RELATIONSHIP BETWEEN BMI, THIGH AND CALF CIRCUMFERENCES AND LOWER LIMBS MUSCULOSKELETAL INJURIES AMONG FOOTBALLERS OF TEAMS IN KANO METROPOLIS

BY

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DECEMBER, 2015

DECLARATION

I hereby declare that this work is undertaken under the supervision of Dr. Magaji Garba Taura and has not been presented anywhere for the award of a degree or certificate. All sources have been duly acknowledged.

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CERTIFICATION

This is to certify that the research work for this dissertation and the subsequent write-up by Abduljalil Hussain Maikarfe, SPS/12/MAN/00008 were carried out under my supervision.

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APPROVAL

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DEDICATION

This work is dedicated to almighty Allah for sparing my life and health and giving me the courage through my entire academic endeavor. It is also dedicated to my mother Hajiya Aishatu Aabdullahi for her prayer and to my wife Malama Aisha Ibrahim for her patience support and understanding for me, and to those who think good, speaks good, and act good.

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ABSTRACT

The roles of height and weight of the individual which are determinants of BMI and the lower limb circumferences should not be underemphasized as potential risk factors for lower limb musculoskeletal injuries among footballers. The paucity of information on effect of body mass index (BMI) and lower limb circumference on lower limb musculoskeletal injuries among footballers especially in Kano state makes it necessary to fill this gap. The aim of this study was to determine the relationship between BMI lower limbs circumferences and lower limbs musculoskeletal injuries among footballers in Kano metropolis. The research was a cross-sectional study carried out in randomly selected football fields in Kano metropolis. A total of 300 footballer participated in this study. All anthropometric variables were recorded using standard protocols. Data were analyzed using inferential statistics of Chi-square at probability level of <0.05. The result revealed injury occurrence of 49.7% among the players. Among the variables considered only height, thigh circumference and calf circumference were the major factors influencing musculoskeletal injuries in lower limbs among Footballers in Kano metropolis. In conclusion, the incidence of lower limb musculoskeletal injuries among footballers in Kano metropolis is significantly high. Therefore coaches and players should have injury preventive techniques seminars.

CHAPTER ONE

INTRODUCTION

There is a consensus that the practice of sports offers numerous benefits (Adirim & Barouh, 2006; Caine *et al.*, 2008; Myer *et al.*, 2009). Although participation in football leads to significant physical benefits such as improving wellbeing, extending life expectancy and reducing the likelihood of several major non-communicable diseases (De Mozzi *et al.*, 2008; Fuller *et al.,* 2010), the possibility to incur in soccer injuries must be considered (Maffulli *et al.*, 2011). Walden *et al.* (2005) reported that soccer (football) is the most popular sport worldwide, with about 200 million players, both professionals and amateurs. Football is the most popular team sports world wide played on a rectangular field with net goals on either side (Tomas *et al.*, 2005; Landry *et al.,* 2009). It involves two teams of 11 players who attempt to propel the ball through a set of goals, while preventing the other team from doing same. The game consists of two 45 minutes halves, with a 15 minutes rest between halves (Putukian, 2000; Wong & Hong, 2005). During a soccer game, an athlete completes about 10 km, divided in running (40%), walking (25%), trotting (15%), velocity (10%) and backward running (10%) (Bjordal *et al.,* 1997). They also reported that a characteristic of soccer is the presence of rough moves at every six seconds, facilitating the onset of injury/injuries. It is a rough contact sport associated with numerous activities including jumping, kicking the ball, tackling, turning, sprinting, changing pace and sustaining forceful contraction to maintain balance and control of the ball against defensive pressure of the adverse team (Tomas *et al.*, 2005; Landry *et al.,* 2009). Injuries have increased in number, since it is a sport characterized by intense physical contact, short, fast and non-continuous movements, such as acceleration, deceleration, jumps and sudden changes of direction (Macedo de Almeida *et al.,* 2013). Hawkins *et al.* (2001) defined injury in sport as one received during training or competition which prevented the injured player from participating in normal training or competition for more than 48 hours, not including the day of the injury. In the United State of America (USA), the National Collegiate Athletic Association (NCAA) of the Injury Surveillance System (ISS) indicates as sports injuries those which limit the athlete's participation for at least one day after, the episode which caused the injury (Macedo de Almeida *et al.,* 2013). They also noted that NCAA classifies injuries according to the time of inability for sports practice, and it can be a light (from one to seven days of time away from practice), moderate (from eight to 21 days) and severe (more than 21 days or with permanent injuries). According to Kirkendall and Dvorak (2010) the most common causes of injury are: running/walking (20%); landing (16%); field hazard (11%); collisions (12%); being kicked (11%); fouls (6%). Although the most common sites of soccer injuries are the same in men and women, the incidence of injuries in men doubles that in women (Hägglund *et al.*, 2009). Kirkendall and Dvorak (2010) stated that in football lower limb is the most common injured site (65.1% of injuries), followed by the upper limb (13.4%) then head and neck (11.1%) and lastly trunk (10.3%). Studies from the professional leagues in Europe (Norway, Sweden, Iceland, Britain, Federation Internationale de Football Association [FIFA] and Union of European Football Associations [UEFA]) agree that injuries to the lower extremities constitute the biggest problem (Andersen *et al.,* 2004; Walden *et al.*, 2005). In a study held in 2009, with professional players of Marilia Athletic Club, the injury with the highest incidence was muscular injuries (Palacio *et al.*, 2009). In another investigation carried out in the same year, the most frequent injury found was the ankle sprain, followed by knee trauma and muscular injury (Vital *et al.,* 2007). According to NCAA injury surveillance system for 2000-2001, the most common injury sites were the ankle, knee and leg among collegiate soccer, field hockey, basketball, and lacrosse athletes (National collegiate athletic association, injury surveillance, 2002). They further reported that the most common type of injury were muscle strains, ligament sprains, and contusions. Constant exposure to repetitive athletic actions and overload place the integrity of bodily structures at risk (Myer *et al.,* 2009). Jamison *et al.* (2012) pointed out that a link has already been established between trunk and upper body kinematics and lower extremity loading during sport-specific tasks. Nilstad *et al.* (2014) in their study pointed out that player suffering a lower extremity injuries during the season were heavier and had a greater body mass index (BMI) compared with players with no injuries. They also pointed out that multivariate analyses identified a greater BMI as the only factor associated with an increased risk of lower extremity injuries. Winter *et al.* (1990) observed that higher body mass may stress joint and ligament structures of the lower extremities to a greater extent and thereby influence the injury risk and also they observed that more than half of the body mass is located in the upper body.

An association exists between the limb girth and injury occurrence (Niyonsenga, 2011). The difference in limb girth could result from lean muscle mass, body fat content or bone geometry (Bennell *et al.,* 1996). They also emphasized that the physiological cross sectional area of muscle is proportional to the maximum magnitude of force that it can develop; as a result limb girth has received interest as a potential risk factor for lower extremity injury with regard to the muscle's ability to stabilize and control the joints. Several studies have reported a relation between limb girth and lower extremity injury. Milgrom *et al.* (1991) reported an increased injury rate of the lateral ankle sprain with the increased gastrocnemius circumference in male military recruits and no association was reported between the thigh circumference and injury.

1.6 **STATEMENT OF RESEARCH PROBLEM**

A lot of researches have been carried out on the risk factors of lower limb musculoskeletal injuries among footballers, less attention was given to BMI and lower limb circumferences. The roles of height and weight of the individual which are determinants of BMI and the lower limb circumference should not be underemphasized as potential risk factors for lower limb musculoskeletal injuries among footballers. The paucity of information on effect of BMI and lower limb circumference (thigh and calf) on lower limb musculoskeletal injuries among footballers especially in Kano state makes it necessary to fill this gap.

1.7 **JUSTIFICATION**

- In Kano State, football is widely popular. Both professional and most especially amateur, which may cause a high level of musculoskeletal injuries when it is played without guidance.
- Observing the frequency and effects of BMI, lower limb circumferences to injuries may provide the best way to handle the athlete's health, always searching for prevention of musculoskeletal problems.
- Another point which justifies this study is the low number of researches which approach this issue in a regional and local context.

