# RADIOLOGICAL IMAGING IN SPORTS: AN ASSESSMENT OF THE PERCEPTION AND KNOWLEDGE BASE OF EDO STATE RADIOGRAPHERS

**BY**

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## DEDICATION

This work is dedicated to God, and to my loving parents, Mr. and Mrs. Danesi, whose unwavering support, guidance, and prayers have been my greatest source of strength and motivation.

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**TABLE OF CONTENTS**

## LIST OF TABLES

**ABSTRACT**

Sports-related injuries are increasingly common in both recreational and competitive settings, and radiological imaging plays a central role in their diagnosis and management. This study assessed the knowledge and perception of radiographers in Edo State regarding sports imaging. A descriptive cross-sectional survey was conducted among 48 radiographers across selected hospitals and diagnostic centers in Benin City, using a structured questionnaire. Data were analyzed with descriptive statistics and chi-square tests at a 0.05 significance level.

Findings showed that most respondents (81.3%) were aware of the applications of radiological imaging in sports, with strong recognition of X-ray, MRI, and ultrasound, but limited awareness of CT and nuclear medicine. Perceptions toward sports imaging were highly positive, with respondents affirming its vital role in injury management, rehabilitation, and the need for specialized training, while rejecting the notion that imaging is overused. Despite this positive outlook, actual practice was limited; only 12.5% had been involved in sports imaging, and many reported rarely or never performing such examinations. Among those involved, less than half followed specific protocols, and challenges such as lack of equipment (67.7%), limited training (61.3%), and poor referral patterns (48.4%) were identified as major barriers.

Chi-square analysis revealed no significant association between years of professional experience and knowledge levels ($\chi^2 = 4.02$, df = 6, $p = 0.674$), indicating that seniority did not predict expertise in sports imaging. The study concludes that while radiographers in Edo State demonstrate strong baseline knowledge and positive perceptions, their practical engagement remains low. Addressing equipment gaps, standardizing protocols, and implementing targeted continuing professional development programs are recommended to bridge the knowledge–practice divide.

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of Study

Over the past few decades, there has been a global shift in the understanding and appreciation of physical activity as a cornerstone of healthy living. As more people engage in sporting and fitness activities for health, leisure, or competition, the incidence of sports-related injuries has likewise increased (Haskell et al., 2007; Heath et al., 2012). From minor sprains and strains to more complex musculoskeletal trauma, the diagnosis and management of these injuries often depend heavily on radiological imaging. Radiographers, as vital members of the healthcare imaging team, play a crucial role in ensuring that accurate, timely, and relevant diagnostic images are acquired to assist clinical decision-making (Jyoti, Jain & Damiani, 2020).

Sport-related injuries are not limited to professional athletes; they also occur frequently among recreational sports participants and physically active individuals (Hootman et al., 2002). With Nigeria's increasing youth population and a culture that encourages participation in football, athletics, and other physical activities, the burden of such injuries is increasingly being felt at both community and clinical levels. As a result, radiological imaging has become indispensable in diagnosing ligament tears, muscle strains, bone fractures, and joint dislocations (Coris et al., 2009). The increasing use of advanced modalities such as MRI and ultrasound in sports medicine has significantly improved injury detection and monitoring, especially in cases involving soft tissues (Sibbitt et al., 2009; Raza et al., 2003).

The success of imaging in sports medicine, however, depends not just on the availability of imaging equipment but also on the competence and perception of the professionals operating them. Radiographers must possess both the technical know-how and clinical understanding to appropriately position patients, select the best imaging modalities, and recognize relevant anatomical and pathological features (McCurdie, 2012). In a region like Edo State, where healthcare services vary

across urban and semi-urban centers, the capacity of radiographers to effectively manage sports imaging needs is especially important.

Several international studies have pointed out that a well-informed and proactive radiography workforce enhances the outcomes of sports medicine imaging (Matheson et al., 2011; Sallis, 2009). The current challenge, however, lies in assessing whether radiographers, particularly in low-resource settings, are keeping pace with the demands of evolving sports medicine practices. Inadequate training, limited exposure to sports-specific cases during clinical rotations, and the lack of continuing professional development opportunities may contribute to gaps in both knowledge and perception. If left unaddressed, these gaps could potentially compromise the quality of care given to injured athletes and hinder interdisciplinary collaboration between radiographers and other sports medicine specialists (McCurdie, 2012; Jyoti et al., 2020).

Another growing concern is the apparent underutilization of imaging in sports injury prevention. Many injuries are repetitive stress-related and can be detected early with appropriate imaging, thereby allowing timely intervention and rehabilitation (Shephard, 2003). However, this requires radiographers to be familiar with not just acute injuries but also chronic changes associated with repetitive motion, overuse, and biomechanical imbalances. Without a strong knowledge base in these areas, radiographers may miss critical early signs that could prevent long-term disability in athletes (Kohl et al., 2012).

The rising burden of physical inactivity worldwide—now recognized as a global pandemic adds another dimension to this issue. While sports-related injuries may seem like the opposite of problems caused by inactivity, both are closely linked in public health (Lee et al., 2012; Kohl et al., 2012). As the global push for increased physical activity intensifies, especially in low- and middle-income countries, healthcare systems must be prepared to manage the resulting increase in physical stress and sports-related injuries. Radiological services, and by extension radiographers, must adapt to this shifting landscape.

In the Nigerian context, very little research has been conducted to assess the preparedness of radiographers for this emerging need. This includes their perceptions of sports imaging, their current level of expertise, and whether they feel equipped to manage complex sports injuries. While radiography training curricula may touch on musculoskeletal imaging, the extent to which sports-specific content is taught or reinforced remains unclear.

Moreover, the relationship between radiographers and other sports health professionals such as physiotherapists, orthopedic surgeons, and sports physicians is critical. An informed radiographer who understands the clinical implications of a meniscus tear or the stages of a stress fracture can significantly contribute to more accurate imaging and diagnosis (Matheson et al., 2013; McCurdie, 2012). However, if the perception is that sports imaging is outside the primary scope of radiography, this could hinder interdisciplinary collaboration and reduce the quality of care.

This study, therefore, seeks to assess the perception and knowledge base of radiographers in Edo State, Nigeria, concerning radiological imaging in sports. The findings will offer insight into current strengths and weaknesses and help identify areas for professional development, ultimately contributing to improved healthcare outcomes for physically active individuals and athletes.

### 1.2 Statement of the Problem

With the growing participation in sports and physical activities across various age groups, there has been a corresponding rise in sports-related injuries. Accurate and timely diagnosis of these injuries often relies heavily on radiological imaging, making radiographers essential to the effective management of such cases. However, in Edo State, the extent to which radiographers possess the necessary knowledge and perception to handle sports-related imaging remains unclear. Despite the increasing relevance of radiological imaging in sports medicine, there appears to be a lack of structured training and awareness among practicing radiographers in the region. Many radiographers may not be sufficiently familiar with the specific imaging requirements, modalities, and protocols

related to sports injuries. Furthermore, the perception of sports imaging as a specialized or low-priority area could lead to limited engagement, reduced accuracy in imaging, and poor collaboration with sports medicine teams.

This knowledge gap presents a potential challenge to the delivery of quality healthcare services for athletes and physically active individuals. If radiographers are not adequately informed or do not fully appreciate the role of imaging in sports medicine, patient outcomes may suffer, and the growing demands of sports health management may not be met effectively. Therefore, there is a need to assess the current perception and knowledge base of radiographers in Edo State regarding sports imaging. This will help identify areas that require improvement, provide data to support targeted training initiatives, and ultimately enhance the role of radiographers in the multidisciplinary management of sports injuries.

### 1.3 Research Questions

1. What is the level of knowledge among Edo State radiographers about radiological imaging in sports injuries?
2. How do radiographers in Edo State perceive the importance of imaging in sports medicine?
3. What imaging modalities are commonly used by radiographers for sports-related injuries?
4. Is there a significant relationship between years of professional experience and radiographers' knowledge in sports imaging?

### 1.4 Research Hypothesis

Null Hypothesis ($H_0$): There is no significant relationship between the years of professional experience and the level of knowledge of radiographers regarding radiological imaging in sports medicine.

Alternative Hypothesis ($H_1$): There is a significant relationship between the years of professional experience and the level of knowledge of radiographers regarding radiological imaging in sports

medicine.

### 1.5 Aim and Objectives of the Study

#### 1.5.1 Aim of Study

To assess the perception and knowledge of radiographers in Edo State regarding radiological imaging in sports medicine.

