# PREDICTORS OF PHYSICAL ACTIVITY LEVEL AMONG PATIENTS WITH KNEE OSTEOARTHRITIS IN UNIVERSITY OF BENIN TEACHING HOSPITAL


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# CERTIFICATION

This dissertation by Akee Caro Paul is accepted in its present form as satisfying the dissertation requirement of the degree of Bachelor of Physiotherapy of the School of Basic Medical Sciences, College of Medical Sciences, University of Benin.

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# DEDICATION

This dissertation is dedicated to Almighty God. To my parents, my friends and family for their support, love and prayers throughout this journey.

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# ABSTRACT

**Background:** Knee osteoarthritis (KOA) is a leading cause of pain, disability, and reduced quality of life worldwide. Despite evidence supporting the benefits of physical activity (PA) in managing KOA, many patients remain inactive. Identifying predictors of PA among this population is essential for developing tailored interventions.

**Aim:** This study investigated the predictors of physical activity levels among patients with knee osteoarthritis attending the University of Benin Teaching Hospital (UBTH).

**Methods:** A cross-sectional study was conducted with 36 participants diagnosed with KOA. Respondents were selected using purposive sampling. Data were collected on socio-demographic (age, sex, education), clinical (pain severity, duration of symptoms, comorbidities), and psychological variables (kinesiophobia, anxiety, depression). Instruments included the International Physical Activity Questionnaire–Short Form (IPAQ-SF), Tampa Scale for Kinesiophobia (TSK), and the Hospital Anxiety and Depression Scale (HADS). Descriptive and inferential statistics were applied, including Chi-square tests and ordinal logistic regression, with significance set at $p<0.05$.

**Results:** About half of the respondents (50%) had moderate PA, while smaller proportions had low (11.1%) or high (38.9%) PA levels. Most patients reported high kinesiophobia, and mild symptoms of anxiety and depression. Anxiety showed a significant association with PA ($P < 0.001$), whereas socio-demographic, clinical, and other psychological factors were not significantly related. Regression analysis showed that none of the variables independently predicted PA levels.

**Conclusion:** Most patients with KOA were moderately active despite reporting high levels of kinesiophobia. Anxiety was related to PA but was not an independent predictor. Overall, PA appears to be influenced by multiple interacting factors, highlighting the need for holistic management strategies that address both physical and psychological aspects.

**Keywords:** Knee osteoarthritis, Physical activity, Kinesiophobia, Anxiety, Depression, Predictors.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of the Study

Osteoarthritis (OA) is the most common form of arthritis and a leading cause of chronic disability worldwide (Ga & Lk, 2022). It is a degenerative joint disease characterized by the gradual deterioration of articular cartilage, subchondral bone remodeling, synovial inflammation, and the formation of osteophytes (He et al., 2020). OA predominantly affects weight-bearing joints such as the knees, hips, and spine, leading to pain, stiffness, swelling, and reduced functional mobility (H. Hsu & Siwiec, 2025). Among the various joints affected, the knee joint is particularly vulnerable due to its critical role in weight-bearing and locomotion, making knee osteoarthritis (knee OA) a significant health concern globally (GBD 2021 Osteoarthritis Collaborators, 2023).

Knee OA is a complex condition influenced by both mechanical and biological factors. It impairs joint function and progressively limits the individual's ability to perform daily activities. The disease burden is considerable, often resulting in decreased quality of life, increased dependency, and substantial socioeconomic costs due to healthcare expenditures and loss of productivity (Argatov & Mishuris, 2016).

Globally, the prevalence of OA has been steadily increasing, largely due to aging populations, rising obesity rates, and sedentary lifestyles. A study by (Cui et al., 2020) showed that global OA cases doubled from 247.51 million in (1990) to 527.81 million (2019) with knee OA remaining the most prevalent form, rising age-standardized rates

(0.32% annual increase). Recent estimates suggest that knee OA affects about 22–39% of individuals aged 40 and above worldwide (Swain et al., 2020).

In Africa, the burden of OA is also on the rise, although the epidemiological data remain limited compared to high-income countries. Studies indicate a growing prevalence linked to urbanization, changes in physical activity patterns, obesity, and increased life expectancy (Usenbo et al., 2015). In Nigeria, knee OA is a major public health concern, especially among older adults. Research has shown that the prevalence of symptomatic knee OA in Nigeria ranges from 10% to as high as 30% among older populations, depending on the diagnostic criteria and study settings (Akpabio et al., 2021). Factors such as traditional occupations involving heavy manual labor, limited access to early medical interventions, and cultural beliefs about aging and joint pain may contribute to the high burden observed.

Numerous factors have been associated with the onset and progression of knee osteoarthritis, including increasing age, female sex, obesity, a history of joint injuries, genetic susceptibility, joint misalignment, and occupations that place repetitive stress on the knees (Dong et al., 2023). Knee osteoarthritis can lead to a wide range of complications, including persistent pain, muscle weakness, joint instability, limited range of motion, impaired physical function, social withdrawal, and mental health issues such as depression and anxiety (H. Hsu & Siwiec, 2025).

Physical activity (PA) refers to any intentional movement of the body driven by skeletal muscles that results in energy expenditure. It covers a wide range of movements, from structured exercise to routine daily tasks, regardless of intensity or time of day (Dasso, 2019). Throughout human history, physical activity has been fundamental to survival, and its importance remains evident today. Regular PA is recommended for various

populations, including healthy individuals, older adults, and those managing chronic health conditions. The benefits of PA extend to multiple systems in the body, including the immune, musculoskeletal, respiratory, and endocrine systems (Ruegsegger & Booth, 2018). Moreover, consistent physical activity is linked to reduced mortality and morbidity from numerous non-communicable diseases such as diabetes, depression, cardiovascular disease, and osteoarthritis (De la Corte-Rodriguez et al., 2024).

Physical activity (PA) plays a critical role in the management of knee OA. It encompasses any bodily movement produced by skeletal muscles that results in energy expenditure, including activities performed during work, play, household chores, travel, and recreational pursuits (Westerterp, 2013). Regular physical activity is recognized for its numerous benefits, including the maintenance of joint health, improvement in muscular strength, reduction of pain, enhancement of physical function, and promotion of psychological well-being among individuals with knee OA (Zeng et al., 2021).

Despite these known benefits, maintaining adequate levels of physical activity in patients with knee OA can be challenging. Pain, joint stiffness, fear of exacerbating symptoms, reduced self-efficacy, lack of motivation, and limited access to exercise facilities are some of the barriers reported.

In Africa, including Nigeria, the participation in physical activity among patients with musculoskeletal conditions remains suboptimal. Cultural perceptions that associate joint pain with inevitable aging, limited health education on the benefits of exercise, financial constraints, and infrastructural barriers further complicate efforts to promote physical activity. Moreover, traditional healing practices and reliance on passive treatments may delay engagement with physiotherapy-led interventions emphasizing active self-management (Tami et al., 2021).

In Nigeria, knee OA constitutes a significant proportion of outpatient physiotherapy consultations. Despite the well-established benefits of physical activity in managing knee OA, many patients remain physically inactive due to a combination of socio-demographic, clinical and psychological factors. Globally and locally, understanding the predictors of physical activity is essential for designing effective interventions that promote long-term engagement in physical activity. However, in Nigeria, there is a scarcity of data on these predictors, especially within clinical populations.

## 1.2 Statement of the Problem

Knee osteoarthritis is a major cause of pain, disability, and reduced quality of life worldwide, particularly among older adults. Despite the well-established benefits of regular physical activity in managing knee OA symptoms and improving functional outcomes, many patients remain insufficiently active. In Nigeria, the burden of knee OA is growing, yet physical activity levels among affected individuals are often low (Tami et al., 2021). Various factors ranging from demographic, clinical and psychological characteristics may impact patients' engagement in physical activity, but these predictors are not well understood in the local context. Without a clear understanding of the predictors of physical activity levels among patients with knee OA, physiotherapists and healthcare providers face challenges in designing effective, individualized interventions. This gap in knowledge underscores the need for research focused on identifying the key predictors of physical activity among patients with knee osteoarthritis in order to inform targeted strategies that promote better management and improved quality of life.

## 1.3 Research Questions

This study was aimed at answering the following questions:

i. What is the level of physical activity among patients with knee osteoarthritis in University of Benin Teaching Hospital?
ii. How do socio-demographic factors (such as age, sex, education level) influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital?
iii. How do clinical factors (such as pain severity, duration of symptoms, and comorbidities) influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital?
iv. How do psychological factors (such as fear of movement, anxiety, and depression) influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital?
v. What are the possible predictors of physical activity levels (socio-demographic, clinical and psychological) among patients with knee osteoarthritis in University of Benin Teaching Hospital?

## 1.4 Aim of the Study

The aim of this study was to investigate the predictors of physical activity levels among patients with Knee Osteoarthritis in University of Benin Teaching Hospital.

### 1.4.1 Specific Objectives

The objectives of the study are to:

i. To evaluate the level of physical activity among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

ii. To evaluate how socio-demographic factors (such as age, sex, education level) may influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital

vi. To assess how clinical factors (such as pain severity, duration of symptoms, and comorbidities) may influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital.

iii. To assess how psychological factors (such as fear of movement, anxiety, and depression) may influence physical activity levels among patients with knee osteoarthritis in University of Benin Teaching Hospital.

iv. To establish the possible predictors of physical activity levels (socio-demographic, clinical and psychological) among patients with knee osteoarthritis in University of Benin Teaching Hospital.

## 1.5 Hypotheses

### 1.5.1 Main Hypothesis

i. There would be no significant association between socio-demographic, clinical, psychological factors and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

### 1.5.2 Sub Hypotheses

i. There would be no significant association between age and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

ii. There would be no significant association between sex and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

iii. There would be no significant association between education level and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

iv. There would be no significant association between pain severity and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

v. There would be no significant association between duration of symptoms and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

vi. There would be no significant association between presence of comorbidities and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

vii. There would be no significant association between fear of movement and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

viii. There would be no significant association between anxiety and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

ix. There would be no significant association between depression and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

## 1.6 Limitations of Study

i. The study included only 36 participants, which may limit the statistical power of the analysis and reduce the ability to detect significant relationships between variables. A small sample size also limits the generalizability of the findings to the broader population of patients with knee osteoarthritis.

ii. The research was conducted only among patients attending the University of Benin Teaching Hospital (UBTH). As a result, the findings may not fully represent patients with knee osteoarthritis in other hospitals, communities, or regions in Nigeria.

iii. The use of a cross-sectional research design means that data were collected at one point in time. Therefore, causal relationships between the predictors (socio-demographic, clinical, and psychological factors) and physical activity levels cannot be established.

iv. The study relied on self-reported instruments such as the International Physical Activity Questionnaire (IPAQ-SF), Tampa Scale for Kinesiophobia (TSK), and Hospital Anxiety and Depression Scale (HADS). Self-report measures may introduce recall bias or social desirability bias, as participants may overestimate or underestimate their responses.

v. The study focused mainly on socio-demographic, clinical, and psychological variables. Other potentially important factors influencing physical activity, such as

environmental factors, social support, economic status, or access to exercise facilities, were not assessed.

vi. The use of purposive sampling may introduce selection bias because participants were selected based on specific criteria rather than randomly. This may affect the representativeness of the sample.

vii. Physical activity levels were measured using questionnaires rather than objective tools such as accelerometers or pedometers, which may provide more accurate measurements of physical activity.

## 1.7 Significance of the Study

**To Clinicians:**

This study will help physiotherapists, physicians, and other healthcare providers at the University of Benin Teaching Hospital to better understand the key factors that influence physical activity levels in patients with knee osteoarthritis. With this knowledge, more personalized and effective rehabilitation and exercise programs can be developed to improve patients' functional outcomes, reduce pain, and enhance overall quality of life.

**To Academics:**

The study will add to the limited body of literature on the predictors of physical activity among patients with knee osteoarthritis in Nigeria and the broader African context. It will provide local, evidence-based data that can serve as a foundation for future research and contribute to academic discussions around musculoskeletal rehabilitation in low- and middle-income countries.

**To Public Health:**

Findings from this study could inform public health strategies aimed at encouraging physical activity among individuals living with chronic musculoskeletal conditions. By highlighting barriers and enablers to physical activity, the study could guide the design of community-based interventions, exercise promotion campaigns, and broader health education efforts.

**Policy Implications:**

The results of this study have the potential to influence healthcare policies by advocating for better access to physiotherapy services, supportive environments for physical activity (such as safe walking spaces), and funding for community exercise programs targeted at individuals with osteoarthritis and other chronic diseases.

**To the Patient:**

By identifying the factors that affect physical activity participation, the study will empower patients with knowledge and strategies to overcome barriers to exercise. Increased awareness can foster greater self-management, improve adherence to prescribed exercise regimens, and ultimately enhance independence and well-being among patients with knee osteoarthritis.

## 1.8 Scope and Delimitation of Study

This study was delimited to:

i. **Participants:** Male and female patients with Knee Osteoarthritis who received care in the University of Benin Teaching Hospital.

**ii. Instruments:**

a) The International Physical Activity Questionnaire – Short Form (IPAQ-SF)

b) The Tampa Scale for Kinesiophobia (TSK)

c) The Hospital Anxiety and Depression Scale (HADS)

## 1.8 Definition of Terms

i. **Osteoarthritis (OA):**

A chronic, degenerative joint disorder characterized by the breakdown of articular cartilage, subchondral bone changes, joint space narrowing, and inflammation, leading to pain, stiffness, and reduced mobility.

ii. **Knee Osteoarthritis:**

A form of osteoarthritis that specifically affects the knee joint, often resulting in pain, swelling, stiffness, and difficulty with walking or other weight-bearing activities.

iii. **Physical Activity (PA):**

Any bodily movement produced by skeletal muscles that requires energy expenditure. This includes activities during work, transportation, household chores, leisure, and structured exercise.

iv. **Physical Activity Level:**

The extent or intensity of physical activity performed by an individual, often measured by frequency, duration, and type of movement. It can be categorized as low, moderate, or high.

## 1.9 List of Abbreviations

OA – Osteoarthritis

KOA – Knee Osteoarthritis

PA – Physical Activity

GBD – Global Burden of Diseases

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Osteoarthritis (OA) is a widely occurring joint disorder, particularly among older adults, with approximately 10% of men and 13% of women over the age of 60 affected globally (Losina et al., 2013). As described by (Yunus et al., 2020), OA is a multifactorial clinical condition involving joint degeneration. It is marked by progressive degradation of articular cartilage, the formation of bone spurs (osteophytes), changes in the underlying bone structure, and inflammation within the joint. OA is a global health concern, affecting a significant portion of the population. Mora et al. (2018) identified it as the leading cause of disability in older individuals and one of the most widespread degenerative joint conditions associated with aging. Specifically, osteoarthritis of the knee and hip are major contributors to long-term disability, negatively influencing the quality of life of sufferers and their families, while also imposing economic burdens and reducing work productivity (Grazio & Balen, 2009). Knee osteoarthritis (KOA) is especially troubling due to its high incidence and tendency to manifest earlier in life, particularly among overweight or obese women (Altman, 2010).

