b>		
Female	17	89.5
Male	2	10.5
<b>Marital status</b>		
Married	13	68.4
Widowed	6	31.6
<b>Educational level</b>		
Primary	6	31.6
Secondary	2	10.5
Tertiary	11	57.9
<b>Occupation</b>		
Civil servants	3	15.8
Farmer	1	5.3
Hair stylist	1	5.3
Retired	7	36.8
Teacher	1	5.3
Trader	6	31.6
<b>Side affected by Knee OA</b>		
Both knees	15	78.9
Left knee	1	5.3
Right knee	3	15.8
<b>Duration of OA</b>		
≤1year	12	63.2
2-5years	5	26.3
6-10years	2	10.5
	<b>Range</b>	<b>Mean±SD</b>
Age	60-80	68.63±6.75

### **4.1.2 Descriptive statistics of the participants**

The Functional independence score before the commencement of resisted active exercises to the knee ranged from 91 to 125 with a mean of  $114.68 \pm 7.72$ . The Functional independence score six weeks after the commencement of resisted active exercises to the knee ranged from 101 to 126 with a mean of  $118.26 \pm 5.85$ . The patient specific functional outcome score of the participants before the commencement of resisted active exercises to the knee ranged from 2 to 9 with a mean of  $5.21 \pm 1.99$  and the patient specific functional outcome score of the participants six weeks after the commencement of resisted active exercises to the knee ranged from 5 to 10 with a mean of  $7.47 \pm 1.26$  as shown in table 2.

**Table 2: Descriptive statistics of the participants**

<b>Variable</b>	<b>Range</b>	<b>Mean <math>\pm</math>SD</b>
<b>Pre-FIM score</b>	91-125	114.68 $\pm$ 7.72
<b>Post-FIM score</b>	101-126	118.26 $\pm$ 5.85
<b>Pre-PSFS score</b>	2-9	5.21 $\pm$ 1.99
<b>Post-PSFS score</b>	5-10	7.47 $\pm$ 1.26

**FIM: Functional Independence Measure**

**PSFS: Patient Specific Functional Scale**

### **4.1.3 Effects of resisted active exercises on the function status of the participants**

Table 3 showed a paired t-test conducted to examine the Effects of resisted active exercises on the FIM and PSFS score of the participants. The findings revealed there was a significant difference functional status (FIM and PSFS) of older adults with knee osteoarthritis following six weeks of resistance exercise training (p-value=0.001)

**Table 3: Effects of resisted active exercises on the functional status of the respondents**

<b>Variable</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>T</b>	<b>P</b>
<b>Pre-FIM score- Post FIM score</b>	-3.579	2.411	-6.470	0.001
<b>Pre-PSFS score- Post-PSFS score</b>	-2.263	1.046	9.433	0.001

## 4.2 Hypothesis testing

1. There would be no significant difference in the functional status (FIM) of older adults with knee osteoarthritis following six weeks of resistance exercise training

Test: Paired t test

Alpha level: 0.05

Observed p value: 0.001

Judgement: Since the observed p value was less than 0.05, the null hypothesis was therefore REJECTED

2. There would be no significant difference in the functional status (PSFS) of older adults with knee osteoarthritis following six weeks of resistance exercise training

Test: Paired t test

Alpha level: 0.05

Observed p value: 0.001

Judgement: Since the observed p value was less than 0.05, the null hypothesis was therefore REJECTED

## CHAPTER FIVE

### DISCUSSION, CONCLUSION AND RECOMMENDATIONS

#### 5.1 DISCUSSION

##### 5.1.1 Discussion of Sociodemographic Characteristics of the Participants

The primary aim of this study was to assess the functional outcome of resisted active exercises on older adults with knee osteoarthritis, using FIM (Functional Independence Measure) and PSFS (Patient-Specific Functional Scale) as tools for measurement. A total of 19 participants participated in this study, with data analyzed to explore their functional status.

Most of the people who took part in this study were women, with an average age falling within the middle-aged to older adult group. A lot of them also had osteoarthritis (OA) in both knees. The fact that most participants were women fits with what's already known about knee OA it's more common in women, especially after menopause (Srikanth et al., 2024). This difference between genders is believed to be caused by a mix of hormones, body structure, and genetics. So, the gender makeup of this group reflects the kind of patients usually seen in hospitals with knee OA. The average age of participants also matches with how OA tends to affect older people more, as the condition often gets worse over time due to wear and tear on the joints (Johnson & Hunter, 2024). Since the ages ranged from 60 to 80, it shows that the study was successful in focusing on older adults.