#### 1.5.2 Objectives of the Study

1. To evaluate the level of knowledge radiographers in Edo State have about radiological imaging in sports injuries.
2. To assess the perception of radiographers towards the importance of imaging in sports medicine.
3. To identify the common imaging modalities used by radiographers in the evaluation of sports-related injuries.
4. To determine the relationship between years of experience and knowledge level of radiographers in sports imaging.

### 1.6 Significance of the Study

**To Health:** This study highlights the critical role of radiological imaging in the early detection, diagnosis, and monitoring of sports-related injuries. By evaluating the knowledge and perception of radiographers in Edo State, the findings can lead to improved diagnostic accuracy and faster intervention for injured athletes and active individuals. Enhanced imaging practices can support better treatment outcomes, reduce the risk of complications, and ultimately promote a healthier population engaged in physical activity.

**To the Profession:** For the radiography profession, this study serves as a foundation for identifying gaps in education and practical knowledge regarding sports imaging. The results may guide the development of specialized training modules or continuing professional development (CPD)

programs. Strengthening radiographers' competencies in sports medicine imaging not only broadens the scope of their practice but also elevates the relevance of the profession within multidisciplinary healthcare teams.

**To Society:** On a broader scale, the study contributes to societal well-being by supporting the safe participation of individuals in sports and exercise. A well-informed radiographic workforce helps ensure that injuries are properly managed, which encourages ongoing physical activity and reduces long-term disability. In addition, strengthening radiological services in this area may boost public confidence in healthcare systems and promote a culture of preventive and responsive sports health management.

### 1.7 Delimitation of the Study

This study was delimited to radiographers currently practicing in Edo State, Nigeria, regardless of their years of experience or specialization. It focused specifically on their knowledge and perception of the role of radiological imaging in sports medicine. The scope was restricted to diagnostic radiographers, excluding radiologists, student radiographers, and other healthcare professionals. Only those radiographers actively involved in patient care within clinical or diagnostic imaging facilities were included. The study did not attempt to assess the actual clinical competence or technical skills in sports imaging but rather concentrated on self-reported knowledge, perceived relevance, and attitudes toward radiological practices in the context of sports injuries and management. Furthermore, the study emphasized conventional radiological modalities, such as X-ray, MRI, CT, and ultrasound, without extensive focus on advanced or emerging technologies like PET scans or AI-assisted diagnostics.

### 1.8 Operational Definition of Terms

**Radiological Imaging**: In this study, radiological imaging refers to diagnostic procedures such as X-rays, Magnetic Resonance Imaging (MRI), Computed Tomography (CT), and Ultrasound that are

used to visualize internal structures of the body, especially in the context of sports-related injuries.

**Sports Injuries:** These are physical injuries that occur during athletic activities or exercise. In this study, the term covers musculoskeletal injuries such as sprains, fractures, ligament tears, and soft tissue damage that may require imaging for diagnosis or monitoring.

**Perception:** This refers to the beliefs, opinions, and attitudes of radiographers regarding the relevance, usefulness, and application of radiological imaging in sports medicine.

**Knowledge Base:** This refers to the understanding and awareness of radiographers concerning the principles, indications, and modalities of radiological imaging used in diagnosing and managing sports injuries.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Conceptual Review

### 2.1.1 Introduction

Sports and exercise medicine is concerned with the medical care of the active individual. Strong evidence suggests that physical exercise raises the risk of numerous undesirable health disorders, including major noncommunicable diseases including coronary heart disease, type 2 diabetes, breast and colon cancers, as well as shortens life expectancy. As a result, physicians are increasingly prescribing exercise and promoting it through government-sponsored health programs in order to reduce morbidity and death associated with inactivity. A side effect is an increase in sports and exercise-related injuries. For optimal management of various disorders, imaging is frequently required to make a clear diagnosis from the outset and determine the best therapy and rehabilitation strategy. Working with professional athletes, who are typically under time constraints for the next game or tournament, presents unique problems for medical personnel. Good communication between the sports medicine physician and the imaging specialist, the interchange of pertinent information and adequate knowledge of musculoskeletal imaging, and having a sense of what is going on in the athlete are all critical components in effective therapy.

### 2.1.2 Concept of Exercise in Medicine

There is compelling evidence that physical inactivity reduces life expectancy and raises the risk of numerous harmful health disorders, including major noncommunicable diseases such as coronary heart disease, type 2 diabetes, and breast and colon cancers (Lee et al., 2012). According to Kohl et al. (2012), physical inactivity ranks as the fourth most common cause of death globally. An estimated 6% of the burden of coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer, and 10% of colon cancer are attributed to physical inactivity. Nine percent of premature mortality, or almost 5.3 million of the 57 million fatalities that took place globally in 2008, are attributable to

inactivity. Over 1.3 million deaths may be prevented annually if inactivity were reduced by 25% (Lee et al., 2012). Many nations have launched successful initiatives to encourage people of all ages to lead more physically active lifestyles and to play sports in response to these concerning data (Heath et al., 2012). In order to stop the rising morbidity and mortality linked to inactivity, sports doctors and other medical professionals play a crucial role in recommending exercise to chronic patients and sedentary individuals (Matheson et al., 2011; Sallis, 2009). According to the American College of Sports Medicine (ACSM), all healthy adults between the ages of 18 and 65 should engage in moderate-intensity aerobic (endurance) physical activity for at least 30 minutes five days a week, or vigorous-intensity aerobic physical activity for at least 20 minutes three days a week, in order to maintain and improve their health (Haskell et al., 2007). To fulfil this recommendation, a mix of moderate- and vigorous-intensity exercise can be done. By doing 10-minute or longer bouts, one can accrue moderate-intensity aerobic activity, which is comparable to a brisk walk and significantly raises heart rate, towards the 30-minute minimum. Jogging is an example of a vigorous-intensity activity that raises heart rate significantly and promotes fast breathing. Every adult should also engage in activities that preserve or improve their muscular endurance and strength at least twice a week. Due to the dose-response relationship between physical activity and health, people who want to increase their level of personal fitness, lower their risk of developing chronic illnesses and disabilities, or avoid unhealthful weight gain may benefit from engaging in more physical activity than is advised. A greater number of specific sports- and exercise-related illnesses and musculoskeletal injuries are unavoidably associated with increased physical activity and sports engagement (Hootman et al. 2002; Shephard 2003). These ailments may force new "athletes" to abandon their recently begun fitness regimen with disappointment, and more seasoned exercisers to dramatically cut back on their active lifestyle. No health benefits may be anticipated in this approach. Becoming a correct diagnosis early on and starting a good rehabilitation program that leads to full recovery are crucial for everyone, especially since prior injuries are the biggest risk factor for

becoming hurt again. When it comes to managing injuries conservatively and surgically, imaging might be crucial. Giving the athlete visual proof of the ailment (such as a stress fracture) and persuading them that (relative) rest is imperative are also beneficial.

### 2.1.3 Concept of Imaging in Sports

In any medical speciality, an accurate diagnosis may only be determined following a comprehensive history and meticulous physical examination. Additional functional assessments are frequently required from the injured athlete to acquire pertinent information regarding their movement patterns, strength, and coordination. Both intrinsic and extrinsic aspects associated to sports should be considered when evaluating a sports injury, particularly in developing an effective, individualised treatment and rehabilitation program. Whether on the sidelines or in the clinic, a critical choice for the sports medicine physician is determining the necessity of imaging for an injury. This is evidently a subjective determination reliant on clinical expertise and diagnostic examination proficiency.

Owing to technological advancements such as accessible office and sideline ultrasound (US), specialised magnetic resonance imaging (MRI), and hybrid diagnostic imaging that integrates three-dimensional computed tomography (CT) with nuclear medicine imaging techniques, clinicians are now presented with a multitude of diagnostic alternatives. With the advent of advanced imaging tools, clinical acumen regarding the timing of specific tests and the interpretation of normal and abnormal findings is increasingly critical. Coris et al. (2009) propose some fundamental principles that adhere to "good medical practice" (Coris et al. 2009): Imaging should be conducted solely if it is expected to impact patient treatment. The patient's dose of ionising radiation must be taken into account.

Selecting the proper imaging modality necessitates comprehension of the pathological process. Plain X-ray should be the initial imaging modality; however, for more superficial tendon and muscle injuries, ultrasonography (US) may be more suitable. The financial implications of the examination for both the patient and the community must also be taken into account. Effective communication

between the sports medicine physician and the imaging specialist is crucial for selecting the most suitable diagnostic procedures.