Knee osteoarthritis (KOA) is a prevalent degenerative joint disease marked by the progressive deterioration of articular cartilage, leading to symptoms such as pain, joint stiffness, swelling, reduced mobility, and significant functional limitations. Globally, KOA stands as a primary cause of disability among elderly individuals, affecting their independence and quality of life. It represents a substantial burden on healthcare systems and is associated with considerable socioeconomic costs (Hunter & Bierma-

Zeinstra, 2019). KOA involves a complex interplay of mechanical, genetic, metabolic, and inflammatory factors, and its management demands an in-depth understanding of the disease's pathophysiology, risk factors, anatomical considerations, and therapeutic interventions.

### 2.1.1 Epidemiology

Knee osteoarthritis (OA) is a leading cause of global disability, with a pooled prevalence of 22.9% in individuals aged ≥40 years worldwide, affecting approximately 654.1 million people in 2020 Cui *et al*. (2020). Women are disproportionately impacted, with a 1.69-fold higher prevalence than men globally. Africa, the Middle East and North Africa (MENA) region saw a 2.88-fold increase in knee OA cases between 1990 and 2019, reaching 17.75 million cases, with higher age-standardized rates in women (4.44%) than men (3.66%) (Hoveidaei et al., 2023). Sub-Saharan Africa faces unique challenges, as evidenced by a 9.9% prevalence among patients with musculoskeletal complaints in Cameroon, where 52% of affected individuals were obese. In Nigeria, community-based studies report a 19.6% prevalence of symptomatic knee OA in adults aged ≥40 years, with a female-to-male ratio of 1.2:1 and 90% experiencing activity limitations (Ekediegwu et al., 2022). While Nigeria's prevalence remains below global averages, rising obesity rates and aging populations signal growing public health concerns.

### 2.1.2 Etiology

Osteoarthritis (OA) arises from a multifaceted interplay of both genetic and environmental influences. Several factors contribute to an individual’s susceptibility to OA, including advanced age, female sex, excess body weight, structural joint abnormalities, previous joint injuries, and muscle weakness (Felson et al., 1997; Kapoor et al., 2011; Neogi et al., 2013). The most common form, known as primary OA, occurs

without an identifiable underlying cause but is associated with these risk factors. While it is more commonly observed in older populations, aging alone does not account for its development, as not all elderly individuals experience its symptoms or functional impairments.

In contrast, secondary OA occurs in response to existing joint abnormalities. As highlighted by Donahue (2018) and Krishnan and Grodzinsky (2018), underlying conditions such as joint trauma, avascular necrosis, infectious or inflammatory arthritis, Marfan syndrome, osteoporosis, and congenital joint deformities can predispose individuals to this form of the disease.

### 2.1.3 Relevant Anatomy

#### 2.1.3.1 The Knee Joint

As described by Moore et al. (2013), the knee is the largest synovial joint in the human body and primarily operates as a hinge joint. It is formed by the articulation of three bones: the femur, tibia, and patella. The patella plays a crucial protective role by absorbing forces from the quadriceps muscle and acting as a fulcrum to enhance the muscle's efficiency (Majewski & Susanne, 2005). The knee comprises two main articulations: the patellofemoral joint, which connects the patella to the femur, and the tibiofemoral joint, which connects the tibia and femur. Several ligaments support the joint, including the patellar ligament, medial and lateral collateral ligaments, and the anterior and posterior cruciate ligaments (Moore et al., 2013). Due to its complex structure, the knee is susceptible to a variety of conditions and injuries such as osteoarthritis, ligament tears, and patellar instability (Majewski & Susanne, 2005).

The tibiofemoral joint, the larger of the two, is formed by the articulation between the femoral condyles and the tibial plateaus, with articular cartilage cushioning the joint surfaces. The medial and lateral femoral condyles, located at the distal end of the femur, are separated by the intercondylar fossa (Moore et al., 2013). Meanwhile, the patellofemoral joint is formed between the posterior surface of the patella and the patellar surface of the distal femur (Moore et al., 2013).

The fibrous capsule of the knee joint encloses the joint and plays a key role in providing structural support and stability. It consists of two continuous layers: an outer dense and robust fibrous layer, and a thinner, more delicate inner layer (Moore et al., 2013). Within this capsule is synovial fluid, which serves to lubricate the joint, reducing friction between the articulating surfaces and surrounding soft tissues. The inner lining of the capsule, known as the synovial membrane, is responsible for producing this lubricating fluid (Moore et al., 2013).

Stability of the knee joint is further reinforced by surrounding ligaments. These include the anterior and posterior cruciate ligaments, which stabilize the joint from within, as well as the medial and lateral collateral ligaments, which strengthen the capsule externally and help maintain joint alignment (Moore et al., 2013).

**Ligaments**

The knee joint is supported by two menisci and a network of ligaments that work together to maintain stability. These include the transverse ligament, arcuate popliteal ligament, oblique popliteal ligament, anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), lateral collateral ligament (LCL), and the popliteofibular ligament (Moore et al., 2013). In addition to mechanical

support, these ligaments contain cutaneous receptors that contribute to proprioception, helping the body sense joint position and movement.

Each ligament plays a distinct role in stabilizing the knee. The PCL limits posterior movement of the tibia relative to the femur, while the ACL resists anterior displacement and rotational forces. The MCL supports the medial side of the knee and protects against valgus stress, especially during external rotation. It is lax during knee flexion and internal rotation, and becomes taut during extension and external rotation. Conversely, the LCL connects the femur to the fibula and stabilizes the lateral aspect of the knee, preventing varus stress and excessive external rotation in various flexed positions. The popliteofibular ligament acts as a static stabilizer, restricting posterior translation and external rotation of the tibia relative to the femur (LaPrade & Wentorf, 2002; Moore et al., 2013).

**Menisci**

The menisci are C-shaped fibrocartilaginous structures positioned between the femur and tibia, playing a critical role in enhancing joint congruency and absorbing shock within the knee. Structurally, the inner part of each meniscus contains radially aligned collagen fibers, while the outer portion is composed of larger, circumferentially oriented collagen bundles. The menisci consist of an outer third that is vascularized and an inner, thinner portion that is largely avascular. Both the medial and lateral menisci anchor to the tibia at their anterior and posterior horns within the intercondylar area (Platzer, 2004).

According to Moore et al. (2013), the medial meniscus is located on the inner aspect of the knee, whereas the lateral meniscus lies on the outer side. The posterior horn of the medial meniscus attaches to the posterior intercondylar region of the tibia, positioned

between the insertion points of the lateral meniscus and the posterior cruciate ligament (PCL). Its anterior horn connects to the anterior intercondylar area and merges partially with the anterior cruciate ligament (ACL). The lateral meniscus, which is more circular in shape, sits atop the lateral tibial plateau. Its anterior horn also shares an attachment with the ACL at the anterior intercondylar region, while its posterior horn anchors just in front of the corresponding attachment of the medial meniscus in the posterior intercondylar region (Moore et al., 2013).

**Bursae**

The knee joint is associated with several bursae, including the prepatellar, infrapatellar, anserine, and semimembranosus bursae (Moore et al., 2013). The prepatellar bursa is located in front of the patella, between it and the overlying skin. The infrapatellar bursa lies between the patellar ligament and the tibial tuberosity. Medially, the anserine bursa is positioned at the point where the tendons of the pes anserinus insert into the proximal tibia. As noted by Moore et al. (2013), the semimembranosus bursa is found posteromedially, situated between the semimembranosus tendon and the medial head of the gastrocnemius muscle.

These bursae function as cushions, reducing friction between bones, tendons, and other soft tissues, thereby aiding smooth movement of the joint. However, they can become inflamed, leading to symptoms such as pain, swelling, and limited range of motion.

**Muscles**

The muscles surrounding the knee joint are just as vital as the ligaments in maintaining joint stability and function. These muscles contribute not only to knee mobility—enabling its six degrees of freedom—but also work in coordination with the

neuromuscular system to regulate movement and enhance proprioception. Most muscles near the knee initially facilitate motion and subsequently assist in stabilizing the joint. Some of these are biarticular muscles, meaning they influence movement at both the knee and hip joints. While they support hip movement, their primary role is to control knee motion, including flexion, extension, and rotation. These muscles are organized into the anterior, posterior, medial, and lateral compartments of the thigh and leg.

Below are key muscles involved in knee joint function:

**i.Quadricepsfemoris**:

Located in the anterior compartment of the thigh, the quadriceps femoris consists of four muscles—rectus femoris, vastus lateralis, vastus intermedius, and vastus medialis. These muscles originate from the ilium and femur and insert into the patella and tibial tuberosity via the patellar ligament. According to Moore et al. (2013), the quadriceps femoris is the primary muscle responsible for extending the knee joint.

**ii.Hamstrings**:

The hamstring group—comprising the biceps femoris, semitendinosus, and semimembranosus—is located in the posterior compartment of the thigh. Originating from the femur and ischial tuberosity, these muscles insert into the tibia and fibula. They are the principal flexors of the knee and also play a role in rotation (Moore et al., 2013).

**iii.Gastrocnemius**:

This two-headed muscle lies at the back of the lower leg and contributes to both knee flexion and ankle plantarflexion. Along with the soleus muscle, it forms the Achilles tendon as it passes behind the knee (Kapandji, 2008).

**iv.Popliteus**:

Situated deep to the gastrocnemius in the posterior leg, the popliteus muscle plays a critical role in unlocking the fully extended knee by medially rotating the tibia, thus allowing for knee flexion (Moore et al., 2013).

**v.Sartorius**:

Found in the anterior compartment of the thigh, the sartorius assists in flexing the knee joint. It also facilitates flexion, abduction, and lateral rotation of the hip (Moore et al., 2013).

**vi.Gracilis**:

Located in the medial thigh, the gracilis aids in adduction of the hip and contributes to flexion and medial rotation of the knee (Moore et al., 2013).

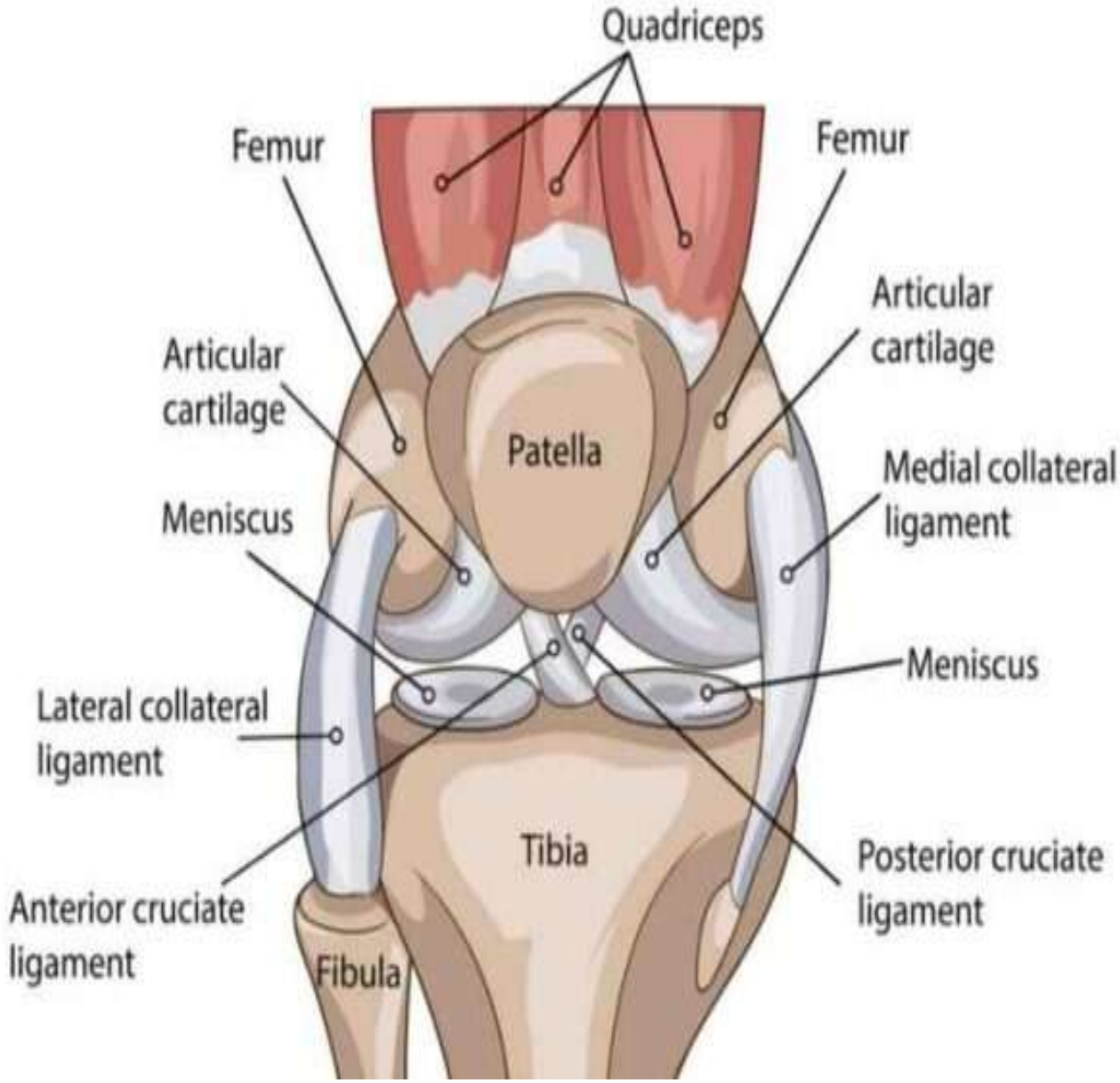


**Figure 2.1: Anatomy of the Knee Joint**

**Image source:** *Matthew Provencher, MD | Orthopedic Knee & Shoulder Surgeon | Vail Aspen Denver Colorado Springs, CO*

The knee joint receives nerve supply from multiple sources, including the femoral, tibial, common fibular (peroneal), saphenous, and obturator nerves. The anterior region of the joint is innervated by articular branches of the femoral nerve. In contrast, the posterior portion is supplied by branches from the tibial nerve, while the lateral side receives innervation from the common fibular nerve. Though primarily a sensory nerve, the saphenous nerve also provides articular fibers, particularly to the medial side of the knee. Additionally, the posterior branch of the obturator nerve contributes to the innervation of the joint.

The knee joint has a rich vascular network that ensures an adequate blood supply, essential for tissue nourishment and repair. This vascularization is primarily maintained by the periarticular genicular anastomosis, a network formed by ten contributing vessels. These include genicular branches from the femoral and popliteal arteries, along with anterior and posterior recurrent branches of the anterior tibial artery and the circumflex fibular artery. The middle genicular arteries, originating from the popliteal artery, penetrate the fibrous capsule to supply internal structures such as the cruciate ligaments, synovial membrane, and peripheral portions of the menisci. This extensive blood supply plays a crucial role in maintaining joint function and supporting recovery from injury.