One important finding from the study is that most of the participants had osteoarthritis in both knees. This shows how serious their condition was, since having OA in both knees usually causes more pain, difficulty with movement, and a longer recovery process than if only one knee

is affected (Sharma et al., 2019). This likely means the participants were already facing major physical limitations before the intervention, which is important when assessing how effective the treatment was.

In addition, around two-thirds of the participants said they'd had OA for a year or less. This might mean they were still in the early stages of the condition, when joints tend to respond better to things like exercise aimed at building strength and protecting the joints. That could help explain why some showed improvement during the study (Lange et al., 2020). Starting treatment early can help slow down the disease and possibly delay surgery (Uthman et al., 2023). However, there's also a chance that their symptoms had been present for a while but only recently became severe enough to lead to a formal diagnosis.

The background of the participants in terms of their education and social status is important to consider. Many of them had tertiary education, which probably helped them understand the exercise routine better, stick to the program, and give accurate feedback about their progress (Gakunga et al., 2021). Also, most of the participants were either retired or traders, which fits the typical jobs for people their age. Since trading usually involves standing and walking a lot, this might affect how their osteoarthritis develops and what they hope to achieve with the treatment.

### **5.1.2 Descriptive statistics of the participants**

The increase in the mean FIM score indicated an improvement in the participants' overall functional independence. The FIM is used in assessing ranges of activities of daily living (ADLs), including self-care, sphincter control, transfers, and locomotion (Keith et al., 2022). These findings are in agreement with previous literature that highlights the efficacy of resistance exercises in building function among individuals affected by knee OA. According to Fransen et

al. (2025), Land-based exercises, especially those that includes resistance components, greatly has an impact in function and decreasing disability in elderly individual with OA. In older individual population with knee OA, difficulties in activities such as walking, moving from a chair, or climbing stairs are common and impact self mobility (Roddy et al., 2025).

The improvement noticed suggests that the resisted exercise program enhanced the participants' ability to do these activities with greater ease and less assistance. This result fits with the idea that making muscles like the quadriceps, hamstrings, and hip stronger helps keep the knee more stable and takes some pressure off it when standing or moving. This makes everyday activities easier to do (Bennell & Hinman, 2021). Also, the smaller spread in the FIM scores after the treatment shows that most participants got better, meaning the exercise program helped.

There was an even bigger and more important improvement in the Patient-Specific Functional Scale (PSFS) scores. On average, the PSFS score went up by 2.26 points, which means people got noticeably better at doing the activities that matter most to them (Stratford et al., 2025). For older adults with knee OA, this might be things like getting in and out of a car, walking long distances, going to the market, dancing, or kneeling to pray. This increase is important because it's more than the 2-point change considered meaningful in studies (Horn et al., 2022). So, the improvements weren't just by chance they really helped with their daily activities. These good results match what other studies say about exercise for knee OA. For example, a big review by Fransen et al. (2025) found that exercises on land, like strength training, reduce pain and help people move better. Our study supports this by showing that a planned exercise program can make a real difference. The improvement probably comes from many things, like stronger

muscles, better balance and awareness of movement, more confidence when moving, and maybe even pain relief from the body's natural chemicals like endorphins (Uthman et al., 2023).

### **5.1.3 Effects of resisted active exercises on the function status of the participants**

The results from this study showed a clear and meaningful improvement in both the Functional Independence Measure (FIM) and the Patient-Specific Functional Scale (PSFS) after the exercise program. The p-value was very significant, meaning the improvement most likely didn't happen by chance, but because of the resisted exercise intervention (Portney & Watkins, 2025). The rise in FIM scores shows that participants were able to do daily tasks better—things like moving around, taking care of themselves, and switching from one position to another, which are all important for staying independent as an older adult. Building muscle strength through resistance training plays a big role in this, since strong muscles help support the joints and improve control during movement (Roddy et al., 2025). Even though the FIM covers a wide range of activities, doing better on it shows progress in major tasks like walking, getting up, and self-care. This supports what we already know: resistance training helps build important muscles like the quadriceps, hamstrings, and hip muscles. These muscles help keep the knee stable and absorb shock, which takes pressure off the joint, reduces pain, and helps people move more easily and independently (Bennell & Hinman, 2021; Fransen et al., 2025).

The noticeable increase in PSFS scores shows that participants were able to do specific activities that they had struggled with before because of pain or stiffness from knee osteoarthritis. The PSFS is a useful tool because it focuses on tasks that matter personally to each patient, making it great for tracking real-life improvements (Abbott & Schmitt, 2019). So, the progress seen here

suggests that the resisted exercise program didn't just improve clinical measurements but also helped participants function better in their day-to-day lives.