The sports medicine physician must furnish the radiologist or nuclear imaging specialist with pertinent clinical findings as well as sports-specific knowledge and its effects on the musculoskeletal system. Only in this manner can the appropriate imaging technology be selected. The imaging specialist should possess a strong interest in sports and the musculoskeletal system. Equally crucial, particularly in the context of elite athletes, is a comprehension of the circumstances and stakes involved for the athlete. They should recognise that in a competitive athlete, even a modest anomaly without clinical significance in a nonathlete may impede the training regimen or fitness to compete. In addition to its function in diagnosis and decision-making, imaging techniques can facilitate specific therapeutic operations. Ultrasound can facilitate intra-articular and intralesional therapeutic injections. This has been shown to enhance the precision of needle placement and improve clinical outcomes relative to unguided treatments (Raza et al. 2003; Sibbitt et al. 2009). In the intricate and frequently challenging realm of top athletics, the functions of sports medicine and imaging appear to diverge significantly. While adherence to "good medical practice" is essential and the athlete's health remains paramount, the emphasis is placed on performance development, competition, and expedited return to play. Consequently, sports medicine professionals frequently solicit supplementary and expensive imaging, as they want a more prompt and precise diagnosis to inform management decisions.

Imaging techniques are commonly employed to assess continuing pathology and to assist with return-to-play determinations (McCurdie 2012). Assistance from radiology and nuclear medicine imaging specialists with a sports-oriented focus is highly beneficial in these circumstances. It is essential to acknowledge that imaging results may influence the athlete's confidence and performance. A slight irregularity on an MRI scan, devoid of clinical implications, may adversely affect the athlete's psychological state if disclosed immediately prior to the game. A negative scan

might significantly enhance the athlete's confidence for optimal performance. There is a risk of over-imaging due to the continuous requests for imaging to assess the improvement of the injury. It is essential to acknowledge that a definitive correlation between symptoms and imaging findings is not always evident, and this should be explicitly communicated to the athlete. An undesirable occurrence, however often a reality in elite sports, is that athletes, along with coaching staff or managers, request a certain scan. They can only be persuaded to train or compete after a scan has been conducted, adhering to the principle of "seeing is believing." This attitude should be dissuaded by fostering a positive relationship with the athlete and staff, as well as by supplying them with pertinent and comprehensible information. In top sports environments, imaging is utilised for screening and pre-participation evaluations (McCurdie 2012).

Pre-participation medical evaluations are prevalent in professional sports, and imaging modalities are increasingly employed to record injuries and their long-term effects resulting from prior trauma or extended physical engagement. This information, which may not consistently represent clinical status and preparedness to participate, may, justifiably or unjustifiably, be utilised to negotiate contract conditions.

When clinical signs in sports injuries are nonspecific, accurate diagnosis using radiological imaging is frequently required. Even if the symptoms and clinical findings in sports injuries are specific, additional imaging examinations may be required for grading to optimise treatment planning (Cook and Purdam 2009). The preferred imaging modality is determined by the diagnostic and grading award, the doctors' and radiologists' comfort with those modalities, the financial costs, and the availability and invasiveness of each technology. Often, such a pathway is not available; in these circumstances, imaging should be adapted to the specific patient. This section discusses general imaging procedures for diagnosing and grading sports injuries. The general benefits of each imaging technology, together with its individual advantages and limitations, will be discussed.

Certainly! Here's the continued corrected version of your document from "Plain and Computed

Tomography and Arthrography" to the final section on "Radiographers in Sports Imaging: Perception at the Edge of Transformation", with all spellings and spacings corrected but no additions or removals:

### 2.1.4 Plain and Computed Tomography and Arthrography

Radiographs in two orthogonal projections are typically the initial and frequently the sole imaging required for fracture assessment. While oblique views can be beneficial, such as in illustrating radial head fractures or identifying bone spurs in anterior and posterior ankle impingement, they are hardly employed in routine clinical practice and have largely been supplanted by cross-sectional imaging. In instances of clinical suspicion of radiographically hidden fractures, it is established that around 35% of fractures in ankle distortions are radiographically undetectable (Connell et al. 1996). CT is utilised for comprehensive visualisation of complicated fractures, while MRI is preferred for detecting occult fractures and post-traumatic avascular necrosis (Breitenseher 1999). The deficiency in soft tissue contrast resolution is a widely acknowledged shortcoming of conventional radiography; computed radiography (CR) offers enhanced yet still inadequate soft tissue assessment, while benefiting from its DICOM format, facilitating electronic distribution. Soft tissue alterations, when evident, may serve as indirect indicators of osseous, articular, and soft tissue disease. The displacement or obscuration of periarticular and intermuscular fat planes in acute trauma is associated with joint effusion, hemarthrosis, and muscle rupture or contusion. Additionally, radiographs can evaluate the presence of radiopaque foreign substances, intra-articular bone fragments, or significant degenerative joint alterations. Stress assessments may offer indirect indications of ligament damage. Recent investigations, however, have called into question the efficacy of stress radiography. In cases of persistent ankle discomfort, significant overlap between stable and unstable ankles has been demonstrated, as per the standards of the American College of Radiology (ACR 2012). Radiographs are essential to verify outcomes following internal or external fixation with dislocation reduction and alignment of displaced fracture fragments, to monitor fracture healing through callus formation or

identify soft tissue calcification after significant muscle or ligament trauma (e.g., myositis ossificans and Pellegrini-Stieda disease), and to detect fractures in osteosynthetic materials. In instances where difficulties arise during the healing process, including loosening, infection, or avascular necrosis, the utility of plain radiography may be constrained due to its poor sensitivity in the initial phases; thus, alternative modalities such as scintigraphic imaging and/or MRI may prove beneficial. For decades, traditional arthrography, following sterile preparation and the injection of intra-articular contrast medium, was employed to examine intra-articular disease. This imaging modality has predominantly been supplanted by cross-sectional imaging techniques and is currently conducted solely as part of CT or MR arthrography.

### 2.1.5 Ultrasound

The major benefits of USS include its excellent spatial resolution for surface structures, low cost, availability on short notice, ease of inspection, quick examination times, and lack of radiation exposure. Because muscle and tendon injuries account for approximately 30% of all sports injuries, ultrasonography (US) plays an important role in sports traumatology, assisting clinicians in determining whether or not the athlete should resume training and competition (Peterson and Renstrom 1986). Because of its superior spatial resolution and definition of muscle structure, US maintains its lead in dealing with muscle strain and contusion, not only in the initial phase for lesion recognition, but also for lesion follow-up and the search for healing problems such as fibrosis, muscle cysts, hernias, or myositis ossificans. Musculoskeletal US examinations are performed using high-frequency (13 MHz or higher) linear-array probes; only deeper-located muscles and tendons are documented at a lower resolution, resulting in less sensitivity, for example, hamstring muscles and the deep flexor compartment of the lower leg in well-trained athletes with increased muscle mass. The highest ultrasound accuracy is computed 24–72 hours after muscle injury, which is due to the ease with which ultrasound detects fully established serosanguinous fluid collections. Due to this limitation, ultrasonography assessment on the sports pitch is not recommended. Transverse and

longitudinal examination are required. Lesion detection is most accurate when the affected muscle compartments are screened transversely from origin to insertion. US palpation is a particularly useful tool for locating the region of maximum discomfort during an examination by gently but firmly compressing the probe against the skin (Peetrons 2002). Active and passive dynamics: A US study can be very helpful in making the correct diagnosis, such as looking for muscle hernias (during muscle contraction), distinguishing between grade II (partial) and grade III (complete) muscle or tendon tears, or evaluating anterior and lateral snapping hip syndrome (during hip flexion and lateral rotation). To avoid artefacts or traps, a comparison with the other side may be required. The addition of color-power Doppler imaging to US has enabled the noninvasive investigation of blood flow and vascularization within anatomical structures, as well as angiogenesis in diseases. Gentle probe manipulation achieves the maximum accuracy in evaluating angiogenesis in surface and relaxed structures. Angiogenesis in the tendon may be associated with clinical symptoms in individuals with tendinosis [Weinberg et al. 1998; Zanetti et al. 2003], and it distinguishes between early (reactive) and advanced (dysrepair or degenerative) phases of tendinopathy (Cook and Purdam 2009). Furthermore, ultrasound (US) provides visual guidance for interventional treatments such as fluid collection and cyst drainage (Peetrons 2002), percutaneous tenotomy, and platelet-rich plasma (PRP) injection in chronic tendinopathy. US-guided sclerosis of neovascularity in painful chronic tendinosis has been described as an effective treatment with significant reduction of pain during activity by Öhberg and Alfredson. However, their accuracy has not been reproduced by other centres. In a large RCT, only moderate results were obtained with few patients cured; the majority still had reduced function and substantial pain after 24 months of follow-up (Öhberg and Alfredson 2002; Hoksrud et al.). The trade-off for high-frequency, linear musculoskeletal transducers is a shallow depth of penetration and a tiny, static scan field. This is a disadvantage if the structure to be visualised is huge (e.g., large intramuscular haematoma) or deep in the body (e.g., hip joint). Extended-field-of-view sonography (EFOVS) compensates for the disadvantage of a tiny static field by producing a

panoramic image. During longitudinal probe translation across the patient's skin, this technology registers images sequentially along a broad examination region, which are then combined into a bigger size and format image (Weng et al. 1997). EFOVS does not significantly improve diagnosis, although it is easily interpretable by novices and facilitates cross-specialty communication. Other (cross-sectional) imaging techniques are frequently necessary in obese or well-trained patients to better evaluate deeply placed structures such as the hip joint, hamstrings, and deep posterior lower leg compartment. Other drawbacks of ultrasonography include operator dependency, selective and frequently confusing documentation, and the inability to penetrate osseous tissues. Regardless, ultrasonography is more sensitive than radiography in detecting rib fractures and ruling out cortical fractures of superficially placed bones (Evans and Harris 2012).