### 2.1.4 Pathophysiology

Osteoarthritis (OA) is a multifactorial joint disease that affects not only the articular cartilage but also other structures within the joint such as the synovium, subchondral bone, ligaments, and periarticular muscles (Berenbaum, 2013; Loeser et al., 2012; Scanzello & Goldring, 2012). The pathological progression of OA is marked by a combination of changes including cartilage deterioration, synovial inflammation,

remodeling of subchondral bone, degeneration of ligaments and menisci, and thickening of the joint capsule (Martel-Pelletier et al., 2008).

Although the exact mechanisms driving the full scope of joint degradation are not yet fully understood, it is believed that the disease results from a complex interaction of mechanical overload, abnormal joint biomechanics, low-grade inflammation, and metabolic dysfunctions. These factors contribute to the production of pro-inflammatory substances and degradative enzymes that accelerate joint damage (Ayhan, 2014). The earliest signs of OA typically emerge within the articular cartilage, presenting as surface fissures, unevenness, and small erosions. As the disease progresses, these lesions deepen and spread, compromising the underlying bone.

Microscopically, cartilage damage disrupts the collagen framework, prompting chondrocyte proliferation and the emergence of hypertrophic chondrocytes. This leads to the development of cartilage outgrowths which subsequently calcify and form osteophytes. With ongoing matrix damage, chondrocyte death increases, and the subchondral bone responds by becoming denser due to the accumulation of poorly mineralized collagen. In more advanced stages, subchondral cysts may form, and erosive OA may also show bone erosions. Although synovial inflammation and hypertrophy may occur, they are not as prominent or central as in classic inflammatory arthritides (Ayhan, 2014).

Articular cartilage lacks blood vessels and nerves; therefore, pain in early OA usually arises from damage to other joint tissues such as the joint capsule, subchondral bone, synovium, ligaments, and surrounding muscles (Ayhan, 2014). As OA advances, structural alterations include joint remodeling, osteophyte formation, muscular atrophy

around the affected joint, ligament laxity, and fluid accumulation in the joint cavity (Dulay et al., 2015).

The role of inflammation in OA remains under investigation. While it is unclear whether inflammation is a cause or result of joint degeneration, it is acknowledged that OA involves a state of low-grade, chronic inflammation driven largely by innate immune mechanisms, distinguishing it from more overtly inflammatory conditions like rheumatoid arthritis (Berenbaum, 2013). Initially, OA presents as localized cartilage disruption, but over time it alters joint loading patterns, exacerbating cartilage wear.

These changes are driven by both cellular and extracellular matrix (ECM) transformations, involving modifications in chondrocyte behavior and ECM composition. This progression is regulated by a complex network of mechanical forces and biochemical signals (Martel-Pelletier et al., 2008). Synovitis, defined by inflammatory cell infiltration of the synovial lining, is commonly observed in OA and tends to increase with disease severity (Robinson et al., 2016).

Inflammatory markers found in the synovial fluid of OA patients include acute-phase proteins (e.g., C-reactive protein), prostaglandins (e.g., PGE2), leukotrienes (e.g., LKB4), cytokines (such as TNF, IL-1β, IL-6, IL-15, IL-17, IL-18, and IL-21), growth factors (including TGF-β, FGF, VEGF, and NGF), nitric oxide, and complement proteins (Robinson et al., 2016; Richards et al., 2016). Locally, these molecules activate matrix metalloproteinases and other catabolic enzymes that break down proteoglycans and collagen, ultimately leading to cartilage destruction (Berenbaum, 2010).

### 2.1.5 Risk Factors

Osteoarthritis (OA) develops due to a combination of joint-specific and personal risk factors. These factors either contribute to abnormal joint mechanics or reduce the body's ability to maintain joint health.

**i. Obesity:**

Excess body weight increases the mechanical load on weight-bearing joints like the knees, thereby accelerating cartilage degeneration. A meta-analysis of 15 studies found a strong correlation between obesity and knee OA (Blagojevic et al., 2010). Silverwood et al. (2010) estimated that nearly 25% of new-onset knee pain cases could be attributed to overweight or obesity. Evidence also suggests that weight reduction improves joint function, decreases pain, and reduces systemic inflammation. For example, the Framingham Study indicated that a 5 kg weight loss could cut the risk of knee OA by half (Palazzo et al., 2016).

**ii. Genetic Predisposition:**

Genetic factors influence the structure and metabolism of joint components, potentially predisposing individuals to OA. Mutations in the COL2A1 gene, which codes for type II collagen, have been associated with increased OA susceptibility in certain populations (Rodriguez-Fontenla et al., 2014). Additionally, variations in genes regulating inflammatory responses—such as TNF-α and IL-1β—have also been linked to OA development (Valdes & Spector, 2008).

**iii. Age:**

Aging is one of the strongest risk factors for OA. As individuals age, cumulative mechanical stress and biological changes in joint tissues—such as increased collagen

cross-linking and decreased proteoglycan levels—make cartilage more vulnerable to damage (Loeser, 2010). Structural degradation due to aging makes joints less resilient to stress and more prone to degenerative changes.

**iv. Ethnicity and Race:**

Racial and ethnic background may influence OA prevalence and severity. For instance, studies show that African Americans experience higher rates of knee OA compared to Caucasians (Jordan et al., 2007). Additionally, Native American and Hispanic populations have shown a greater incidence of hip OA than their Caucasian counterparts (Murphy et al., 2010). These differences may stem from variations in joint shape, activity levels, and access to healthcare.

**v. Repetitive Joint Stress:**

Engaging in frequent, repetitive movements involving specific joints can increase the likelihood of OA. For instance, individuals who routinely squat or bend their knees during occupational or daily activities may face a heightened risk of developing knee osteoarthritis (Hunter et al., 2005).

**vi. Joint Injuries:**

Previous injuries, particularly those affecting joint structures, significantly raise the risk of developing OA later in life. One of the most common knee injuries involves the anterior cruciate ligament (ACL). Research shows that approximately 13% of individuals may develop early-onset knee OA within 10–15 years following an ACL rupture. This risk increases substantially, up to 21–40%, when additional structures such as the cartilage, menisci, collateral ligaments, or subchondral bone are also damaged—injuries that occur in 65–75% of ACL rupture cases (Palazzo et al., 2016). Felson et al.

(1997) also reported that individuals with prior joint trauma have a significantly higher incidence of OA than those without such a history.

**vii. Joint Misalignment:**

Improper alignment of joints can cause uneven stress distribution across joint surfaces, accelerating wear and increasing the risk of OA. Varus deformity (bow-leggedness) is particularly associated with increased medial compartment OA, whereas valgus deformity (knock-knees) is linked to lateral OA progression (Sharma et al., 2001). Furthermore, the severity of misalignment correlates with a decline in physical performance, suggesting that corrective interventions could potentially slow disease progression and improve function.

### 2.1.6 Stages of Progression

Osteoarthritis (OA) is a chronic, progressive condition that worsens over several years. The severity of OA is commonly assessed using the Kellgren-Lawrence (KL) grading system, which classifies the disease into five stages based on radiographic changes observed in the joint.

Stage 0: No visible changes or damage to the joint on X-rays.

Stage 1: Possible slight narrowing of the joint space and minimal formation of bone spurs (osteophytic lipping), but changes are uncertain.

Stage 2: Clear presence of osteophytes (bone spurs) along with some narrowing of the joint space.

Stage 3: Moderate to severe narrowing of the joint space, increased density (sclerosis) of the subchondral bone, and evident osteophyte formation.

Stage 4: Severe joint space narrowing accompanied by large osteophytes, marked sclerosis of the subchondral bone, and possibly the appearance of subchondral cysts.

This grading system helps guide diagnosis, treatment decisions, and monitoring of disease progression.

### 2.1.7 Clinical Features

Knee osteoarthritis (OA) typically progresses slowly, with symptoms that may persist long-term or fluctuate over time. One of the most common signs is pain, often difficult to pinpoint precisely (Felson et al., 2009). Early-stage pain is usually mild to moderate, intermittent, and described as dull or aching. It often improves with rest and worsens with activity. Weather changes can also influence pain intensity. As OA advances, pain may become more constant, severe, and even disrupt sleep. Joint swelling or edema often increases discomfort by exerting pressure on surrounding tissues.

Joint stiffness is another hallmark of OA, particularly in the morning. This stiffness can last from a few minutes up to 30 minutes, typically easing with movement. Environmental factors like low atmospheric pressure or high humidity may exacerbate stiffness.

Swelling and joint deformities can develop as OA progresses, with bony enlargements such as Heberden's and Bouchard's nodes commonly seen in the hands. A characteristic crepitus—a grinding or crackling sensation during joint movement—often indicates damaged or rough cartilage surfaces, especially in the knee.

Muscle weakness around the affected joint is frequently observed. This weakness can lead to uncoordinated movements that further stress the joint, accelerating deterioration. Other physical signs include the presence of osteophytes (bony spurs) at joint margins,

decreased range of motion, and loud crunching sounds caused initially by rough cartilage edges and later by bone-on-bone contact. Soft tissue swelling and joint effusion may also be evident, alongside tenderness upon pressure to the patella or joint area.

Joint laxity can occur due to cartilage loss and slackening of ligaments and joint capsules. In advanced knee OA, deformities and misalignment may develop, accompanied by weakened quadriceps muscles (Hunter et al., 2008).

**Radiological Features of Knee Osteoarthritis**

Radiographic imaging is a critical tool for diagnosing and assessing the severity of knee OA (McAlindon et al., 2014). Key radiographic findings include:

Joint space narrowing: Reduced space between the femur and tibia due to cartilage loss.

Osteophytes: Bony outgrowths at the edges of the joint.

Subchondral sclerosis: Increased bone density beneath the cartilage caused by elevated mechanical load.

Subchondral cysts: Fluid-filled cavities in the bone beneath the cartilage.

Deformity: Changes in the shape or structure of the bones or joint.

Alignment changes: Altered positioning of bones, often evident in weight-bearing radiographs.

It is important to note that radiographic severity does not always correlate directly with symptoms. Some individuals show radiographic evidence of OA without significant pain or functional impairment, while others experience considerable symptoms despite minimal radiographic changes.

### 2.1.8 Diagnosis of Osteoarthritis (OA)

Knee osteoarthritis (KOA) is generally diagnosed through a combination of clinical evaluation, detailed history taking, and radiographic confirmation. Osteoarthritis is a joint disorder that causes pain and stiffness, especially following extended periods of inactivity, a phenomenon often called the "gelling phenomenon." Unlike rheumatoid arthritis, where stiffness tends to last 45 minutes or more, the morning stiffness associated with OA is common but usually persists for less than 30 minutes. Patients may also experience sensations of joint locking or instability, which can negatively affect function and limit daily activities. Although osteoarthritis can affect nearly any joint, it is most commonly seen in the hands, knees, hips, and spine. The disease often presents asymmetrically, with one knee possibly severely affected while the other maintains near-normal function.

A thorough physical examination is crucial for diagnosing OA, often revealing pain and restricted range of motion. Specific joint findings may include tenderness, crepitus, swelling, or deformity. To confirm the diagnosis and evaluate the extent of joint damage, diagnostic tools such as X-rays and MRI scans may be utilized. Blood tests can be performed to exclude other conditions, such as rheumatoid arthritis (Manek and Lane, 2000).

### 2.1.9 Management of Osteoarthritis

#### 2.1.9.1 Surgical Management

Osteoarthritis (OA) is a degenerative joint disease that affects millions worldwide. While non-surgical treatments such as exercise, weight management, and medications are often effective in symptom control, some patients require surgical intervention to

alleviate pain and improve joint function. Arthroplasty, which involves replacing the damaged joint with a prosthetic implant, is one such surgical treatment option. Total knee arthroplasty (TKA) and total hip arthroplasty (THA) are common procedures for managing knee and hip OA, respectively.

According to a systematic review and meta-analysis by Zhao et al. (2022), TKA is effective in relieving pain and enhancing function in patients with knee OA. The study reported significant improvements in pain relief, functional capacity, and patient satisfaction, alongside a low risk of complications. Similarly, Bottai et al. (2021) found THA to be a safe and efficacious treatment

for hip OA, leading to substantial improvements in pain, function, and quality of life with minimal complications.

Knee osteotomy is another surgical option for treating KOA. This procedure involves cutting and realigning the bone to redistribute weight more evenly across the knee joint. Normally, body weight is transmitted from the hip center to the knee center and then to the ankle center. However, in cases where pressure is focused on one side of the knee due to injury or disease, osteotomy shifts the load from the affected compartment to the healthier side (Hussain, 2016).

### 2.1.9.2 Conservative Management

#### I. Physiotherapy Management

Physiotherapy forms a critical component of the multidisciplinary treatment for patients with KOA. Various physiotherapy interventions effectively alleviate symptoms, including:

**Exercise:** Osteoarthritis is characterized by the gradual deterioration of joint cartilage, leading to pain, stiffness, and limited movement. Although there is no cure, exercise plays a vital role in managing OA. It helps improve joint function, reduce pain and stiffness, and enhance mobility and flexibility. Low-impact aerobic exercises, such as walking, cycling, and aquatic activities, are especially beneficial for patients with OA. A comprehensive review by Fransen et al. (2015) showed that aerobic exercise reduces pain and improves physical function in knee and hip OA patients. Strength training strengthens muscles surrounding the affected joint, thereby improving joint stability and decreasing pain. Hernandez et al. (2015) demonstrated that strength training enhances physical function and muscle strength in knee and hip OA. Flexibility exercises like stretching and yoga also improve joint mobility and range of motion. Bartels et al. (2015) found that yoga reduces pain and improves function in these patients. It is essential to tailor exercise programs to individual needs in consultation with healthcare professionals, considering any other health conditions.

**Knee taping:** This technique involves applying rigid adhesive tape to realign the patella and surrounding soft tissues, relieving pressure on the patellofemoral joint and reducing pain. Studies by Page et al. (2011) and Crossley et al. (2015) support taping as a pain-relieving physiotherapy method that promotes patellar alignment and improves muscle activation and function.

Manual therapy: Techniques such as joint manipulation and mobilization may also help relieve pain in knee OA patients. Mobilization involves slow, repetitive passive movements within a joint's range of motion, while manipulation is a rapid, small-amplitude thrust near the end of the joint's range. Manual therapy's pain-relieving effect is attributed to hypoalgesia, as demonstrated in some studies (Page, 2011).

**Bracing:** Bracing can reduce pain by redistributing load away from the painful side of the knee joint. The effectiveness of braces varies depending on patient characteristics and brace type. Obese patients may experience less benefit, and custom-made braces generally outperform off-the-shelf options (Pollo et al., 2002; Page, 2011).

**Electrotherapeutic modalities:** Various electrotherapy techniques, such as transcutaneous electrical nerve stimulation (TENS), neuromuscular electrical stimulation (NMES), ultrasound, and infrared radiation, are frequently employed in knee OA management to alleviate pain (Osiri et al., 2000; Nicolakis et al., 2002; Cadena et al., 2019).

**II. Pharmacological Management**

Pharmacological treatment is fundamental in OA management and aims to reduce pain and inflammation while improving joint function.