1.8 **AIM**

The aim of the study is to determine the relationship between BMI, thigh and calf circumferences and lower limbs musculoskeletal injuries among footballers of teams in Kano metropolis.

1.4.1 Objectives

The specific objectives are to study the:-

1. To find the relationship between height and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.
2. To find the relationship between BMI and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.
3. To find the relationship between lower limb height and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.

4. To find the relationship between thigh circumference and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.
5. To find the relationship between calf circumference and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.

1.5 HYPOTHESIS

Null Hypothesis (H_o)

There is no statistical relationship between BMI, lower limb circumferences (thigh and calf) and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.

Alternate Hypothesis (H_i)

There is statistical relationship between BMI, lower limb circumferences (thigh and calf) and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis.

CHAPTER TWO

LITERATURE REVIEW

2.1 OVERVIEW

The lower limbs (extremities) are extensions from the trunk specialized to support body weight, for locomotion, the ability to move from one place to another and maintain balance (Moore & Dalley, 2006).The lower limb consists of the following areas: Gluteal region, thigh, knee, leg, ankle and foot.

- **Gluteal Region**: This is a transitional region between the trunk and free lower limb. It overlies the hip joint and greater trochanter of the femur.
- **Thigh Region**: This part of the free lower limb lies between the gluteal, abdominal, and perineal regions proximally and the knee region distally. It contains most of the femur (thigh bone), which connects the hip and knee.
- **Knee Region**: This part includes the prominences (condyles) of the distal femur and proximal tibia, the head of the fibula, and the patella (knee cap, which lies anterior to the distal end of the femur) as well as the joints between these bony structures.
- **Leg Region**: is the part that lies between the knee and the rounded medial and lateral prominences (malleoli) that flank the ankle joint. The leg contains the tibia (shin bone) and fibula and connects the knee and foot.
- **Ankle Region**: This includes the narrow, distal part of the leg and the malleoli.

- **Foot Region**: The foot is the distal part of the lower limb containing the tarsus, metatarsus, and phalanges (Moore & Dalley, 2006).

2.2 MUSCLES OF THE LOWER LIMB

2.2.1 Gluteal Muscles

The gluteal muscles share a common compartment but are organized into two layers, superficial and deep:

The superficial layer: Consists of the three large glutei (maximus, medius, and minimus) and the tensor fascia lata are mainly extensors, abductors, and medial rotators of the thigh (Stephens, 2004).

The deep layer: Consists of smaller muscles:

- Piriformis
- Obturator internus
- Superior and inferior gemelli
- and quadratus femoris (Stephens,2004)

2.2.2 Thigh Muscles:

The thigh muscles are organized into three compartments by intermuscular septa that pass deeply between the muscle groups from the inner surface of the fascia lata to the linea aspera of the femur. The compartments are anterior or extensor, medial or adductor, and posterior or flexor, so named on the basis of their location or action at the knee joint (Stephens, 2004).

Anterior group

The anterior compartment of the thigh contains the flexors of the hip and extensors of the knee (Moore & Dalley, 2006). The anterior thigh muscles include:

- Pectineus.
- Iliopsoas.
- Sartorius.
- Quadriceps Femoris(Stehens,2004).

Medial group

The medial thigh muscles, collectively called the adductor group, are in the medial compartment of the thigh (Stephens, 2004). The adductor group of thigh muscles consists of:

- Adductor Longus.
- Adductor Brevis.
- Adductor Magnus.
- Gracilis.
- Obturator Externus (Stephens,2004).

Posterior group

They include:

- Semitendinosus.
- Semimembranosus.
- Biceps femoris (long and short head) (Stephens,2004).

2.2.3 Leg Muscles

Muscles of anterior compartment

- Tibialis anterior.
- Extensor digitorum longus.
- Extensor hallucis longus.
- Fibularis tertius(Moore & Dalley, 2006).

Muscles of lateral compartment

- Fibularis longus.
- Fibularis brevis muscles (Moore & Dalley, 2006).

Muscles of Posterior compartment of the leg

The posterior compartment is the largest of the three leg compartments. The posterior compartment and the calf muscles within it are divided into superficial and deep muscle groups by the transverse intermuscular septum (Stephens, 2004).

Superficial group of muscles in the posterior compartment

The superficial groups of calf muscles include:

- Gastrocnemius.
- Soleus.
- Plantaris.(Stephens,2004).

Deep muscles group in the posterior compartment

Four muscles make up the deep group in the posterior compartment of the leg are:

- Popliteus.
- Flexor Digitorum Longus.
- Flexor Hallucis Longus.
- Tibialis Posterior (Moore & Dalley, 2006).

2.2.4 Intrinsic Muscles of the Foot

Intrinsic muscles in the dorsum of the foot

- Extensor digitorum brevis
- Extensor hallucis brevis (Moore & Dalley, 2006).

Intrinsic muscles in the sole of the foot

- Abductor Digiti Minimi
- Abductor Hallucis
- Adductor Hallucis
- Flexor Digiti Minimi Brevis
- Flexor Digitorum Brevis
- Flexor Hallucis Brevis
- Dorsal Interossei
- Plantar Interossei
- Lumbricales

- Quadratus Plantae (Stephens, 2004).

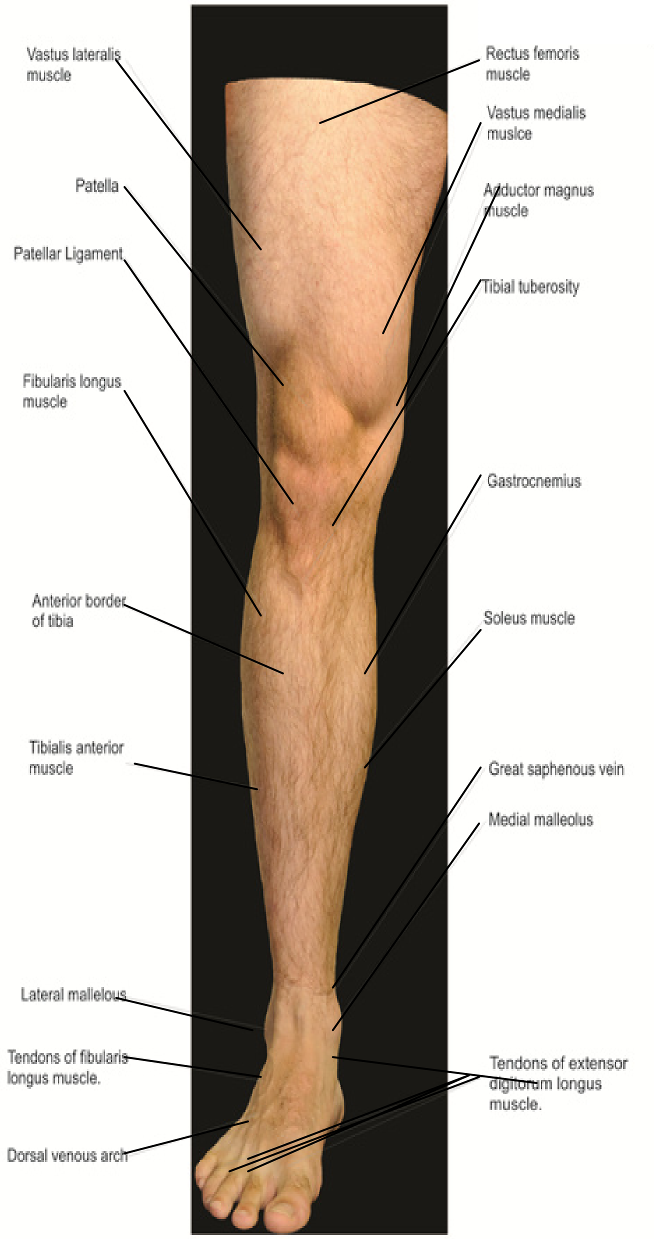

Plate I Surface Anatomy of the Muscles of the Lower Limb
Anterior view
Source: www.nysora.com