Seeing good results from both the general scale (FIM) and the more personalized one (PSFS) suggests that even within a short six-week period, doing resisted active exercises can make a real difference. It helped participants become more independent overall and better at the specific tasks that were important to them. This supports what many studies, including a Cochrane review, have already shown: that land-based strength training is one of the most effective ways to manage knee osteoarthritis. It leads to clear and meaningful improvements in how people move and handle daily physical tasks (Fransen et al., 2025; Uthman et al., 2023).

## **5.2 Conclusion**

This study evaluated the functional outcomes of performing six weeks of resisted active exercises in older adults with knee osteoarthritis using a sand bag and a theraband of different weight and resistance. The findings demonstrated significant improvements in both general functional independence and task-specific abilities, as evidenced by statistically significant increases in FIM and PSFS scores. These results support the effectiveness of resisted active exercises as a simple, low-cost, and non-pharmacological intervention for improving functional status in older adults with knee OA. Early implementation of such exercise programs can help reduce disability, enhance independence, and improve quality of life in this population.

## **5.3 Recommendations**

Considering the clear improvements in function after six weeks of resisted active exercises in older adults with knee osteoarthritis, these suggestions can be made:Physiotherapists should

create resistance exercise plans based on each person's condition and make sure exercises are done correctly, especially in the beginning stages. Tools like the FIM and PSFS should be used regularly to check how the patient is doing and to adjust the difficulty of the exercises as needed. In places with limited resources, healthcare centers should support exercise programs within communities that focus on helping older adults who may lose function due to OA. Awareness campaigns should highlight how staying physically active, especially through resistance training, can help older people stay independent and manage joint problems.

#### **5.4 Implications for Further Study**

The findings of this study highlight the positive impact of resisted active exercises on the functional status of older adults with knee osteoarthritis. However, the study also opens several avenues for further research:

**Long-term Effects:** This study was limited to a six-week intervention. Future studies should explore the long-term effects of continued resisted active exercise on functional outcomes, pain management, and disease progression in knee OA.

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# APPENDIX 1

**HEALTH RESEARCH ETHICS COMMITTEE (HREC)**  
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PROTOCOL NUMBER: ADM/E 22/A/VOL.VII/2025/123

PROPOSAL TITLE: "FUNCTIONAL OUTCOME OF RESISTED ACTIVE EXERCISES ON OLDER ADULTS WITH KNEE OSTEOARTHRITIS"

PRINCIPAL INVESTIGATOR(S): OCHUKO-OBODOEKE VWAERHE

DEPARTMENT/INSTITUTION: DEPARTMENT OF PHYSIOTHERAPY, SCHOOL OF BASIC MEDICAL SCIENCES UNIVERSITY OF BENIN, BENIN CITY, EDO STATE

DATE CONSIDERED: JULY 14<sup>TH</sup>, 2025

DECISION OF THE COMMITTEE: APPROVED

*THIS APPROVAL DATES 14/7/2025 TO 13/7/2026. IF THERE IS DELAY IN STARTING THE RESEARCH, PLEASE INFORM THE HREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY*

REMARK:

CHAIRMAN: PROF. (MRS) A.N. OFILI

SUPERVISOR (S): DR(MRS) OLUWASEUN S. KUBEYINJE

DECLARATION BY INVESTIGATOR(S):  
PROTOCOL NUMBER (please quote in all enquiries)  
Note that no participant accrual or activity related to this research may be conducted outside of these dates. All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study. In multiyear research, endeavor to submit your annual re-port to the HREC early in order to obtain renewal of your approval and avoid disruption of your research. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code. The HREC reserves the right to conduct compliance visit your research site without previous notification

Signature & Date.....

Signature & Date: Prof. A.N. Ofili 14/7/2025

ubthresearchethics@gmail.com Registration Number: NHREC-UBTH-HREC/24/12/2023B

## APPENDIX 2

### INFORMED CONSENT FORM

**Title of study:** Functional outcome of resisted active exercises on older adults with knee osteoarthritis.

**Investigator:** Ochuko-obodoeke vwaerhe

**Supervisors:** Dr (Mrs) Oluwaseun Susan Kubenyinje

**Financial Sponsorship:** This research project is self-sponsored

**Purpose of the research:** The purpose is to determine resisted active exercises effect on the functional outcome of older adults with knee osteoarthritis.

#### **Procedures and protocol involved in the study**

You are politely invited to participate in a research study that involves a structured exercise intervention. The Functional Independence Measure (FIM) score and Patient Specific Functional Scale (PSFS) will be used to assess your functional status before and after undergoing the program of resisted active exercises tailored to manage knee osteoarthritis.

The exercises will be administered and conducted at the orthopedic physiotherapy outpatient clinic under supervision three times a week for the next six weeks. All information collected will be used solely for research purposes and will remain strictly confidential.