**Nonsteroidal anti-inflammatory drugs (NSAIDs):** These medications are the most commonly prescribed to control pain and inflammation in OA. They function by inhibiting cyclooxygenase (COX) enzymes, which decreases prostaglandin synthesis, molecules involved in pain and inflammation. However, NSAIDs carry risks such as cardiovascular and renal adverse effects, necessitating cautious and limited use, particularly in at-risk patients (Zhang et al., 2005).

**Paracetamol (acetaminophen):** This non-opioid analgesic is effective for mild to moderate OA pain but has limited efficacy in severe cases. Long-term use of high doses poses a risk of liver toxicity (Da Costa et al., 2017).

**Opioids:** Used primarily for severe pain unresponsive to other treatments, opioids inhibit pain signal transmission in the brain and spinal cord. Due to risks of addiction,

tolerance, and side effects like constipation, their use remains controversial in OA treatment (Jung et al., 2018).

## 2.2 Physical Activity

The term "physical activity" (PA) refers to any bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization, 2022). This broad and diverse behavior includes a wide array of movements such as daily activities, exercise routines, and competitive sports (Miles, 2007). Participation in any form of physical activity is beneficial, with exercise specifically recognized for its considerable positive impact on individual health (Brach et al., 2004). Physical activity helps to prevent functional decline, reduces the progression of cardiovascular conditions, counters the loss of muscle and bone mass associated with aging, and decreases the risk of osteoporotic fractures among older adults (Miles, 2007). It also improves mental health and fosters social engagement in the elderly population (U.S. Health and Human Services, 2008). Structured physical activity, commonly referred to as exercise, is purposeful, systematic, and designed to improve or maintain particular components of physical fitness, such as muscle strength and flexibility. In contrast, unstructured physical activity, often described as "free time" physical activity, typically occurs spontaneously and includes routine tasks like household chores or commuting (Strath et al., 2013).

On the other hand, inadequate physical activity is a significant contributor to increased risk of cardiovascular diseases, stroke, diabetes, certain cancers, and obesity (Department of Health, 2020; World Health Organization, 2022). Recognized as a major global health concern, physical inactivity is responsible for 6% of deaths worldwide and

is the fourth leading risk factor for mortality globally (World Health Organization, 2009). Thus, physical inactivity poses a substantial challenge to public health.

### 2.2.1 Types of Physical Activity

Physical activity (PA) can be broadly categorized into four main types: aerobic activities, strengthening activities, flexibility activities, and balance activities.

i. **Aerobic Activities**: Also known as endurance or cardiovascular exercises, these involve continuous, rhythmic use of the major muscle groups over a prolonged period. Examples include walking, hiking, jogging, running, and sports such as table tennis. Participating in aerobic physical activity raises the heart rate and breathing rate while enhancing the efficiency of the cardiorespiratory system to support the body's movement demands.

ii. **Flexibility Activities:** These exercises focus on increasing the range of motion of joints, which helps in injury prevention, reduces bodily discomfort, and improves overall mobility. Common flexibility exercises include stretching, yoga, and tai chi. They are typically performed for 5 to 10 minutes prior to vigorous physical activity to boost blood flow and oxygen delivery to muscles, facilitating easier stretching. Flexibility routines are also done after intense exercise to aid in muscle relaxation.

iii. **Strengthening Activities:** This category includes exercises that enhance both bone strength and muscle strength. Bone-strengthening activities apply mechanical stress to bones, promoting bone growth and increasing bone density, often through ground impact. Examples include running, jumping rope, basketball, tennis, and hopscotch. Muscle-strengthening exercises, which may be called strength, resistance, or weight training, involve

deliberate actions performed either with or without equipment, as described by the American College of Sports Medicine (2009). Regular practice of these exercises has been shown to improve muscle strength, power, and endurance. Activities in this group include working with resistance bands, heavy gardening tasks such as digging and shoveling, climbing stairs, hill walking, cycling, dancing, and bodyweight exercises like push-ups, sit-ups, and squats. These exercises are especially advantageous for older adults and individuals recovering from health conditions such as stroke, as they support muscle and bone strengthening.

iv. **Balance Activities:** These exercises aim to reduce the risk of falls by strengthening muscles in the back, abdomen, and legs. Examples include walking heel-to-toe, practicing sit-to-stand movements, and using a wobble board.

### 2.2.2 Level of Physical Activity

The well-recognized health benefits of physical activity (PA) include lowering the risk of cardiovascular diseases, hypertension, stroke, diabetes, as well as breast and colon cancers. In addition, PA positively influences mental health, delays the onset of dementia, and helps maintain a healthy body weight (Physical Activity Guidelines Advisory Committee, 2008; Sallis et al., 2010; Warburton et al., 2010; WHO, 2010; Choi et al., 2017). For adults aged 60 years and above, recommended PA guidelines suggest at least 150 minutes of moderate-intensity aerobic exercise or a minimum of 75 minutes of vigorous-intensity aerobic activity weekly (WHO, 2020). Moreover, it is advised to perform muscle-strengthening exercises on two or more days per week. Data

from the Australian Bureau of Statistics (2021) shows that about 41.8% of older adults meet these PA recommendations.

Worldwide, roughly one in three women and one in four men do not engage in sufficient physical activity to maintain health, representing over a quarter of the adult population. This inactivity ranks as the fourth highest risk factor for mortality globally, contributing to an estimated 3 million deaths annually (Lee et al., 2017). Epidemiological evidence indicates that physical inactivity accounts for 15-20% of the total risk for coronary heart disease, type 2 diabetes, colon cancer, and breast cancer, while also increasing the risk of hip fractures in older adults (Oja, 2004). The indirect economic burden of inactivity is substantial, including decreased productivity due to illness, work disabilities linked to chronic diseases, and premature mortality (Andersen et al., 2000; Finkelstein et al., 2016; Lee et al., 2017; Nguyen et al., 2017). Mortality related to non-communicable diseases tends to rise with increased body weight, especially among obese individuals, with physical inactivity playing a significant role in this association (World Health Organization, 2015).

In Nigeria, about 28% of elderly people are physically inactive, a situation likely exacerbated by increasing urbanization which contributes to environmental barriers limiting participation in PA. These include issues such as crime, heavy traffic, poor air quality, pollution, and a scarcity of parks and recreational facilities (Adeloye, 2012). Additionally, low health literacy and socio-cultural barriers further complicate the situation. Importantly, certain cultural attitudes in Nigeria discourage walking because it is often viewed as a sign of lower socioeconomic status, leading many to prefer owning or driving a car instead (Abubakari & Bhopal, 2008; Oduwole et al., 2012).

### 2.2.3 Components of Physical Activity

Physical activity (PA) can manifest either as structured and deliberate, such as in planned workouts or sports, or as spontaneous and unstructured, like everyday movements including walking or gardening. The components of PA are generally divided into three key dimensions: intensity, duration, and frequency, according to the Physical Activity Guidelines Advisory Committee Scientific Report (2018).

i. **Intensity:** This refers to the level of effort or exertion required during physical activity. It can be measured by indicators such as heart rate, metabolic equivalents (METs), or the rating of perceived exertion (RPE). Activities classified as high-intensity typically demand 6 METs or more, or involve 70% or higher of an individual's maximum heart rate. Moderate-intensity activities require between 3 and 6 METs, or 50% to 70% of maximum heart rate. Low-intensity activities require less than 3 METs or below 50% of the maximum heart rate (Physical Activity Guidelines Advisory Committee, 2018). The Borg RPE scale, which ranges from 6 to 20, categorizes low intensity as scores between 9 and 11, moderate intensity between 12 and 14, and vigorous intensity from 15 to 20 (Williams, 2017).

   These intensity levels consist of low, moderate, and vigorous, measured using the metabolic equivalent of task (METs) (Mendes *et al*., 2018). PA can be divided into three primary categories based on intensity levels: vigorous, moderate, and low, as outlined by the Physical Activity Guidelines Advisory Committee in 2018. Vigorous intensity PA entails activities demanding a high level of effort, significantly increasing heart rate and breathing, such as running, swimming laps, and participating in sports like basketball, soccer, or

hockey. Moderate-intensity PA includes physical activities requiring a moderate level of effort, elevating heart rate and breathing, though not as intensely as vigorous-intensity PA, such as brisk walking, hiking, cycling at a moderate pace, and engaging in gardening or yard work. Low-intensity PA encompasses activities demanding minimal effort, with no significant increase in heart rate and breathing. This category includes light household chores like washing dishes or folding laundry, as well as leisure activities like reading, watching TV, or playing board games. The classification of PA into these three categories aids individuals and health professionals in assessing the intensity of PA and designing suitable PA programs to achieve specific health goals (Physical Activity Guidelines Advisory Committee, 2018).

ii. **Duration:** This dimension relates to the length of time spent performing physical activity. Adults are generally recommended to engage in at least 150 minutes of moderate-intensity PA or 75 minutes of vigorous-intensity PA per session (Physical Activity Guidelines Advisory Committee, 2018). Besides these factors, the specific type or mode of PA is also important, including activities such as aerobic exercise, resistance training, flexibility workouts, and balance exercises.

iii. **Frequency:** This refers to how often physical activity is performed. Guidelines suggest that adults accumulate a minimum of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity each week, spread out over no fewer than three days (Physical Activity Guidelines Advisory Committee, 2018).

### 2.2.4 Risk factors for Physical Inactivity

Physical inactivity stands out as a significant public health concern in the twenty-first century, playing a major role in the development of various chronic diseases (Blair, 2009). The World Health Organization has recognized it as a primary risk factor for cerebrovascular disease (Bijnen *et al*., 1994). Additionally, physical inactivity contributes to conditions such as Type II diabetes, colon cancer, back pain, hypertension, obesity, osteoporosis, anxiety, depression, and stress (Centers for Disease and Prevention Control, 1996).

Lee & Ellingson (2018) have outlined two main categories of risk factors associated with physical inactivity: individual and environmental factors. Individual factors include socioeconomic aspects (such as female gender, older adults, low income, low education, and cultural norms unsupportive of physical activity), health factors (including obesity, functional limitations, injury, depression, and chronic diseases), and psychological factors (like low self-efficacy, diminished enjoyment of exercise, and limited belief in exercise benefits). Psychological elements, such as low self-efficacy, lack of motivation, and perceived barriers, have been identified as contributors to physical inactivity (Idowu *et al*., 2013; Rhodes & Kates, 2015).

On the other hand, environmental factors are categorized into four domains of physical activity: household/domestic (involving appliances like washing machines and dishwashers, the presence of cleaning robots, the use of motorized lawn mowers, lack of a garden or backyard, and long distances to grocery stores and supermarkets), occupational/school (encompassing sedentary jobs, labor-saving robots, elevators or lifts, absence of employee fitness programs, limited physical exercise in schools, and restricted school playgrounds), leisure time (including activities like watching

television, engaging in social media, inactive gaming, limited social support, residing in unsafe neighborhoods, lack of pet ownership, and unfavorable weather conditions), and transportation (involving factors like car ownership, absence of street lights, low walkability, long commuting distances, and rural living) (Lee & Ellingson, 2018).

### 2.2.5 Measurement of Physical Activity

The effectiveness of PA programs depends on the level of effort invested in the program and the implementation of various interventions (CDC, 2020). It is crucial to assess and measure PA for both clinical and research purposes to understand and assess its health benefits. Different techniques can be employed to measure PA, including self-report methods, objective monitors, and direct observation (Welk, 2002a). Self-report techniques rely on participants recalling their PA retrospectively and can be documented through questionnaires, either self-administered or interview-administered (Matthews, 2002), as well as through the use of daily logs and diaries (Sylvia, 2014). Objective monitors involve the use of monitoring devices like accelerometers, pedometers, and heart rate monitors to measure PA (Taylor, 2014). These devices, when worn, gauge the intensity of body acceleration using electronic components embedded within them (Graham & Hipp, 2014).

i. **Accelerometers**: These devices are employed to gauge physical activity by monitoring body accelerations during movement, offering the benefit of capturing the frequency, duration, and intensity of physical activity over a period (Strath *et al*., 2013). They are compact, non-intrusive gadgets that offer dependable data regarding human movements (Welk, 2002b). Typically, the device is affixed to the body using a strap, positioned at the hip, ankle, wrist, or lower back (Strath *et al*., 2013; Arvidsson *et al*., 2019).

ii. **Direct observation**: This involves acquiring precise details about an individual's frequency, duration, intensity, and type of physical activity (Taylor, 2014). Direct observation entails evaluating levels of physical activity in specific settings (Dughill & Stratton, 2007), such as playgrounds or classes, and can be conducted by a trained observer or through videotaping.

iii. **PA dairies:** These are commonly utilized to obtain a comprehensive record of physical activity on an hourly or activity-specific basis (Strath *et al*., 2013). Users complete these diaries, which can take the form of a paper-and-pencil booklet (Ainsworth & Coleman, 2013) or a cell phone programmed to prompt users to document information about ongoing or past activities within the last 1 to 4 hours (Sternfeld *et al*., 2012). Typically, the recorded information includes the start and end times of an activity, an intensity rating, and the mode or type of physical activity (Strath *et al*., 2013). Examples include a physical activity logbook (Ainsworth *et al*., 2000) and the Bouchard Physical Activity Record (Bouchard *et al*., 1983).

iv. **Heart rate monitors:** The gadget is equipped with an electrocardiogram (ECG) transmitter that transmits signals to the receiver. The receiver calculates the average heart rate intervals in 5 to 15-second increments and presents the information as beats per minute (Welk, 2002). These devices are commonly worn on the chest or wrist and are employed to compute energy expenditure and monitor physical activity in both observational and intervention studies (Janz, 2002).

v. **PA Questionnaires:** These tools are employed to assess the various aspects and categories of PA behaviors, using either self-reported responses or

interviews (Strath *et al*., 2013). The domains of PA encompass occupational, domestic, transportation, and leisure time, while the dimensions of PA include mode, frequency, intensity, and duration (Strath *et al*., 2013; Lee & Ellingson, 2018). Examples of such tools include the International Physical Activity Questionnaire (IPAQ) (Hagströmer *et al*., 2006) and the Global Physical Activity Questionnaire (GPAQ) (WHO, 2021). The GPAQ, developed by the WHO in 2002 as part of the WHO STEP wise Approach to Chronic Disease Risk Factor Surveillance for PA monitoring and observation (WHO, 2005), is utilized to categorize individuals as active or inactive. It helps determine if a person meets a PA requirement, such as achieving 150 minutes per week of moderate to vigorous PA (Strath *et al*., 2013). On the other hand, the IPAQ was created by an international group of experts to gauge PA patterns among populations from diverse countries and socio-cultural contexts (Craig *et al*., 2003).

## 2.3 Physical Activity and Knee Osteoarthritis

Knee osteoarthritis (KOA) is a degenerative joint disorder that primarily affects the articular cartilage, subchondral bone, and surrounding soft tissues of the knee. It is a leading cause of pain, disability, and reduced quality of life, particularly among older adults and individuals with risk factors such as obesity, previous joint injuries, and mechanical stress (Argatov & Mishuris, 2016). As the global population continues to age and the prevalence of lifestyle-related conditions rises, KOA is becoming an increasingly significant public health concern.