### 2.1.6 Computed Tomography Imaging

CT imaging is a valuable imaging tool for the evaluation of all types of sports injuries due to its exceptional multiplanar capability and submillimeter spatial resolution, which are a result of the development of the spiral acquisition mode and current multidetector row technology (Berland and Smith, 1998). The standard has been the rapid acquisition of images of vast volumes with a section thickness of submillimeters. It has been demonstrated to be a successful method for documenting injuries, particularly in complex bony structures like the wrist and pelvic. Additionally, it may reveal post-traumatic changes that are not visible on radiography. Slice thickness is 0.75 mm for the majority of musculoskeletal investigations, and the images are reconstructed to 1 mm with an increment of 0.5 mm. The images should be evaluated using both bone and soft tissue window parameters. Images can be reformatted in other planes (2-D technique) and utilised for volume rendering (3-D technique) from the three-dimensional data set. The 2-D reformatting of sagittal and coronal images from axial images can facilitate the evaluation of horizontal interfaces, such as the acetabular roof, by emphasising longitudinal fracture lines. The volume data can be displayed in a variety of ways through 3-D visualisation. The most frequently employed technique is surface

rendering by thresholding, which, in contrast to volume rendering, introduces only a portion of the data into the 3-D image. A shaded surface display (SSD) can be accomplished by incorporating a virtual light source, which improves the 3-D comprehension of the image. Nevertheless, it may not adequately depict undisplaced and intra-articular fragments, and in comparison to axial imaging, surface rendering does not enhance the detection rate of fractures. Consequently, it should be used as a supplementary tool to plain films and axial CT scans in the assessment of comminuted fractures. Volume rendering necessitates additional computer processing to integrate all of the data into the 3-D image. Complex anatomic and pathologic structures are more effectively displayed by all reconstruction methods. It may be beneficial for the evaluation of comminuted fractures, as it enhances the visualisation of the fracture's extent and location, the shape and position of the fracture fragments, and the condition of articular surfaces (Bohndorf et al. 2001). New iterative CT reconstruction algorithms and cone beam computerised tomography (CBCT) techniques are being developed to reduce radiation dose while maintaining or improving image quality.

### 2.1.7 CT Arthrography

Under fluoroscopic or ultrasonographic observation, an intra-articular injection of iodinated contrast material mixed with 1 ml of a 0.1% solution of epinephrine is administered (Newberg et al. 1985; Jacobson et al. 2012; Berkoff et al. 2012). The volume of contrast medium injected is contingent upon the joint being examined: the shoulder requires 10–15 ml, the wrist 5 ml, the hip 10 ml, the knee 20 ml, and the ankle 6–12 ml. Following the injection of contrast material, patients are instructed to undertake full-range mobilisation of the affected joint while bearing weight and walking a few steps if it is a lower limb joint. The entire articular cavity is typically imaged using anteroposterior, lateral, and oblique views. Afterward, a multidetector computed tomography (CT) is accomplished. The primary benefit of CT arthrography (CTA) for the evaluation of cartilage is the exceptional conspicuity of focal morphologic cartilage lesions that are continuous with the articular surface of the cartilage. This is due to the high spatial resolution and the high attenuation difference

between the cartilage substance and the joint contrast filling the lesion. In a study involving spiral CTA of cadaver knees, Vande Berg et al. (2002) discovered a superior correlation between spiral CTA and macroscopic examination for the purpose of grading articular surfaces compared to MR imaging. Spiral CTA offers additional potential benefits in the context of MR imaging, including its short examination time, availability at short notice (short waiting list), and the low sensitivity and limited degree of imaging artefacts associated with the presence of microscopic metallic debris, which may impede MR imaging studies. The invasiveness, potential allergic reaction, use of ionising radiation, and inadequate contrast resolution of extra-articular soft tissue are among the limitations of CTA. Another significant limitation of CTA imaging of the cartilage is its utter insensitivity to changes in the deep layers of the cartilage.

### 2.1.8 Magnetic Resonance Imaging

Magnetic resonance imaging is the most complete radiological imaging technique with accurate evaluation of musculoskeletal soft tissues, bony structures, and joints. Its major indication in sports injury is internal derangement of joints, occult bone fractures, stress reaction and fracture of the bone, and deeply located muscle and tendon tears. Acute, subacute, and active chronic lesions are demonstrated with high conspicuity due to their increased water content that produces a “light bulb effect” on fat-suppressed sequences with long repetition time (TR); this sequence has become the cornerstone of musculoskeletal imaging. This light bulb is present in similar areas with high tracer uptake in bone scintigraphy and PET imaging.

The equipment and techniques for MRI exhibit significant variability. While high-field-strength magnets are widely recognised for producing superior image quality, recent advancements in low-field-strength systems have markedly enhanced their imaging capabilities.

The open-bore gantry design is offered in low- and mid-field MRI systems and provides distinct biomechanical benefits associated with off-center placement and enhanced patient comfort, minimising feelings of claustrophobia. The primary benefits of low-cost extremities small-bore

design (e-MRI) are the lack of claustrophobia and affordability; it operates at low field strengths up to 1.5 T and is utilised only for examining peripheral joints, including the wrist, elbow, foot and ankle, and knee.

The selection of imaging planes is contingent upon the anatomical location, desired coverage, and anticipated pathology; a comprehensive MR examination of musculoskeletal regions necessitates the acquisition or reconstruction of images in the axial, coronal, and sagittal planes. It is imperative to adhere to the anatomical orthogonal planes, as excessive limb rotation may lead to improper imaging plane orientation, resulting in images that are challenging to interpret.

Oblique planes can be advantageous, for instance, in the hip with femoroacetabular impingement (FAI) using paracoronal and parasagittal imaging, and in the wrist for ligamentous disorders involving the lunotriquetral (LT) ligament through paraxial views.

The quantity of pulse sequences and combinations ("hybrid techniques") is virtually limitless: in musculoskeletal MRI, the most often employed sequences comprise standard spin echo (SE) for T1 weighting, turbo spin echo (TSE) sequences for intermediate or T2 weighting, and gradient echo (GRE) sequences.

SE T1-WI is utilised for anatomical detail and as a supplementary tool in assessing osseous structures. The TSE sequence has supplanted traditional SE for T2 weighting because of its comparatively extended acquisition durations. Due to picture blurring, TSE sequences are not advisable for proton density imaging.

Blurring can be minimised by augmenting TE, reducing inter-echo time and echo train length (ETL), and increasing the matrix size. At elevated field strengths (3 T), volumetric sequences are accessible with multiplanar reconstruction capabilities at high resolution (0.5 mm) across all imaging planes.

3D-SPACE (sampling perfection with application-optimized contrasts utilising varying flip-angle evolution) is already overshadowing 2D TSE T2 or intermediate TE. TSE sequences exhibit greater resilience to field inhomogeneity compared to SE sequences. Consequently, in the presence of

metallic artefacts, as observed in postsurgical patients, TSE sequences are favoured over SE and GRE.

GRE sequences and TSE sequences with intermediate TE are employed for the assessment of articular cartilage. GRE sequences are employed for dynamic contrast-enhanced imaging. They are moreover utilised in a restricted array of T2 treatments (glenoid labrum, meniscus of the knee).

When employing short echo times in T1-weighted or proton density imaging, one must consider the magic angle phenomenon, which can lead to false-positive MRI findings.

A pulse sequence represents a trade-off among acquisition time, contrast, detail, and signal-to-noise ratio (SNR). The signal-to-noise ratio (SNR) is maximal in turbo spin echo (TSE) sequences and diminishes sequentially in spin echo (SE) and gradient echo (GRE) sequences.