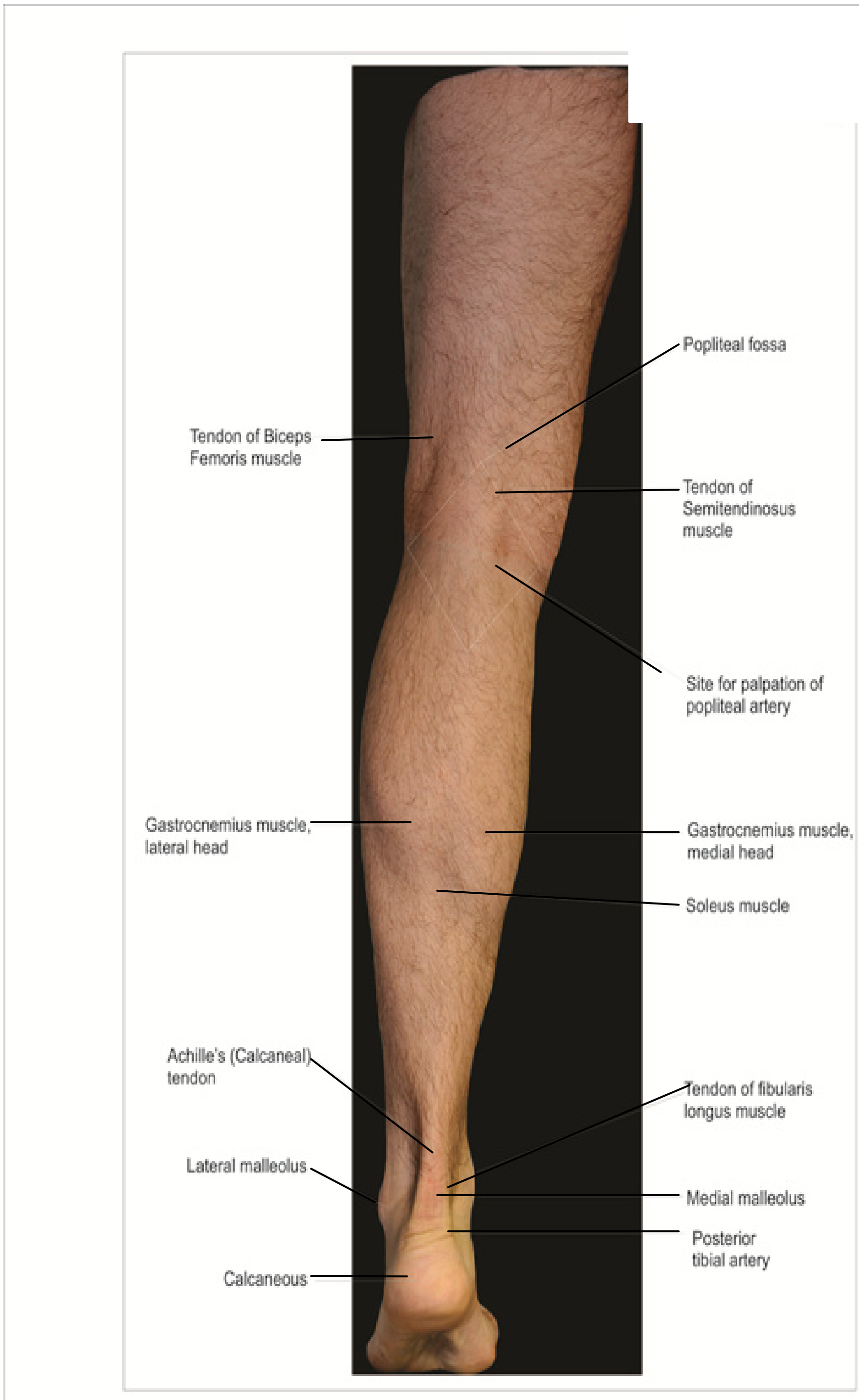

Plate II Surface Anatomy of the Muscles of the Lower Limb
Posterior view
Source: www.nysora.com

2.3 BONES OF THE LOWER LIMB

2.3.1 Femur

The femur is the longest and heaviest bone in the body. It transmits body weight from the hip bone to the tibia when a person is standing. Its length is approximately a quarter of the person's height. The femur consists of a shaft (body) and two ends, superior or proximal and inferior or distal. The shaft is slightly bowed (convex) anteriorly. Most of the shaft is smoothly rounded, providing fleshy origin to extensors of the knee, except posteriorly where a broad, rough line, the linea aspera, provides aponeurotic attachment for adductors of the thigh (Moore & Dalley, 2006).

2.3.2 Tibia

Located on the anteromedial side of the leg, nearly parallel to the fibula, the tibia (shin bone) is the second largest bone in the body. It flares outward at both ends to provide an increased area for articulation and weight transfer. At the superior end of the anterior border, a broad, oblong tibial tuberosity provides distal attachment for the patellar ligament, which stretches between the inferior margin of the patella and the tibial tuberosity. The distal end of the tibia is smaller than the proximal end, flaring only medially; the medial expansion extends inferior to the rest of the shaft as the medial malleolus (Moore & Dalley, 2006).

2.3.3 <u>Fibula</u>

The slender fibula lies posterolateral to the tibia and is firmly attached to it by interosseous membrane. The distal end enlarges and is prolonged laterally and inferiorly as the lateral malleolus. The proximal end of the fibula consists of an enlarged head and smaller neck (Moore & Dalley, 2006).

2.3.4 <u>Bones of the Foot</u>

The bones of the foot include:

- Tarsus
- Metatarsus
- Phalanges (Moore & Dalley, 2006).

2.4 JOINTS OF THE LOWER LIMB

- Hip joint
- Knee joint
- Superior and inferior tibiofibular joint
- Ankle joint
- Tarsal joints
- Metacarpophalangeal joints
- Interphalangeal joints (Ellis, 2006).

2.4.1 Hip Joint

Hip joint is the largest joint in the body. It is a strong and stable multiaxial ball and socket type of synovial joint (Moore & Dalley, 2006). It is made up of:

- Synovial membrane
- Joint capsule and ligament that reinforce it:
- Iliofemoral ligament
- Pubofemoral ligament
- Ischiofemoral and Ligament of the head of the femur (Ellis, 2006).

Movements of the hip joint

Hip joint movements are:

- Flexion
- Extension
- Abduction
- Adduction
- Medial rotation
- Lateral rotation
- Circumduction (Moore & Dalley, 2006).

2.4.2 Knee Joint

The knee is a hinge type of synovial joint made up of the articulations between the femoral and tibial condyles and between the patella and the patellar surface of the femur (Moore & Dalley, 2006).

It is made up of:

- **Joint capsule**
- **Cruciate ligaments**: are extremely strong connections between the tibia and femur.
- **Semilunar cartilages (menisci)**: are crescent-shaped and are triangular in cross-section, the medial being larger and less curved than the lateral (Ellis, 2006).

Movements of the knee joint

The principal knee joint movements are:

- Flexion
- Extension
- Rotation (Moore & Dalley, 2006).

2.4.3 Tibiofibular Joints

The tibia and fibula are connected by:

- **Superior tibiofibular joint**: a synovial joint between the head of the fibula and the lateral condyle of the tibia.
- **Interosseous membrane**: this is crossed by the anterior tibial vessels above and pierced by the perforating branch of the peroneal artery below.
- **Inferior tibiofibular joint:** a fibrous joint, the only one in the limbs, between the triangular areas of each bone immediately above the ankle joint (Moore & Dalley, 2006).

2.4.4 The Ankle Joint

The ankle is a hinge-type of synovial joint formed by the malleoli and lower end of the tibia and the body of the talus. The capsule of the joint fits closely around its articular surfaces, and, as in every hinge joint, it is weak anteriorly and posteriorly but reinforced laterally and medially (Deltoid ligament) by collateral ligaments (Moore & Dalley, 2006).

Ligaments of the ankle joint

- Anterior talofibular ligament.
- Posterior talofibular ligament.
- Calcaneofibular ligament (Ellis, 2006).

Movements of the ankle joint

The ankle joint is capable of:

- Plantarflexion
- Dorsiflexion (Moore & Dalley, 2006).