One of the most effective non-pharmacological strategies for managing KOA is regular physical activity (PA). Physical activity refers to any bodily movement produced by

skeletal muscles that requires energy expenditure (Dasso, 2019). This includes a wide range of activities, from structured exercise to routine daily tasks such as walking, gardening, or climbing stairs. In the context of KOA, physical activity is essential not only for maintaining joint mobility and muscle strength but also for mitigating symptoms like pain and stiffness.

Engaging in appropriate physical activity has been shown to improve physical function, delay disease progression, and enhance overall well-being in individuals with KOA. It helps to strengthen the muscles around the knee joint, improve balance and proprioception, and reduce the mechanical load on the affected joints. Moreover, regular physical activity has systemic benefits, including improved cardiovascular health, weight management, and reduced risk of comorbidities such as type 2 diabetes and depression, which are often present in people living with KOA (Fransen et al., 2015).

Despite its proven benefits, many individuals with KOA remain physically inactive, often due to pain, fear of worsening symptoms, or a lack of guidance on suitable exercise options. Psychological factors such as fear of movement (kinesiophobia), low motivation, and anxiety may further contribute to sedentary behavior (Kanavaki et al., 2017).

### 2.3.1 Level of PA among Patients with Knee OA

Patients with knee osteoarthritis (OA) typically demonstrate low levels of physical activity, with most failing to meet recommended guidelines. Studies show that up to 70% of early knee OA patients do not achieve recommended levels of moderate or vigorous physical activity, and many accumulate little to no vigorous activity at all (Farr et al., 2008). Objective accelerometry data reveal that only a small proportion of adults with knee OA meet public health recommendations of 150 minutes of moderate-to-

vigorous activity per week, with rates as low as 12.9% in men and 7.7% in women. A substantial segment of this population is considered inactive, with 40.1% of men and 56.5% of women not engaging in any moderate-to-vigorous activity lasting at least 10 minutes over a week (Farr et al., 2008). The relationship between physical activity and pain in knee OA is dynamic; while higher activity and fitness levels are associated with less pain, many patients experience transient pain increases after activity, which can discourage further participation (Burrows et al., 2020). Despite these challenges, increasing physical activity even below official guidelines is associated with improved functional performance and quality of life, underscoring the importance of encouraging movement tailored to individual abilities and pain levels (Huffman et al., 2024).

### 2.3.2 Causes of Physical Inactivity among Patients with Knee OA

Physical inactivity in patients with knee osteoarthritis (OA) arises from a combination of pain, fear of worsening symptoms, and functional limitations. Debilitating pain is a primary cause, as it directly limits walking ability and discourages engagement in physical activities (Hsu et al., 2022). Many individuals worry that increased activity may exacerbate joint damage or lead to further pain, resulting in a reluctance to move and a preference for rest. Additionally, stiffness and reduced joint mobility, common in knee OA, make it physically challenging to initiate or sustain activity. Psychological factors, such as anxiety or depression related to chronic pain and disability, also contribute to decreased motivation for physical activity. Furthermore, muscle weakness due to prolonged inactivity creates a cycle of reduced joint support and increased instability, further discouraging movement. Environmental and social factors, including lack of access to safe exercise facilities or social support, can further limit opportunities

for physical activity in this population (Kanavaki et al., 2017). Collectively, these interrelated factors perpetuate a sedentary lifestyle among individuals with knee OA.

### 2.3.4 Impact of Physical Inactivity among Patients with Knee OA

Physical inactivity in patients with knee osteoarthritis (OA) leads to a cascade of negative health consequences. Sedentary behavior is associated with increased joint stiffness, muscle weakness, and reduced joint stability, all of which can accelerate disease progression and worsen pain (Ma et al., 2024). Prolonged inactivity results in muscle atrophy, particularly in the quadriceps and hamstrings, further destabilizing the knee joint and increasing susceptibility to further injury. Inactivity also contributes to weight gain, which places additional mechanical stress on already compromised knee joints and is a known risk factor for OA progression.

Reduced physical activity limits blood flow and nutrient delivery to joint tissues, impairing cartilage health and repair mechanisms. Furthermore, a sedentary lifestyle is linked to significant declines in health-related quality of life, as well as increased risk for comorbidities such as cardiovascular disease, diabetes, and cancer among individuals with knee OA. Recent Mendelian randomization studies confirm that sedentary behavior is a strong independent risk factor for knee OA, with inactive individuals showing a substantially higher likelihood of disease development and progression compared to those engaging in appropriate physical activity (Ma et al., 2024).

### 2.3.5 Benefits of PA among Patients with Knee OA

Physical activity provides multiple benefits for patients with knee osteoarthritis (OA), including reduced pain, enhanced joint function, and improved quality of life. Regular exercise strengthens the muscles surrounding the knee, offering better support and stability to the joint and reducing mechanical stress. Physical activity also supports

cartilage health and may help slow disease progression by enhancing joint nutrition through increased synovial fluid circulation. Additionally, exercise aids in weight management, which is important for decreasing the load on knee joints. Beyond physical improvements, regular activity is associated with better mental health outcomes, such as reduced symptoms of depression and anxiety that often accompany chronic pain. Notably, even moderate levels of physical activity have been shown to improve functional performance and reduce disability in individuals with knee OA (Fransen et al., 2015; Bennell et al., 2014; Hurley et al., 2018).

### 2.3.6 Types of Physical Activity among Patients with Knee OA

**Aerobic activities:**

Aerobic activities such as walking, jogging, cycling, and swimming are simple and practical strategies for managing knee osteoarthritis (KOA). They enhance cardiovascular function, reduce oxidative stress, prevent muscle wasting, and support cartilage regeneration (Feng et al., 2021). These exercises also contribute to improved immunity and quality of life, particularly among older adults (Qin et al., 2022). Walking, including retro-walking, improves immune response and functional independence while aiding quadriceps strengthening (Qin et al., 2022; Verma et al., 2020).

Evidence shows that both low- and high-intensity aerobic regimens can reduce pain and improve joint function, with low-intensity programs being more suitable for patients with severe KOA and high-intensity protocols offering greater benefits in mild cases (Jung et al., 2020; Rahnama et al., 2021). High-intensity interval training has also been found effective in improving muscle mass and physical function, particularly in patients with coexisting chronic illnesses (Bouchard et al., 2020).

**Strength Training:**

Strength training, including isokinetic, isometric, and isotonic modalities, is fundamental in reducing pain and stiffness, enhancing muscular strength, and improving shock absorption and gait.

i. **Isokinetic Exercise:** Isokinetic training involves controlled-speed movements and is effective in improving dynamic strength and reducing inflammation. Studies have shown significant reductions in pro-inflammatory cytokines like TNF-α and IL-6, improved walking distance, and better quality of life among KOA patients (Anwer et al., 2011; Elboim-Gabyzon et al., 2011). Eccentric isokinetic exercises, in particular, show superior benefits in pain reduction and gait enhancement compared to concentric forms (Mueller et al., 2019; Segal et al., 2021).

ii. **Isometric Exercise:** Involving static muscle contractions, isometric training improves joint lubrication, neuromuscular control, and balance. It is also beneficial for both limbs through cross-training effects (Sharma et al., 2019). It has shown efficacy in reducing pain and increasing quadriceps strength, with no significant gender differences (Rafiq et al., 2021).

iii. **Isotonic Exercise:** Isotonic training involves consistent tension during muscle lengthening and shortening movements. This includes activities such as stair climbing and squats. These exercises significantly reduce pain and stiffness and improve mobility (Gurung et al., 2019). Studies comparing concentric and eccentric isotonic modalities have reported similar clinical benefits, suggesting that the choice can depend on patient preference (Verma et al., 2020).

iv. **Other Strength-Based Interventions:** Additional strength-oriented strategies include elastic-band resistance training and blood flow restriction (BFR) training. Elastic-band training has been effective in pain reduction and improving functional status, particularly in women (Lai et al., 2021). BFR training, which involves using cuffs to limit blood flow during low-load exercises, enhances strength gains without stressing the joint, making it ideal for individuals with more advanced KOA (Bryk et al., 2016).

**Neuromuscular Training**

Neuromuscular training focuses on improving movement coordination and joint stability, addressing deficits in muscle control and alignment (Ageberg et al., 2013). This form of training is particularly beneficial for patients with malaligned knees or those preparing for joint replacement. Studies suggest that neuromuscular programs are more effective than strength training alone in improving pain, physical function, and muscle activation patterns (Fitzgerald et al., 2011).

**Balance Training**

Balance exercises aim to improve postural control and reduce the risk of falls, which is particularly important for older adults with KOA. Techniques include static and dynamic balance tasks, VR-based activities, and balance platforms like the Biodex system. These interventions have demonstrated improvements in gait, functional mobility, and fall prevention (Sadeghi et al., 2021; Atay et al., 2018). Preoperative balance training is also beneficial for improving postoperative recovery (Ko et al., 2022).

**Proprioceptive Training**

KOA often impairs proprioception due to muscle weakness and joint instability. Proprioceptive training focuses on enhancing joint position sense and neuromuscular control, helping to reduce pain and improve functional capacity (Li et al., 2022). It is especially useful in early-stage KOA and for patients experiencing weight-bearing pain (Song et al., 2017).

**Aquatic Training**

Aquatic exercise leverages water's buoyancy and resistance to reduce joint stress while allowing greater mobility. It promotes improvements in cartilage thickness, joint flexibility, and muscle strength, particularly in obese patients or those with restricted mobility (Bartels et al., 2016; Messier et al., 2021). Aquatic dance and underwater treadmill training have also shown positive effects on pain relief and quality of life (Wang et al., 2020).

### 2.3.7 Physical Activity Guidelines Specific to Knee OA

Standard physical activity guidelines specific to knee osteoarthritis (OA) emphasize a combination of aerobic, strength, and flexibility exercises tailored to individual capabilities, with the primary goals of reducing pain, improving function, and maintaining overall joint health. International and clinical guidelines recommend that adults with knee OA accumulate at least 150 minutes of moderate-intensity aerobic activity each week, ideally distributed across several days and performed in bouts of at least 10 minutes to accommodate comfort and tolerance (Burrows et al., 2020). Low-impact activities such as walking, cycling, and aquatic exercises are preferred, as they minimize joint stress while providing cardiovascular benefits.

Strength training should be incorporated at least two days per week, focusing on major muscle groups around the knee such as the quadriceps, hamstrings, hip abductors, and calf muscles to improve joint stability and function. Each strength exercise should be performed in sets of 8–12 repetitions with sufficient resistance to achieve muscle overload, but not to the point of joint pain or excessive fatigue. Flexibility and range-of-motion exercises are also encouraged at least three times per week to maintain joint mobility and reduce stiffness (Fransen et al., 2015).

Exercise intensity should be moderate, meaning the individual feels "somewhat hard" exertion able to talk but not sing during aerobic activity. Resistance exercises should be challenging enough to promote muscle adaptation but adjusted to avoid pain or joint irritation. It is important to initiate exercise at a low intensity and short duration, gradually increasing as tolerated to prevent exacerbation of symptoms. General muscle soreness after activity is acceptable, but joint pain lasting more than two hours after exercise may indicate the need to modify the activity's type, duration, or intensity (Fransen et al., 2015).

Clinical guidelines stress the importance of individualized exercise prescriptions, considering factors such as disease severity, comorbidities, physical limitations, and personal preferences. Strategies to enhance adherence include setting realistic goals, providing supervision or support (in-person or remotely), and addressing barriers such as pain, fear, or lack of access to facilities. Wearing supportive footwear and, when indicated, using orthotics or braces can help minimize joint loading and improve safety during activity (Fransen et al., 2015).

The American College of Rheumatology (ACR) strongly recommends both land-based and aquatic aerobic and resistance exercise for managing knee OA, noting that these

interventions are supported by high-quality evidence for pain reduction and functional improvement. Walking, muscle-strengthening exercises, and mind-body practices such as Tai Chi are particularly recommended, while stationary cycling and Hatha yoga may be appropriate for some individuals. Exercise is considered a core treatment for knee OA, regardless of age, disease severity, or pain level, and should be maintained long-term to sustain benefits (Fransen et al., 2015).

## 2.4 Empirical Review of Literature

### Table 2.1: Empirical Review of Literature

| AUTHOR/ YEAR | TITLE | SAMPLE SIZE | AIM OF STUDY | STUDY TYPE | FINDINGS |
|---|---|---|---|---|---|
| (Kraus et al., 2019) | Effects of Physical Activity in Knee and Hip Osteoarthritis: A Systematic Umbrella Review. | A total of 6 Meta-analysis and 3 Systematic review studies were retained for the final summary. | The aim of this study was to evaluate the literature relating to effects of physical activity on pain, physical function, health-related quality of life, comorbid conditions and osteoarthritis (OA) structural disease progression in individuals with lower-extremity OA. | A Systematic Umbrella Review | Physical activity decreased pain and improved physical function (strong evidence) and improved health-related quality of life (moderate evidence) among people with hip or knee OA relative to less active adults with OA. |
| (Restuccia et al., 2022) | The preventive and therapeutic role of physical activity in knee osteoarthritis. | A total of 86 papers written in English and published from 1957 to 2021 were selected. | The aim of this study was to discuss the results of studies investigating the role of physical activity in knee osteoarthritis (OA) . | A Systematic review | Scientific evidence suggests that both land-based and aquatic activities combining aerobics, strength, and endurance programs are safe and effective. |

| | | | | | |
|---|---|---|---|---|---|
| (Morgan et al., 2024) | Physical activity and joint health: Implications for knee osteoarthritis disease pathophysiology and mechanics | A total of 57 studies were selected | The aim of this study was to demonstrate how a nuanced approach to the relationship between physical activity and knee osteoarthritis can help to dispel misconceptions, leading to better management strategies and improved quality of life for patients. | A systematic review | The reliance on self-reported physical activity data in human research introduces significant limitations owing to lack of specificity and potential biases, resulting in contrasting and confounding findings |
| (Raposo et al., 2021) | Effects of exercise on knee osteoarthritis: A systematic review | A systematic search was performed at Pubmed, Scopus and Web of Science databases, limiting the studies to English, French and Portuguese language, from 2010 to May 2020. Eligible studies were randomized control trials or clinical control trials that compared an intervention consisting of an exercise | The aim of this study was to review the existing evidence regarding the impact of exercise in people with knee osteoarthritis concerning physical and functional outcomes. The secondary aim is to provide both healthcare professionals and patients with updated and high-quality recommendations for the management of this condition. | A systematic review | Exercise programmes appear to be safe and effective in knee osteoarthritis patients, mainly regarding pain and strength improvement. Pilates, aerobic and strengthening exercise programmes performed for 8-12 weeks, 3-5 sessions per week; each session lasting 1 h appear to be effective. Both aquatic and land-based programmes show comparable and positive effects. |

| | | | | | |
|---|---|---|---|---|---|
| | | programme in adult participants with knee osteoarthritis against no intervention. | | | |

# CHAPTER THREE

# MATERIALS AND METHODS

## 3.1 Materials

### 3.1.1 Population

The study population comprised of male and female patients with Knee Osteoarthritis who received care in the University of Benin Teaching Hospital.