Regarding the various fat-suppression (FS) strategies, our institution favours the spectral FS methodology due to its superior signal-to-noise ratio (SNR) and spatial resolution in comparison to inversion recovery fat-suppression methods (Fleckenstein et al. 1991).

T2-weighted images with spectral fat saturation and STIR images exhibit the highest sensitivity to bone marrow and soft tissue oedema, as well as joint effusion. To ensure effective detection of fluid while maintaining anatomical detail and distinguishing between joint fluid and hyaline cartilage, we use an FS TSE intermediate-weighted sequence (TR/TE = 75/30–35 msec) in at least one imaging plane within our usual methods.

Sequences specific to cartilage have been established (Disler et al. 2000; Ulbrich et al. 2013). The musculoskeletal system, particularly in the extremities, is unaffected by motion, resulting in infrequent motion artefacts. Infolding artefacts can be mitigated by using a suitable imaging matrix, saturating anatomical regions outside the area of interest, and employing off-center imaging techniques.

Artefacts resulting from aberrations in the local magnetic field are ascribed to ferromagnetic and, to a lesser extent, nonferromagnetic orthopaedic equipment. Employing surface multichannel coils will

enhance the signal-to-noise ratio; reduced slice thickness and increased matrix sizes are crucial for soft tissue imaging.

Opting for a reduced "field of view" (FOV) but maintaining the matrix size will enhance spatial resolution. Occasionally, imaging of the contralateral side may prove beneficial, necessitating an expanded field of view and the utilisation of a body coil.

Contrast-enhanced MR scans result in extended examination durations and elevated expenses; hence, the administration of intravenous contrast agents is unwarranted when assessing a sports-related lesion. It ought to be designated for instances where the outcomes will impact patient management (Kransdorf and Murphey 2000).

The administration of intravenous gadolinium is warranted for the evaluation of tumoral or pseudotumoral masses to identify neovascularisation and intralesional necrosis, significant indicators of malignancy, in instances of inflammation, or as a component of indirect arthrography.

To identify modest regions of contrast enhancement, we employ subtraction pictures (SE T1-WI with FS post-gadolinium minus SE T1-WI with FS pre-gadolinium) in static MR imaging.

Following intravenous administration of gadolinium, STIR-type sequences should be avoided, since they will display both fat and enhancing tissue with diminished signal strength.

MR arthrography (MRA) employs direct injection of 3% diluted gadolinium DTPA into the joint or utilises an indirect approach including intravenous administration and joint mobilisation for particular joints and specific reasons. The primary indications for MRA include labral lesions of the shoulder and hip joints, triangular fibrocartilage (TFC) and intrinsic ligament lesions of the wrist, and grade III osteochondral lesions of the talus.

Diffusion-weighted (DWI) MR sequences identify Brownian motion in regions with elevated water content and facilitate the mapping of water diffusion in tissues. Diffusion patterns of water molecules can elucidate microscopic details of tissue architecture, whether in a normal or pathological condition.

In regions exhibiting restricted diffusion, an elevated T2 signal is observed; conversely, in regions with heightened water content devoid of diffusion restriction, a diminished signal intensity is noted. DWI is practically applicable in sports-related cerebral concussions.

Recently, diffusion tensor imaging (DTI) has been employed to examine muscle architecture and structure. In the future, DTI may serve as a valuable instrument for detecting small alterations in skeletal muscle, maybe resulting from ageing, atrophy, or illness (Galban et al. 2004).

Moreover, critical insights into muscle biomechanics, muscle energetics, and joint function can be acquired by specialised MRI contrasts, including T2 mapping, spectroscopy, blood oxygenation level-dependent (BOLD) imaging, and molecular imaging. These novel approaches offer the potential for a more comprehensive and effective assessment of the musculoskeletal system (Gold 2003).

The clinical MR imaging protocol will be significantly affected by regional preferences, temporal limitations, and the available MR system (field strength, local coil). MRI is often poorly tolerated by patients, is incompatible with dynamic manoeuvres, and may not be feasible in emergency situations. Moreover, it offers an assessment of a complete anatomical region, including osseous features, although is effective solely for the examination of a restricted segment of the skeleton. This contrasts with scintigraphy, which allows for the simultaneous evaluation of the entire skeleton. Alternatively, MRI clarifies the actual characteristics of extremely nonspecific hotspots observed in scintigraphy.

### 2.1.9 Radiation Protections and Considerations

A wide range of radiation absorbed doses is delivered to patients by various diagnostic imaging modalities that use ionizing radiation (radiography, CT, nuclear medicine). The potential for radiation-induced injuries exists. Quantitative proof of risks for radiation-induced cancer in humans can be derived from the life span study at organ cumulative doses above approximately 100 mSv, although significant effects can only be observed above 200 mSv (Little 2003; Heidenreich et al. 1997). The effective radiation dose is regarded as a good indicator for the possible biological effect

of radiation; it is a measured unity to compare the stochastic risk of a nonuniform exposure of ionizing radiation with a uniform exposure to the body. Its actual SI unit of measurement is Sv (Sievert); the old unity was rem (radiation equivalent in men), 1 Sv = 100 rem (McCollough and Schueler 2000). The natural background radiation is the natural radiation; it varies by geographic location; the mean level of NBR is 2.5–3 mSv/year. BERT (background equivalent radiation time) is the unit of measurement to compare the effective radiation dose of imaging procedures with the natural background radiation of 1-year time (3 mSv). For example, one thorax radiography is equivalent to 1/52 BERT; 1 CT abdomen is equivalent to 3.3 years BERT. Digital radiography and iterative CT reconstruction or cone beam CT imply less effective radiation dose compared to conventional radiography and classic CT reconstruction, respectively. At the knee, multislice computed tomography (MSCT) with iterative reconstruction effective radiation doses range between 0.27 and 0.48 mSv; for CBCT, the effective radiation dose was 0.12 mSv, compared to digital radiography of the knee in lateral view of 0.018 mSv and 0.012 mSv for AP view (Koivisto et al. 2013). A series of ten PET or four PET-CT examinations on older equipment may imply a radiation dose with increased cancer risk! Radiologists and specialists in nuclear medicine should be aware of methods by which radiation dose may be minimized with regard to using the lowest possible dose to achieve a diagnosis. Medical alternatives should be taken in consideration for CT and nuclear imaging techniques such as MRI of the whole body. We have to weigh the acute risk for the patient on the one hand and on the other hand the overall low risk of radiation exposure.

### 2.2 Empirical Review

Sports imaging radiographers are at a turning point in their careers. Previously viewed as technical and auxiliary, they are now on the verge of increased clinical influence, interdisciplinary collaboration, and athlete-centered treatment. Radiographers are evolving from backstage technicians to frontline facilitators of quick diagnostic decision-making as medical imaging becomes more and

more integrated into sports medicine, especially in elite and competitive settings. However, this development brings up important issues about how radiographers view their responsibilities and how the sports medicine ecosystem views them.

Although there isn't much research specifically looking at radiographers' perspectives in this field, new findings from more general sports imaging studies provide an interesting context. The growing usage of imaging at pitchside and in high-pressure, real-time sporting scenarios is shown by Jyoti et al. (2020). These days, modalities like MRI, ultrasound, and CT are used not only for post-injury diagnoses but also to inform prompt management choices, including whether an athlete should continue competing. The radiographer's duties are subtly elevated by this immediacy, particularly when it comes to getting accurate images within tight deadlines.

McCurdie (2012) frames imaging as a key component of performance-based medical decision-making within the larger context of sport and exercise medicine (SEM). The working relationship between radiologists and sports physicians is highlighted, but it also raises questions about a little-known dynamic: the interaction between SEM specialists and radiographers. Radiographers are frequently the unsung heroes of these cutting-edge modalities, creating the images that eventually influence surgical considerations, rehabilitation plans, and return-to-play decisions. The visibility of radiographers in decision-making is still restricted in spite of this crucial input. Traditional hierarchies, where radiologists and doctors predominate in interpretative and consulting positions, may still influence how they are seen within the SEM team. Radiographers may experience a divided professional identity as a result of this duality being essential but underappreciated. Are they developing into clinical partners, or are they just creating images? Patient interaction is another important component that shapes perception, particularly in sports where athletes are acutely aware of their physical state.

Radiographers may find themselves providing not just technical services but also psychological support and procedural explanations, as athletes often demand prompt responses. Although informal,

this dynamic influences how patients and their multidisciplinary teams view radiographers. Advanced abilities beyond traditional radiography training are also required due to the increasing usage of portable ultrasound, real-time elastography, and musculoskeletal imaging at stadiums and training grounds. Radiographers who upskill may gain more respect and recognition as new technologies become ingrained in standard sports care, while those who do not run the risk of being marginalised even within their field.