2.4.5 Joints of the Foot

They include:

- Tarsal joint
- Metatarsopophalangeal joint
- Interphalangeal joint

They allow inversion and eversion of the foot as well as flexion and extension of the phalanges (Moore & Dalley, 2006).

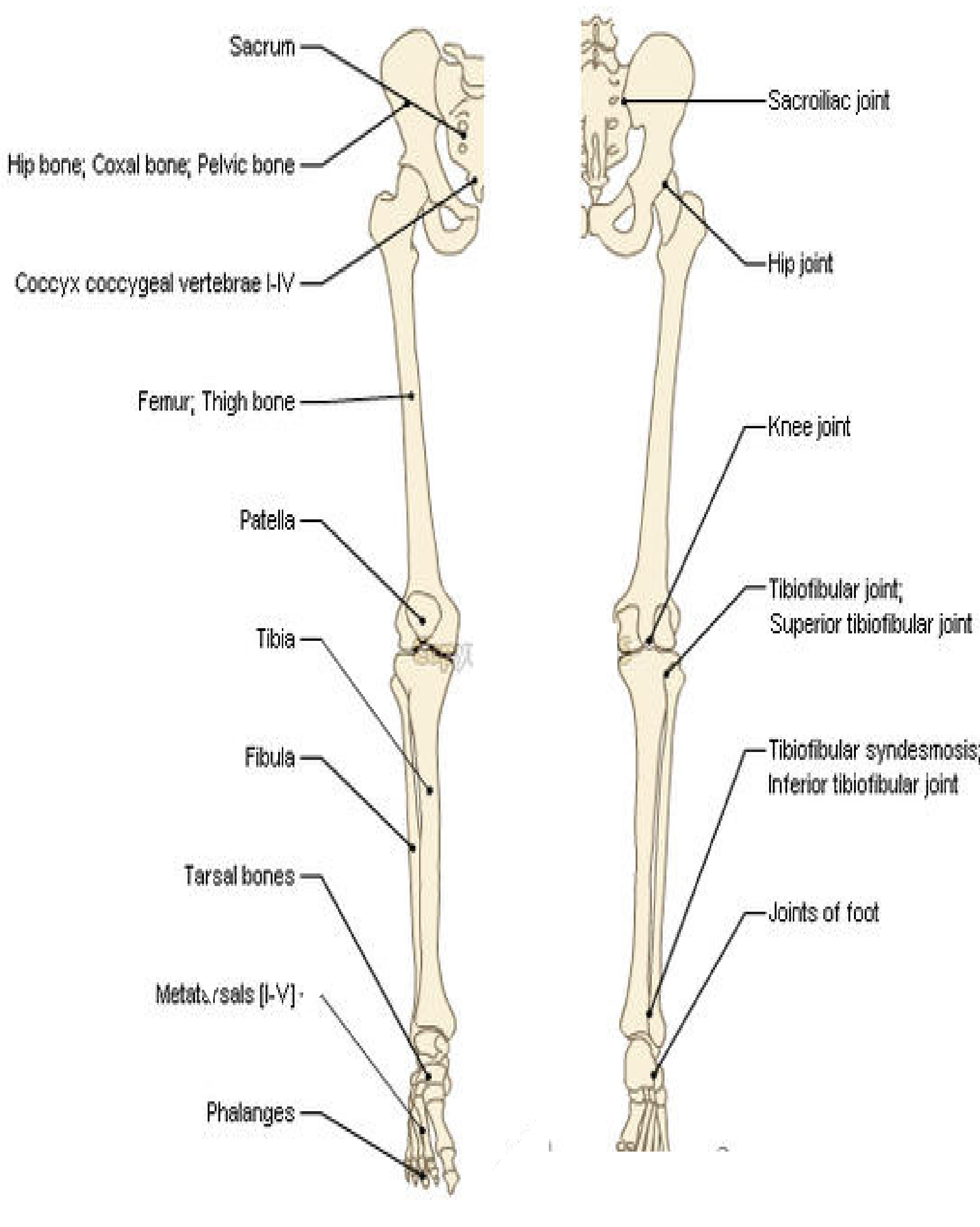

Plate III Bones and Joints of the Lower Limb

Source: www.imaios.com

Body mass is quite often studied as a potential risk factor for sports injury. Body mass index (BMI) is calculated as the weight in kilograms divided by height in meters (kg/m2). It was then summarized and categorized into underweight, normal, overweight and obese (WHO, 2003). BMI is classified into underweight (BMI<18.5kg/m^2), normal weight (BMI 18.5-24.9 kg/m2), overweight (BMI 25.0- 29.9 kg/m2), and obese (BMI ≥ 30 kg/m2) (National Institute of Health and Clinical Excellence [NICE], 2006). Body size has been analysed in risk factor studies in a number of ways including BMI (Backous *et al.,* 1988), Quetelet index (Prager *et al.,*1989) and mass moment of inertia (Milgrom, *et al.,*1991).These variables have been considered as risk factors for injury because an increase in any one produces a proportional increase in the forces that articular, ligamentous, and muscular structures must resist (Murphy *et al.,* 2003). Body mass index is associated with musculoskeletal symptoms, in particular symptoms of the lower extremity. Increased forces across the joints are likely to play a larger role in the relationship between a high BMI and weight-bearing joints (lower extremities), compared to symptoms in non-weight-bearing joints (in the shoulder/neck and upper extremities) (Viester *et al.,* 2013).

Much of the literature on sports injuries relates to body mass and does not distinguish between fat and lean mass. Rather, attention is often directed to the consequences of body mass (whether muscle, bone or fat) on injury risk in certain situations that arise in sports. Particular situations differ between sports (Norton *et al.,* 2011). It should be noted that athletes, particularly elite athletes, are likely to have higher muscle mass than most people. This will contribute to elevation of BMI values, though with different implications to the elevation of BMI due to high mass of fat, the situation in overweight and obesity (Norton *et al.,* 2011). The relationship of body mass and injury risk during sport is complicated by the diversity of sporting activities and by the fact that the usual BMI-based measure of obesity is not appropriate for many athletes, whose higher BMI can reflect increased muscle mass rather than fat (Norton *et al.,* 2011). Studies of lower extremity injuries have reported conflicting results regarding the relationship between BMI and the incidence of injuries. Some studies have demonstrated an increased incidence in individuals who are taller (Watson, 1999) and heavier (Milgrom *et al.,*1991), while others reported no difference in the incidence of ankle sprain injury (Faude *et al.,* 2006). These studies have reported an increased incidence of lower extremity injuries (Gomez *et al.,* 1998) and ankle sprain (Tyler *et al.,* 2006) in high school football players with an above-average BMI. Gomez *et al.* (1998) reported that linemen in high school gridiron (American football) with a higher BMI were at a greater risk of lower extremity injury than those with lower BMI, with ankle sprain being the most common injury. In contact sports, the mass of players affects the energy dissipated during collisions between players. This affects the potential for harm, lighter players tending to do worse than heavier players. In sports requiring sudden stopping or turning, a player's mass can have important effects on the load borne by his joints, ligaments and tendons. In this situation, lighter players may do better than heavier players (Norton *et al.,* 2011). Evidence on effects of body mass on injury risk in children and young people varies between sports and sometimes within them, limiting the potential for general conclusions. In collision sports (American football being the most often studied example), players who have a greater BMI are less likely to be injured in a collision than the lower BMI player (Malina *et al.,* 2006). However, several other studies have reported an increased rate of injury among heavier players (Goldberg *et al.,* 1988; Kaplan *et al.,* 1995; Stuart *et al.,* 2002; Emery, 2005) or players with a high BMI (Gomez *et al.,* 1998; Tyler *et al.,* 2006). A 3-year retrospective review of injured US high school athletes from a nationally representative sample of 100 US high schools found that patterns of injury also varied with BMI. Fractures were more prevalent in the small group of underweight injured athletes and knee injuries were prevalent in the obese group, both compared with the normal-weight group (Yard & Comstock, 2011). Milgrom *et al.* (1991) found that male military recruits with a larger mass moment of inertia had a significantly increased risk of sustaining a lateral ankle sprain.