### 3.1.2 Selection Criteria

#### 3.1.2.1 Inclusion Criteria

Participants eligible for this study included:

i. Individuals aged 18 years and above.
ii. Individuals clinically diagnosed with knee osteoarthritis by a qualified medical practitioner.
iii. Individuals who were able to provide informed consent.
iv. Individuals with no cognitive impairments preventing participation in the study.
v. Individuals who could effectively communicate in English Language or Pidgin English.

#### 3.1.2.2 Exclusion Criteria

The study excluded the following individuals:

i. Individuals with the presence of other forms of arthritis.

ii. Individuals who have undergone acute knee injuries or surgeries in the last 6 months.

### 3.1.3 Instruments

i. Pro-forma

ii. The International Physical Activity Questionnaire – Short Form (IPAQ-SF)

iii. The Tampa Scale for Kinesiophobia (TSK)

iv. The Hospital Anxiety and Depression Scale (HADS)

### 3.1.4 Description of Instruments

i. A Pro forma containing demographics and clinical variables: The demographic variables included age, sex, occupation, education level, marital status, religion, and ethnicity. The clinical variables included disease severity, duration of symptoms and presence of comorbidities.

ii. **The International Physical Activity Questionnaire – Short Form (IPAQ-SF)** is a widely used and validated self-report instrument designed to assess physical activity levels among individuals aged 15 to 69 years. Developed by an international consensus group in 1998, it was created to provide a standardized tool for comparing physical activity across populations globally. The IPAQ-SF has gained endorsement from leading public health bodies, including the World Health Organization, due to its practicality and adaptability across different cultures and settings.

This tool captures physical activity over the previous seven days, offering a comprehensive estimate of total activity regardless of the domain in which it occurs whether during work, transportation, domestic duties, or leisure. It collects information on the frequency and duration of walking, moderate-intensity activities, and vigorous-intensity activities, as well as time spent sitting, which serves as an indicator of sedentary behavior. Responses are converted into metabolic equivalent task minutes per week (MET-min/week), allowing for the classification of respondents into low, moderate, or high physical activity levels. This classification aids in determining whether individuals meet recommended physical activity guidelines for health maintenance and disease prevention.

The IPAQ-SF has demonstrated acceptable psychometric properties, with test-retest reliability coefficients often exceeding 0.70, and moderate correlations with objective physical activity measurements such as accelerometers. Its construct and criterion validity have been tested across diverse populations, including clinical groups and community-dwelling adults in various regions of the world, including sub-Saharan Africa (Lee et al., 2011). Its simplicity, brevity, and ease of administration make it especially valuable in clinical and research environments where time and resources are limited.

iii. **The Tampa Scale for Kinesiophobia (TSK)**: is a standardized self-report tool used to assess the fear of movement or re-injury, especially in individuals with chronic pain conditions such as knee osteoarthritis. Originally developed by Kori, Miller, and Todd in 1990, the TSK evaluates an individual's beliefs about how physical activity might cause pain or exacerbate injury. The scale helps

identify patients whose fear of movement may hinder rehabilitation or lead to activity avoidance.

The most commonly used version, the TSK-11, consists of 11 items scored on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). Total scores range from 11 to 44, with higher scores indicating greater levels of kinesiophobia. The scale covers two key dimensions: activity avoidance and somatic focus, both of which are relevant in conditions associated with chronic pain and functional limitation.

Numerous studies have confirmed the TSK's psychometric robustness. The TSK-11 has demonstrated strong internal consistency, with Cronbach's alpha values typically ranging from 0.76 to 0.84, and test-retest reliability coefficients exceeding 0.80, indicating stability over time. Its construct validity has been supported by its correlations with measures of pain intensity, disability, and physical activity levels in various populations, including those with low back pain and osteoarthritis (Roelofs et al., 2004; Vlaeyen et al., 1995).

The TSK is particularly relevant in the context of knee osteoarthritis, where fear of pain or further joint damage can lead to reduced physical activity, muscle deconditioning, and worsening disability.

iv. **The Hospital Anxiety and Depression Scale (HADS**) is a widely used, validated self-report instrument designed to detect symptoms of anxiety and depression in medical and physiotherapy settings, particularly among patients with chronic physical health conditions, including osteoarthritis. Developed by Zigmond and Snaith in 1983, the HADS is specifically structured to avoid

confounding psychological symptoms with physical illness-related complaints (e.g., fatigue, insomnia), making it ideal for populations with musculoskeletal disorders like knee OA.

The scale comprises 14 items divided into two subscales:

HADS-A for anxiety (7 items)

HADS-D for depression (7 items)

Each item is rated on a 4-point Likert scale (0–3), leading to subscale scores ranging from 0 to 21. A score of 0–7 is considered normal, 8–10 suggests borderline abnormal (mild), and 11–21 indicates clinically significant anxiety or depression.

The HADS has been validated extensively across various clinical populations and countries, including in African contexts. It has shown good internal consistency (Cronbach's alpha typically ranging from 0.78 to 0.93), construct validity, and sensitivity/specificity in identifying psychological distress (Zigmond & Snaith, 1983). It has been used successfully in studies assessing mental health among individuals with chronic pain, arthritis, and mobility limitations.

## 3.2 Methods

### 3.2.1 Research Design

This research was a cross-sectional analytical study.

### 3.2.2 Sampling Technique

Purposive sampling was used to select the participants for this study.

### 3.2.3 Sample Size Calculation

The sample size for this study was determined by the Yamane formula (Yamane, 1967).

Where:

n = required sample size

N = population size (total number of patients with Knee OA at Physiotherapy department, UBTH in the last 3 months)

e = level of precision (0.05 for 95% confidence).

Given;

N = 40

e = 0.05

n = 36

Therefore, the required sample size for this study was **36.**

### 3.2.4 Ethical Consideration

Ethical approval for this study was obtained from the Health Research Ethics Committee of the University of Benin Teaching Hospital, Benin City.

### 3.2.5 Procedure for Data Collection

Informed consent was obtained from the participants. Demographic and clinical details were obtained from the participants and case note. The demographic variables included age, sex, occupation, education level, marital status, religion, and ethnicity. The clinical variables included pain severity, duration of symptoms and presence of comorbidities. Pain Severity was assessed using the Numerical Pain Rating Scale (NPRS). Questionnaires were administered to the participants to assess their levels of Physical Activity, fear of movement, anxiety and depression, and the questionnaire were collected as soon as they were completed.

### 3.2.6 Data Analysis

Data was analyzed using the IBM Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize demographic characteristics and other relevant variables. Inferential statistics of Chi Square test was used to determine the association between selected socio-demographic and clinical variables with levels of physical activity. Ordinal logistic regression was used to determine the predictors of physical activity levels among patients with Knee Osteoarthritis. The level of statistical significance was set at an alpha value of $p < 0.05$

# CHAPTER FOUR

# RESULTS

## 4.1 Preamble

This chapter presents the results of the study on the predictors of physical activity level among patients with knee osteoarthritis (KOA) at the University of Benin Teaching Hospital. The data obtained were analyzed using descriptive and inferential statistics. Results are presented in tables and figures according to the study objectives. The descriptive statistics include frequency counts, percentages, means, and standard deviations, while inferential statistics include Chi-square and ordinal logistic regression. A total of 36 respondents participated in the study.

### 4.1.1 Socio-demographic Characteristics of the Respondents

Table 4.1 shows the socio-demographic characteristics of the respondents. The age group with the highest representation was 71–75 years (27.8%), followed by 56–60 years (25%). The least represented age group was 45–50 years (2.8%). The majority of respondents were female (75%) compared to males (25%). Most respondents were married (94.4%), while only 5.6% were widowed. All participants were Christians (100%). In terms of ethnicity, Bini (44.4%) formed the largest group, followed by Esan (25%), while Edo and others accounted for 8.3% and 22.2% respectively. Occupation-wise, traders and civil servants had the highest proportions (36.1% each), followed by others (25%). Regarding educational attainment, more than half of the respondents (55.6%) had tertiary education, while 13.9% each had primary or no formal education.

| Variables | Categories | n | % |
|---|---|---|---|
| **Age Group** | 45-50years | 1 | 2.8 |
| | 51.55years | 5 | 13.9 |
| | 56-60years | 9 | 25.0 |
| | 61-65years | 5 | 13.9 |
| | 66-70years | 3 | 8.3 |
| | 71-75years | 10 | 27.8 |
| | 76-80years | 3 | 8.3 |
| **Gender** | Male | 9 | 25.0 |
| | Female | 27 | 75.0 |
| **Marital Status** | Single | 0 | 0.0 |
| | Married | 34 | 94.4 |
| | Widowed | 2 | 5.6 |
| **Religion** | Christianity | 36 | 100.0 |
| | Islam | 0 | 0.0 |
| **Ethnicity** | Bini | 10 | 44.4 |
| | Edo | 3 | 8.3 |
| | Esan | 9 | 25.0 |
| | Others | 8 | 22.2 |
| **Occupation** | Trader | 13 | 36.1 |
| | Civil Servant | 13 | 36.1 |
| | Business | 1 | 2.8 |
| | Others | 9 | 25.0 |
| **Educational Level** | No Formal Education | 5 | 13.9 |
| | Primary | 5 | 13.9 |
| | Secondary | 6 | 16.7 |
| | Tertiary | 20 | 55.6 |

**Table 4.1: Socio-demographic Characteristics of Respondents (N = 36)**

### 4.1.2 Characteristics of Respondents' Pain, Severity, and Co-morbidities

Table 4.2 shows the clinical profile of the respondents. Most participants had OA for less than 1 year (41.7%) or 1–5 years (38.9%), while only 8.3% and 11.1% had 6–10 years and >10 years duration, respectively. Half of the respondents (50%) reported moderate pain severity, while 27.8% reported severe pain, and 22.2% reported mild pain. A majority (72.2%) of participants had comorbidities, while 52.8% reported hypertension, 80.6% reported diabetes mellitus, and 88.9% reported peptic ulcer.

**Table 4.2: Characteristics of Respondents' Pain, Severity and Co-morbidities (N = 36)**

| Variables | Categories | n | % |
|---|---|---|---|
| **Duration of OA** | <1Year | 15 | 41.7 |
| | 1-5Years | 14 | 38.9 |
| | 6-10Years | 3 | 8.3 |
| | >10Years | 4 | 11.1 |
| **OA Pain Severity** | Mild | 8 | 22.2 |
| | Moderate | 18 | 50.0 |
| | Severe | 10 | 27.8 |
| **Co-Morbidities** | Yes | 26 | 72.2 |
| | No | 10 | 27.8 |
| **Hypertension** | Yes | 19 | 52.8 |
| | No | 17 | 47.2 |
| **Diabetes Mellitus** | Yes | 29 | 80.6 |
| | No | 7 | 19.4 |
| **Peptic Ulcer** | Yes | 32 | 88.9 |
| | No | 4 | 11.1 |

### 4.1.3 Mean Scores of Physical Activity, Kinesiophobia, Anxiety, and Depression

Table 4.3 shows the mean scores of Physical Activity, kinesiophobia, anxiety and depression. The mean total physical activity (PA) score was 44,688 ± 8,402.83 MET-min/week, with subcategories showing mean scores of 1,350.71 ± 2,442.62 (low PA), 10,080.00 ± 2,551.16 (moderate PA), and 23,520.00 ± 4,229.37 (high PA). The mean kinesiophobia score was 40.55 ± 3.58, indicating greater kinesiophobia among respondents. Anxiety and depression had mean scores of 4.55 ± 3.71 and 5.94 ± 3.81, respectively, suggesting that on average, participants experienced mild levels of anxiety and depression.

**Table 2.3: Mean value of Respondents' Physical Activity, Kinesiophobia, Anxiety and Depression Score (N=36)**

| Variables | Category | Minimum | Maximum | Mean +- | Standard Deviation |
|---|---|---|---|---|---|
| **Physical Activity** | Low MET | 33.00 | 11088.00 | 1350.71 +- | 2442.62 |
| | Moderate | 40.00 | 10080.00 | 1914.44 +- | 2551.16 |
| | Vigorous/High | 32.00 | 23520.00 | 2218.44 +- | 4229.37 |
| | Overall Total MET | 273.00 | 44688.00 | 5483.59 +- | 8402.83 |
| **Kinesiophobia** | Total Score | 32.00 | 46.00 | 40.55 +- | 3.58 |
| **HASD (Anxiety) Score** | Total Score | 0.00 | 13.00 | 4.55 +- | 3.71 |
| **HASD (Depression) Score** | Total Score | 0.00 | 12.00 | 5.94 +- | 3.81 |

### 4.1.4 Categorical Distribution of Physical Activity, Kinesiophobia, Anxiety, and Depression

As shown in Table 4.4, half of the respondents (50%) had moderate physical activity, 38.9% had high physical activity, while 11.1% had low physical activity. Regarding kinesiophobia, the majority (86.1%) had greater kinesiophobia, while only 13.9% had low kinesiophobia. Anxiety levels revealed that 80.6% were within the normal range, 8.3% had mild anxiety, and 11.1% had severe anxiety. For depression, 63.9% were normal, 13.9% had mild depression, and 22.2% had severe depression.