## **Compensation**

There will be no financial compensation for participating in this study.

## **Voluntary Participation**

Please note that your participation in this research is entirely voluntary. No form of discrimination will be meted to you, should you decide not to participate in this study; You are entirely free to change your mind and stop participating even if you agreed earlier.

## **Side Effects**

There is no anticipated adverse effect associated with participating in this study.

## **Benefits**

The purpose of this study is to evaluate the functional outcome of older adults with knee osteoarthritis following six weeks of resisted active exercises.

## **Confidentiality**

All information and data obtained in the course of this study will be treated confidentially. The names of the participants will not be written on the questionnaire, and all information collected will be encoded in a file in my personal computer and passworded. Thereafter the questionnaires will be shelved and locked in my personal document cabinet.

## **CONTACT INFORMATION**

OCHUKO-OBODOEKE VWAERHE

PROJECT STUDENT

Email: vwaerheobodoeke400@gmail.com

Ethics and Research Committee

University of Benin Teaching Hospital

Benin City.

Phone Number: 08150352806

## **CERTIFICATE OF CONSENT**

having read the above information (or it has been read to me). I had the opportunity to ask questions about it and the questions were answered to my satisfaction.

I consent voluntarily to take part as a participant in this study

I do not consent to participate in this study.

Signature of participant: \_\_\_\_\_

Date: \_\_\_\_\_

## APPENDIX 3

### Sociodemographic Data

Age: \_\_\_\_\_

Gender:

Female [  ]

Male [  ]

Marital Status:

Single [  ]

Married [  ]

Divorced [  ]

Widowed [  ]

Others: \_\_\_\_\_ [  ]

Educational Level:

None [  ]

Primary [  ]

Secondary [  ]

Tertiary [  ]

Occupation:

Unemployed [ ]

Retired [ ]

Trader [ ]

Civil Servant [ ]

Others: \_\_\_\_\_ [ ]

Side affected:

Both knees: \_\_\_\_\_

Right knee: \_\_\_\_\_

Left knee: \_\_\_\_\_

Duration of knee osteoarthritis diagnosis: \_\_\_\_\_ months/years

# APPENDIX 4

## FUNCTIONAL INDEPENDENCE MEASURE SCORE

functional independence measure (FIM) instrument

	ADMISSION	DISCHARGE	FOLLOW-UP
<b>Self-Care</b>			
A. Eating			
B. Grooming			
C. Bathing			
D. Dressing - Upper Body			
E. Dressing - Lower Body			
F. Toileting			
<b>Sphincter Control</b>			
G. Bladder Management			
H. Bowel Management			
<b>Transfers</b>			
I. Bed, Chair, Wheelchair			
J. Toilet			
K. Tub, Shower			
<b>Locomotion</b>			
L. Walk/Wheelchair			
M. Stairs			
<i>Motor Subtotal Score</i>			
<b>Communication</b>			
N. Comprehension			
O. Expression			
<b>Social Cognition</b>			
P. Social Interaction			
Q. Problem Solving			
R. Memory			
<i>Cognitive Subtotal Score</i>			
<b>TOTAL FIM Score</b>			

<b>L E V E L S</b>	<b>Independent</b> 7 Complete Independence (Timely, Safely) 6 Modified Independence (Device)	<b>NO HELPER</b>
	<b>Modified Dependence</b> 5 Supervision (Subject = 100%+) 4 Minimal Assist (Subject = 75%+) 3 Moderate Assist (Subject = 50%+)	<b>HELPER</b>
	<b>Complete Dependence</b> 2 Maximal Assist (Subject = 25%+) 1 Total Assist (Subject = less than 25%)	
Note: Leave no blanks. Enter 1 if patient is not testable due to risk.		

FIM Instrument. Copyright © 1997 Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities, Inc. Reprinted with the permission of UDSMR, University at Buffalo, 232 Parker Hall, 3435 Main St., Buffalo, NY 14214

## APPENDIX 5

### Patient-specific activity scoring scheme (Point to one number):

0	1	2	3	4	5	6	7	8	9	10
Unable to perform activity					Able to perform activity at the same level as before injury or problem					

**(Date and Score)**

Activity	Initial					
1.						
2.						
3.						
4.						
5.						
Additional						
Additional						

Total score = sum of the activity scores/number of activities  
 Minimum detectable change (90%CI) for average score = 2 points  
 Minimum detectable change (90%CI) for single activity score = 3 points

PSFS developed by: Stratford, P., Gill, C., Westaway, M., & Binkley, J. (1995). Assessing disability and change on individual patients: a report of a patient specific measure. *Physiotherapy Canada*, 47, 258-263.

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