Conversely, a number of studies have reported no association between body size and lower limb injuries (Norton *et al.,* 2011). Knapik *et al.* (2001) did not find height, weight, or BMI to be risk factors for injuries among female and male military recruits. Prager *et al.* (1989) found no association between Quetelet index ([weight/height] *100) and injuries among high school football players. Baumhauer *et al.* (1995) reported no effect of height or weight on the incidence of ankle injury among collegiate athletes participating in soccer, field hockey, and lacrosse.

Numerous injuries occur each year caused by sport, resulting in decreased physical activity and work time lost in addition to substantial medical cost (Murphy *et al.,* 2003). Football is a contact sport and running game that involves periods of continuous physical activity, interspersed with periods of high-intensity activity, including unexpected, explosive and agile movements and heavy physical contact. The game features contribute to the high risk of injury (Johansson *et al.,* 1991; Goldie *et al.,* 1989). Lower limb musculoskeletal injury (LLMI) is the most common injury found in soccer (Junge *et al.,* 2006), According to the National Collegiate Athletic Association injury surveillance system for 2000–2001, the most common injury sites were the ankle, knee, and lower leg among collegiate soccer, field hockey, basketball, and lacrosse athletes. The most common injury types were muscle strains, ligament sprains, and contusions (National Collegiate Athletic Association, 2002).

Injury risks were found to reach its highest rate in the first and last 15 minutes of the game reflecting the intense engagements in the opening period and the possible effects of fatigue in the closing period. The latter together with the areas of the pitch where possession of the ball was vigorously contested, specifically the attacking and defending zones close to the goal were reported to be highly associated with injury occurrence in soccer (Rahnama *et al.,* 2002). The ankle, knee and thigh were the most targeted parts of the lower extremities and ankle sprains together with anterior cruciate ligament (ACL) were the most commonly diagnosed injuries (Azubuike & Okojie, 2009; Emery & Meeusse, 2006) than stress fracture, concussion, contusion, muscle strain, groin,back and head injuries respectively (Faude *et al.,* 2006). The both traumatic and overuse injuries also controlled the leading front of all competition injuries specifically at the beginning of competitive season (Engstrom *et al.,* 1991; Jacobson & Tegner, 2006). Several researchers documented the possible association between the player's position and their soccer injuries. These studies reported diverging findings and conclusions. Morgan and Oberland (2001) reported no link between the prevalence and severity of soccer injuries and the players playing position. Conversely, midfielders were found to be more prone to suffer from soccer injuries than other players (Giza *et al.,* 2005) and injury incidence was considerably high in defenders (9.4/1000 hours exposure) and strikers (8.4/1000 hours exposure) compared with goalkeepers (4.8/1000 hours exposure) and midfielders (4.6/hours exposure) (Faude *et al.,* 2006).

The definition of injury as well as the severity of injury differs somewhat between studies, which make exact comparisons difficult, but studies have shown that acute injuries represent 69-94% of all injuries in football, while 6-31% is overuse injuries (Ostenberg & Roos, 2000). Most injuries occurred as result of direct contact with the player of the opposite team and/or team mates (DeLee *et al.,* 2009; Ellen *et al.,* 2008). Most of the time contact injuries occurred during tackling, being tackled and/or collision with other players (DeLee *et al.,* 2009; Yard *et al.,* 2008). The tackled players looked more vulnerable to injuries (55%) but neither tackling players were not kept away from the injuries (45%) (Tscholl *et al.,* 2007). Alternatively, the non-contact injuries resulted from poor landing, sudden cutting, kicking the ball, sprinting, deceleration, changing pace and direction (Alenton- Geli *et al.,* 2009; DeLee *et al.,* 2009; Yard *et al.,* 2008). Depending on the severity, injuries are classified in three different categories: Minor/Slight, Moderate and Severe/Major. Injury was classified minor/slight if an injured player was absent in training or competition 2 to 3 days; moderate if an injured player was absent in training or competition 4 to 7 days and severe/major if an injured player was absent in training or competition 1 week and above (Hawkins & Fuller, 1999). Furthermore, Morgan and Oberlaner (2001) classified the sustained soccer injury as incident (no time lost from training/competition), minor (less than 7 days of absence from training or competition participation), moderate (7 to 29 days of absence in training or competition participation) and major (more than 30 days lost from training or competition participation).

The most frequent injury locations are the ankle(11-36%), knee (14-33%), thigh (8-23%), groin (7-13%), foot (5-21%), lower leg (2-13%), back (2-11%) and head (1-4%) (Woods *et al.,* 2002). Of specific injury types, most previous studies indicate that ankle sprains are the most common in football (Woods *et al.,* 2002). However, some recent studies show a higher proportion of hamstring strains than ankle or knee sprains (Hawkins *et al.,* 2001). Male professional footballers showed that muscle injuries represent more than 30% of all injuries and cause about one quarter of total injury absence. Over 90% of muscle injuries affected the four major muscle groups of the lower extremity: hamstrings, adductors, quadriceps and gastrocnemius (Ekstrand *et al.,* 2011).

Contusions result from a direct blow to the muscle or soft tissue and are most common in collision sports such as football and hockey. Most are mild injuries that resolve with ice and a short period of rest. Quadriceps contusions tend to be the most disabling. Physical examination reveals diffuse anterior thigh tenderness, often associate with swelling and ecchymosis. Pain is worse with passive knee flexion and hip extension. Injury severity is classified based on knee range of motion 12 to 24 hours after injury (mild, $>90^0$; moderate, 45^o-90^o; severe, $<45^o$) (Jackson & Faegin, 1973). A contusion with a large intramuscular hematoma may be complicated by myositis ossificans, a benign proliferation of bone and cartilage that occurs in a muscle 3 to 4 weeks after trauma (Ryan *et al.,* 1991).

Abrasion results from superficial removal of the granular and keratinized cells from the underlying dermis which is produced by acute contact of exposed skin with the immediate environment (Basler *et al.,* 2001). It appears as irregularly denuded epidermis and an exposed upper dermis with punctuate bleeding and tissue exudates. When player-surface contact involves too much energy, the skin is likely to fail, resulting in an abrasion (Basler *et al.,* 2001).

Laceration is a wound produced by the tearing of body tissue (Miller-Keane *et al.,* 2003). External lacerations may be caused in many ways, such as a blow from a blunt instrument, a fall against a rough surface, or an accident with machinery. It appears as a cut or incision (Miller-Keane *et al.,* 2003).

Muscle strains are caused by a sudden forceful change in the length of the muscle-tendon unit, resulting in a stretch or tear of the muscle fibers (Sherry & Best, 2004). They occur most commonly at the musculotendinous junction. Muscle strains are classified as mild, moderate, or severe. A mild strain is a stretch injury to the muscle, with no loss of strength or motion. A moderate strain is a partial tear of the muscle, with some loss of strength and/or motion and some degree of ecchymosis or swelling (Heiser *et al.,* 1984). A severe strain is a complete muscle tear with major hemorrhage and complete loss of function. The hamstrings are the most frequently strained muscle in the lower extremity and can lead to significant disability. Athletes who sprint, jump, leap, or kick are most susceptible. Injured athletes report a sudden, painful ‘pop’ and are unable to bear weight comfortably. Physical examination reveals posterior thigh tenderness and pain with contraction or passive stretch of the hamstrings (Sherry & Best, 2004).

Boden *et al.,* (2000) reported that over 70% of ACL injuries occur without any contact with another player, typically while landing from a jump, decelerating quickly, or changing direction suddenly. He also pointed out that the mechanism of injury is most often a combination of excessive femoral internal rotation and valgus stress with the foot fixed and hyperextension is also a common mechanism. Athletes with ACL injury typically report a twisting injury to the knee associated with a painful pop, immediate swelling, feeling of instability, and an inability to bear weight (Boden *et al.,* 2000). Physical examination usually reveals a significant hemarthrosis and limited range of motion. There may not be much tenderness unless associated injuries are present. Sprains of the medial collateral ligament (MCL) can occur in isolation or in conjunction with ACL injuries (Boden *et al.,* 2000). The mechanism is a valgus stress and/or external rotation of the tibia on a fixed foot and is often associated with contact with another player. Athletes report sharp medial knee pain, immediate swelling, a feeling of instability, and inability to bear weight (Erickson & Schmale, 2003).Physical examination reveals limited range of motion, with localized swelling and significant tenderness along the medial aspect of the knee. A valgus stress test confirms the diagnosis and determines injury severity. Posterior collateral ligament disruption mechanisms include hyperextension, posterior directed torsion, and (car) dashboard-type flexed knee injuries (Erickson & Schmale, 2003).

Ankle sprains account for up to 28% of all sports-related injuries. Eighty-five percent of ankle sprains are lateral, 10% are syndesmotic, and 5% are medial (Garrick, 1977). The usual mechanism for a lateral ankle sprain is excessive inversion of a plantar flexed ankle and for medial ankle sprain is excessive eversion, usually from a fall, causing injury to the deltoid ligament. The anterior talofibular is the weakest of the 3 lateral ligaments and is the most frequently injured, followed by the calcaneofibularligament(Garrick, 1977). The posterior talofibular ligament is least frequently injured (Fallat *et al.,* 1998). At the time of injury, athletes usually experience a pop or snap. Those with more severe sprains will be unable to bear weight. On physical examination, swelling and bruising are localized to the lateral ankle, and the injured ligament is tender to palpation (Casillas, 2003).

Dislocations are often caused by sudden trauma on the joint like an impact or fall. A joint dislocation can cause damage to the surrounding ligaments, tendons, muscles, and nerves. Dislocations can occur in any joint major (shoulder, knees, etc.) or minor such as toes and fingers (Smith & Brunolli, 1990).

Fracture involves traumatic break of bone (Hagglund *et al.,* 2005). The mechanism of kicking in soccer may be associated with the generation of high kinetic energy. Since soccer is a contact sport, the kicking leg can cause severe injuries. During miskicks or slide tackles, the energy may be transmitted to an opponent's lower leg, resulting in a fracture (Francisco & Roger, 2000).

The difference in limb girth could result from lean muscle mass, body fat content or bone geometry (Bennell *et al.,* 1996). The physiological cross sectional area of muscle is proportional to the maximum magnitude of force that it can develop, as a result limb girth has received interest as a potential risk factor for lower extremity injury with regard to the muscle's ability to stabilize and control the joints. In a study of risk factors for lower extremity injury in 45 recreational basketball players, Shambaugh *et al.* (1991) found that injured athletes had a greater side to side discrepancy in quadriceps girth than uninjured athletes. Milgrom (1991) reported an increased injury rate of the lateral ankle sprain with the increased gastrocnemius circumference in male military recruits and no association was reported between the thigh circumference and injury. In a prospective study of risk factors for lower extremity stress fractures in male and female track athletes, the smaller gastrocnemius girth was found to predispose female athletes to injury but not for males (Bennell *et al.,* 1996).

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY AREA

The study area is Kano metropolis. Kano (city) is located in north western Nigeria it is the capital of Kano State (Redmond, 2009). Kano is located between latitude 12^o 25 to 12^o 40^oN and longitude 8^o 35N to 8^o 45E (Nabegu, 2010). It is bordered by the states of Jigawa to the north and east, Bauchi to the southeast, Kaduna to the southwest, and Katsina to the northwest (Encyclopedia Britannica, 2012).It is a powerful city-state of the Hausa people and has been an important Islamic city of the West African savanna for centuries (Redmond, 2009). Kano metropolis is among the fastest growing cities in Nigeria (Nabegu, 2010). It has population of 9,383,682 in 2006 (Encyclopædia Britannica, 2012). Kano is referred to as the Center of Commerce in the Country due to long flourished marketing activities (Ayila *et al.,* 2014).

The study area is made up of randomly selected football fields from the eight (8) metropolitan Local goverments. They include Dala, Fagge, Gwale, Kano Municipal, Nassarawa, Tarauni and parts of Ungogo and Kumbotso local governments.

3.2 STUDY POPULATION

The population included four hundred footballers (in 20 football teams) playing for football teams in Kano metropolis including the goal keepers which were selected through systematic random sampling.

3.2.1 Sample Size Determination

Determination of the sample size will be in accordance with the formula.

$$N = \frac{Z^2 pq}{d^2}$$

Z = Confidence limit, if 95% confidence in result is desired which is equal to 1.96.

P = occurrence rate within the population 0.5.

q = 1- p.

d = desired precision of the estimate (example your result are accurate within the limit of plus or minus 5% or 0.05)

N = sample size

So, using the formula

$$N = \frac{(1.96)^2 *(0.5)\ (0.5)}{0.05^2} = 384$$

This means we need sample size of at least 384 to be 95% of our overall results, within a range of plus or minus 5 % (Smith, 2013).

3.2.2 Selection Criteria

Inclusion criteria

- Both professional and amateur players
- Goal keepers
- Players of 18 - 41 years of age

Exclusion criteria

Part time players.

3.3 EQUIPMENTS/ INSTRUMENTS

- Weighing scale (Seca 762)
- Stadiometer (Seca 217)
- Non elastic tape measure
- Personal Computer
- Stationery e.g. Reams of A4 papers, markers etc

The following measurements were carried out:

- Weight using Weighing scale (Seca 762).
- Height using Stadiometer (Seca 217).
- Lower limb height, thigh and calf circumference using non elastic tape measure.

Plate IV Weighing Scale (Seca 762)

Plate V Stadiometer (Seca 217)

Plate VI Non Elastic Tape Measure

3.4 METHODOLOGY

The research was a cross-sectional study. This study design was best suited as it requires only one contact with the study population (Kumar, 2005). An introductory letter about the research was issued by the Department of Anatomy, College of Health Sciences, Bayero University Kano. The volunteers were approached either prior to or following training sessions in order not to interfere in the normal dynamics and routine of the sport. The objectives of the study were explained to the participants. Verbal consent was taken from the participants before commencement of the study. The questionnaires were issued to the participants through personal contact and assistance by research assistants and team coaches. Furthermore, specific measurements were taken including body weight and height, length of lower limbs, and thigh and calf circumferences.

3.4.1 Procedures

Measurements were taken (cm) three times on right lower limb and left lower limb for right footed and left footed players respectively and the average were recorded.

- **Lower Limb Height**: This was measured between the summit of the iliac crest and the heel (Plate VII) (Barry & Maria, 2010). For the purpose of this research lower limb heights are categorized as: Short (<99cm), average (99-106cm) long (>106cm).

- **Height:** Height was measured using a portable stadiometer with a sliding head plate, a base plate and three connecting rods marked with a metric measuring scale. Participants were asked to remove their shoes. Vertical distance measured between standing surface and the vertex of the head (Plate VIII) (Craig *et al*, 2009). Height is classified below as: short (<161 cm) average (161-170 cm) tall (>170 cm) (Niyonsenga, 2011).

- **Weight**: Body weight was measured using Seca 762 scale. Participants were asked to remove their shoes and any bulky clothing (Plate IX) (Craig *et al*, 2009).

- **Body Mass Index (BMI)**: The BMI is the ratio of weight to height squared (kg/m^2) (Nihiser *et al.,* 2007). BMI was classified into underweight (BMI<18.5kg/m^2), normal weight (BMI 18.5-24.9 kg/m2), overweight (BMI 25.0- 29.9 kg/m2), and obese (BMI ≥ 30 kg/m2) (NICE, 2006).

- **Thigh Girth**: This was measured when the subjects stand straight with lower limbs spread and weight evenly distributed between two feet (Mcdougall, 2014). The perimeter of the thigh perpendicular to the long axis of the femur at the mid trochanterion-tibiale laterale level was measured (Plate X) (Norton et. al., 1996). For this research thigh girth is categorized as: Small (<50cm), medium (50-56cm) large (>56cm).

- **Calf Girth**: The perimeter of the calf was measured when the subject stands erect, legs slightly parted, weight equally distributed on both feet. The tape was maneuvered to obtain the maximum perimeter of the calf. This measure was obtained by manipulating the tape, taking a series of girth measurements to assure the largest value (Plate XI)

(Norton *et al.,* 1996). For this research calf girth is categorized as: Small (<32cm), medium (32-38cm) and large (>38cm).

3.4.2 Limitation

Self-report measures are open to bias and misreporting, particularly when the time and type of sustained injury were not remembered or simply not be in mood of answering that questions.

Plate VII Measurement of Lower Limb Height Using Tape Measure

Plate VIII Measurement of Body Height Using Stadiometer

Plate IX Measurement of Body Weight Using Weighing Scale

Plate X Measurement of Thigh Circumference Using Tape Measure

Plate XI Measurement of Calf Circumference Using Tape Measure

3.5 STATISTICAL ANALYSIS

The data were presented using simple frequency and percentage for descriptive purpose. The relationship between the study variables (height, BMI, lower limb height, thigh circumference and calf circumference) and injury status were investigated using Pearson's chi-square (x^2) test. All the analyses were carried out using SPSS version 20. The level of significance was set as $P \leq 0.05$.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 RESULTS

The findings of the study are presented based on height variations and the occurrence of lower limb musculoskeletal injuries, variation in body mass index (BMI) and the occurrence of lower limb musculoskeletal injuries, variation in lower limb height and the occurrence of lower limb musculoskeletal injuries, variation in thigh circumference and the occurrence of lower limb musculoskeletal injuries and variation in calf circumference and the occurrence of lower limb musculoskeletal injuries. A total of 400 questionnaires were distributed and 300 were retrieved.

The data were analyzed using SPSS statistical software. Factors associated with injuries were studied by means of the chi-square test. Following analysis, it was found out that 49.7% of total players were injured while 50.3% where not. The results obtained are presented in tables 1 - 5.

Table 1: Injury During Training or Competition and Height

Variables			Height			Total
			Short	Average	Tall	
Injury during training or competition	Injured	Count	10 (83.3%)	55 (55.0%)	84 (44.7%)	149 (49.7%)
		Expected Count	6.0	49.7	93.4	149
		Std. Residual	1.7	.08	-1.0	
	Not injured	Count	2 (16.7%)	45 (45.0%)	104 (55.3%)	151 (50.3%)
		Expected Count	6.0	50.3	94.6	151
		Std. Residual	-1.6	-0.8	1.0	
Total count			12 (100%)	100 (100%)	188 (100%)	300 (100%)

$x^2 =$ 8.448 df = 2, P = 0.015

Table 2: Injury During Training or Competition and BMI

Variables			BMI				
			Underweight	Normal	Overweight	Obese	Total
Injury during training or competition	Injured	Count	29 (55.8%)	110 (48.7%)	9 (42.9%)	1 (100%)	149 (49.7%)
		Expected Count	25.8	112.2	10.4	0.5	149
		Std. Residual	0.6	-0.2	-0.4	0.7	
	Not injured	Count	23 (44.2%)	116 (51.3%)	12 (57.1%)	0 (0.0%)	151 (50.3%)
		Expected Count	26.2	113.8	10.6	0.5	151
		Std. Residual	-0.6	0.2	0.4	-0.7	
Total count			52 (100%)	226 (100%)	21 (100%)	1 (100%)	300 (100%)

x^2 =2.267, p = 0.519 , df = 3

Table 3: Injury During Training or Competition and Lower Limb Height

Variable			Lower limb height			Total
			Short	Average	Long	
Injury during training or competition.	Injured	Count	36 (55.4%)	83 (52.5%)	30 (39.0%)	149 (49.7%)
		Expected Count	32.3	78.5	38.2	149
		Std. Residual	0.7	0.5	-1.3	
	Not injured	Count	29 (44.6%)	75 (47.5%)	47 (61.0%)	151 (50.3%)
		Expected Count	32.7	79.5	38.8	151
		Std. Residual	-0.6	-0.5	1.3	
Total count			65 (100%)	158 (100%)	77 (100%)	300 (100%)
x^2 =4.899, P =0.086, df = 2						

Table 4: Injury During Training or Competition and Thigh Circumference

Variable			Thigh circumference			Total
			Small	Medium	Large	
Injury during training or competition.	Injured	Count	46 (63.9%)	89 (49.2%)	14 (29.8%)	149 (49.7%)
		Expected Count	35.8	89.9	23.3	149
		Std. Residual	1.7	-0.1	-1.9	
	Not injured	Count	26 (36.1%)	92 (50.8%)	33 (70.2%)	151 (50.7%)
		Expected Count	36.2	91.1	23.7	151
		Std. Residual	-1.7	0.1	1.9	
Total count			72 (100%)	181 (100%)	47 (100%)	300 (100%)

x^2 = 13.273, P =0.001, df = 2

Table 5: Injury During Training or Competition and Calf Circumference

Variable			Calf circumference (cm)			Total
			Small	Medium	Large	
Injury during training or competition.	injured	Count	36 (75.0%)	96 (44.9%)	17 (44.7%)	149 (49.7%)
		Expected Count	23.8	106.3	18.9	149
		Std. Residual	2.5	-1.0	-0.4	
	Not injured	Count	12 (25.0%)	118 (55.1%)	21 (55.3%)	151 (50.3%)
		Expected Count	24.2	107.7	19.1	151
		Std. Residual	-2.5	1.0	0.4	
Total count			48 (100%)	214 (100%)	38 (100%)	300 (100%)

$x^2 = 7.843$, P = 0.020, df = 2

In Table1, it is shown that there is statistically significant association between height of players and lower limb musculoskeletal injuries among footballers (χ^2 = 8.448, p = 0.015) and the alternate hypothesis is accepted. The outcome indicated that 84 (44.68%) of tall players suffered lower limb musculoskeletal injuries, among players with average height 55 (55%) sustained the injuries while short players were the category with highest number of injuries 10 (83.33%).

In Table 2 it is demonstrated that no statistical significant association between player's BMI and occurrence of lower limb musculoskeletal injury (χ^2 =2.267, p = 0.519) and null hypothesis is accepted.

There is no statistically significant association between player's lower limb height and the occurrence of lower limb musculoskeletal injury among footballers in Table 3 (χ^2 = 4.899, p = 0.086), hence null hypothesis is accepted.

The statistically significant association in Table 4 exists between player's thigh circumference and injuries sustained among the footballers (χ^2 = 13.273, p = 0.001), hence alternate hypothesis is accepted. The result showed decreasing trend in injury with increasing thigh circumferences. The result showed 46 (63.89%) of small size thigh circumference to have sustained injuries, 89 (49.17%) for medium size and 14 (29.79%) for large size.

The statistically significant association in Table 5 was between player's calf circumference and lower limb musculoskeletal injury (χ^2 = 7.843, p = 0.020) and the alternate hypothesis is accepted. The result also indicated decreasing trend in injury with increasing calf circumferences: 36 (75%) for small size, 96 (44.86%) for medium size and 17 (44.74%) for large size circumference.

4.2 DISCUSSIONS

The study was carried out to investigate the relationship between BMI, lower limb circumferences (thigh and calf) and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis. The study revealed that there was statistically significant relationship between footballer's height, thigh circumferences, calf circumference and musculoskeletal injuries in lower limbs. While statistically insignificant relationship were observed in footballer's BMI and lower limbs height.

The study showed that lower limb musculoskeletal injuries increases with decreasing height. This is in accordance with finding by Venturelli *et al.,* (2010) which shows that shorter players were injured more from impacts than taller players. This may stem from the current change in soccer style, in which shorter players generally take up offensive positions and have more direct contact with the defenders of the opposing team (Venturelli *et al.*, 2010). According to Zanuto *et al.*, (2010) shorter individuals are responsible for moving the ball down field due to their greater agility. Physical contact through intensive and often violent checking predisposes these athletes to injuries inherent to soccer (Caine *et al.*, 2006). In another study Orchard (2001) reported an increased incidence of quadriceps injury among Australian football players of height less than 182 cm compared with taller athletes. This is not surprising because shorter players has better coordination and have the tendency of holding the Ball to their possession for longer period which will in turn attract more opponents that are willing to get the Ball from them more often violently resulting in injury.

The study did not found BMI to be associated with lower limb musculoskeletal injury which is in line with findings by Wiesler *et al.,* (1996) which did not find BMI to be a risk factor for lower extremity injury among dancers. In a study of general injury risk factors in 136 physical education students participating in intramural sports, Twellaar *et al.,* (1997) found no significant differences in terms of BMI between those who sustained injury and those who did not. The singular reason for this is regular physical activity enhances body fitness. Footballers are not exception due to the rigorous training and highly competitive matches they play. This makes a quite number of them to fall under the normal weight category which is a state of fitness.

The study shows no association between lower limb height and occurrence of musculoskeletal injury in lower limbs among footballers. Although to the best of my knowledge, this has not been investigated in other studies. The possible reason is probably because injury occurrence is better explained with body height due to the significant effect of trunk weight on lower limbs rather than just considering lower limb height as seen in other studies.

The study suggested that thigh circumference was found to have statistically significant relationship with lower limb musculoskeletal injury among footballers. In a study of risk factors for lower extremity injury in 45 recreational basketball players, Shambaugh *et al.,* (1991) found that injured athletes had a greater side to side discrepancy in quadriceps girth than uninjured athletes. Miller (2010) reported that for noncontact ankle sprain, athletes with greater side-side differences in thigh girth were at greater risk. The explanation behind this is lower limb muscles are active in activities like jumping, sprinting, running, kicking, tackling and etc. Contraction of lower limb muscles makes the joint they surround stiff, and the stiffness is directly proportional to the energy generated by the muscles which is also proportional to the muscle bulkiness (size). All these are dependent on the amount of adenosine triphosphate (ATP) they produce as bulkier muscles have greater number of mitochondrion.

The study also pointed out that calf circumference has statistically significant association with lower limb musculoskeletal injuries among footballers. Bennel *et al.,* (1996) emphasized that the physiological cross sectional area of muscle is proportional to the maximum magnitude of force that it can develop; as a result limb girth has received interest as a potential risk factor for lower extremity injury with regard to the muscle's ability to stabilize and control the joints. In a prospective study of risk factors for lower extremity fracture in male and female track athlete Bennel *et al.,* (1996) found association between smaller gastrocnemius girth and injury in women. The same principle for thigh circumference explanation is applied for calf circumference that is calf muscles with greater circumference have greater tendency for stabilizing and protecting the joints they surround.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

The study was conducted to investigate the relationship between body mass index (BMI), lower limb circumferences and lower limb musculoskeletal injuries among footballers of teams in Kano metropolis. From the study it was revealed that 49.7% of football players were injured whereas 50.3% were not. At the end of the study, it was found out that football player's height, thigh circumference and calf circumference were the major factors influencing lower limb musculoskeletal injuries. However, BMI and lower limb height were not found to significantly influence lower limb musculoskeletal injuries.

5.2 CONCLUSION

Based on the findings from the work it was concluded that:

- The incidence of lower limb musculoskeletal injuries among footballers in Kano metropolis is significantly high.
- Height, thigh circumference and calf circumference were the major factors influencing musculoskeletal injuries in lower limbs among Footballers.
- BMI and lower limbs height were found to have no association with musculoskeletal injuries in lower limbs among footballers.

5.3 RECOMMENDATIONS

Based on the findings of this study the followings are recommended:

- Players need to adhere to a regular strength training regimen in their lower limbs to serve as a protective mechanism against musculoskeletal injury especially thigh and calf muscles.
- Knee and ankle braces should be used as protective equipments especially during rigorous matches.
- Coaches and players should have injury preventive techniques seminars.
- Further studies should be carried out in other parts of the country to confirm the study and to explore other risk factors.

RESEARCH BENEFIT

The study helped in revealing the extent to which height and lower limb circumference have influence in causing lower limb musculoskeletal injuries among footballers of teams in Kano metropolis. In addition to that, it will help football players, team trainers and team coaches to consider height and lower limb circumference as predisposing factors to lower limb injuries and take preventive measures to minimize them.

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APPENDIX A

INFORMED CONSENT FORM ON RELATIONSHIP BETWEEN BODY MASS INDEX, THIGH AND CALF CIRCUMFERENCES AND LOWER LIMB MUSCLOSKELETAL INJURY AMONG FOOTBALLERS OF SELECTED TEAMS IN KANO STATE OF NIGERIA

I am Abduljalil H. Maikarfe, a student from Department of Anatomy, faculty of Basic medical Sciences, College of Health Sciences Bayero University Kano. I am carrying out a study on relationship between body mass index (BMI), thigh and calf circumferences and lower limb musculoskeletal injuries among footballers of teams in Kano State metropolis**.** Please appreciate the fact that all information given during the study would remain entirely confidential and will be treated with honesty. Your name is not required so that it will never be used with any information you must have been given.

The information you provide will help in revealing the extent to which BMI and lower limb circumference have influence in causing lower limb musculoskeletal injuries among footballers of teams in Kano state of Nigeria. Additionally, it will help football players, team trainers and team coaches to consider limb circumference and BMI as predisposing factors to lower limb injuries and take preventive measures to minimize them.

The questions in the questionnaires involve the use of simple terms and no question is meant to embarrass you. Refusing to participate from this study is at your liberty.

I will be most grateful if you offer your full co-operation and participation for the successful conduct of this study.

Consent: The study has been well explained to me and I appreciate the entire procedure involved, I volunteer to be part of the study.

___________________ ___________________

Signature/Thumb print of Participant
Date: ____________

Signature/Thumb print of Researcher
Date: ____________

APPENDIX B

DEPARTMENT OF ANATOMY FACULTY OF BASIC MEDICAL SCIENCES, COLLEGE OF HEALTH SCIENCES BAYERO UNIVERSITY KANO

QUESTIONNAIRE ON LOWER LIMB MUSCLOSKELETAL INJURY AMONG FOOTBALLERS OF TEAMS IN KANO METROPOLIS

This questionnaire is designed as an instrument of data collection for research: Relationship between BMI, Thigh and Calf circumference and Lower limb musculoskeletal injuries among Footballers of teams in Kano metropolis.

Please, answer every question appropriately (tick where necessary) as all information will be treated with utmost confidentiality. Thanks for your anticipated cooperation.

SECTION A

1. **Age**

   a) 18 -23 ☐ b) 24-29 ☐ c) 30-35 ☐ d) 36-41 ☐

2. **Tribe………………..**
3. **Qualification**

   a) Primary school level ☐ b) Secondary school level ☐

   c) Tertiary level ☐ d) Others ☐

SECTION B

4. **Height (cm)………………….**
5. **Weight (kg)………………..**
6. **Lower limb height (cm)…………………….**
7. **Thigh circumference (cm)…………………**
8. **Calf circumference (cm)………………….**
9. **Position**

   a) Defender ☐ b)Midfielder ☐ c)Attacker ☐

   d) Goal keeper ☐

10. **Footedness** a)Right footed ☐ b)Left footed ☐

11. **Have you ever sustained injury in the leg during training or competition in the last six month?**

    a) Yes ☐ b) No ☐

12. **If yes, what type of injury have you sustained?**

    a) Cramp ☐ b) Bruise/contusion ☐ c) Abrasion ☐ d) Strain ☐

    e) Sprain ☐ f) Laceration/incision ☐ g) Dislocation ☐

    h) Fracture ☐ i) Others ☐

13. **What causes the injury?**

    a) With contact ☐ b)Without contact ☐ c)No idea ☐

14. **Part of the leg involved(tick which is applicable)**

    a) Foot R ☐ L ☐ b) Ankle joint R ☐ L ☐

    c) Leg R ☐ L ☐ d) Knee joint R ☐ L ☐

    e) Thigh R ☐ L ☐ f) Hip joint R ☐ L ☐

15. **How long were you absent from playing following the injury?**

    a) < 1 day ☐ b)1 – 7 days ☐

    c) 8 - 21 days ☐ d) > 21 days ☐

16. **Duration of play**

    a) < 1 year ☐ b) 1 – 6 years ☐ c) 7 – 12 years ☐

    d) 13 – 18 years ☐ e) More than 18 years ☐

17. **Frequency of days of play per week…………………..**

18. **Do you perform other sport activities (basket ball, volley ball, long tennis), others specify……………….**

19. **If yes how often……………………..**