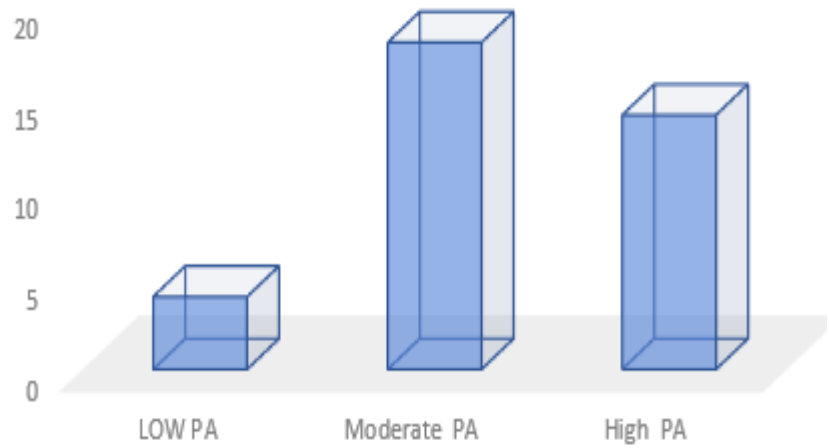


**Figure 4.1: A Bar Chart Sowing the Level of Physical Activity**

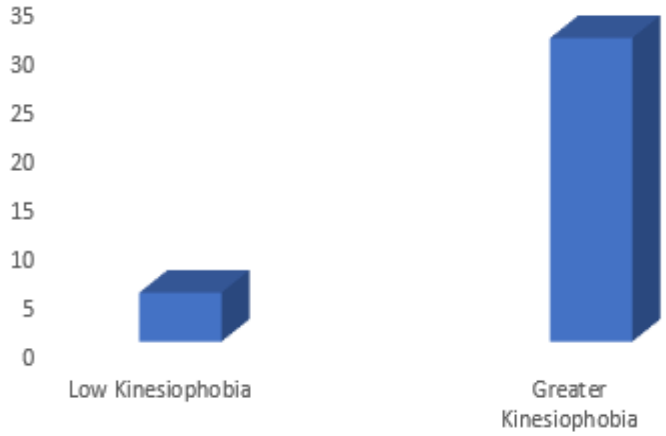


**Figure 4.2 :A Bar Chart Sowing the Level of Kinesiophobia**

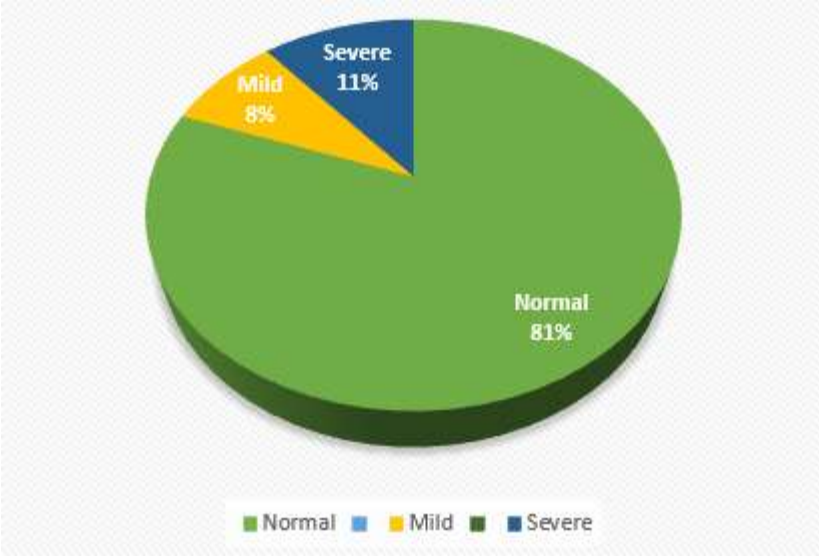


**Figure 2.3: A Pie Chart Sowing the Level of HASD (Anxiety) Score**

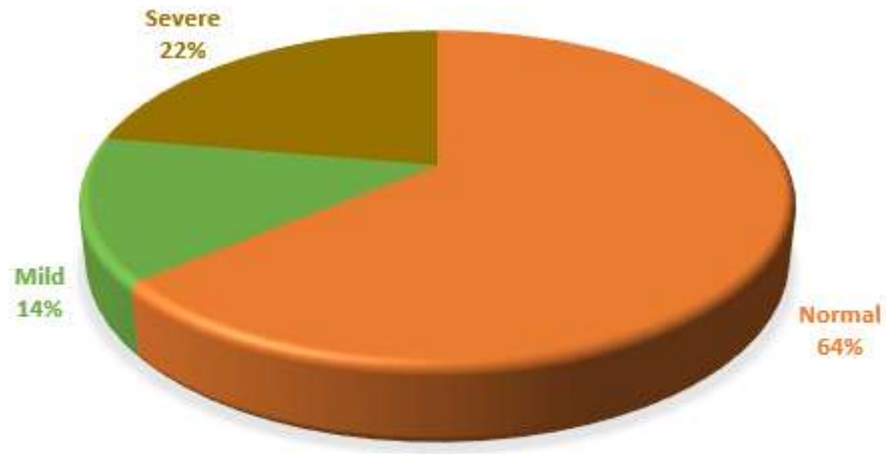


**Figure 4.4: A Pie Chart Sowing the Level of HASD (Depression) Score**

### 4.1.5 Association between Physical Activity and Socio-demographic Factors

Table 4.5 shows the result of test of association between physical activity and socio-demographic factors, the result reveled no significant association between age group and physical activity level ($X^2 = 19.384$, $p = 0.080$). Similarly, gender showed no significant association with physical activity ($X^2 = 0.169$, $p = 0.919$). Educational attainment also showed no significant association ($X^2 = 5.940$, $p = 0.430$). This indicates that socio-demographic characteristics did not significantly predict the level of physical activity among respondents.

**Table 4.4: Chi Square Test of Association between Physical Activity Level and Selected Socio- demographic Factors (N=36)**

| Variables | | Low PA n (%) | Moderate PA n (%) | High PA n(%) | $X^2$ | P Value |
|---|---|---|---|---|---|---|
| **Age Group** | 45-50years | 0(0.0) | 0(0.0) | 1(7.1) | | |
| | 51-55years | 0(0.0) | 1(5.6) | 4(28.6) | | |
| | 56-60years | 2(50.0) | 2(11.1) | 5(35.7) | | |
| | 61-65years | 0(0.0) | 3(16.7) | 2(14.3) | 19.384 | 0.080 |
| | 66-70years | 0)0.0) | 1(5.6) | 2(14.3) | | |
| | 71-75years | 2(50.0) | 8(44.4) | 0(0.0) | | |
| | 76-80years | 0(0.0) | 3(16.7) | 0(0.0) | | |
| **Gender** | Male | 1(25.0) | 5(27.8) | 3(21.4) | 0.169 | 0.919 |
| | Female | 3(75.0) | 13(72.2) | 11(78.6) | | |
| **Education** | No Formal Education | 1(25.0) | 3(16.7) | 1(7.1) | | |
| | Primary | 0(0.0) | 1(5.6) | 4(28.6) | | |
| | Secondary | 0(0.0) | 4(22.2) | 2(14.3) | 5.940 | 0.430 |
| | Tertiary | 3(75.0) | 10(55.6) | 7(50.0) | | |

P<0.05 indicate Significant Association

P>0.05 indicate No Significant Association

### 4.1.6 Association between Physical Activity and selected Clinical Factors

Table 4.6 shows the association between physical activity and selected clinical factors. Clinical factors such as pain severity, duration of pain, and co-morbidities showed no significant association with physical activity levels. For pain severity, the association was not significant ($X^2 = 2.500$, $p = 0.645$). Similarly, the duration of pain ($X^2 = 4.205$, $p = 0.649$) and presence of co-morbidities ($X^2 = 0.732$, $p = 0.694$) did not show significant relationships with physical activity

**Table 4.5: Chi Square Test of Association between Physical Activity Level and Selected Clinical Factors (N=36)**

| Variables | | Low PA n (%) | Moderate PA n (%) | High PA n(%) | $X^2$ | P Value |
|---|---|---|---|---|---|---|
| **Pain Severity** | Mild | 1(25.0) | 3(16.7) | 4(28.6) | | |
| | Moderate | 2(50.0) | 8(44.4) | 8(57.1) | 2.500 | 0.645 |
| | Severe | 1(25.0) | 7(38.9) | 2(14.3) | | |
| **Duration of Pain** | <1Year | 2(50.0) | 7(38.9) | 6(42.9) | | |
| | 1-5Years | 1(25.0) | 7(38.9) | 6(42.9) | 4.205 | 0.649 |
| | 6-10Years | 0(0.0) | 1(5.6) | 2(14.3) | | |
| | >10Years | 1(25.0) | 3(16.7) | 0(0.0) | | |
| **Co-Morbidities** | Yes | 3(75.0) | 14(77.8) | 9(64.3) | 0.732 | 0.694 |
| | No | 1(25.0) | 4(22.2) | 5(35.7) | | |

P<0.05 indicate Significant Association

P>0.05 indicate No Significant Association

### 4.1.7 Association between Physical Activity and Selected Psychological Factors

Table 4.7 shows the association between physical activity and selected psychological factors. Psychological factors revealed mixed findings. Kinesiophobia showed no significant relationship with physical activity levels ($X^2 = 0.531$, $p = 0.767$). Depression was also not significantly associated with physical activity levels ($X^2 = 7.016$, $p = 0.135$). However, anxiety presented a statistically significant relationship with physical activity levels ($X^2 = 21.706$, $p = 0.000$).

**Table 4.6: Chi Square Test of Association Between Physical Activity Level and Selected Psychological Factors (N=36)**

| Variables | | Low PA n (%) | Moderate PA n (%) | High PA n(%) | $X^2$ | P Value |
|---|---|---|---|---|---|---|
| **Kinesiophobia** | Low Kinesiophobia | 1(25.0) | 2(11.1) | 2(14.3) | 0.531 | 0.767 |
| | Greater Kinesiophobia | 3(75.0) | 16(88.9) | 12(85.7) | | |
| **Anxiety** | Normal | 1(25.0) | 15(83.3) | 13(92.9) | | |
| | Mild Anxiety | 0(0.0) | 3(16.7) | 0(0.0) | 21.706 | 0.000** |
| | Severe Anxiety | 3(75.0) | 0(0.0) | 1(25.0) | | |
| **Depression** | Normal | 2(50.0) | 13(72.2) | 8(57.1) | | |
| | Mild Depression | 2(50.0) | 2(11.2) | 1(7.1) | 7.016 | 0.135 |
| | Severe Depression | 0(0.0) | 3(16.7) | 5(35.7) | | |

P<0.05 indicate Significant Association

P>0.05 indicate No Significant Association

### 4.1.8 Predictors of Physical Activity Levels among Respondents

Table 4.8: the ordinal logistic regression analysis revealed that none of the variables significantly predicted physical activity levels ($p > 0.05$). Although age group, pain severity, anxiety, and depression showed odds ratios greater than 1, suggesting a trend towards higher physical activity, the associations were not statistically significant. This implies that socio-demographic, clinical, and psychological factors did not independently predict physical activity levels among the respondents.

**Table 4.7: Ordinal Logistic Regression Test of Predictors of Physical Activity Among Respondents (N=36)**

| Variable/Predictors | | Estimate (B) | Std. Error | Wald | df | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|---|
| Threshold | Low PA Level | 21.331 | 51.826 | .169 | 1 | .681 | -80.246 | 122.907 |
| | Moderate PA | 42.395 | 103.555 | .168 | 1 | .682 | -160.568 | 245.359 |
| Age Group | 45-50years | 11.462 | 246.967 | .002 | 1 | .963 | -472.584 | 495.508 |
| | 51-55years | 32.288 | 79.647 | .164 | 1 | .685 | -123.818 | 188.394 |
| | 56-60years | 13.854 | 35.037 | .156 | 1 | .693 | -54.817 | 82.526 |
| | 61-65years | 12.248 | 34.995 | .123 | 1 | .726 | -56.341 | 80.838 |
| | 66-70years | 12.963 | 38.334 | .114 | 1 | .735 | -62.171 | 88.096 |
| | 71-75years | 1.205 | 2.212 | .297 | 1 | .586 | -3.130 | 5.540 |
| | 76-80years | 0[a] | . | . | 0 | . | . | . |
| Pain Severity | Mild Pain | 7.954 | 38.199 | .043 | 1 | .835 | -66.915 | 82.823 |
| | Moderate Pain | 10.098 | 38.208 | .070 | 1 | .792 | -64.789 | 84.984 |
| | Severe Pain | 0[a] | . | . | 0 | . | . | . |
| Kinesiophobia | Low Kinesiophobia | -1.192 | 2.084 | .327 | 1 | .567 | -5.277 | 2.893 |
| | Greater Kinesiophobia | 0[a] | . | . | 0 | . | . | . |
| Anxiety | | | | | | | | |
| | Normal | 31.854 | 79.615 | .160 | 1 | .689 | -124.188 | 187.897 |
| | Mild Anxiety | 10.286 | 34.936 | .087 | 1 | .768 | -58.188 | 78.759 |
| Depression | Severe Anxiety | 0[a] | . | . | 0 | . | . | . |
| | Normal | -10.266 | 34.930 | .086 | 1 | .769 | -78.727 | 58.195 |
| | Mild Depression | -2.612 | 2.437 | 1.148 | 1 | .284 | -7.389 | 2.165 |
| | Severe Depression | 0[a] | . | . | 0 | . | . | . |

P is set at <0.05

Calculated P-value is >0.05,

## 4.2 Hypothesis testing

1. There would be no significant relationship between age and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.080

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

2. There would be no significant relationship between sex and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.919

Judgement: Since the observed p value was greater than 0.05, the null hypothesis is therefore NOT REJECTED

3. There would be no significant relationship between education level and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.430

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

4. There would be no significant relationship between pain severity and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.645

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

5. There would be no significant relationship between duration of symptoms and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.649

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

6. There would be no significant relationship between presence of comorbidities and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.694

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

7. There would be no significant relationship between fear of movement and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.767

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

8. There would be no significant relationship between anxiety and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: <0.001

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

9. There would be no significant relationship between depression and physical activity levels among patients with knee osteoarthritis in the University of Benin Teaching Hospital.

Test: Chi square test

Alpha level: 0.05

Observed p value: 0.135

Judgement: Since the observed p value is greater than 0.05, the null hypothesis is therefore NOT REJECTED

# CHAPTER FIVE

## DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

### 5.1 Discussion

This study explored the predictors of physical activity (PA) levels among patients with knee osteoarthritis (KOA) at the University of Benin Teaching Hospital (UBTH).

### 5.1.1 Levels of Physical Activity

The descriptive results showed that half of the participants (50.0%) engaged in moderate levels of PA, 38.9% reported high levels, while only 11.1% fell within the low PA category. This distribution suggests that most patients remained at least moderately active despite their condition.

This finding aligns with Raposo et al. (2021), who observed that KOA patients often engage in moderate PA levels but not as high as recommended by global guidelines. Similarly, a Nigerian study by Tami et al. (2021) found that patients with musculoskeletal conditions reported moderate PA levels, although they were still below optimal WHO recommendations. On the contrary, Messier et al. (2021), in a U.S. cohort, reported that most KOA patients were predominantly inactive, highlighting possible cultural or contextual influences.

The higher proportion of moderate and high PA in this study may reflect the active lifestyle of Nigerian patients, where walking, market activities, and household chores

contribute significantly to energy expenditure. However, the persistence of low PA in 11% indicates that barriers still exist and require targeted interventions.

### 5.1.2 Socio-demographic Factors (Age, Sex, Education)

The descriptive analysis showed that the participants were predominantly older adults, with females having a higher representation (75%). A fair proportion had attained at least secondary or tertiary education, suggesting a relatively literate sample population.

This distribution is consistent with reports that KOA prevalence increases with age, especially in individuals above 40 years, and is slightly more common among females globally (Cui et al., 2020). In Nigeria, Ekediegwu et al. (2022) reported a female predominance in KOA, attributing this to hormonal influences which is in line with this study.

Educational attainment was fairly high among participants, which contrasts with findings from Usenbo et al. (2015), who noted that lower educational status was common among African OA patients, often limiting health literacy and access to care. The higher education profile in this study population could partly explain the moderate-to-high PA levels observed, as education has been linked with better health awareness and adherence to activity guidelines (Alonge et al., 2020).

The socio-demographic results revealed no significant associations between age, sex, or education level and PA levels.

This aligns with Dunlop et al. (2014), who also found that demographic characteristics alone did not predict PA once psychological and environmental variables were

considered. Similarly, Raposo et al. (2021) noted that age and education were not consistent predictors of PA in KOA populations.

However, other studies have reported contrasting results. For example, Haq et al. (2019) found that older age was associated with reduced PA, and Alonge et al. (2020) in Nigeria observed that higher education levels correlated with better exercise adherence. The absence of such associations in this study may reflect the homogeneity of the or the overriding effect of psychological factors like anxiety and fear.

### 5.1.3 Kinesiophobia

The majority of participants (86.1%) demonstrated high kinesiophobia, while only a small fraction showed low fear of movement. This indicates that fear of pain or worsening symptoms was widespread among patients.