In conclusion, radiography as a profession is in fact on the verge of change in the context of sports imaging. Unevenly, perceptions are changing. Radiographers must push for more defined positions, advanced training, and institutional inclusion as their technical, clinical, and interpersonal contributions grow in order to fully realise this new frontier.

# CHAPTER THREE

# RESEARCH METHODOLOGY

## 3.1 Research Setting

This study was conducted in Edo State, Nigeria, particularly within Benin City, which hosts a number of reputable healthcare institutions offering diagnostic imaging services. Edo State is notable for its commitment to both healthcare and sports development, making it an ideal location for a study assessing radiographers' knowledge and perception of sports imaging. The research was carried out in four selected institutions—two hospitals and two diagnostic centres—chosen for their reputations, facilities, and diverse service delivery models. These include:

University of Benin Teaching Hospital (UBTH): Established in 1973, UBTH is one of Nigeria's foremost tertiary healthcare institutions. It was created to serve as a training ground for medical students and healthcare professionals, and as a referral centre for the South-South region. The Radiology Department is fully equipped and offers comprehensive diagnostic imaging services, including conventional radiography, CT, MRI, and ultrasound. UBTH plays a key role in training radiographers and managing both trauma and sports-related cases.

Lily Hospital: Founded in 1984 in Warri, Delta State, Lily Hospital later expanded to Benin City, establishing itself as a trusted private healthcare provider in southern Nigeria. The Benin branch boasts a modern radiology department that supports various specialties, including orthopaedics and sports medicine. The hospital is known for combining quality service delivery with patient-centered care.

Raytouch Diagnostic Centre: Raytouch is a relatively modern diagnostic facility established in the 2010s to meet the growing demand for accurate, fast, and affordable imaging services in Benin City. It specializes in high-resolution imaging, including digital X-ray, CT scans, and ultrasound. The centre is widely used by private practitioners and sports organizations for musculoskeletal and trauma-related investigations.

Benin Medical Care (BMC): Inaugurated in 2019, BMC is a state-of-the-art medical facility built by the Lift Above Poverty Organization (LAPO). Its mission is to provide world-class healthcare services locally. BMC is equipped with advanced diagnostic equipment and a competent team of radiographers and radiologists. Its radiology unit supports diverse imaging needs, including injury assessments often required in sports medicine.

These institutions were selected to provide a broad perspective of radiographic practice in both public and private settings. Their combined capacities ensure that the study will capture relevant insights into the knowledge, exposure, and perceptions of radiographers in the field of sports imaging.

### 3.2 Research Design

A descriptive cross-sectional survey design was employed for this study. This design was chosen to provide a snapshot of the current knowledge and perception of radiographers in Edo State concerning radiological imaging in sports. The approach was suitable for identifying trends, relationships, and gaps in knowledge within a population at a specific point in time.

### 3.3 Target Population

The target population for this study comprises all licensed and practicing radiographers working within four selected healthcare institutions in Benin City, Edo State. These institutions include the University of Benin Teaching Hospital (UBTH), Raytouch Diagnostic Centre, Lily Hospital, and Benin Medical Care (BMC). The population includes radiographers across different levels of experience and specialization, as long as they are actively engaged in diagnostic imaging. These centers were deliberately selected to represent both public and private healthcare settings, providing a balanced perspective on radiographic practice as it relates to sports imaging.

### 3.4 Sample Technique and Sample Size

This study adopted a census sampling technique. Given the relatively small and clearly defined

number of radiographers across the selected institutions, every eligible radiographer within these facilities was included in the study. This approach ensured a full representation of the target population and eliminates sampling bias.

The total number of radiographers in the selected facilities includes 31 from the University of Benin Teaching Hospital (UBTH), 7 from Raytouch Diagnostic Centre, 5 from Lily Hospital, and 5 from Benin Medical Care (BMC), making a total of 48 radiographers. Therefore, all 48 radiographers were targeted and included in the research.

### 3.5 Instrument of Data Collection

The main instrument for data collection was a structured self-administered questionnaire. The questionnaire consisted of both closed-ended questions divided into four sections:

Section A: Demographic information

Section B: Knowledge of radiological imaging in sports

Section C: Perception of sports imaging

Section D: Practice patterns and challenge

The questionnaire was designed to be concise, easy to understand, and focused on the research objectives.

### 3.6 Validity of Instrument

The content validity of the questionnaire was ensured through expert review by professionals in radiography and research methodology. Necessary modifications and corrections were also made to ensure clarity, relevance, and coverage of the subject matter. The final version was tested for face validity to confirm its suitability for the target audience.

### 3.7 Reliability of Instrument

The reliability of the instrument was established through a pilot study conducted among 10 radiographers outside the main study area. Responses were analyzed, and the Cronbach's Alpha coefficient was calculated to assess internal consistency. A reliability coefficient of 0.78 was obtained, and it indicated a good level of reliability.

### 3.8 Method of Data Collection

Data collection was conducted over a period of four weeks using an online (Google Forms) questionnaire. Respondents were contacted directly at their workplaces and through professional networks. Informed consent was obtained prior to distribution, and anonymity was maintained throughout the process.

### 3.9 Method of Data Analysis

Collected data were sorted, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0. Descriptive statistics such as frequencies, percentages, and means were used to summarize demographic data and responses. Inferential statistics such as Chi-square tests was used to assess relationships between demographic variables and levels of knowledge or perception. Results were presented in tables and charts.

### 3.10 Ethical Considerations

Ethical approval was obtained from a relevant institutional ethics committee prior to the commencement of the study. Participation was voluntary, and informed consent was sought from all respondents. Confidentiality and anonymity were assured, and data collected was used solely for research purposes. Respondents were informed of their right to withdraw from the study at any point without penalty.

# CHAPTER FOUR

## RESULTS AND DISCUSSION

This chapter presents the findings of the study on the perception and knowledge of radiographers in Edo State regarding radiological imaging in sports medicine. The results are organized in line with the study objectives, covering demographic characteristics of respondents, their knowledge of radiological imaging in sports, perceptions towards its role and relevance, practice patterns, and challenges encountered. Tables are used to illustrate the distribution of responses, while statistical analysis, including the Chi-square test, was applied to test the stated hypothesis.

The discussion follows immediately after the presentation of results, providing interpretation and contextualization of the findings in relation to previous studies. This approach highlights areas of agreement or divergence with existing literature, and demonstrates the implications of the study for radiography practice, training, and policy in Edo State and beyond.

### 4.1 Results

**Table 4.1 Demographic Characteristics of Respondents**

| Variable | FREQUENCY | PERCENTAGE % |
|---|---|---|
| **Age (years)** | | |
| < 25 | 11 | 22.9 |
| 25–34 | 17 | 35.4 |
| 35–44 | 9 | 18.8 |
| 45 and above | 11 | 22.9 |
| **Gender** | | |
| Male | 31 | 64.5 |
| Female | 17 | 35.5 |
| **Years of Experience** | | |
| < 1 year | 19 | 39.6 |
| 1–5 years | 11 | 22.9 |
| 6–10 years | 5 | 10.4 |
| > 10 years | 13 | 27.1 |
| **Place of Work** | | |
| Public hospital | 23 | 47.9 |
| Private hospital | 15 | 31.3 |
| Other | 10 | 20.4 |
| **Involved in Sports Imaging** | | |
| Yes | 6 | 12.5 |
| No | 42 | 87.5 |

From table 4.1 most were 25–34 years (35.4%) with males 64.5%. The majority had less than 1 year experience (39.6%). Nearly half work in public hospitals (47.9%). Strikingly, only 12.5% had been involved in sports imaging**,** highlighting a significant gap in exposure.

**Table 4.2: Knowledge of Radiological Imaging (n = 48)**

| Item | FREQUENCY | PERCENTAGE % |
|---|---|---|
| **Awareness of radiological imaging in sports** | | |
| Yes | 39 | 81.3 |
| No | 9 | 18.7 |
| **Common modalities used (multiple response)** | | |
| X-ray | 37 | 77.1 |
| MRI | 35 | 72.9 |
| CT | 23 | 47.9 |
| Ultrasound | 29 | 60.4 |
| Nuclear Medicine | 7 | 14.6 |
| **MRI preferred for soft-tissue injuries** | | |
| True | 43 | 89.6 |
| False | 5 | 10.4 |
| **Ultrasound useful for real-time musculoskeletal assessment** | | |
| Agree | 41 | 85.4 |
| Disagree | 7 | 14.6 |
| **Most Commonly Imaged Region** | | |
| Knee | 37 | 77.1 |
| Shoulder | 33 | 68.8 |
| Ankle | 29 | 60.4 |
| Spine | 19 | 39.6 |
| Elbow | 21 | 43.8 |

According to table 4.2 most radiographers in Edo State (81.3%) were aware of radiological applications in sports. Knowledge was strongest for X-ray, MRI, and ultrasound, while CT and nuclear medicine were less recognized. The majority correctly identified MRI as the preferred modality for soft tissue injuries (89.6%) and ultrasound as useful for real-time musculoskeletal assessment (85.4%). Knees and shoulders emerged as the most commonly imaged regions.