Kinesiophobia is a well-recognized psychological barrier to PA. Restuccia et al. (2022) reported similar findings, where patients with KOA and higher fear-avoidance scores engaged in less PA. Locally, Tami et al. (2021) emphasized that fear of exacerbating symptoms was among the strongest barriers to activity among Nigerian patients. The present finding therefore reflects the global trend that kinesiophobia is a critical determinant of inactivity in chronic musculoskeletal conditions.

However, despite the high prevalence of kinesiophobia in this study, PA levels were still mostly moderate. This may indicate that cultural resilience, economic necessity, or reliance on informal physical tasks (such as farming, trading, and walking as a mode of transport) helps patients stay active despite fear. Clinically, this underscores the need for

reassurance and cognitive-behavioral interventions to reduce maladaptive avoidance behavior.

### 5.1.4 Anxiety

The descriptive findings revealed that while most patients had normal anxiety levels, 11.1% experienced severe anxiety. Importantly, the association analysis demonstrated a significant relationship between anxiety and PA levels ($\chi^2 = 21.706$, $p < 0.001$), with higher anxiety linked to lower PA engagement.

This supports Stubbs et al. (2017), who showed that anxiety negatively influenced PA participation in patients with chronic pain. Similarly, Zeng et al. (2021) highlighted that anxiety was an independent barrier to PA adherence in KOA management. In the Nigerian context, studies such as Tami et al. (2021) have also reported that psychological distress reduces willingness to engage in exercise.

Conversely, not all literature agrees. For example, White et al. (2019) found no significant link between anxiety and PA in KOA patients, suggesting that contextual or methodological factors may moderate this relationship. The present finding emphasizes the importance of addressing anxiety symptoms during physiotherapy to encourage activity participation.

### 5.1.5 Depression

In this study, 22.2% of participants reported severe depression, while the rest had mild to moderate or normal levels. Interestingly, depression did not show a significant association with PA levels.

This finding diverges from White et al. (2019) and Holla et al. (2016), who demonstrated that depressive symptoms strongly predict inactivity in KOA patients. One possible explanation is the protective role of social support networks in Nigeria, where family and community members often encourage mobility and functional independence, potentially buffering the depressive impact on PA.

Nevertheless, the prevalence of severe depression among participants underscores the importance of psychological assessment in KOA care, even if its direct statistical link with PA was not evident here.

### 5.1.6 Clinical Factors (Pain Severity, Duration of Symptoms, Comorbidities)

Clinical variables, including pain intensity, duration of symptoms, and comorbidities, were not significantly associated with PA levels in this study.

This finding contrasts with Haq et al. (2019), who showed that pain severity was a major determinant of inactivity among KOA patients. It also differs from Dunlop et al. (2014), where multimorbidity significantly reduced PA engagement. However, it supports Raposo et al. (2021), who found that pain was not always a reliable predictor of PA, as many patients maintained activity despite discomfort.

A possible explanation is that Nigerian patients may prioritize mobility for daily survival tasks, meaning pain alone does not stop them from being active. Additionally, reliance on analgesics or traditional remedies may mitigate the disabling impact of pain and comorbidities, allowing continued engagement in physical tasks.

### 5.1.7 Predictors of Physical Activity

Ordinal logistic regression indicated that none of the studied predictors (age, pain severity, kinesiophobia, anxiety, depression) independently predicted PA when analyzed together. Although anxiety showed a significant bivariate association with PA, it did not retain significance after adjustment.

This finding underscores the multifactorial nature of PA behavior in KOA, where no single factor dominates. It agrees with Dunlop et al. (2014), who noted that PA is determined by a complex interaction of demographic, psychosocial, cultural, and environmental variables. The implication is that interventions should not focus narrowly on one factor (e.g., pain or anxiety) but instead adopt a holistic strategy combining education, psychological support, and environmental modifications.

## 5.2 Conclusion

The findings of this study showed that most patients with Knee Osteoarthritis (KOA) at the University of Benin Teaching Hospital (UBTH) engaged in moderate levels of physical activity (PA), although a notable number still remained insufficiently active. Kinesiophobia, was found to be highly prevalent among these patients, indicating that even those who were moderately active still experienced significant anxiety about movement. Interestingly, anxiety was significantly associated with levels of physical activity, whereas depression did not show a similar correlation. The study also highlighted that socio-demographic and clinical factors did not significantly influence PA levels. Lastly, regression analysis revealed no single predictor that independently determined PA behavior, suggesting that the factors influencing physical activity in KOA patients are multifactorial in nature.

## 5.3 Recommendations

1. **For Clinicians**:
    - Integrate psychological screening for anxiety and kinesiophobia in routine assessment.
    - Use cognitive-behavioral techniques and graded exposure to reduce fear of movement.
    - Provide individualized exercise programs tailored to patients' psychological and functional profiles.
2. **For Patients**:

- Engage in moderate physical activities such as brisk walking, cycling, and low-impact aerobics.
- Join group-based exercise sessions for social support and motivation.

3. **For Policy Makers**:
    - Develop public health campaigns promoting safe PA for individuals with chronic joint conditions.
    - Improve access to community physiotherapy services and safe walking environments.
4. **For Researchers**:
    - Explore environmental and cultural influences on PA in KOA patients.
    - Conduct intervention studies testing psychological therapies to improve PA adherence.

## 5.4 Suggestions for Further Studies

- Larger, multicenter studies to increase generalizability.
- Use of objective PA measures (accelerometers) alongside IPAQ-SF.
- Longitudinal studies to establish causal links between anxiety, depression, and PA.
- Exploration of environmental and sociocultural barriers in Nigeria.

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# APPENDIX I

## INFORMED CONSENT FORM

My name is Akee Caro Paul, a final year student of the Department of Physiotherapy, School of Basic Medical Sciences, University of Benin. I am conducting a study on "PREDICTORS OF PHYSICAL ACTIVITY LEVEL AMONG PATIENTS WITH KNEE OSTEOARTHRITIS IN UNIVERSITY OF BENIN TEACHING HOSPITAL". You are invited to participate in this research study. Before you decide, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully.

**Purpose of the Study:**

The Aim of this study was to investigate the predictors of physical activity levels among patients with Knee Osteoarthritis in University of Benin Teaching Hospital.

**Voluntary Participation:**

Your participation in this study is entirely voluntary. You may choose not to participate or to withdraw at any point without any consequences.

**Procedures:**

If you agree to participate, you will be asked to complete a short questionnaire. The questionnaire will take about 10–15 minutes. All information collected will be kept strictly confidential and used only for academic purposes. Your sincere response to the questionnaire and/or interview will be most helpful.

**Confidentiality:**

All information collected will be kept strictly confidential and used only for academic purposes. No identifying information will be recorded. Your participation and responses will be appreciated and kept confidential.

**Benefits and Risks:**

There are no direct benefits to you, but your participation will offer the opportunity to gain valuable insight into your level of physical activity. There are no anticipated risks.

**Consent Statement:**

I have read and understood the purpose of this research and what it involves. I voluntarily agree to participate.

**Signature of Participant:** _____

**Date:** _____

## APPENDIX II

# DATA COLLECTION PROFORMA

Title of Study: _____

Participant Code: _____ Date: ___ / ___ / _____

## Section A: Informed Consent

Informed Consent Obtained: □ Yes □ No
(Attach signed consent form)

## Section B: Demographic Information

| Variable | Response Options / Space for Entry |
|---|---|
| 1. Age | _____ years |
| 2. Sex | □ Male □ Female □ Other: _____ |
| 3. Occupation | _____ |
| 4. Education Level | □ No formal education □ Primary □ Secondary □ Tertiary □ Other: _____ |
| 5. Marital Status | □ Single □ Married □ Divorced □ |

| | |
|---|---|
| | Widowed □ Other: _____ |
| 6. Religion | □ Christianity □ Islam □ Traditional □ Other: _____ |
| 7. Ethnicity | _____ |

## Section C: Clinical Information

| Variable | Response Options / Space for Entry |
|---|---|
| 1. Disease Severity | □ Mild □ Moderate □ Severe □ Very Severe (Specify scale if applicable: _____) |
| 2. Duration of Symptoms | _____ years/months |
| 3. Comorbidities Present | □ Yes □ No |
| If Yes, list comorbidities: | _____ |

## Section D: Source of Clinical Data

Source of Clinical Information: □ Participant Interview □ Case Note □ Both

# APPENDIX III

## INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE-SHORT FORM (IPAQ-SF)

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

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ days per week

**No vigorous physical activities Skip to question 3**

2. How much time did you usually spend doing vigorous physical activities on one of those days?

_____ Hours per day

_____ Minutes per day

[ ] Don't know/Not sure

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

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?

[ ] Do not include walking.

_____ Days per week

**No moderate physical activities Skip to question 5**

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

_____ Hours per day

_____ Minutes per day

[ ] Don't know/Not sure

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

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

_____ Days per week

[ ] No walking Skip to question 7

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

_____ Hours per day

_____ Minutes per day

[ ] Don't know/Not sure

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

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

___ Hours per day

_____ Minutes per day

[ ] Don't know/Not sure

8. During the past 7 days how often have you done any light housework such as dusting, sweeping, washing dishes.

___ Hours per day

_____ Minutes per day

[ ] Don't know/Not sure

9. During the past 7 days how often have you done any heavy housework or chores such as scrubbing floor washing windows or wall

___ Hours per day
_____ Minutes per day
[ ] Don't know/Not sure

# APPENDIX IV

## TAMPA SCALE OF KINESIOPHOBIA

Instructions: For each of the following statements, please indicate how much you agree or disagree with it by choosing the appropriate number.

Legend:

1 = Strongly disagree
2 = Disagree
3 = Agree
4 = Strongly agree

| Item | Statement | Score |
|---|---|---|
| 1 | I'm afraid that I might injure myself accidentally. | [ ] |
| 2 | If I tried to overcome it, my pain would increase. | [ ] |
| 3 | My body is telling me I have something dangerously wrong. | [ ] |
| 4 | People aren't taking my medical condition seriously enough. | [ ] |
| 5 | My pain is caused by physical activity. | [ ] |
| 6 | Pain lets me know when to stop exercising so that I don't injure myself. | [ ] |
| 7 | I'm afraid that I might injure myself if I exercise. | [ ] |
| 8 | I can't do all the things normal people do because it's too easy for me to get injured. | [ ] |
| 9 | No one should have to exercise when they're in pain. | [ ] |
| 10 | I'm afraid that I might injure myself even if I exercise carefully. | [ ] |
| 11 | Simply being careful that I do not make any unnecessary movements is the safest way to protect | [ ] |

| | | |
|---|---|---|
| | myself from further injury. | |
| 12 | I wouldn't have this much pain if there weren't something potentially dangerous going on. | [ ] |
| 13 | Although my condition is painful, I would be better off if I were physically active. | [ ] |
| 14 | Pain always means I have injured my body. | [ ] |
| 15 | Just because something increases pain doesn't mean it's dangerous. | [ ] |
| 16 | I wouldn't do anything that might increase my pain. | [ ] |
| 17 | It's really not safe for a person with a condition like mine to be physically active. | [ ] |

Scoring:

- Reverse-score items: 4, 8, 12, 14, 15

- Add up scores for a total (range: 17–68).

- Higher scores indicate greater fear of movement/reinjury.

# APPENDIX V

## HOSPITAL ANXIETY AND DEPRESSION SCALE

**Tick the box beside the reply that is closest to how you have been feeling in the past week.**

**Don’t take too long over you replies: your immediate is best.**

| D | A | | D | A | |
|---|---|---|---|---|---|
| | | **I feel tense or 'wound up':** | | | **I feel as if I am slowed down:** |
| | 3 | Most of the time | 3 | | Nearly all the time |
| | 2 | A lot of the time | 2 | | Very often |
| | 1 | From time to time, occasionally | 1 | | Sometimes |
| | 0 | Not at all | 0 | | Not at all |
| | | **I still enjoy the things I used to enjoy:** | | | **I get a sort of frightened feeling like 'butterflies' in the stomach:** |
| 0 | | Definitely as much | | 0 | Not at all |
| 1 | | Not quite so much | | 1 | Occasionally |
| 2 | | Only a little | | 2 | Quite Often |
| 3 | | Hardly at all | | 3 | Very Often |
| | | **I get a sort of frightened feeling as if something awful is about to happen:** | | | **I have lost interest in my appearance:** |
| | 3 | Very definitely and quite badly | 3 | | Definitely |
| | 2 | Yes, but not too badly | 2 | | I don't take as much care as I should |
| | 1 | A little, but it doesn't worry me | 1 | | I may not take quite as much care |
| | 0 | Not at all | 0 | | I take just as much care as ever |
| | | **I can laugh and see the funny side of things:** | | | **I feel restless as I have to be on the move:** |
| 0 | | As much as I always could | | 3 | Very much indeed |
| 1 | | Not quite so much now | | 2 | Quite a lot |
| 2 | | Definitely not so much now | | 1 | Not very much |
| 3 | | Not at all | | 0 | Not at all |
| | | **Worrying thoughts go through my mind:** | | | **I look forward with enjoyment to things:** |
| | 3 | A great deal of the time | 0 | | As much as I ever did |
| | 2 | A lot of the time | 1 | | Rather less than I used to |
| | 1 | From time to time, but not too often | 2 | | Definitely less than I used to |
| | 0 | Only occasionally | 3 | | Hardly at all |
| | | **I feel cheerful:** | | | **I get sudden feelings of panic:** |
| 3 | | Not at all | | 3 | Very often indeed |
| 2 | | Not often | | 2 | Quite often |
| 1 | | Sometimes | | 1 | Not very often |
| 0 | | Most of the time | | 0 | Not at all |
| | | **I can sit at ease and feel relaxed:** | 1 | | **I can enjoy a good book or radio or TV program:** |
| | 0 | Definitely | 0 | | Often |
| | 1 | Usually | 1 | | Sometimes |
| | 2 | Not Often | 2 | | Not often |
| | 3 | Not at all | 3 | | Very seldom |

# APPENDIX VI

# ETHICAL APPROVAL

HEALTH RESEARCH ETHICS COMMITTEE (HREC)

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NHREC-UBTH-HREC/24/12/2022B

**PROTOCOL NUMBER:** ADM/E 22/A/VOL.VII/2025/121

**PROPOSAL TITLE:** "PREDICTORS OF PHYSICAL ACTIVITY LEVEL AMONG PATIENTS WITH KNEE OSTEOARTHRITIS IN UNIVERSITY OF BENIN TEACHING HOSPITAL"

**PRINCIPAL INVESTIGATOR(S):** AKEE CARO PAUL

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

**DATE CONSIDERED:** JULY 14TH, 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 UREC SO THAT THE DATES OF APPROVAL CAN BE ADJUSTED ACCORDINGLY*

**REMARK:**

**CHAIRMAN: PROF. (MRS) A.N. OFILI** **SIGNATURE & DATE** 14/7/2025

**SUPERVISOR (S): DR. S.O BOLARINDE**

**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**.....

ubthresearchethics@gmail.com Registration Number: NHREC/24/01/202