**Table 4.3 Perception of Sports Imaging**

| Statement | SA (%) | A (%) | N (%) | D (%) | SD (%) | Mean | Decision |
|---|---|---|---|---|---|---|---|
| Imaging plays a vital role in managing sports injuries | 29 (60.4) | 13 (27.1) | 3 (6.3) | 1 (2.1) | 2 (4.2) | 4.38 | Agree |
| Specialized training is needed in sports imaging | 25 (52.1) | 15 (31.3) | 3 (6.3) | 3 (6.3) | 2 (4.2) | 4.21 | Agree |
| Imaging modalities are overused in sports injury management | 7 (14.6) | 11 (22.9) | 9 (18.8) | 13 (27.1) | 8 (16.7) | 2.92 | Disagree |
| Sports imaging improves athlete rehabilitation outcomes | 23 (47.9) | 17 (35.4) | 5 (10.4) | 1 (2.1) | 2 (4.2) | 4.21 | Agree |

Decision rule: Item Mean > Grand Mean = Agree; Item Mean < Grand Mean = Disagree. Grand Mean = 3.93

The results from Table 4.3 demonstrate that radiographers in Edo State generally hold a positive perception toward sports imaging. The items relating to the vital role of imaging in sports injury management, the need for specialized training, and its contribution to athlete rehabilitation all had mean scores above the grand mean of 3.93, indicating strong agreement among respondents. Conversely, the item suggesting that imaging modalities are overused in sports injury management recorded a mean score below the grand mean (2.92), reflecting disagreement with this statement. Taken together, these findings suggest that radiographers view imaging as an indispensable tool in sports medicine and are receptive to further professional development in this area, while rejecting the notion that its application is excessive. This underscores both their recognition of imaging as a critical component of sports care and their readiness to embrace greater responsibilities in the field.

### 4.2 Hypothesis Testing

Knowledge level was categorized as Low, Moderate, and High. Years of professional experience retained the four original categories. A Chi-square test of independence was conducted at $\alpha = 0.05$.

**Table 4.4: Cross-tabulation of Years of Experience × Knowledge Level (Observed Frequencies; n = 48)**

| Years of Experience | Low | Moderate | High | Total |
|---|---|---|---|---|
| < 1 year (n=5) | 3 | 2 | 0 | 5 |
| 1–5 years (n=19) | 8 | 8 | 3 | 19 |
| 6–10 years (n=11) | 3 | 5 | 3 | 11 |
| > 10 years (n=13) | 3 | 6 | 4 | 13 |
| Total | 17 | 21 | 10 | 48 |

Chi-square test (4 × 3): $\chi^2 = 4.02$, df = 6, p = 0.674; Cramér's V = 0.205 (small effect).

Decision ($\alpha = 0.05$): Fail to reject $H_0$. There is no statistically significant association between years of professional experience and knowledge level of radiographers regarding sports imaging in this sample.

### 4.3 Discussion of Findings

Objective 1: To evaluate the level of knowledge radiographers in Edo State have about radiological imaging in sports injuries.

From Table 4.2, the study revealed that a majority of respondents (81.3%) were aware of the applications of radiological imaging in sports medicine. Knowledge about specific modalities was, however, uneven. While a large proportion correctly identified X-ray (77.1%) and MRI (72.9%) as essential tools, fewer respondents recognized CT (47.9%) and ultrasound (60.4%) as integral to sports imaging. Nuclear medicine was the least acknowledged (14.6%). On specific knowledge items, most respondents correctly affirmed MRI as the preferred modality for soft tissue injuries (89.6%) and also acknowledged the role of ultrasound in real-time musculoskeletal assessment (85.4%). Taken together, these findings suggest that although Edo State radiographers demonstrate a strong foundational awareness of sports imaging, there are gaps in their understanding of advanced modalities, particularly nuclear medicine and CT. This result highlights both strengths and areas for

improvement. The fact that radiographers are confident with MRI and ultrasound resonates with global patterns, since these modalities dominate sports injury evaluation due to their sensitivity in soft tissue and musculoskeletal cases. However, the relatively low recognition of CT and nuclear medicine suggests a narrower perspective, perhaps influenced by limited exposure or lack of specialized training opportunities within their local practice environment. Such knowledge gaps may hinder comprehensive care in cases where complex bone injuries, metabolic imaging, or advanced rehabilitation monitoring are required.

When compared with existing literature, these findings align with observations by Jyoti et al. (2020), who noted the increasing reliance on MRI and ultrasound in fast-paced sports environments, particularly pitch-side decisions. The strong awareness of MRI and ultrasound among Edo radiographers mirrors this global trend, showing that even in resource-constrained contexts, professionals are attuned to the clinical importance of these modalities. On the other hand, the limited knowledge of CT and nuclear medicine appears to echo concerns raised by McCurdie (2012) about the visibility and recognition of radiographers in sports and exercise medicine. McCurdie emphasized that radiographers often remain in the background, with their roles narrowly defined around image production. This restricted visibility could explain why less mainstream modalities like nuclear medicine are poorly understood within this cohort they are neither widely practiced nor strongly emphasized in their day-to-day professional culture.

The findings from this objective point to an encouraging baseline knowledge, especially around mainstream modalities, but also underscore the need for broader training. If radiographers are to fully integrate into the sports medicine team, they will require structured exposure not only to routine tools like MRI and X-ray but also to advanced and emerging modalities that can expand their clinical relevance.

Objective 2: To assess the perception of radiographers towards the importance of imaging in sports medicine.

From Table 4.3, the perception of radiographers in Edo State towards sports imaging was generally positive. The grand mean across items was 3.93, and any mean above this was considered agreement, while those below were interpreted as disagreement. The majority of respondents agreed that imaging plays a vital role in managing sports injuries (mean = 4.38) and that specialized training is needed in sports imaging (mean = 4.21). They also agreed that sports imaging improves rehabilitation outcomes for athletes (mean = 4.21). Interestingly, the only statement that fell below the grand mean was the idea that imaging is overused in sports injury management (mean = 2.92), which respondents disagreed with. This indicates that Edo radiographers strongly value imaging in sports care and see it as a necessary and beneficial practice rather than something that is excessive. The implication of this result is twofold. First, radiographers demonstrate a healthy professional outlook, recognizing imaging as central to athlete management and rehabilitation. This suggests they see themselves as potential contributors to multidisciplinary teams, which could improve their professional standing. Second, their rejection of the notion of "overuse" may reflect both their limited exposure to sports imaging in practice (since most reported rarely or never performing it) and their aspirational view of its importance. In other words, because sports imaging is not yet commonplace in their setting, they do not perceive it as being over-relied upon, but rather as underutilized.

When compared to empirical literature, this positive perception resonates with the work of Jyoti et al. (2020), who highlighted the growing use of imaging in real-time, high-pressure sporting contexts where MRI and ultrasound are crucial for immediate decision-making. The perception of Edo radiographers that imaging improves rehabilitation aligns with Jyoti's findings that timely imaging directly influences whether an athlete continues competing or begins recovery. However, a contrasting perspective comes from McCurdie (2012), who described radiographers as often being limited to the technical role of producing images, with minimal visibility in sports and exercise medicine decision-making. This traditional hierarchy stands in contrast to the aspirational perception

of Edo radiographers, who appear ready to embrace a more clinically integrated role in sports imaging.

Taken together, these results suggest that radiographers in Edo State are motivated to expand their scope within sports medicine. Their positive perception reflects both recognition of imaging's impact on athletes and a desire for professional development through specialized training. However, these aspirations must be matched with practical opportunities structured training programs, policy inclusion, and deliberate integration of radiographers into sports medicine teams to ensure their perceptions translate into meaningful contributions.

Objective 3: To identify the common imaging modalities used by radiographers in the evaluation of sports-related injuries.

From Table 4.2, the most commonly identified modalities for sports imaging were X-ray (77.1%), MRI (72.9%), and Ultrasound (60.4%). Fewer respondents recognized CT (47.9%), while Nuclear Medicine (14.6%) was rarely mentioned. This suggests that radiographers in Edo State primarily associate sports imaging with conventional and widely available modalities, while advanced or specialized techniques remain underrecognized. This finding has important implications. X-ray remains the default entry point for musculoskeletal imaging, which explains its dominance. MRI's strong recognition indicates that radiographers understand its role as the gold standard for soft tissue injury evaluation. Similarly, ultrasound's fair recognition highlights awareness of its real-time musculoskeletal applications, though this could be higher considering its portability and increasing relevance in pitch-side care. By contrast, the low identification of CT and nuclear medicine reveals a limited grasp of modalities used for complex skeletal injuries, metabolic assessments, or advanced sports diagnostics. This imbalance reflects both resource availability in Edo State and the scope of radiographers' practical exposure.

These results align with Jyoti et al. (2020), who emphasized the expanding role of MRI and ultrasound in sports medicine, particularly for rapid injury evaluation and management. The

prominence of these two modalities in the present study mirrors that global trend. However, the weak recognition of CT and nuclear medicine contrasts with the broader sports imaging literature, where such modalities are increasingly utilized for detailed skeletal assessments and advanced monitoring. This gap may reflect the resource limitations in local hospitals and the lack of specialized sports imaging programs for radiographers in Nigeria. McCurdie (2012) also provides a useful lens: he noted that radiographers often remain limited to core modalities dictated by their institutional settings, with less exposure to advanced technologies unless specifically trained. This resonates with the present findings radiographers in Edo appear confident with familiar tools (X-ray, MRI, ultrasound) but lack broader engagement with modalities that require specialized training or advanced infrastructure.

Radiographers in Edo State identify the most common and accessible modalities, but their awareness of advanced sports imaging technologies remains narrow. This suggests a need for targeted training initiatives and policy-driven access to a wider range of imaging tools. Expanding knowledge and exposure beyond routine modalities would better prepare them to meet the evolving demands of sports medicine, particularly as the field increasingly emphasizes comprehensive, multidisciplinary care for athletes.

Objective 4: To determine the relationship between years of experience and knowledge level of radiographers in sports imaging.

From Tables 4.4 the chi-square analysis showed no statistically significant association between years of experience and knowledge level of radiographers regarding sports imaging. The test with the four original experience categories produced $\chi^2(6) = 4.02$, $p = 0.674$, the null hypothesis was retained, suggesting that years of professional experience did not predict differences in knowledge levels. This finding indicates that length of service in radiography does not automatically translate into greater knowledge of sports imaging. The result is understandable within the local context, where most respondents reported rarely or never performing sports imaging and only a minority acknowledged

following specific protocols when they did. Without regular practice opportunities and structured professional development focused on sports imaging, additional years of work are unlikely to build competence in this subspecialty. Instead, knowledge appears to depend more on targeted exposure and training than on seniority alone.

The result echoes the concern raised by McCurdie (2012), who observed that radiographers in sports and exercise medicine often remain restricted to routine technical roles, with little room for growth in clinical decision-making or advanced modalities. In such settings, more years of work may reinforce habitual practices rather than expand specialist knowledge. On the other hand, the findings contrast with the perspective of Jyoti et al. (2020), who emphasized the increasing need for radiographers to acquire advanced skills in ultrasound and MRI for real-time sports assessments. In that view, experience can only raise knowledge levels if accompanied by deliberate upskilling in contemporary modalities.

This study's findings suggest that seniority by itself is not enough to guarantee expertise in sports imaging. If radiographers in Edo State are to bridge the knowledge gap, particularly in under-recognized modalities such as CT and nuclear medicine, there is a need for focused training programs, structured exposure in sports clinics, and greater inclusion in multidisciplinary sports medicine teams.

# CHAPTER FIVE

# CONCLUSION, SUMMARY AND SUGGESTION FOR FIRTHER STUDIES

## 5.1 Conclusion

This study concludes that while radiographers in Edo State possess a solid baseline knowledge and a positive outlook on sports imaging, their actual involvement in practice remains minimal. The profession is at a point where enthusiasm and awareness are evident, but these are not matched by structured opportunities for practice, access to advanced modalities, or specialized training. The absence of a significant relationship between years of experience and knowledge underscores the need for intentional capacity building rather than reliance on seniority. Strengthening professional development and providing access to appropriate equipment and clinical pathways will be essential if radiographers are to play a meaningful role in the expanding field of sports medicine.

## 5.2 Summary of Findings

The major findings of this study are summarized as follows:

1. Most radiographers in Edo State (81.3%) were aware of the applications of sports imaging, with strong knowledge of X-ray, MRI, and ultrasound, but low recognition of CT and nuclear medicine.
2. Perceptions toward sports imaging were generally positive, with respondents agreeing that imaging is vital in sports injury management, rehabilitation, and that specialized training is required.
3. The chi-square analysis revealed no statistically significant relationship between years of professional experience and knowledge level, indicating that seniority alone does not translate into higher expertise in sports imaging.

### 5.3 Recommendations

Based on these findings, the following recommendations are made:

1. Targeted continuing professional development (CPD) programs on sports imaging should be organized for radiographers, with emphasis on advanced modalities such as CT and nuclear medicine.
2. Healthcare institutions should provide adequate equipment and standardized imaging protocols to improve consistency and quality of sports imaging practice.
3. Radiography curricula in Nigerian training institutions should incorporate sports imaging modules to prepare students for emerging roles.
4. Professional associations should promote workshops, seminars, and collaborations that expose radiographers to sports imaging practices locally and internationally.
5. Multidisciplinary teamwork between radiographers, radiologists, physiotherapists, and sports physicians should be encouraged to strengthen the role of imaging in comprehensive athlete care.

### 5.4 Suggestions for Further Study

Future studies should consider the following:

1. Expanding the scope of research to include radiographers from other states and regions in Nigeria to improve generalizability of findings.
2. Employing qualitative research methods to capture in-depth experiences and challenges of radiographers involved in sports medicine.
3. Carrying out comparative studies between Nigerian radiographers and those in countries with advanced sports imaging practices to identify adaptable strategies.
2. Exploring the perspectives of other healthcare professionals such as sports physicians and physiotherapists on the role of radiographers in sports medicine.

### 5.5 Limitations of the Study

The study was subject to the following limitations:

1. Reliance on self-reported questionnaires may have introduced response bias, including social desirability and recall bias.
2. The study was restricted to Edo State, which may not reflect the situation in other parts of Nigeria.
3. Limited access to sports imaging facilities in the study area may have influenced the depth of responses regarding practice and protocol use.

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## APPENDIX I

## QUESTIONNAIRE

Title: **Radiological Imaging in Sports: An Assessment of the Perception and Knowledge Base of Edo State Radiographers**

Instruction: Please tick (✓) or fill in the appropriate response. All information will be treated with confidentiality and used for research purposes only.

### SECTION A: DEMOGRAPHIC INFORMATION

1. Age: _____
2. Gender:
   ☐ Male ☐ Female ☐ Prefer not to say
3. Years of experience:
   ☐ Less than 1 year ☐ 1–5 years ☐ 6–10 years ☐ Over 10 years
4. Place of work:
   ☐ Public hospital ☐ Private hospital ☐ Sports clinic ☐ Other (specify): _____
5. Have you ever been involved in sports-related diagnostic imaging?
   ☐ Yes ☐ No

### SECTION B: KNOWLEDGE OF RADIOLOGICAL IMAGING IN SPORTS

6. Are you aware of radiological imaging applications in sports injury diagnosis?
   ☐ Yes ☐ No
7. Which of the following modalities are commonly used in sports imaging? (Tick all that apply)
   ☐ X-ray ☐ MRI ☐ CT ☐ Ultrasound ☐ Nuclear Medicine
8. MRI is preferred for evaluating soft tissue injuries in athletes.
   ☐ True ☐ False ☐ Not sure
9. Ultrasound is useful in assessing real-time musculoskeletal movements.
   ☐ Agree ☐ Disagree ☐ Not sure
10. Which body regions are commonly imaged in sports injuries? (Tick all that apply)
    ☐ Knee ☐ Shoulder ☐ Ankle ☐ Spine ☐ Elbow ☐ Other: _____

### SECTION C: PERCEPTION OF SPORTS IMAGING

11. Radiological imaging plays a vital role in managing sports injuries.
    ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
12. Radiographers and radiologists need specialized training in sports imaging.
    ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
13. Imaging modalities are overused in sports injury management.
    ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
14. Sports imaging improves athlete rehabilitation outcomes.
    ☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree