INCIDENCE AND PREVALENCE OF INJURIES AMONG RUGBY PLAYERS DURING A RUGBY TOURNAMENT

By

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ABSTRACT

Introduction: The world of sports is ever growing and changing, and the popularity of different sports activities has increased in these last three decades. The rugby football sport is collision sport recognized worldwide and heavily supported in Europe, Canada, the Pacific nations and Africa. Rugby at UWC is primarily an amateur sport, and in 2011, the UWC rugby team participated in the First National Bank (FNB) Varsity Shield competition for the first time in history. The sport of rugby football has been identified as being one of the highest contributors of sports injuries at the University of the Western Cape physiotherapy clinic. **Objectives:** The study aimed at determining the prevalence, incidences, locations and re-occurrences of rugby injuries during the FNB Varsity Shield tournament. In addition, the study aimed to identify some of the preventive and management strategies used by the players during the tournament. **Methods:** In a prospective quantitative cohort study, data was collected with a standardized injury report form during training sessions and matches for the duration of the tournament, this instrument was tested for inter and intra-reliability, and the score of the instrument was 80%. The research instruments collected information concerning player's socio-demographic data, sustained injuries, and action taken after an injury. The Statistical Package for Social Sciences (SPSS) version 19.0 was used for analysis. **Results:** Thirty seven (37) rugby players participated in the study. The injury prevalence for the tournament was 86.5%, and the total incident rate was 540 injuries per 1000 playing hours. The match injury incident rate was 256 injuries per 1000 playing hours, and for training it was 266 injuries per 1000 playing hours. In addition, the Backs suffered more injuries compared to the Forwards with an injury prevalence of 56.6% (n=82) and 43.4% (n=63) respectively. Most of the injuries were in the second half, with second half injury

prevalence of 73% (n= 60) compared to first half with injury prevalence of 27%, (n= 22). These injuries were mostly minor and moderate. The lower limb suffered most of the injuries (n=88) (60.17%), and the upper leg (n=27) (18.6%) throughout the tournament. Furthermore, , there was no significant relationship between the injury site and players' position (Fischer exact =23.19, p>0.05), and the re-occurrence of injuries being at 29.7%. The most preventive strategies used were warm-ups, stretches, and straps and taping. In addition, the medical staff used mostly ice therapy, exercises, taping and straps to manage the injuries sustained during the tournament. **Conclusion:** The results of the study identified that the prevalence and incidence rates were among the highest in the world at amateur level of this sport. The re-occurrence of the injuries was significantly higher than in previous studies. Furthermore, most of the injuries were minor and moderate. This showed that the work of the physiotherapist is more critical during sports events.

DECLARATION.

DECLARATION CONCERNING FULL THESIS PRESENTED FOR PARTIAL FULFILMENT OF THE DEGREE OF MASTERS OF SCIENCE IN PHYSIOTHERAPY

I, Samuel Kiwanuka Lubega of The University of the Western Cape, South Africa, solemnly and sincerely, declare, in relation to the thesis entitled,

INCIDENCE AND PREVALENCE OF INJURIES AMONG RUGBY PLAYERS DURING A RUGBY TOURNAMENT.

I did this work, personally. In addition, the material has not previously been accepted in whole, or in partial, for any other degree or diploma.

Samuel Kiwanka Lubega

Signature..... November 2011

Prof. Julie Philips (witness)

Signature..... November 2011

DEDICATION

To my mother Nankya Jalia Bulwadda, and my grandmother late Najjuko Florence.

To my beloved daughter Najjuko Sarah Nansamba and my brother Richard David Kamoga.

To my staff Deborah Nalubowa and my friend Esther Asiimwe.

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KEY WORDS

Injury

Rugby

Prevalence

Incidences

University

Prevention

Management

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CHAPTER ONE

INTRODUCTION

1.0 INTRODUCTION TO THE CHAPTER

The present study investigates the incidence and prevalence of rugby injuries sustained by rugby players of the University of the Western Cape during the First National Bank Varsity Shield Cup tournament. The study also identifies the location and recurrence of these injuries. It further report on the prevention and management strategies used during the tournament. This chapter contextualizes the importance of the study, highlighting the benefits of sports generally, definition of rugby, the brief history of rugby, and the sport of rugby in South Africa since 1860s to the present. It highlights numerous contributing factors exposing rugby players to these injuries and the consequences of these injuries. This chapter further presents and outlines the aims and objectives of the study.

1.1 BACKGROUND TO THE STUDY.

The word "sport" originates from French, Greek and Chinese, meaning activities related to physical training or athleticism. The world of sports is continuously growing and evolving. The popularity of different sports activities such as soccer, rugby football (MacQueen & Dexter, 2010), basketball, tennis, golf and athletics have increased in this last three decades (Mclntosh *et al.*, 2008; Sandelin & Santavirt, 1991). Today sports participation is no longer aimed at just having fun but winning medals, becoming famous, and other economic benefits (Ljungquvista *et al.*, 2009). It is often claimed that sports or any other form of physical activity, when performed regularly, helps to reduce the risks of premature mortality rate, and several diseases such as: type

II diabetes, coronary heart diseases and hypertension, obesity, and colon cancer, which are dependent on one's life-style (Ljungvista, 2008; Middelkoop *et al.*, 2008; D`Souza, 1994). The above-mentioned researchers maintain to affirm that sports participation helps to reduce early developmental disorders of various kinds. In addition, participation in sports, aims at achieving elite and professional level of sporting (Goldberg *et al.*, 2007). The above benefits have contributed to the increase in the sports support and participation, especially at collegiate level (Hootman *et al.*, 2011; MacQueen & Dexter, 2010).This study aimed at looking for the commonest injuries in collegiate (University) rugby union football.

The current sport under discourse is the rugby football sport. In the 16th century, rugby school gave birth to the current rugby football. Rugby football consists of rugby union and league, which are played by professionals and amateurs (Gabbett, 2005; Viljoen, 2003). The Rugby Union consists of two main groups of players for each team (8 Forwards and 7 Backs) on the field, and seven or eight reserves for interchange depending on which rank of the union or league level (Brooks & Fuller, 2006; King D, Hume P, Milburn P, & Guttenbeil D, 2010); . The demands on the players vary according to the specific position played (Gabbett, 2005), possibly contributing to a different injury profiles in the sport (Hoskins *et al.*, 2006). The Forwards are made of two Props, one Hooker, two-second Rowers, and one Lock which are mostly involved in large number of physical collisions and tackles. The Backs sector consist of one Halfback, one standoff No. 8, two Centers, two Wings and one Full Back which spend more time in free running but are also involved in tackles and collisions (MacQueen & Dexter, 2010; Gabbett, 2005). The fifteen players can be temporarily or permanentary substituted at any time during the game because of a bloody injury and severe injury or for a tactical reason respectively (Brooks & Fuller, 2006). It is the only contact sports where the rules for women and men are the same

(MacQueen & Dexter, 2010). It is claimed that rugby is one of the most violent sports played in the world to date. It is further claimed that violence and intimidation have become integral part of rugby strategy (Viljoen, 2003).

An Englishman named William Webb Ellis is often credited with the pioneer status of modern rugby and it is understood that he first created the sport of rugby around 1823, hence the rugby World Cup is named the Ellis Webb trophy,. It is understood that he once picked up a soccer ball in a direct disregard to the usual rules during a match and ran with it and after that "incident" rugby main rules were born (MacQueen & Dexter, 2010). Today, it is estimated that there are four million athletes around the globe who are members of rugby football union (MacQueen & Dexter, 2010). In 1995, the International Rugby Board (IRB) introduced the game of rugby as a professional sport. This was seen as a way of preserving the game of rugby as well as maintaining the players (Puren & Barnard, 2007).

In the twentieth and twenty-first centuries, there was a great development in the sport of rugby worldwide (MacQueen & Dexter, 2010). These developments include nations changing from rugby union to rugby league (King *et al.*, 2010), from amateur to semi-professional and professional rugby football leagues (Gabbett, 2005). Currently, there are many flourishing professional rugby football clubs around the world. In addition, during the 2016 International Olympic Games (IOG), the International Olympic Committee (IOC) approved that rugby football will also be staged like other contact team sports (MacQueen & Dexter, 2010; Brooks *et al.*, 2005). In some countries such as New Zealand, Russia, Australia, France, Republic of Ireland, the United Kingdom, South Africa and several Pacific island nations, including Fiji, participation and support has dramatically increased. With this increased profile, there is likely to be an even higher influx of junior and amateur players into the sport (McManus, 2004). In USA,

there is significant increase in the number of participants at high school and college level. As such, among the contact sports it is second to soccer, with reports claiming that the support is growing by 25% per annum (MacQueen & Dexter, 2010). These numerous changes have had a profound effect on the sport, such as the way the game is played, the level of fitness, and the meticulousness every player must have. This high quality fitness requires players to train hard and longer as a pre-requisite to playing in the professional teams (King *et al.*, 2010).

In South Africa, the sport of rugby is one of the main professional sports, and second to soccer among the team contact sports with high number of supporters (Viljoen, 2003). The sport of rugby was introduced on the South African soil in 1860. According to literature survey, the first international game was in 1891, between South African Springboks and the British Isles (commonly known as British Lions) in Port Elizabeth. At the time of writing this thesis, South African Springboks is the current world cup champion of the rugby football union; they won the cup in France in 2007 (The History of South African Rugby, 2011).

There are also various competitions on the South African rugby football calendar, included among them; Super 14 Rugby (previously called Super 12), Currie Cup, Vodacom Cup, Craven Week Cup, the IRB Sevens World Series, South African Sevens Cup and Intervarsity Cups.

The intervarsity cup competition started in 1918, held between two universities, the Victoria College and South African College today known as the University of Stellenbosch and the University of Cape Town respectively (History-UCTRFC, 2011). In 2008, South Africa Rugby Union introduced the varsity cup; this was seen as a way of promoting rugby union football in the universities. In addition, they contribute to semi-professional and professional clubs with competent players. This competition is the third most important domestic competition on the

South African rugby football calendar after the Curie cup and Vodacom Cup. In this competition, currently there are two sections: section A (Varsity cup) and section B (Shield cup). The Varsity Shield Cup started 2011 as a way of keeping pressure on the teams in the section A. Every year, there is promotion and relegation playoff. The first team or the winner in the shield cup replaces the last team in the section A (Varsity Cup). The teams in the Shield cup are motivated to join, and compete in the elite university Varsity Cup (Central University of Technology coach conversation).

The game of rugby football is highly physical; requiring a combination of strength, aerobic and anaerobic endurance; stamina, and agility (MacQueen & Dexter, 2010; Hoskins *et al.*, 2006). It is widely reported that high speed, body contacts collision sports are important source of injuries to participants, as seen in rugby leagues (Gabbett, 2005). The intense physical nature of the game requires players to draw upon a variety of fitness components, including muscular strength and power, endurance, speed, acceleration, and agility (Gabbett, 2000). Because of intermittent and contact nature of the game, the physiological demands of rugby football are complex (King *et al.*, 2010). Players require maximal aerobic power, speed, muscular strength, and agility appropriately developed to be able to compete in such a match environment (King *et al.*, 2010). The elite athletes, with this evidence of quality of hard work they do (McKenna, Delaney & Phillips, 2002) in order to meet the demands and excellent performance increase the likelihood of sustaining injuries (Beardmore *et al.*, 2005). D`Souza (1994) highlighted that, the higher the level of performance at which these athletes competed, the more likely they were to be injured.

The risk of rugby injuries is comparable to another sport known as Rodeo, where the environment is completely unforgiving, and there is limited protection as humans compete with animals in a traditional way. In such an environment, the potential for severe injuries is imminent

(Meyer & Laurent, 2010). Garraway & Macleod (1995) reported that, injuries are important source of morbidity in young players. Despite some studies reporting the sport of rugby being as safe as any other contact sports such as ice hockey, and soccer (Collins *et al.*, 2008), this has not been the trend in the last two decades in rugby football. Because of the increased demands on athletes to reach the elite level, and even show performance, this has prompted them to often have intensive and longer training periods (Viljoen *et al.,* 2009). This change in the physical activities of the athletes has increased the risk of acute and overuse sports injuries (Wong & Mafuli, 2003), coupled with increasing number of participants in the sport of rugby (Collin *et al.,* 2003). Kevin *et al.* (2006) reported that the high intensity of the game, over-training and ball being in play for a long time contribute to players' risk of acquiring an injury. Furthermore, injuries are extremely common because of the high number of body contact collisions, and dynamic nature of the game (MacQueen & Dexter, 2010; Hoskins *et al.*, 2006 and Mahaffey *et al.*, 2006). Gabbett (2005) has indicated that, because of physical collisions and the nature of the game, musculoskeletal injuries are the commonest. Some studies in the Scottish league comparing junior teams and the senior teams, found the injury incident rate was higher in the senior team compared to the junior teams (Nicol *et al.*, 2010; Sharp, Murray & Macleod, 2001; Garraway & Macleod, 1995). This shows that high injury incident rates are recurrent themes of injury epidemiological studies in the sport of rugby (Gabbett, 2000).

The consequences of injuries do not only affect the players, but also the coach, the team, parents, work and school education. For the team, the success hinges on how many players are available for selections so that, the more injuries the team has; the lesser are the chances of winning (Beardmore *et al.*, 2005). The injured collegiate athletes often miss classes; parents lose several hours of work productivity, and the injured player experiences a negative psychological

consequence such as mood swings and lowered self-esteem (Goldberg *et al.*, 2007; .Brewer cited in Podlogy & Eklund, 2009). Yang *et al.* (2010) indicated that the psychological distress for an injured player evokes anger, depression, anxiety, tension and low self-esteem. Further evidence has shown that the sport of rugby is reported to result in more hospitalizations and visits to the emergency room compared to any other sporting code (Mahaffey *et al.*, 2006). In England and Wales, soccer accounted for more than 25% of all exercise related morbidity, furthermore, the risk of a substantive injury resulting in treatment costs or participants being unable to take part in the normal activities are three times higher in rugby than soccer (Mahaffey *et al.*, 2006). In US, half a million athletes consult doctors, this result in thirty thousand hospital admissions each year, which costs the US health care system over $2 billion annually. A serious injury affecting the players' ability to play will have an effect in more than one legal area, such as a detrimental effect on the injured players ability to perform in terms of contract with the union, and when an extrinsic injury occurs, the person responsible for such an injury may incur criminal or delictual liabilities or disciplinary action (Viljoen, 2003).

It is evident that data concerning players' injuries at all levels such as professionals, semi-professionals, amateurs and youth leagues is not well coordinated (Hoskins *et al.*, 2006). Several studies which have reported incidences of injuries in amateur rugby league, indicating differences in fitness and skill levels, ground conditions, refereeing standards, attitudes towards aggression and violence, compared to professional rugby players, and therefore injury rates are reported high in amateur rugby union players (King *et al.*, 2010; Gabbett, 2000). Furthermore, at amateur level there is evidence of more injuries especially in poorer performing clubs, but recent research has shown injury prevalence and incidences being the same at all the levels of play (Sandeline & Santavirtas, 1991). Ljungjvist (2009) cautions that all athletes would want to

perform to the best of their ability but injuries prevent them, and there is no guarantee that these injuries will occur but measures should be put in place, such that when this does occur it is handled professionally.

There is paucity of published information as regards to injury incidences, prevalence, nature, causes and mechanisms amongst South African universities rugby football players. The few studies reported in literature about incidences and prevalence of injuries in rugby football union, most of the studies are carried out on professional players, semiprofessional players, as well as on intra-university rugby competitions and at secondary schools in developed countries such as USA, England, New Zealand and Australia (MacQueen & Dexter, 2010; Garraway & Macleod, 1995; King *et al,* 2010 ; Grobler, 2004; Finch *et al.*, 1999). Moreover, the findings cannot be compared to rugby football union of South Africa inter-Universities, specifically UWC.

1.2 PROBLEM STATEMENT

There is noticeable increase of young athletes in the sport of rugby due to media attention, corporate sponsorship; product licenses and prize money. With the increase of the young athletes in the sport, we subsequently expect increase in the trauma and fatality cases. It is further reported that most injuries occur at amateur level, and this is where the majority of young players are recorded (King *et al.*, 2010; McManus, 2004). As such, there is a need for guided, well informed and coordinated medical community attention especially physiotherapists towards the prevention and management of sport injuries (King *et al.*, 2010; Meyers & Laurent, 2010).

It is widely noted that, despite of the rule changes in amateur and professional rugby union football, injury profiles have not changed (Puren & Barnard, 2007; Bathgate & Maclead, 2000). This is because the emphasis is put on the players speed, size, strength, and endurance, but not

on the players safety (Puren & Barnard, 2007; Garraway *et al.*, 2000). Very few prospective studies report less injuries during training (King *et al.*, 2010) compared to matches, despite of 16-30% of these studies, reporting high levels of severe injuries. In addition, research about the sports injuries in youth rugby football in South Africa has not been extensive. The available information is from high schools, hostel or inter-residence competitions, very few studies are published during competitive tournaments between universities (Nicole, Pollock, Kirkwood, Parekh and Robson, 2010; Hoskins *et al.*, 2006; Grobler, 2004; Seward *et al.*, 1993). For example, the most recent studies done in South Africa were carried out on the professional, high school and junior schools, and for the few studies done on university competitions, they are intra not interuniversity competitions. The available information on studies about sports injuries suggests an indication of differences in injury definition, survey period and the severity of injuries (MacQueen & Dexter, 2010; Viljoen *et al.*, 2009; Brooks & Fuller, 2006; Grobler, 2004; Garraway & Macleod, 1995). This makes injury surveillance studies incomparable. Furthermore, these studies have different sample size and age differences (Mahaffey *et al*, 2006). Therefore, studies on injury incidences, prevalence, risk factors, nature, and mechanisms, have suffered inconsistencies in the injury definition, severity, sample size and age, play levels and research designs. This affect the way data is analysed and reported, and cannot significantly support the recommendations made. Therefore, in the development of rugby football, it is always very important to continuously carry out injury surveillance studies (Brooks *et al.*, 2005; Brooks & Fuller, 2006). The sports department at the UWC has no formalized way of collecting players' injury data, such as; carrying out injury surveillances, injury management, and follow ups of the player, and the consequences of these injuries. To try identifying the rate of injuries at UWC

would require the use of inconsistent data and incomplete players' registrations. As a result trying to establish the injury incidence rate becomes a challenge.

Therefore, due to the above problems, there was a need to do a study on the UWC-FNB rugby team, during a competitive tournament that lasted for 60 days. It would help towards making informed decisions about prevention and management of injuries by the UWC sports administration.

1.3 SIGNIFICANCE OF THE STUDY

As far as sports events are concern, sports injury surveillance during competition or training sessions is part of the duty of care to the participants, this will help to make the events safer both in present times, and for the future.

During the end of 2010 season, the UWC rugby club teams were at their highest level of competitiveness in the first division of the Western Province Rugby Football Union (WPRFU). It was also preparing to play in the Varsity Shield Cup for the first time in 2011. Because of these preparations, more training sessions and high match intensity were expected, and as such, players were at risk of sustaining injuries during the tournament. In addition, at such level of competition, there is more aggressiveness, which could cause changes in their injury profile, and this is a challenge to the injury management team. The scientific process of preventing sports injuries requires an accurate and reliable understanding of the burden of these injuries. Epidemiology studies play a key role in understanding improved management of sports injuries, such as developing, applying and assessing of injury causes, prevention and better management techniques. McIntosh *et al.* (2008) highlighted that injury management is still a major challenge in the developing countries (this includes proper medical preparations, quicker diagnosis, urgent

treatments, presence of doctor/ therapists, easy communication). This is because of the lack of understanding of the site, nature, and cause of these injuries to specific player position (Gabbett, 2005).

In addition, the different changes that rugby football goes through, it is inevitable that frequent research is not conducted. This information benefits promoters of rugby football, and policy makers to identify suitable preventive and safety priorities, which make the game safer. This study will help coaches, sports promoters, and athletes on the modification of skills or training patterns to lower the risk of injuries. It will further help the medical team involved in the management of these injuries to make viable evidenced decisions.

As sports continue to grow, it is important that physiotherapists have a good understanding of the demands and peculiarities of sports. This is to provide the appropriate evidence-based treatments on the sideline (MacQueen & Dexter, 2010). In addition, legal officials heavily rely on the work of the medical team for evidence such as doctors, physiotherapist, biokineticits, and first Aid officials. It is stressed that the work of a medical team is not only necessary but also very crucial as clinical evidence for a sports injury case (Viljoen, 2003). This is because the mechanism of an injury is very crucial in establishing liability to the coaches or referee to incur liabilities because of their failure to control the foul that caused the injury (Viljoen, 2003).

The points above suggest the significance of epidemiological data, as there is evidence that injury prevention programmes and rule changes have been successful in decreasing the number of catastrophic injuries in rugby football union (MacQueen & Dexter, 2010). Players' injuries are of great importance to the individual team's success and for their livelihood, especially for professional and semi-professional rugby players, and for students' academic excellence (Seward

et al., 1993). Therefore, the study will help in the prevention of severe injuries, because it will provide guided evidence to the physiotherapists as far as the management of sports injuries are concern, and reduce financial costs and psychological effects that may accompany these injuries.

1.4 RESEARCH QUESTION

What were the incidences and prevalence of injuries among rugby players at UWC during the 2011 FNB-Varsity Shield Cup tournament?

1.5 AIM OF THE STUDY

To determine the incidences and prevalence of injuries among rugby players of UWC during the FNB-Varsity Shield Cup tournament.

1.6 OBJECTIVES OF THE STUDY

The primary objective of the study was;

1.7.1 To establish the cumulative incidences of injuries among rugby players during the FNB Varsity Shield Cup tournament

The secondary objectives of the study are:

1.7.2 To establish the prevalence of injuries among rugby players during the tournament.

1.7.3 To establish the location and recurrence of injuries among the rugby players during the tournament.

1.7.4 To identify the mechanisms of injuries that occurred during the tournament.

1.7.5 To determine the management / treatment of injuries sustained by the players during the tournament.

1.7.6 To investigate whether there was possible preventative measures among the rugby players.

1.7 DEFINITION OF TERMS.

Forwards: Classified as players numbered 1 to 8 and referred to as "ball winners" (Duthie *et al.*, 2003). Within the Forwards, players 1 to 3 are referred to as the "front row", while 1 to 5 are commonly known as the "tight 5". The locks (players 4 and 5) form the "second row". The "loose Forwards" are players 6 to 8, and referred as the "back row".

Backs: Classified as players numbered 9 to 15 and referred to as "ball carriers" (Duthie *et al.*, 2003). Within the Backs, half Backs" players 9 to 10, while 9 to 13 are commonly known as the "inside Backs". The "midfield Backs" (centers) are 12 and 13, and "outside Backs" are 11, 14 and 15.

Scrum: The scrum is a way to restart play after a minor infringement or a stoppage. A scrum is formed in the field of play when eight players from each team, bound together in three rows for each team, close up with their opponents so that the heads of the front rows are interlocked. This creates a tunnel into which a scrum half throws in the ball so that front row players can compete for possession by hooking the ball with either of their feet (SA Rugby, 2007).

Maul: A maul occurs when a player carrying the ball is held by one or more opponents, and one or more of the ball carrier's team mates bind on the ball carrier. A maul therefore consists of at least three players, all on their feet; the ball carrier and one player from each team. All the players involved must be caught in or bound to the maul and must be on their feet and moving towards a goal line (SA Rugby, 2007).

Ruck: A ruck is a phase of play where one or more players from each team, who are on their feet, in physical contact, close around the ball on the ground (SA Rugby, 2007).

Injury: Any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, which was sustained by a player during a rugby match or rugby training, irrespective of the need for medical attention or time-loss from rugby activities. For an injury that results in a player receiving medical attention is referred to as a 'medical-attention' injury and an injury that results in a player being unable to take a full part in future rugby training or match play as a 'time-loss' injury. (Fuller, 2007*).*

Injury Re-occurrence: Injury of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury. A recurrent injury occurring within 2 months of a player's return to full participation is referred to as an 'early recurrence'; one occurring 2 to 12 months after a player's return to full participation as a 'late recurrence'; and one occurring more than 12 months after a player's return to full participation as a 'delayed recurrence' (Brooks & Fuller, 2006).

Severity:

Minor injury: any injury where a player was able to return to the field and play the match or continue with the training sessions after the injury has occurred or between day 0 to day one (0< 1).

Mild injury: any injury, which caused a player to miss one week (7 days).

Moderate injury: any injury that caused a player to miss two weeks (14 days).

Severe injury; any injury that caused a player to miss more than two weeks.

Prevalence of injury: Refers to the proportion of athletes who have an existing injury at any given point in time.

Incidences of injuries: The number of new injuries that occurred over a specific period, that is to say, from the start of the study to the end (Knowles, Marshall & Guskiewics, 2006).

Therefore, the **risk** is the number of injured athletes of the whole team, and the **rate** is the number of injuries sustained by the whole team.

Population at risk: was defined as the players who were selected or usually selected to participate in the FNB Varsity Shield Cup tournament.

Time at risk: Considered as time during the match without (extra time) and time spent on training.

Sport: Any activity, experience the human can practice to increase the level of activity to the body, and it is focused on fitness, recreation, athletics or leisure (Richard, 2005).

Semi-professional: These players receive moderate remuneration to play rugby league, and rely on additional employment to generate income.

Amateur players: These players do not receive match payments.

Professional players: These players generate their income from their involvement in rugby league.

1.8 ABBREVIATIONS USED IN THE STUDY

IRB: International Rugby Board.

FIFA: Federation of International Football Associations.

IOC: International Olympic Committee.

SARU: South African Rugby Union.

WPRFU: Western Province Rugby Football Union.

UWC: University of the Western Cape.

DR ABC: Danger, respond, Airway, Breathing, and Circulation.

SALTAPS: Stop, Look, Touch, Active movement, Passive movement, and Stand up.

1.9 OUTLINE OF THE THESIS

Chapter one describes the importance of sports generally, discusses the origin and definition of the sport of rugby and developments in the sport of rugby. It further contextualizes the importance of the current study, problem statement, the significance of the study and the aims and objectives of the study.

In **Chapter two**, the literature review highlights essential issues that informs the current study such as clarifications of terms used in rugby injury studies, prevalence, incidences, nature, causes and mechanisms, severity and location of the rugby injuries. It further highlights the relationship that exists between these injuries to broad and specific player positions, and review of the standard management and prevention of these injuries.

Chapter three discusses the methodological issues used in the study, including; study setting, population and sampling, study design and instruments used, methods of data collections and all procedures employed to complete this research. It further discusses how data was analyzed and the ethical issues considered during the research.

Chapter four presents a brief description of the main results from the study. The bio-social demographic information of the UWC-FNB rugby players, prevalence, incidences, types, causes,

severity and location of the injuries. In addition, it presents the relationship of these injuries to the Back and Forward players, and ends with the reporting of the prevention strategies and injury management methods used during the tournament.

In **Chapter five** the results of the current study are interpreted, and compared with similar studies as per the reviewed literature. It further discusses how the problems related to this study can be resolved, and finally the chapter ends with study limitations.

The **final chapter** is the summary of the study, which presents the conclusive information about the study, and recommendations from the research. It provides suggestions for further work or research in this area of the current study.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter reviews various sources of literature on rugby injury surveillances, prevention and management in developed, and developing countries, including South Africa.

Given the broadness of the sports injury field, this review of literature cannot provide the comprehensive coverage of all the relevant issues. It will therefore focus first on the clarification of the key areas in rugby footballs injury surveillances. Followed by the prevalence, incidences and causes/mechanisms of sports injuries. It will look at the rugby injury characteristic profiles such as the common injury locations on the body parts, nature/types, and severity of the injuries, broad and specific positions of players on the field with the most injury risks, the period / game time mostly at risk to these injuries. It will further look at the sports injury prevention methods in general, and specifically to rugby football and it will end with the management of these injuries.

2.1 CLARIFICATION OF THE KEY AREAS IN RUGBY FOOTBALLS INJURY SURVEILLANCES

In the literature, there have been key areas that required clarification because of the varying opinions from different authors these aid in developing a common understanding when carrying out sports injury surveillance in rugby football. These areas will include the sports injury definition, sports injury causes and mechanisms, sports injury severity, location and recurrence of the injuries, sports injury type /nature, risk exposure period and incident rates.

2.1.1 Sports injury definitions

The sports injury definition ensures the collection of appropriate sports injury data, and it further enables comparison of data within the current literature as to create, and write a meaningful academic conservation. For example, the council of Europe defined a sports injury as one that occurs whilst participating in sports and leads to one of the following consequences: a reduction in the amount or level of sports activity, the need for advice or treatment, and /or adverse economic or social effects (Watson cited by King, 2006). This definition has been criticized for not being suitable to collect data concerning the incidences of sports injuries in many sporting codes (Stevenson, Hamer, Finch, Elliot, & Kresnow cited in King, 2006; Luke *et al.*, 2002). Noyes, Lindenfield and Marshall cited by King (2006:19) urged that a definition of sports injury should be one that excludes lumps, bumps, and bruises but includes any medical care that can go beyond ice, and bandaging. However, 25-65% of the injuries are transient/ minor or mild and these involve more of the soft tissues and often require ice and bandaging as the appropriate treatments (Oluwatoyosi & Owoeye, 2010; Jelsma *et al.*, 1997).

The National Collegiate Athletic Association (NCAA), currently one of the largest athletic database, defined sports injury as one that result from participation in an organized collegiate practice or game, and requires medical attention by a team athletic trainer or physician, and result in restriction of the student athlete's participation for one or more days beyond the day of the injury (Dick, Agel & Marshall, 2007). The medical attention definition has been criticized, as it is likely not to record minor injuries. In addition, some teams do not have access to medical staff, so there is likelihood of creating bias from various surveillance studies. It is therefore

suggested that an instrumental manual for all injury definitions would provide a solution to such biasness (Hagglud, Walden, Bahr & Ekstrand cited by Naidoo, 2008:41).

According to FIFA, an injury is defined as any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time loss from football activities. This injury definition includes three important aspects: (1) all injuries (not only time loss or reduced performance), (2) newly incurred (exclusion of pre-existing and not fully rehabilitated injuries), and (3) exclusion of illnesses and diseases (Fuller *et al.*, 2007).

Another study by Mahaffey *et al.* (2006) used the injury definition that included; any interruption of normal training or match participation or the need for medical attention. The author further explained that the interruption or need for medical attention might be caused by;

1. Players who had been injured during a match and had been temporary or permanently replaced for the rest of the match.
2. Players absent from match or practices as a direct result of rugby injury
3. Players who had received medical attention for a rugby injury sustained during a rugby practice or match.

Note: An injury that results in a player receiving medical attention is referred to as a "medical-attention" injury, and an injury that results in a player being unable to take a full part in future football training or match play as a "miss match" injury (Fuller, 2006). However, medical attention is not recognized due to the fact that, the variations in medical support may create a difference in the incidences of injuries reported between studies (Bahr, 2009). The time loss or

miss match definitions' strength lies on the fact that records can be obtained from various source such as medical records, from coach attendance records, or parents/caregivers.

It is therefore seen that in the current literature about the sport of rugby, several authors have applied different injury definitions to collect data about rugby injuries such as:

"a physical impairment received during a competitive match that prevented a player from being available for selection to play in the next competitive game" (Gissane, Jennings, Cumine, Stephenson & White, cited by King, 2006; Brooks, Fuller, Kemp and Reddin, 2005; Nicol, Pollock, Kirkwood, Parekh & Robson, 2011; King, Clark, and Kellmann, 2010; Garraway and Macleod, 1995; Erasmus & Spamer, 2007; Sharp, Murray & Maclead (2001).

and

"any unintentional or intentional damage to the body resulting from participation in any pastime or game requiring physical effort that is undertaken for amusement, diversion or fun", (Chalmers cited by King, 2006).

and

"Injuries presenting for treatment (by appointment with Sports Physician or other doctor) at a sports medicine center" (Baquie, & Brukner cited by King, 2006; Mahaffey *et al.*, 2006; Holtzhausan, Schwellnus, Jakoet & Pretorius, 2006; Viljoen, Saunders, Hechter, Aginsky & Millso, 2009). Therefore, the most commonly used definition of a sports injury in rugby Union found in the literature survey is:

"any pain or disability suffered by a player during a match or training session (Grobler, 2004; Gabbett, 2003; Gabbatte, 2005; King, 2006; Junge, Cheung, Edwards & Dvorak, 2004)…during

or immediately after the match or training session and that which caused the player to miss subsequent games, or training sessions and needed advice and /or treatment" (Gissane, Jennings, Cumine, Stephenson & White cited by King, 2006; Brooks, Fuller, Kemp and Reddin, 2005; Nicol, Pollock, Kirkwood, Parekh & Robson, 2011; King, Clark, and Kellmann, 2010; Garraway and Macleod, 1995; Erasmus & Spamer, 2007; Sharp, Murray & Maclead, 2001).

The various disputes and discussions around the sports injury definition (Van Machelen, Hlobil & Kemper, 1992; Orchards & Hoskins cited by King *et al.*, 2010), and their lack of a common understanding of the standard definition for rugby injuries (Van Mechelen, Hlobil& Kemper; Finch, 2006 cited by King *et al.*, 2010) has resulted in a large discrepancy in the reported results, and conclusions about rugby injuries (Gabbett, 2005; Gabbett, 2004; Hodgson *et al.*, 2006; Orchard & Seward, 2002; Van Machelen, Hlobil & Kemper cited by King *et al.*, 2010). It is therefore clear that, this last sports injury definition has comprehensively included all the injuries in all the disputed aspects of the sport participation. However, any physical complaint definition of sports injury has been challenged because most players have complaints, otherwise many injuries may go unrecorded (Bahr, 2009).

Therefore, the advantage of a broad injury definition is that it becomes possible to assess the effect of the full spectrum of injuries from mild contusions to fractures. This helps in assessing the long-term consequences of injuries, because the analysis of injury sequences shows moderate or major ones are often a result of minor injuries, and acute complaints are a predictor of subsequent injuries. In addition, athletes sometimes compete despite an injury.

The injury cause has also been an area of serious debate in the sport of rugby. Injury causation is usually complex, but understanding the mechanism of sports injury is critical to advance in

epidemiology knowledge towards sports injury prevention (Meeuwissee cited by Florenes, 2010; Gerrald, Waller & Bird, 1994), and therefore decreasing the prevalence and incidences of injuries (Holtzhausen, Schwellnus, Jakoet & Pretoruis, 2006). The causes of sports injury have been reported by Bahr and Krosshaug cited by Florenes (2010), to involve internal and external factors. The internal factors include: age (maturation and aging), sex, body composition (body weight, fat mass and anthropometry), health of the athlete (history of previous injury, and joint instability), physical fitness (muscles, strength, power speed, agility, and joint range of motion), anatomy of joints (alignment, intercondular notch and width), skill level (sports specific techniques and postural stability), and psychological factors such as competitiveness, motivation and perception of risks. External factors are: sports related factors such as coaching, rules and referees, protective equipment, sports equipment, and environmental factors. Gerald, Waller and Bird indicated that vigorous attempts such as skill of tackling, scrummaging, rucking, mauling and lineout, and are highly associated with soft tissue contusions, joint strains, fractures, dislocations and lacerations. It is therefore important to note that the cause of sports injury is all factors that lead to an injury, and the mechanism of an injury explains, how these factors leads to injuries (Meeuwisse cited by Florenes, 2010). Such mechanisms may include contact situations such as tackling, rucks, mauls, line out, collisions, foul play and kicking specifically in the sport of rugby. Non-contact situations may include chronic overuse, over exertion following open running or a ball staying in the field for a long time, and muscle fatigue (Holtzhausen, Schwellnus, Jakoet & Pretonuis, 2006).

In the sports injury surveillance studies, the severity of sports injuries has been reported differently from the various authors. The National Athletic Injury/ Illnesses Registration System (NAIRS) suggests that a minor injury is an injury that cause a player to miss seven days (one

match and probably 2 training sessions). Amoderate injury may cost a player from eight to twenty-one days of absence from sports activity, and a serious injury above twenty-one days or suffering permanent damage (Junge & Dvorakcited by king, 2006: 23). Other authors have attributed a minor injury to be less than seven days, moderate injury from seven to twenty-eight days, and severe injury above twenty-eight days being a severe injury (Junge & Dvorak, 2000; Sandelin *et al.*, 1987 cited by King, 2006:23). According to the Scotland Rugby Union, a mild injury restricts a player from training and playing for up to 28 days, a moderate injury cost a player between 28-84 days, and severe injury above 84 days (Garraway & Macleod, 1995 cited by King 2006). Other scientists in the field of epidemiology have determined the severity of injuries based on the hospital-assessed injury is reported severe, the professional assessed injury is said to be moderate, and on field, care or self-assessed injury is reported as mild (Steven, Hamer, Finch, Eliot & Kresnow, 2000). Van Mechellen (1992, 1997 cited by King, 2006) recommended that the severity of the sports injury should be based on six criteria;

1. The nature of the injury,
2. The nature and duration of the treatment,
3. The time lost from sporting activity,
4. The time lost from work activity,
5. Any permanent damage and,
6. The cost associated with the injury (Gabbett, 2004; Van Mechelen 1997; Van Mechelen, Hlobil & Kemper cited by King, 2006: 24).

In further development, the consensus statement in the sport of rugby union injury severity definition recommends that the severity of an injury should be based on time loss or days lost

from competition and practice. This means the number of days that elapses from the time a player is injured to the time a player returns to the team for training and is available for team selections. It further encourages these injuries to be grouped, for example:

1. Slight injury is said to be between 0-1 day,
2. Minimal injury should be between 2-3 days,
3. Mild injury should be between 4-7 days,
4. Moderate injury should be between 8-28 days,
5. Severe injury should be between 28<, this includes career-ending type of injuries, and non-fatal catastrophic injuries (Fuller *et al.*, 2007). However, Bahr (2009) indicated that, in case of overuse injuries to be included, a functional limitation definition would be appropriate.

However, most of the authors in the literature have used the severity definition as;

1. The transient (minor) where the player did not need to miss any sporting activity,

2. The mild injury, where the player missed a game or one-week absence from the sporting activities.

3. The moderate injury, where a player missed two to four weeks from sporting activities,

4. The severe injury, where a player was absent from the game or training more than four weeks (McManus, 2000; King, 2006).

These injury severity definitions are considered very useful as it enables the comparison between with other sports injury literature, especially in the sport of rugby, and can report all the type of injuries that occurrs in the game, enabling a greater database to be established thus ensuring that

all injuries are able to be identified (King, 2006: 24; Bahr, 2009). However, it is reported that, transient/non missed match injuries, for some authors who may not record them, but these injuries can have a long term effects on the players (Drawer & Fuller cited by Florenes, 2010). In the current study, the researcher used this last definition.

The location and re-occurrence of sports injury is another area of interest in sports injury surveillance reports. Fuller *et al.* (2006) suggested that the location of an injury should be reported as main and categorical groupings shown in the Table 1 below. In addition, these injuries are reported according to the anatomical locations on the body of an athlete. However, when the incidences of injuries are fewer, then the main grouping should be applied (combining individual categories into a main group).

Injury recurrence has been also an area of serious discussion. Fuller *et al.* (2006) indicated that a recurrent injury is the injury of the same type and at the same site as the index injury, and which occurs after a player's return to full participation from the index injury. The specific sites of such an injury, in case of ligament or muscles should be used when reporting recurrent injury, instead of general locations such as thigh or knee. The same authors further explained that an injury occurring within 2 month period of a player's return to full participation is an early recurrence, beyond 2 to 12 months is a later recurrence, and beyond 12 months after a player's return to full participation is a delayed recurrence. It is highlighted that the sports injuries, which lead to contusion, lacerations, and concussions and sequelae resulting from the index injury, should not be recorded as a recurrent injury because of the recall bias (King *et al.*, 2010).

Table 2.1 Specific location of injuries.

Main groupings and categories for classifying injury location		
Main group categories		**OSCIC body area character**
Head and Neck	Head and face	H
Neck and cervical spine		N
Upper limb	Shoulder and Clavicle	S
Upper arm		U
Forearm		R
Wrist		W
Hand/finger/thumb		P
Trunk	Sternum/ribs/upper back	C, D
Abdomen		O
Lower back/Pelvis/Sacrum		B, L
Lower limb	Hip/Groin	G
Thigh		T
Knee		K
Lower leg/Achilles's tendon		Q, A
Ankle		A
Foot/Toe		F

OSICS, Orchard Sports Injury Classification System (Orchard, cited by Fuller *et al.*, 2006).

The standard reporting on the nature / type of a sport injury has been recommended by Orchard cited by Fuller *et al.* (2006). The sport injury nature / type have their own main grouping and categories. Table 3 below indicates such groupings and categories. In the situation where the injuries are fewer, the main grouping of such injuries applies.

Table 2.2 Nature / Type of injuries.

Main grouping	Categories	OSICS Pathology character
Fracture and bone stress	Fracture	F
Other bone injuries		G, Q, S
Joint (non-bone) and ligament	Dislocation/subluxation	D, U
Sprain/ligament injury		J, L
Lesion of Meniscus or cartilage		C
Central/Peripheral nervous system, concussion (with or without consciousness)		N
Nerve injury		N
Other	Dental injury	G

Note: Concussion may be defined as immediate and transient impairment of neural function, such as alteration of consciousness, disturbance of vision and equilibrium.

2.1.2 Injury Exposure and Incidences.

The need for comparison of results across the sporting codes (Schootman, 1994), requires a standardized reporting of the results of data collected for sports participation (Brook & Fuller, 2006; Hawkins & Fuller, 1999; Hodgson, 2002; Pakkari, Kujala & Kannus, 2001). Various studies involving all levels of rugby footballs participation have reported the injuries in rates, and these injury rates are expressed as injury rates per 1000 playing hours (IR/1000hrs). This has allowed comparison between different sports codes, and within the different environments such as training, appearances, or competitions. The rates show the injury risk exposure hours, which

then can be used to identify the number of injuries that occurred for every thousand hours of participation in any sport at any level of sport or participation (Viljoen *et al.*, 2009; King, 2006).

In the sport of rugby, injury risk exposure hours have been calculated using:

1. The number of players (NP) on the field at any time (NP-30 for rugby union & 12 for the league),
2. Duration of the game/match/practice in terms of hours (GD or TD),
3. Total number of matches/games/practices (NG).

2.2 RUGBY INJURY PREVALENCE AND INCIDENCE

According to Knowles and Marshall (2006), the prevalence of sports injuries is the proportion of one athletic team who is currently injured at a specific period or it is the number of current cases of injured athletes relative to the size of the population at risk. The study conducted by Garraway and Macleod (1995) reported a prevalence of 30.88% for rugby football injured players. This study was conducted on the 1169 Scottish rugby union amateur players, aged between 16 to 35 years of age during the 1993-1994 rugby seasons. In this study, the author defined an injury as, any injury sustained on the field during a competitive match, during practice game, or during other training activity directly associated with rugby football. In addition, this prevented the player from training or playing rugby football from the time of the injury or from the end of the match or practice in which the injury was sustained. Furthermore, it is reported that Linkmen who were appointed to the 26 clubs, who liaised with a Physiotherapist on weekly basis, collected the injury data.

The study conducted by Mahaffey *et al.* (2006) reported 58 players injured out of 220 players, leading to an injury prevalence of 26.4% among the university hostel rugby league players in

South Africa during the 2003 rugby league season. During the study, the captain of each team and the players collected data by filling an injury report form. The injury definition used during this study was any interruption of normal training or match participation or by the need for medical attention.

Holtzhause, Schwellnus, Jakoet and Pretorius (2006) conducted another study; the authors investigated the incidences and nature of injuries among the South African players participating in the Super 12 rugby union competition. The study revealed a prevalence of 64%; 48 players were injured out of 75 players who participated in the professional competition during a 14 week competition in 1999 Super 12-rugby competition. The injury data was collected by the team physician, and according to the injury definition used by the author any injury that prevented a player from playing or squad training, or one that required a special medical treatment (medical attention such as medications, suturing and radiographies).

In another study by Viljoen *et al.* (2009) using a retrospective study design, investigated for the association between training volume and injury incidence among the super 14 (formerly Super 12) professional rugby union team players representing the South African during the 3 rugby union seasons that is; 2002, 2003 and 2004. The study revealed 38 of the participants reported to have been injured out of the 40 players who agreed to take part in the study, which resulted a prevalence of 95%. The injury definition used was the medical attention definition, with physiotherapist and the team physicians assisting the authors to collect data.

Gerald, Waller and Bird (1994) found a prevalence of 70% among the New Zealand Rugby Union Players. The authors using miss match and medical attention injury definition, carried out an investigation about the previous experience of players at using safety equipments and

availability of medical service to injured players from clubs and secondary schools on the injuries sustained while participating in both organized and non-organized rugby football. Furthermore, injury rates were high among players who played organized rugby with 86.6% compared to 59% for non-organized games.

However, the methodological differences such as data collection methods, study period and study settings and population size, participation levels were evident in the literature surveyed for comparison and necessitated carrying out further research on prevalence of rugby injuries among school rugby players.

The rugby injury incidences have been reported by various authors, but before the mentioning of the incidences of an injury, it is important to understand the standard definition of injury incidence. Knowles, Marshall and Guskiewicz (2006) indicated that incidence of injuries is the number of new occurrences of a disease problem in a defined population during a specified period. The authors further suggested that incident rate is the occurrence of an injury per unit of athlete time.

Brooks, Fuller, Kemp and Reddin (2005) investigated the incidences of match injuries among 546 rugby players in the 12 English professional rugby union clubs during the 2002/2003, and 2003/2004 rugby seasons, which lasted for 98 weeks. The authors reported match injury incident rate of 91 per 1000 player-hours, the injury details of each player were recorded on the injury report form by the team medical professionals. In addition, data was collected by the team medical staff, using sports injury definition of, any injury that prevented a player from participating fully in all training and match play activities typically planned for that day for a

period of greater than 24 hours from midnight at the end of the day from which the injury was sustained.

Gabbett (2003) investigated the incidences of rugby injuries among 156 semiprofessional Australian Rugby league players over two consecutive seasons (2000 and 2001). The author reported the overall injury incident rate of 156.4 per 1000 player-hours, with 824.7 per 1000 player-hours being the sports injury rate for the match and 45.3 per 1000 player-hours during training sessions. The author used a comprehensive sports injury definition; any pain or disability suffered by a player during a match or training session, and subsequently assessed by the head trainer during, or immediately following the match or training sessions.

In the Scottish youth rugby union, Nicol, Pollock, Kirkwood, Parekh and Robson (2011) investigated the incidences of rugby footballs injuries among 470 rugby-playing schoolchildren between the ages of 13-19 during the second half of the season, and reported a match incident rate of 10.8 per 1000 player-hours. According to the age group, 10.8 per 1000 playing hours is a lower incidence rate, however, the study period, data collection methods and the miss –match or training injury definition could have led to lower sports injury incidences. This is believed to be a common practice in lower rugby games (King, 2006).

The study conducted by Viljoen, Saunders, Hechter, Aginsky and Millso (2009) investigating the association between the training volume, and the incidences of rugby injuries among the South African Super 12-rugby union training squad, for 3 rugby seasons. The authors indicated that in 2002, the overall prevalence of rugby injuries of 38% was recorded and the match incident rate of 126.7 per 1000 player-hours, and further reported a training incident rate of 7.3 per 1000 player-hours. In 2003, the prevalence reported was 55%, match incident rate of 96.4 per 1000

playing hours, and training incident rate reported was 6.5 per 1000 player-hours. In 2004, the prevalence of rugby injuries reported was 55.2%, with match incident rate of injuries 115.4 per 1000 player-hours and training incident rate of 7.1 player-hours. The authors used retrospective study design on the 40 contracted rugby players during the 3 rugby competitive seasons.

The comparative study between the two team sports; soccer and the sport of rugby conducted by Junge, Cheung, Edwards and Dvorak (2004) that investigated on the incidences of sports injuries at the amateur level, the authors reported incident rates of 49.4 per 1000 player-hours among the rugby players and 27.9 per 1000 player- hours among the soccer player. The study was conducted on 261 school soccer players and 123 school rugby players. This study suggested that rugby has more injury risk compared to soccer; however, the exposure time between the two sports could have caused the variation in results. In Nigeria, Oluwatoyosi & Owoeye (2010) investigated the pattern of injuries among all the athletes who participated in the national games, including the rugby footballs, among the team contact sports, basketball and baseball had a highest risk of sports injuries with 0.92, and 0.47-injury risk respectively compared to rugby football with 0.34 injury risks. However, due to a small number of medical staff on field and the injury data collection methods, there was likelihood of missing more injury details in a lot of sporting codes.

Garraway and Macleod (1995) investigated the incidences and prevalence of rugby injuries among the Scottish senior amateur players, varying in age from 16-35 years. The authors reported match incident rates basing on the age groups ranging from 3.41 to 18.39 per 1000 player-hours. The age at risk was among players between the ages of 19-24 years with a prevalent rate of 18.39 per 1000 playing hours. The authors used a miss match or training injury

definition on large sample size of 1169 participants who agreed to take part in the study of 1993-94 rugby union season.

Mahaffey *et al.* (2006) investigated the prevalence and incidences of rugby injuries in the Free State University in South Africa, where 220 rugby players participated in the study. The authors reported injury incidences ranging from 21.4% to 32%. The likelihood of variation in age groups, and the difference in the interuniversity hostel team capabilities could have caused the difference in the injury incidences reported. In addition, the participants and the coach, with the injury definition used as; any interruption of normal training or match/game play or a need for medical attention of the player recorded the injuries.

The study conducted by Holtzhausan, Schwellnus, Jakoet and Pretorius (2006) investigated the prevalence and incidence of rugby union injuries in the South African professional rugby players during a rugby union tournament. The report revealed an overall prevalence of 64% and incident rate of 11 per 1000 player-hours, with 55.4 per 1000 player-hours happening during the match, and 4.3 per 1000 player-hours during the training sessions. The study was conducted on 75 professional rugby union players from the three professional clubs who participated in the Super 12, during 1999 rugby union competitions. The data was collected by the team physicians and using an injury definition of miss match or training to qualify as sports injury in the study.

The above reports indicate that tournaments have various effects on player's injury incidence rates depending on the frequency of a player's appearance and duration. For example tournaments can vary from several matches in a week to one game a week, and consists of players who may have different usual playing levels, competing against each other or within the same team. In the season matches or games there is a regular schedule over a longer period for a

specific participation level, this causes a change in the injury incidences and profiles among the participants. Despite of variations, such as; different levels of participation, injury definition, and playing periods, most studies indicated a range of incidences rate from 0.30/ 1000 to 100/1000 in professional players, from 27- 825 per 1000 semiprofessional or senior athletes and between 10 to 200 per 1000 in amateur athletes.

2.2.1 Time of the game.

There are limited studies which present, document or provide information about the trend in time of the occurrence of rugby injuries. However, Brooks, Fuller, Kemp and Reddin (2005) reported more injuries in the second half, especially in the last quarter of the game. Several authors (King, 2006) have suggested this, because in professional sports, wining is the order of the day. Gabbett (2003) reported more injuries in the first half of the game. It is likely that, in the power based games players are stronger, and aggressive, so the chances of acquiring injuries are high. Nicol, Pollock, Kirkwood, Parekh and Robson (2011) reported 65.5% match injuries in second half but the authors carried out their study in the second half of the season. However, the author highlighted that injuries are more prevalent in the second round of the rugby season, hence the motivation of the study period. Nevertheless, Garraway and Macleod reported more incidences of injuries in the first round of the season with a prevalence rate of 15.2 per 1000 hours, compared to the second half of the rugby season with a prevalence rate of 12.3 per 1000 player – hours. The same report by Grobler (2004) reported more injuries in the first season in the top-level high schools in South Africa when the author conducted controlled experiment on students, to investigate the factors associated to cause of sports injuries in top-level school in South Africa. The study conducted by Sharp, Murray and Macleod (2001) reported 70% match injuries occurring in the second half compared to 30% in the first half, however the first half of the

seasons registered more bleeding injuries compared to second half of the seasons. This was a cohort study of 7 years following senior clubs in the 8 divisions in Scotland.

According to the above reports, there are indications of disagreement about the incidences of rugby injuries during the seasonal periods, and tournament- match time. Several studies have indicated that the first half of the rugby union season has the highest risk to rugby injuries compared to the second season, and other authors have shown disagreement. In terms of match time, the several studies above have indicated that players are more at risk of rugby injuries in the second half of the games, compared to the first half; however, other studies have reported significantly high incidences of rugby injuries in the first half.

2.2.2 Player positions

Forwards have been identified as the broad player position with greater risks to rugby injuries. Gabbett (2005) described the two broad positions of players such as Forwards; as all those players that participate in the scrum, and the Back players known as the Backs as those players all out of the scrum aspect of rugby football play.

Several authors (King, Clark, and Kellman, 2010; Brooks, Fuller, Kemp and Reddin, 2005; Gabbett, 2003) have identified Forwards, and the specific positions such as fly off, and hookers with more risk of rugby injuries. Gabbett (2003) reported Forwards with more injury risk, with 68 per 1000 player hours occurring among the Forwards compared to 57 per 1000 player hours occurring to the Backs. The above authors agreed that, specific positions such as hookers and outside center report more injuries. This is because they are in positions where they have to absorb and transfer greater forces during scrumming. However the same authors added that Rights, Locks and Flankers are also at risk of severe rugby football injuries.

Gabett (2005) urged that Hookers and Props compared to the Fullback and Half Backs carry the highest risks of rugby injuries. This is because of the high offensive and defensive work rates, coupled with covering of greater total distance during matches, as well as defending the middle of the ruck, distribute and support players who are carrying the ball. This was identified using the motion pictures; found that they are involved in all critical situations of the game.

Garraway and Macleod (1995) reported that Forwards compared to the Backs were three times more at risk to rugby footballs injuries during their study in Scotland. Sharp, Murray and Macleod (2001) reported 60% of the injuries occurring to the Forwards, during their investigation of Scottish rugby union for senior clubs. However, Nicole, Pollock, Kirkwood, Parekh and Robson (2011) reported 59.4% injuries among the Backs, and 40.6% among the Forwards. In the specific positions, these authors reported Wings with most at risk of rugby injuries at 21.6% and Centers with 18.9% of the total sports injuries (Garraway and Macleod, 1995). Sharp, Murray, and Macleod (2001) reported Flankers, Props, Centers and Wings as risky positions. In another development Mahaffey *et al.* (2006) identified Wings, Centers and Flankers. Holtzhausen, Schwellnus, Jakoet and Pretorius (2006) identified Centers and Full Backs with highest incidences of rugby injuries, in addition, Centers and Wings had the most intermediate and severe injuries.

Despite of the variation as regards to the broad position at risk of rugby injuries, the available data indicate Forwards, specifically Centers, Hookers, Wings and Props with the highest risk of rugby injuries.

2.3 THE RECURRENT INJURIES

A recurrent injury is defined as an injury of the same type and at the same site as an index injury, and which occurs after a player's return to full participation from the index injury (King et al., 2010). A recurrent injury occurring within two months of a player's return to full participation is referred to as an "early recurrence"; one occurring two to 12 months after a player's return to full participation as a "late recurrence"; and one occurring more than 12 months after a player's return to full participation as a "delayed recurrence.''

Recurrent injuries are normally under reported because of the definition of the recurrent injuries to most authors creates a challenge (Viljoen *et al.*, 2009; Jelsma *et al.*, 1997), however, Brooks, Fuller, Kemp and Reddin (2005) reported 18% of the total injuries were recurrent injuries among the professional players in the English rugby union season. Viljoen *et al.* (2009) in their investigation on the effect of training volume on incidence of rugby injuries during the three rugby union seasons, reported increasing incidences of recurrent injuries from 12, to 18 and 18 from 2002 to 2004 respectively. This indicated that the increasing recurrent injuries were direct proportional to team overloading.

Garraway and Macleod (1995) reported 26% of recurrent injuries among the amateur Scottish rugby union players. Erasmus and Spammer (2007) reported that, 80% of the intrinsic injuries from the study were due to previous injuries. This was among the South African school teams, and attributed to the lack of enough time to fully address the previous injuries. Grobler (2004) investigated the cause of sports injuries in rugby football at the top-level secondary schools in South Africa, reported 35% of the injuries were recurrent among the players between the age of 14-19 years, and for the open age, the estimate was 58% of the recurrent injuries. Mahaffey *et al.* (2006) reported 40% recurrent injuries in the inter-university hostel game at the Free State

University rugby games season. During the Super 12-rugby tournament, Holtzhausan *et al. (2006)* reported 13 % recurrent injuries. The period of the competitions or tournaments, a ball having stayed in play for long time, and lack of effective and completion of rehabilitative course of treatment are some of the reasons given by the authors for recurrence of sports injuries. They further clarified that recurrence was a decision of the physician

2.4 CHARACTERISTIC PROFILE OF THE RUGBY FOOTBALL INJURIES.

This section will present injury characteristic profiles study findings such as; causes and mechanisms, nature and type of the injuries, the severity of sports injuries generally and rugby in particular, location of the injuries and the relationship of injury profiles to the Forwards versus Backs

2.4.1 Causes and mechanisms of sports injuries in rugby football.

Several authors have identified the cause of sports injuries in rugby to be related to internal as well as external factors, where the external factors include contacts and non-contact causes.

Brooks, Fuller, Kemp and Reddin (2005) reported 72 % of the injuries were due to contact with another player, and involved mechanisms such as tackles mostly to the Backs because of high kinetic energy as in running in an open play, such that any simple tackle would cause a miss match or training injury. Furthermore, they reported that rucking and mauls affected mostly the Forwards.

Gabbett (2003) reported non-contact causes of the rugby injuries such as falls, and stumbling due to mechanisms like over-use, over-exertion and muscle fatigue for the Forwards, especially during training. The lower maximal aerobic power, training intensity and volume has been implicated for leading to such ill-health. He further indicated that contact mechanisms such as

tackles and collisions during the matches affected mostly the Forwards. Nicole, Pollock, Kirkwood, Parekh and Robson (2011) reported most injuries as contact, with 62.1% due to the tackles, 24.3% rucking, and 8.1% being caused by other mechanisms. Viljoen *et al.* (2009) have reported another cause of sports injuries in the sport of rugby as the training techniques, causing an over load of players, leading to over-use, exertion and muscle fatigue injury mechanisms. Junge, Cheung, Edwards and Dvorak (2004) reported two thirds of the injuries were contact with another player in rugby football, well as in soccer, and the cause and mechanisms of injuries were equally distributed among the sporting codes.

Garraway & Macleod (1995) indicated that, the age group between 19-24 years had the most injuries with18.39 % compared to below 16 years and above 34 years age groups with 3.7% and 13.6 % respectively. The contact injuries caused 49% of the injuries with the tackle, ruck, scrum, line out, and others causing 15%, 8%, 12%, 6 %, and 6 % respectively. Erasmus and Spammer (2007) indicated that previous injuries caused 80% of the intrinsic injuries among players of age group between 15-16 years. Mahaffey *et al.* (2010) reported 41% of injury incidences were caused by tackles, and open play caused 23 % of injury incidences and other mechanisms caused 34%. In a study by Holtzhausen, Schwellnus, Jakoet and Pretorius (2006) reported 64.5% injuries were due to contacts such as tackles, ruck, mauls and line out, and 34.5% were due to non-contact causes such as over-use injuries.

The above literature indicates that in the sport of rugby, most of the injuries are due to contact with another player, and tackles have been identified as the mechanism through which these injuries occur. Therefore, policy makers in the sport of rugby (International Rugby Board) should work on the ways of how to reduce number of contact each play has to make in the sport of rugby. The coaches should concentrate on training the skills of how to tackle safely, and

improve on the conditioning of players to avoid fatigue, over-use and exertion of players, and reduce the training volume.

2.4.2 Nature and Type of sports injuries.

The nature of sports injuries represents the type of medical diagnosis of these injuries (Frantz, 2000); however, because of the variation in research methodologies, not all published injury types are well-diagnosed sports injuries.

Brooks, Fuller, Kemp and Reddin (2005) reported thigh hematomas, and hamstrings affecting the Forwards and Backs respectively. The authors further reported the knee anterior cruciate ligament and neck affected the Forwards. Gabbett (2003) and Oluwatoyosi and Owoeye, 2010 indicated that, 36.4% were muscle related injuries in all athletics games in Nigeria. They reported the nature of injuries were mostly muscular leading to strains, joints sprains and dislocations, the skin having more lacerations, abrasions and blisters. Few brain concussions and bone fractures were reported as well. Nicole, Pollock, Kirkwood, Parekh and Robson (2011) reported the nature of sports injuries by location such as: ligament sprains (10%), concussion and muscle injury being 6%, and the least being bone fractures. King, Clark and Kellmann (2010) reported that, most type of injuries were strains, contusions, fractures and dislocations. Junge, Cheung and Dvorak reported strains, sprains and contusion were common to soccer and rugby football. However, the severe type of sports injuries have been reported among the rugby players such as; dislocations, fractures, and concussions. Garraway and Macleod (1995) reported dislocations, strains and sprains as the most injuries, and concussions, fractures, and lacerations being fewer. Mahaffey *et al.* (2011) reported sprains were 59%, strains 21%, brain injuries and cartilage damages were fewer. The report by Holtzhausen, Schwellnus, Jakoet and Pretorius

(2006) reported 25% of all players were suffering from ligaments, 70% muscles (contusions, hematomas) and face had lacerations and concussions to the head being 1.6%.

McQueen & Dexter (2010) cited Best *et al.*(2003) investigated 546 elite players in two rugby seasons. The authors found that hamstring injuries were 5.6 per 1000 hours of play during match compared to 0.2 per 1000 hours during training. The risk of hamstring muscle injury was due to previous injury, this has been identified (Viljoen *et al.*, 2009) to be associated to the volume of training. However, hamstrings, calf, quadriceps, and ankle injuries have been reported to be common to the Backs, and for the injury to hip flexors reported common during training sessions (Brooks, Kemp, Fuller & Reddnin, 2005). Generally, thigh, knee, and ankle injuries are the commonest injuries in rugby union.

In the literature above, several authors have reported both the nature and types of injuries common in the sport of rugby, and others have reported only nature or type of injuries common among the rugby players. The available information indicate that the nature of sports injuries common in rugby footballs are muscular, ligamentous and concussions, and the most type of injuries are strains, sprains, contusions, and hematomas. However, there are other serious injuries in the sport of rugby with lower incidences, which, unfortunately, when they occur, have serious consequences. These injuries include; fractures, joint dislocations, and deep cut wounds.

2.4.3 Severity of the sports injuries.

Different authors have provided literature about the severity of injuries. However, the definition of injury severity has varied significantly, making the reporting, and comparison difficult. For example, severe match injuries have been identified to mean that a player is unable partake in practice or match (Fuller *et al.*, 2007). However, this has varied from team to team and club to

club, and state-to-state, depending on the availability of a medical staff and other resources. Amateur teams or clubs in rugby football are likely not to have full medical staff as compared to semi elite, and elite clubs, and this is likely to compromise the level of reporting. Severity of injury reports are important to understand the risks associated with the sport injury generally, and for the specific positions and level of participation in particular.

Brooks, Fuller, Kemp and Reddin (2005), during their investigation on the incidences of rugby injuries among the English professional players, reported that an average of 18 days lost time were due to severe injuries. Gabbett (2003) reported transient and minor injuries were most recorded. These kinds of injuries did not cause a player to miss a practice or match, and this was followed by moderate injuries, where a player missed less than 14 days. Nicole *et al* (2011) using the time loss injury definition, reported a prevalence of 45.9% and that, most of the injuries players sustained led to their absence for between 21-42 days out of practice or match participation during the sport of rugby union in the Scottish schools. King, Clark and Kellmann, (2010) reported that 87% of the injuries were transient. Junge, Cheung and Dvorak reported 30.9% injuries caused players to miss match and practice from football sport, well as 20.9% of the rugby football missed match and practices. Despite of the few injury severity incidences among the rugby players, the report indicated that it caused long-term morbidity compared to soccer-injured players. Garraway and Macleod (1995) reported that 34% mild injuries, 24 % moderate, and 22 % transient and 16% severe. Mahaffey *et al* (2010) reported 92% of the injuries caused players to miss match and practice because of injuries among the university student rugby players. Holtzhausan, Schwellnus, Jakoet and Pretorius (2006) reported 39% of injuries among the professional rugby players in South Africa's rugby union football being

minor injuries, 27% intermediate, and 34% severe. This contributed to 61% of injuries that were reported serious during the study.

The above studies show that most of the authors report transient/minor and moderate injuries. This implies that, the services of a physiotherapist are critical, since most of these injuries would require ice therapy, bandages and strapping and graded exercises.

2.4.4 Location of sports injuries.

Brooks, Fuller, Kemp and Reddin (2005) reported more injuries on the knee and the thigh, and the Forwards had more injuries to the neck and face. Gabette (2003) reported the lower limbs, specifically the hamstrings, and calf muscles as well as the shoulder highly affected body sites during the matches. Nicole *et al* (2010) reported more head / face, and shoulder injuries. King Clark and Kellmann (2010) reported more injuries on the upper limb and the lower limb. Junge Cheung and Dovark in their comparison of soccer and rugby football injuries, reported soccer with 77% of the injuries occurring on the lower limb compared to rugby where 43% of the injuries were in the lower limb. Garraway and Macleod (1995) reported most injuries occurred to the lower limb followed by the upper limb, and shoulder respectively. Mahaffey *et al.* (2006) reported 52% of injuries on the lower limb, head and the neck respectively. Holtzhausan, Schwellnus, Jakoet and Pretorius (2006) reported more injuries on the pelvis, the hip, head and face followed, and foot was the least reported site for the injuries. Oluwatoyosi & Owoeye (2010) reported a majority of injuries in the lower extremity among the athletes in all game including rugby football.

In the above literature, there is only one study that reported the most severe injuries to the upper limb and another one to the pelvis and hips. Other studies have qualified the lower limb to be the region with high risk of rugby injuries, specifically the hip, groin, and the thigh.

2.4.5 Forward versus Back players.

Several authors have concluded that Forwards to have a higher risk of incidences of rugby football injuries compared to the Backs. They further suggested the location causes, and severity of these injuries to the rugby players. The literature below looks at the evidences of such claims. The Forward have the highest incidences of the rugby injuries and severity, specifically the hooker and centers (McQueen & Dexter 2010; Brooks, Fuller, Kemp and Reddin, 2005; King, Clark, & Kellmann, 2010). Gabbett (2003) reports further suggestions; however, Forward suffered mostly the over-use injuries compared to the Backs during the author's study. Garraway and Macleod reported that Forward were three times at risk of injuries compared to the Backs, specifically the Centers and Wings. Sharp, and Murray reported 60% of injuries to Forward and 40 % to Backs, specifically Flankers, and Props for Forward and Wings and Centers for the Backs.

In the study conducted by Nicole *et al.* (2011) reported 59.4% of the injuries occurred to Backs, and 40.6% occurred to the Forward, specifically wings and centers. However, Mahaffey *et al.* (2006) reported Flankers, Centers and Wings as the most injured players respectively. Furthermore, Holtzhausan *et al.* (2006) reported centers and full Backs with most injuries among the Back players. Best, McIntosh & Savage cited Dexter and McQueen (2010) reported Flankers and 8-man at high risk of rugby union injuries in the 2003 World Cup. In another study, McQueen& Dexter (2010) reported Hookers to have high risks of injuries because of their position being compromised, and coupled with compression forces at the scrum engagements. In

2003 World Cup Best, McIntosh, & Savege (2005) (cited by McQueen& Dexter, 2010) reported Flankers and 8th-man at high risk of injuries. However, in England, 2002 -2004 seasons Brooks, Fuller, Kemp and Reddinn, 2005, reported on the elite players, Hookers and Outside Centers were at risk of severe and high incidences of injuries.

The literature surveyed, indicate that, more resources should be directed towards the Forward compared to the Backs, specifically looking at the Hookers, Centers, Flankers, and Wings for the Back players.

2.5 PREVENTION OF SPORTS INJURIES.

Sports injuries present a big health concern, not only to the participants, but also to the public. Valovich MacLeod *et al.* (2011) indicated that because of the sports injury consequences such as lost in participation time, numerous physician visits, lengthy and often recurring rehabilitation. It is likely that the affected individuals fail even to participate in recreational sports, adding on the burden of sedentary life hence the risk of obesity. It is against this background that the prevention of sports injury is a major concern.

Several authors have suggested the establishment of the extent of sports injuries, analyzing the causes, including the risk factors to sports injury as the first step towards sports injury prevention (Van Machelen, 1997; Bahr, 2010). The epidemiological data that include the incidences, mechanisms, locations and severity of injuries offer useful information and assistance for developing specific preventive strategies. Furthermore, it is important to be carried out for individual or specific sports, because of the varying skill specifics: In addition, this should involve sports participants, their coaches and sporting bodies so as to make easy adaptations of the suggested preventive strategies by epidemiologists (Finch, 2006). Therefore, VanMechelen *et*

al. (1992) suggested a four way model of preventing sports injuries, that included the injury surveillance, establishing the cause and mechanisms, and then developing an appropriate prevention methods and lastly the assessment of the effectiveness of the strategies put in place.

Over the years, researchers and sports experts have been using the Van Mechelen *et al. (*1992*)* model in challenging issues surrounding injury prevalence and incidences (Bahr, 2010; Bruckner & Khan, 2009). In recent studies, this model has been criticized for adapting a broad risk management and epidemiological control model to address the problem. Furthermore, this model failed to involve the stakeholders in the evaluation of the effectiveness of the introduced measures, hence the acceptance challenges (Finch, 2006). The author further emphasized that very few sporting authorities or bodies will take up the preventive policies untill they are sure that they work. Finch (2006), suggested Translating Research into Injury Prevention Practice (TRIPP) model. In this model, the author highlighted the six stages, which involve the injury surveillance, causes and mechanisms, developing an appropriate preventive measure, then evaluating the measures. In addition, using the research evidence to take it to the real world context (such as stakeholders), and lastly evaluating the implementation program. In addition, Valovich Mcleod *et al.* (2011) suggested the injury surveillances to further help to identify the risk factors for the injury such as lack of; pre-participation physical examinations, proper supervision and education (coaching and medical), sports alterations, training and conditioning programmes which would enormously reduce on the risk of over-use injury.

With evidenced injury prevention research, there are several of such programmes that have been presented ,such as BokSmart in New Zealand and South Africa, mouth guards, game rule changes, protective gears, straps and taping (McLean, 2011; Pollar & Gronin, 2005). In terms of exercises such as stretches, warm ups and cool downs, and specific training techniques such as

drills and agility exercises. However, injuries are considered to result from a variable number of circumstances or conditions. The chain of events that lead to injuries may include; pre-event, during the event and post event (McGrath & Ozanne-Smith, 1997). The same authors further suggested that, most of the injury prevention methods mentioned above embrace the pre-event injury challenges, but less effort has been put into during the event and post event circumstances (King, Clark and Kellmann, 2010).

In primary prevention (Pre-event stage), it focuses on conditioning the participants, use of protective equipment, caring about the environmental conditions, adequate warm ups, strengthening exercises, good player' nutritional intake, correct use or maintance of sports equipment and awareness of the personal limitations including health promotion among the stakeholders (Bahr, 2010: Chap.6).

The secondary preventive measures aim at reducing the severity of injuries. In the study by Quarrie, Gianoth, Hopkins & Hume (2003) cited by McQueen & Dexter (2010) the authors cited Shelly *et al.* (2003) highlighting their study on the perception of amateur injured players towards their injuries. Several athletes reported that their injuries could have been preventable, and others believed that the initial management was inadequate. Such measures include the use of RICE, and DR ABC, SALTAPS, therapeutic ultrasound, transcutaneous muscle stimulation and effecting immediate proper referrals.

The tertially preventive measures is aimed at reducing severe injury consequences and may include the proper rehabilitation strategies and advising the player to return to full sport after a qualified medical expert in the specific sports injury.

The provision of adequate safety measures such as adhering to the rugby rules, effecting coach's role such as checking sports equipment, field conditions, and protective equipment must be part of preventive strategies (Bruckner & Khan, 2010). In rugby football union, there is a BokSmart guide. This is a practical guide for playing smart rugby and the primary aim of the BokSmart guide is to provide rugby coaches, referees, players, and administrators with correct knowledge, skills, and leadership abilities to ensure that safety and best principles are incorporated into all aspects of contact rugby practices or matches. In New Zealand, they introduced smart-rugby programme in 2001, specifically targeting the prevention of catastrophic cervical injuries. The findings indicated that, in the period of four years, the prevalence of spinal injuries had reduced especially during scrummage (Quarrie, Gianoth, Hopkins & Hume cited by McQueen & Dexter, 2010). The rule changes in England that "depower" the scrum in under-19 athletes in the 1980s-1990 are reported to have reduced the incidence of spinal injuries in some countries (Haylen, 2004).

The tackling technique is very important in the reduction of sports injuries, McQueen & Dexter (2010) highlighted that Hookers have a high risk of injuries because their position is compromised, and also coupled with compression forces at the scrum engagement. The back line (Wings and FullBacks) are at a risk of injuries because of the tackles which and occur frequently at high speed, therefore the tackling technique is very important to the coaches and the referee so as to prevent severe injuries amongst these players. Coaches must help in health promotion. In the study by Sharp, Murray and Macleod (2007) it is reported that the referee was used to record data on all the replaced players due to injuries during the 1990-1991 season. In 1993-1994 a law allowing or accepting up to 3-4 replacements was passed.

The use of proper diet and good hydration has been emphasized as a way of preventing sports injuries, and increasing performance (Bahr, 2010; Bruckner & Khan, 2010). The BokSmart guide encourages the use of a diet that will provide a rugby player with nutrients that would meet the player's physical demands of practice, and still be able to provide enough energy for optimal performance on match day. It further highlights that, compromised carbohydrates, proteins, fats, vitamins, mineral salts, and a slightest level of dehydration is likely to compromise focus, and hence impair performance.

The proper training methods for rugby football have been suggested to effectively prevent some types of injuries. Overuse or repetitive trauma injuries have been identified as the commonest type of injuries both in adults and in pediatric sports related events (Gabbett, 2003). Furthermore, several authors have reported injuries to occur most in the lower extremities, and recommend the directing of prevention programme of injuries mostly to the lower limbs to reduce the risk of injuries. Because most of the injuries are reported on the lower limbs, the BokSmart guide, highlights the role of the coach to effectively implement strategies such as the training of the basic effective tackling techniques, physical preparations, and proper recovery techniques (insufficient recovery can lead to fatigue with high injury risks) such as basic warm ups, cool-downs, stretches, effective scrumming and line-out. In addition, the referees should engage participants in pre-match briefs and checks, proper handling and preventions of foul play and lastly, applying the laws of the game during scrums, rucking, and the line outs maneuvers.

With regard to re-match or seasonal screening of the athletes, literature suggests a need for the medical staff and coaches to do pre-season testing and the physical profiling of players such as anthropometry, flexibility, speed and agility, power, cardio respiratory fitness and muscle strength. Jelsmal *et al.* (1997) reported 34.6% of injuries from the All Africa Games in

Zimbabwe resulted from previous injuries, so it is important to do pre-participation examination and close supervision of players. In addition, McQueen & Dexter (2010) reported that players do not respect healing periods, and that 48% of the professional players returned within a week of healing after a concussion.

2.6 MANAGEMENT OF SPORTS INJURIES

There are few studies published about the management of sports injuries during events, however the available information indicate that a player's injury management, heavily rely on the parents, partners or volunteers to provide any immediate on field or sideline medical care to the injured player at amateur level of participation (King, 2003b; Gerrald, Waller & Bird, 1994). This eventually leads to an uncoordinated care system. Furthermore, there is little information on the practical medical services offered on the sideline published for individual team events. The available data of sideline medical services offered are mainly from mega events, and from all sports, such Olympic Games, and National events.

Immediate care services

The injury profiles from the literature suggest that players may not be fully assessed or treated appropriately, however, immediate attention has been recommended, as it reduces the risk of injuries. Gerrald, Waller, and Bird (1994) found out that, 61% of the players had not received medical attention for previous injuries. In New Zealand, academies were started to train individuals (elite-trainers) to manage or provide immediate treatment to injured players. In addition, each amateur club is entitled to have an elite athletic trainer by law, who is professionally trained to provide an immediate management of the injured players (King, 2006:40). For example, most injured sites are head and face at all age groups, specifically lacerations. Sideline physicians can repair these quickly and efficiently. The role of sideline

physicians is to refer, assess, treat and make quick referrals. In addition, since for most of the injuries the medical personnel use ice, bandaging, and anti-inflammatory in the form of massage, it is important that physiotherapist should be a part of the core medical team providing prevention and treatment for these injuries (Oluwatoyosi & Owoeye, 2010). Cyriax (1993) cited by Purcell (2010) emphasized healing with movement. This helps in the formation of a strong and mobile scar, furthermore, prevents problems caused by scars in mobile or conducting tissues such as blocking nerve impulse, giving rise to formation of adhesions which sometimes are the site of chronic inflammation, pain and calcification (Purcell, 2010).

The **protection** of the injured site has been recommended. Protection prevents tension on the fleshy injured tissue which could lead to weakness causing fibres at the injured site from becoming frail and even giving undue stress which disrupts repair. Several authors have indicated the use of straps and taping in; which protects, support and enhances the healing processes of the injured tissues (Oluwatoyosi & Owoeye, 2010; Gerrald, Waller, & Bird, 1994). The Kinesio-taping is one of such techniques utilized. This form of tape is an elastic tape. It is reported to exhibit effects such as activation of neurological and circulatory system with movement; hence, it is applied in edema reduction, pain management, inhibition and facilitation of motor activity. It can stretch to 130-140% from the static length, hence allowing the motion without much stress on the muscles around the joint (Osterhues, 2004). Taping is widely used in the field of rehabilitation as both a means of treatment and prevention of sports related injuries (Birrer, 1996; Host, 1995; Kneeshaw cited by Thelen, Dauder, & Stoneman, 2008). The authors emphasize that tape provide support essentially, enhance proprioception hence prevents occurrence of injuries, and non-stretchable tapes provide protection and support.

Resting of the injured site. Despite of the enormous benefit a healing tissue may get from movement, a desirable amount of rest is needed. This prevents the formation of scars and poor muscle regeneration (Bruckner & Khan, 2010)

Ice therapy has been recommended for use on the injured site. It helps to reduce nerve conduction, hence relieving pain from the injured site of an athlete (Purcell, 2010; Tippet, 1990). The authors indicate that it is easy to use and less expensive. It is further reported that ice stops cell metabolism (slow down the use of oxygen) at the injured site and has anesthetic effects (Tippet, 1990). This reduces the rate of cell death due to lack of oxygen, and inflammation. However, ice therapy should be used with precaution; it can lead to skin and nerve damage where fat pads are inadequate (Purcell, 2010).

Compression is effected using bandages. Bandages discourages bleeding and swelling by exerting a circumferential pressure on the limb. However, it should also be used with precaution, especially during elevation or when the patient is lying down. Tippet (1990) reported that the use of ice and compression reduces more swelling than individual use of ice or compression alone.

Exercise therapy. The physiotherapists have a big role of prescribing the possible exercises needed at each stage of recovery after an injury. Exercise helps to maintain the normality of the injured area, improve flexibility, restore strength, and coordination. These exercises may include warm-ups and stretching exercises. Warm-ups prepare the body for exercises and later sport specific exercises, as well as improving blood and oxygen flow to muscles, speed up of nerve impulses and increase cardiovascular response to sudden strenuous exercises among other benefits. Following over activity or under activity, muscles develop stiffness. Stretching has been recommended to increase general flexibility, especially in the joints. The general flexibility can

be achieved by dynamic or static stretches. The ability to move a joint smoothly throughout a full range of movement is considered an important component of good health. Stretching is believed to reduce musculotendinous injuries, and alleviate muscle soreness (Bahr, 2010: chapt. 6). In addition to the presented forms of exercises, Hunter (1998) recommended another form of specific soft tissue mobilization (SST) in the management of soft tissue dysfunction. Following an injury, the ability of soft tissue to tolerate demands of functional loading decreases, and with SSTM, graded and progressive application of force by the use of physiological, accessory or combined techniques, these soft tissues are reported to improve faster. The same author indicated that in case of spasms, it promotes changes in the viscoelastic response of the tissue.

Ultrasound treatment has been suggested beneficial to the injured site (Tippet, 1990; Purcell, 2010). Ultrasound sends high –frequency sound waves, through the medium of gel on the skin, directly into the tissue. Its effects are described as thermal and non-thermal. This helps in the reduction and resolution of hematomas, swelling, spasms, and certain kind of pains, myositis ossificans, adhesions and contractures. However, Tippet (1990) supports the use of U/S with precaution on an injured athlete. Gerald, Waller, and Bird (1994) found out that 55% of the previously injured players used U/S during their rehabilitation of previous injury, and only 24% of players who used straps recommended by medical personal; others procured their straps from a variety of sources.

The **Transcutaneous Electrical Nerve Stimulation** (TENS) has been widely recommended for treatments in acute phases of an injury through to full recovery (Tippet, 1990). It is a strong modality in reducing pain, it does not cause further bleeding and no the disruption of tissue repair has been reported. It further increases the athlete's compression towards exercises for such injuries where static exercises are beneficial.

According to Benjamin and Lamp (1996), **massage** refers to a variety of techniques that differ widely in their application and effects that are used to manipulate soft tissues. Same authors quote a British scientist Joseph Fay, who defined massage as a systematic treatment of muscle, not lightly but vigorously to bring about definite results, such as getting rid of wastes or toxins from muscles, that collect in its depth, and cause fatigue and stiffness of the whole body. The massage therapy services have been highly recommended by the IOC medical commission for its recovery and activation of muscles, relaxation of athletes, officials and coaches. Therapeutic Massage is a wider field of study in modern world today. It is another form of soft tissue mobilization therapy; this treatment method has been used by clinicians from a multiple disciplines, and across cultures for centuries (Hyde & Gengerbach, 2007). Its benefits have ranged from therapeutic to psychological, and now it's widely used in HIV treatment and sports medicine. Massage benefits are enormous, especially when applied slowly, smoothly in addition to gliding movements. It brings physiological benefits such as stimulation of action of the sympathetic and parasympathetic autonomic nervous system (Donoyama, Munakata & Shibasaki, 2010). Muscular relaxation and normalization of the muscle tone (Benjamin & Lamp, 1996: pp 10), elicits an increase in mental alertness and clarity necessary for competition (Birukov & Peisahov, 1979), deactivates trigger points (Benjamin & Lamp), normalizes the range of joint movements (Crosman, Chateuvert & Wesburg, 1985) and reduces pain (Kresge, 1993; Trevel & Simons, 1992).

With regard to treatment modalities mentioned above, several studies have reported usefulness during events. Jelsma *et al.* (1997) reported cryocuff (cryo-therapy), Ultra sound, and trigger point massage as the most used form of treatment of injuries at All Africa Games in 1995 and the authors further recommend that such modalities should be put in place at every sports event.

However, the authors mentioned that most of the treated athletes were self-referred, and 35.3% of the athletes had previous injuries, and 24% with chronic injuries because of over-use. Therefore, prevention of sports injuries should be the duty of the health professional to address all the pre-existing sports injuries. In Brazil 2007 Pan-American Games, Dies Lopez *et al.* (2008) reported that during the sports event, the physiotherapy team used mostly kinesio-therapy, Ultra sound, and ice-therapy respectively; furthermore, most treated conditions were of over-use injuries such as tendonipathies, and muscle strains.

2.7 SUMMARY

In summary, the challenges of "sick role" following a sports injury incidence is a major concerned to players, coaches and parents. Literature has recommended the use of protective equipments, conditioning of players, adequate warm-ups and strengthening exercise, nutritional factors, correct use or maintenance of sports equipments, and awareness of the personal limitations, in addition to immediate quality care to the injured player. However, despite of such arrangements and facilities put in place, injuries still occur. Furthermore, proper immediate medical care during and after a sports injury is affected by quality assessments, and proper quick diagnosis. Most medical specialists such as orthopedic surgeons and radiologists may not be licensed to work beyond daytime, and most sports injuries occur in the evenings, this compromises immediate medical care for a player. However, the use of DR ABC, SALTAPS, RICE AND TENS by even non-medical staff has provided a significant relief especially to the minor or mild injuries.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter outlines how the study was conducted during the period of eight weeks of collecting data concerning sports rugby injuries from the UWC-FNB Varsity Shield Cup team players. It will outline the research design, describe the setting, the population and sample size. It will further discuss the study instruments, reliability and the validity of the instrument, the data collection procedures and data analysis processes. The chapter will end with an outline of the ethical outlines of the considerations used during the study.

3.1 RESEARCH SETTING

The study was conducted at the University of Western Cape. The University of Western Cape is located in the northern suburbs of Cape Town, a cosmopolitan city in the Western Cape Province, in South Africa.

The University of the Western Cape (UWC) was established by the South African Government as tertiary institute in 1960 for the so-called colored people only. The establishment of the UWC was because of separate University Education Bill of 1957. The University has a rich history of creative struggle against apartheid and oppression and extensive practical engagement in helping the historically marginalized group to fully participate in the intellectual, social, and economic life of the nation. It is in the forefront of South Africa's history change, playing a unique role in disseminating knowledge that is dynamic and relevant to the challenges of a modern world, and a

transforming society. The University is readily accessible by car, taxi, bus or even train because of its own railway station Unibell, on the southern boundary of the campus.

UWC has modern sports facilities such as an athletic track and field stadium, where the sport of rugby is also played, a cricket oval, netball courts, tennis courts, volleyball courts, as well as an equipped gymnasium and biokinetic-conditioning gymnasium. It also has a swimming pool. All sport activities at UWC are administered by the Sport Administration office, which is located near the stadium. In total, there are approximately 24 sports codes at UWC, and the sport of rugby is one of the 24 sports codes at the University of the Western Cape. Accessibility to the facilities, admission and membership to the sports clubs at UWC is offered to students, staff, and the public. In case of an injury, the UWC Physiotherapy Department provides services through the on campus clinic.In addition, there is a student Health Center, which is in charge of all medical emergencies, including sports injuries.

The University of the Western Cape Sport Council (UWCSC) represents the student organizations in the South African Student Sport Union (SASSU). The University of the Western Cape Rugby Football Club (UWCRFC) is made up of four senior teams including one for women. In addition, there is one team under-20. These teams participate in amateur rugby games in the Western Province in South Africa. In 2010, the total number of registered UWCRFC members was 200 players (Personal conversation with rugby administrator). UWCFRFC is also proud of the history of some of its players representing the province and country in both regional and international games (Personal conversation with the UWC rugby administrator). Despite of long history of rugby football at UWC, no studies have been conducted to investigate the incidence, prevalence, mechanisms and risk factors to rugby injuries among the players. Such

studies would help to develop a database about rugby injuries. This can help to improve the available safety and prevention facilities.

3.2 STUDY POPULATION AND STUDY SAMPLE

The study was conducted among the UWC-RFC players who participated in the FNB-Varsity Shield Cup 2011. The squad consisted of 37 players under the age of 25 years. This squad was selected from the teams which represented UWC in the 2010 WPRFU. Because of the small number of participants, they were all approached for the study. However, Barhar and Holmes cited by Brooks & Fuller (2006) reported that, the larger the sample size of the population of study, the more reliable the recommendations and conclusions can be made about the incidence and distribution of risk factors to these injuries.

3.3 STUDY DESIGN

A quantitative cohort, descriptive study design was used for the study. This study design, with the specific nature of this research, was found to be suitable to meet the research objectives. Quantitative research is the numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect (Sukamolson, 2011). The study was classified as descriptive and cohort as it aimed to achieve insight into the incidences of injuries, risk factors, location and re-occurrence, management and preventive strategies that were used for the UWC-FNB varsity shield team over the competitive period. Cohort studies are very important in establishing injuries that can lead to degeneration of joints and chronic overuse (Garraway & Macleod, 1995). Furthermore, this design avoids recall bias. Brooks and Fuller (2006) indicated that, the descriptive studies are very useful in identifying the associations between the incidences or proportions of injuries and risk factors.

3.4 METHODS OF DATA COLLECTION

A demographic questionnaire and injury report form was used to collect data for the study.

3.4.1 Research instrument

This section describes the instrument used for data collection. The data was collected with two instruments; the demographic questionnaire, and the injury report form.

The demographic questionnaire (Appendix A) requested information regarding the age of the player, years of experience, history of any injury before the event, number of training sessions a week, and educational level. Furthermore, information regarding anthropometrics; including body mass and height were requested.

The injury report form (Appendix A), used in this study consisted of four sections (McManus, 2000). The first section reported on information regarding age of the injured player, venue, event and the time of the injury occurrence. The second section consisted of a body chart on which the researcher had to indicate the location of the injury. For the section about severity of the injury, options were minor, mild, moderate or severe. The third section reported on the risk factors to a cause of the injury, such as terrain, weather, phase of play, and player's position. The fourth section consisted of information concerning the results of the assessment done on the injured player by the team physiotherapist or doctor, treatment given or action taken such as referral, instructions to the player / career and other information concerning the injury.

3.4.2 Reliability and validity of the instrument

The researcher used the Rugby injury report form developed and tested by McManus (2000). The reliability and validity of this report form was assessed in a study by McManus (2000). The

inter and intra-rater reliability, score was 80%. This instrument has been used in various studies including of the study of Doyle and George (2004).

3.5 PROCEDURE

After obtaining ethical clearance from the Senate Research Grants and Study Leave Committee and the Senate Higher Degree Committee at the University of the Western Cape (Appendix D), further permission was sought from the relevant authorities at the sports department and club administration. These included the head of the sports department, rugby administrator, the head coach and their manager before meeting with the players. The information sheet (Appendix C) containing all the details of the study was given out to the coaches, manager and the team medical staff. The medical team comprised of a physiotherapist, biokineticist, and the senior first aid official. The coach gave details of matches and training session for the 8 weeks of the tournament.

At a pre-determined time, the researcher met the team to explain the details of the study and to request their participation. Information sheets and consent forms were distributed at this meeting.

All injuries sustained during the tournament were recorded on the injury report form, furthermore, the injured player his weight and height were obtained from the coach's attendance records book. The researcher recorded all injuries sustained while playing matches at UWC. The biokineticist, who received training regarding the data collection procedure, recorded all injuries sustained while playing away from their home field. To verify data, the video-recordings of all the matches were examined. Telephone and social networks were used to contact injured players for clarifications. The study lasted for sixty (60) days, with players attending an average of 4

training sessions a week. The total numbers of matches played were eight for the whole tournament.

The team physiotherapist did the assessment and management of injuries during the match, and the day after the match. Paramedical teams from the nearby hospital were also available for all the matches for more attention. In case of serious injury, they were immediately taken to the hospital by the University ambulance, but also the Emergency Medical Service (EMS) team from Provincial hospitals were also available to assist during matches. In case of an injury, a player was booked to see a physiotherapist the day after training. Several players were referred to appropriate health care providers for additional injury management during and after the training sessions. Thereafter he would refer serious injuries that require diagnosis to the team doctor. This followed booking with the team doctor who stayed away from the club. The team physiotherapist was available twice a week, unless special attention was required. For further medical attention, such as rehabilitation of players, some players were booked to attend the UWC physiotherapy clinic.

If a player sustained multiple injuries in a particular game, each injury was counted individually, in overall rating. The severity and concussion definitions used in the study had been used in several studies (Lee & Garraway, 1996; McManus & Cross, 2004).

3.6 DATA ANALYSIS

Data was captured on a spreadsheet using the Microsoft Excel programme. The Statistical Package for Social Sciences (SPSS) version 19.0 was used to analyze the data. Descriptive statistics were employed to summarize the demographic data of the study. These were expressed as frequencies, percentages, means and standard deviations. The data were further, summarized

and presented using tables and graphs. Injury prevalence and cumulative incidence was calculated as a proportion rate along with a 95% confidence interval. Chi-square tests were used to test for significant association between categorical data, and injuries sustained. Risk factors were assessed using suitable models for categorical data. Alpha level was set at $P < 0.05$.

3.7 ETHICAL CONSIDERATIONS

Ethical clearance was granted from the Senate Research Grant and Study Leave Committee of the University of the Western Cape. Furthermore, permission was obtained from the relevant authorities at the Department of Sports Administration. Prior to the commencement of the study, written information on the study and its aim as well as a consent letter was given to each participant. Those who participated in the study were asked to provide written informed consent. Participation was voluntary and any member of the group had the liberty to withdraw from the study at any time. Participants were assured of strict confidentiality of the information provided. All information was kept and locked in a safe place, and if a report or article is written about the research findings, the identity of the participant will be protected to the maximum extent possible. All rugby players who sustained an injury were referred to the doctor and physiotherapist for appropriate action. The research findings will be made available to all the relevant stakeholders.

CHAPTER FOUR

RESULTS OF THE STUDY

4.0 INTRODUCTION TO CHAPTER.

This chapter presents the results of the study. The results are summarized and illustrated by means of tables and figures.

4.1 SOCIO DEMOGRAPHIC INFORMATION

The sample consisted of 37 players who took part in the study. The average age, height, weight and BMI of the players are summarized in the **Table 4.1**. The team consisted of 16 Backs (43.2%), and 21 Forward (56.8%), with average experience of 11.14 years. The team trained four times a week.

Table 4.1 Demographic characteristics of the study sample (n=37 Players)

Items	Mean	SD	95% CI
Experience	11.4	3.4	12.17- 9.7
Age of players	21.3	1.7	21.9- 20.66
Height	1.82m	0.085	1.86- 1.79
Weight	92.7kg	14.6	98.25- 87.57
BMI	27.98	26.5*	29.41-26.24
Training	4	4*	4.71-4.04

*= Median values

4.2 CUMULATIVE INCIDENCES OF INJURIES

4.2.1 Prevalence of rugby injuries.

Over the period of sixty days of data collection, 32 players experienced one or more injuries during the tournament. The overall prevalence of the rugby injuries at the end of the observation period therefore, was 86.5% (95% **CI**: 82.0-86.8)

4.2.2 The player positions

A total of 145 injuries were recorded during the period of 60 days tournament. About the broad player positions, Backs (56.6%) as illustrated in the Table 4.2 below sustained the highest numbers of injuries.

Table 4.2 Number of injuries sustained by players according to their positions (n=145).

Position	**Frequency (n)**	**percentages**
Backs	82	56.6%
Forward	63	43.4%
Total	145	100.0%

The inside center sustained the highest number of injuries (n=23) during the tournament. The least number of injuries were sustained by the right Locks (RL) and Hookers (H) respectively as illustrated in the Figure 4.1 below.

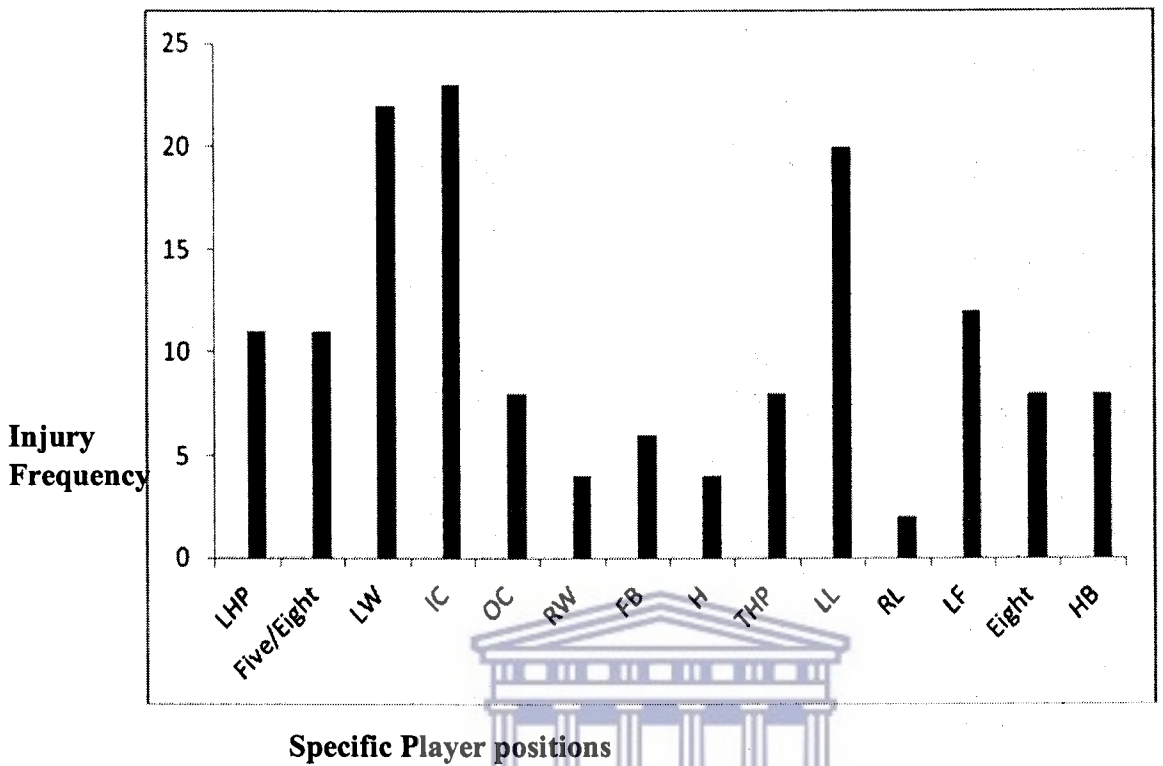


Figure 4.1 Number of injuries by player position (n=145)

4.3 LOCATION OF INJURIES

4.3.1 Location of injuries in relation to body regions

The most injured body region was the lower limbs 60.17% of the total injuries, the upper limb (18.6%), the trunk (13.1%) and the least injured body region was the head/ neck with a total of 11 injuries (7.6%). Table 4.3 summaries the location of injuries for the study sample.

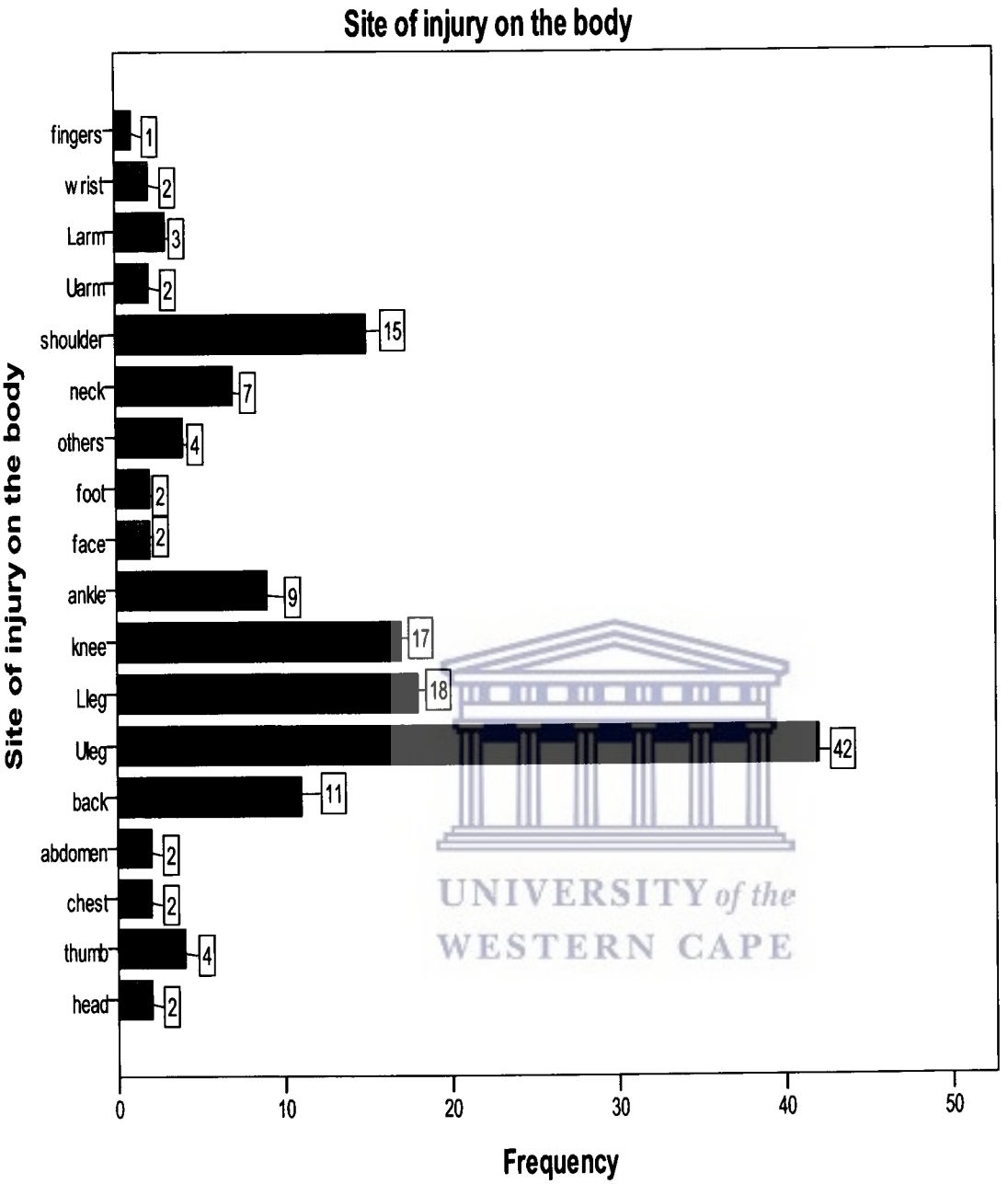


Figure 4.2 Number of injuries per body site (n= 145)

4.3.1.1 Injury locations in relation to Back and Forward players

Among the broad player position categories, both the Backs (59.8%) and Forward (61.9%) had most injuries occurring in the lower limb. No significant difference was found for player position and injury site ($\chi 2 = 0.393$, df = 3, $p > 0.05$)

Table 4.4 Injury for Backs and Forward location (n=145)

	Backs (n)	**Forward (n)**	**Total**
Head/Neck	6 (7.3%)	5 (7.9%)	11 (7.6%)
Upper limb	15 (18.3%)	12 (19%)	27 (18.6%)
Trunk	12 (14.6%)	7 (11.1%)	19 (13.1%)
Lower limb	49 (59.8%)	39 (61.9%)	88 (60.7)
Total	**82 (56.6%)**	**63 (43.4%)**	**145 (100)**

4.3.1.2 Injury specific body sites in relations to Backs / Forwards

Most of the injuries of the back players occurred to the upper leg (n=23) and lower leg (n=14) of the lower limb while Forward sustained 19 injuries to the upper leg and 4 to the lower leg of the lower limb. No significant relationship was found between body sites and broad player position (Fischer exact =23.19, $p > 0.05$).

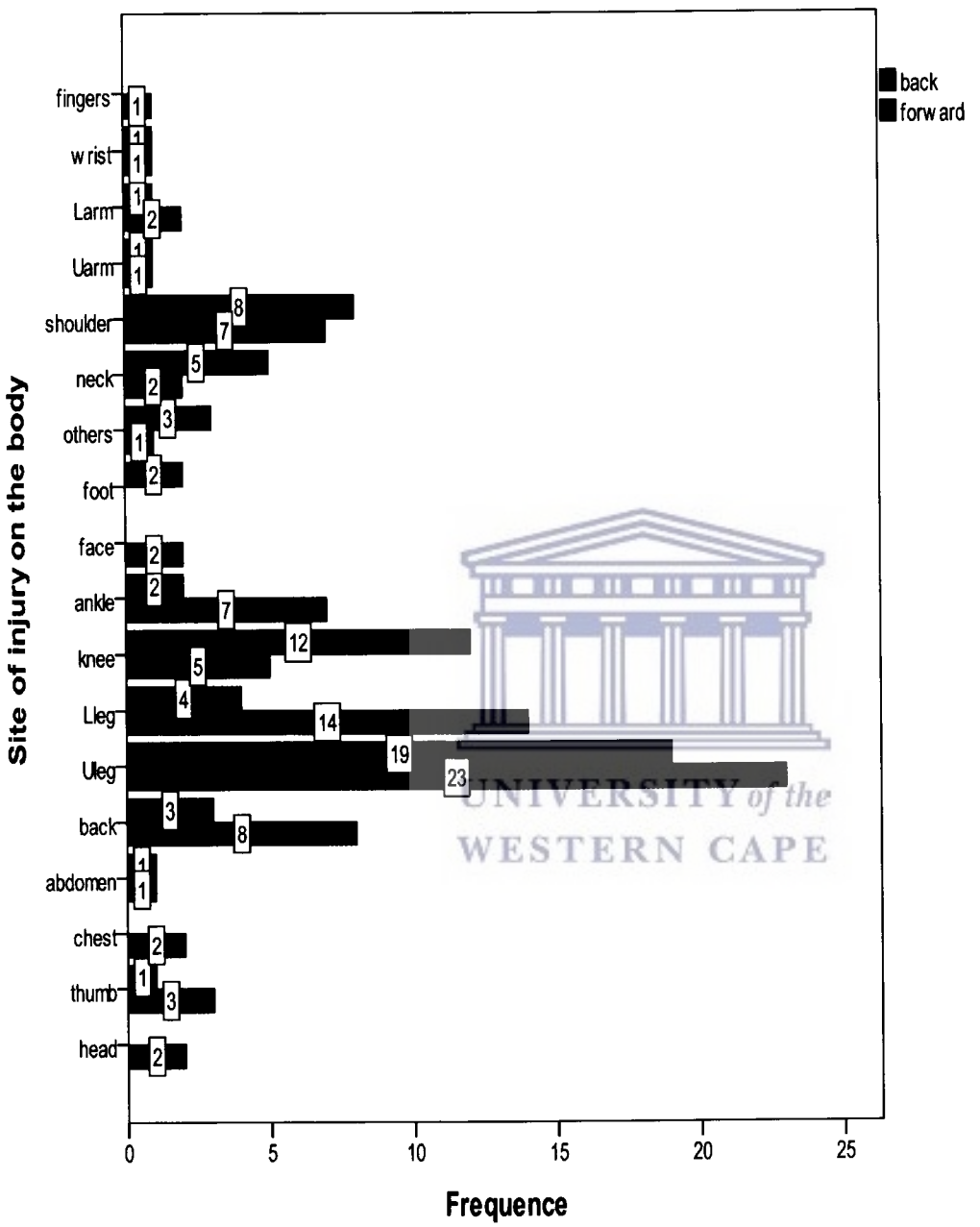


Figure 4.3 Injuries according to body site for Backs and Forward (n=145)

4.4 MECHANISM OF THE INJURIES

Most of the injuries recorded were caused by others mechanisms (50.3%), followed by tackles (31.0%). Mauls, and collisions caused the least injuries as shown in the Table 4.5 below.

Table 4.5 Mechanism of injuries to the players.

Aspect of play	frequency	percentage
Scrum	7	4.8
Ruck	8	5.5
Maul	6	4.1
Tackle	45	31.0
Collision	6	4.1
Others*	73	50.3
Total	**145**	**100**

Others* represents: over-exertion, over-use, falls, stumbles, twists, slipping, muscle fatigues and aggravation of the previous injury (Gabbett, 2005).

4.4.1 Injury mechanisms to Backs/Forward players

There was a significant relationship between the mechanism of injuries between the Backs and Forward players during this tournament (χ^2= 20.81, df = 5, P<0.05). Tackles caused most of the injuries to the Forward, in addition to scrums and mauls. While most injuries to the Back players

were due to other mechanisms; mainly intrinsic circumstances such as over-exertion, over-use, falling, stumbling and twisting, slipping and tripping, muscle fatigue, and aggravation of the previous injury, rucking and collisions.

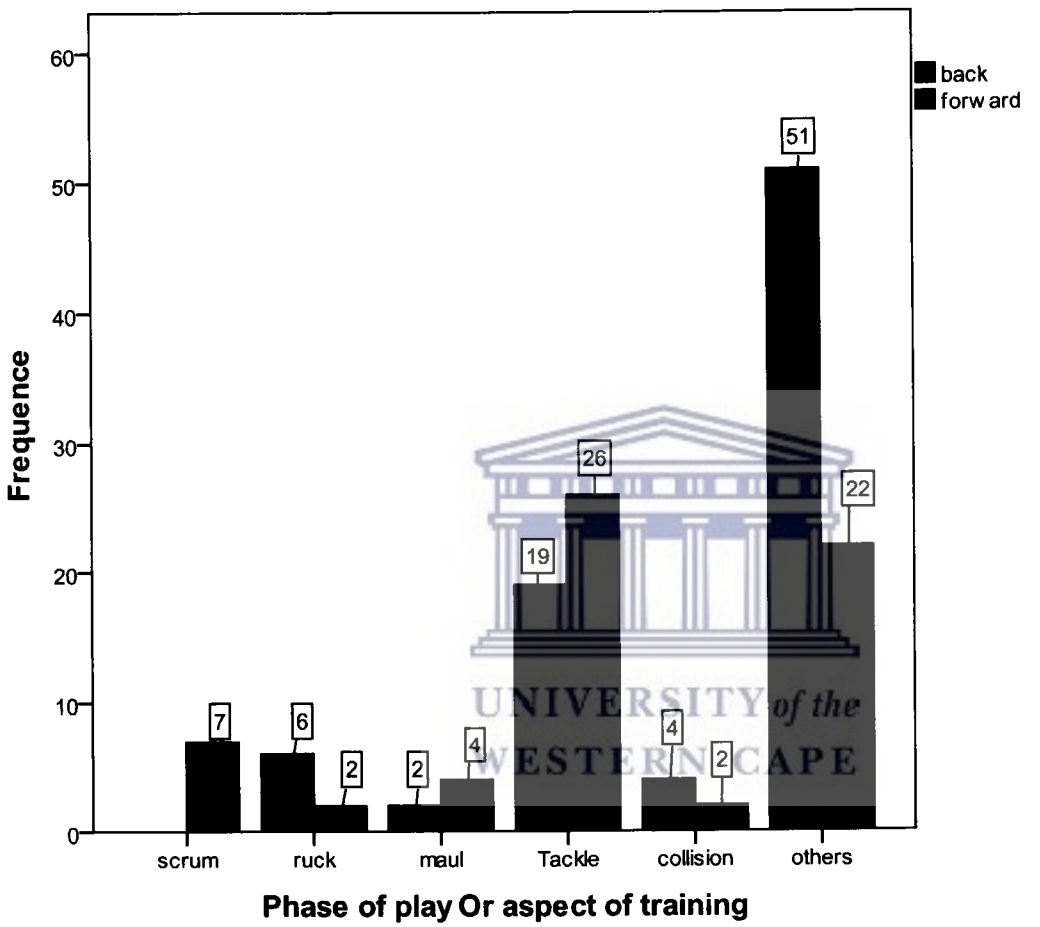


Figure 4.4 The mechanism of injuries to the Back and Forward

4.4.2 Severity of the injuries

The injuries were classified according to injury severity (Gabbett, 2005). Generally, the tournament had minor to mild injuries, with very few severe injuries. During this study, the minor injuries were all injuries that could allow a player to return to a game or training in which the injury happened. With a mild injury a player missed one week, with a moderate injury a player missed at least two weeks, and the severe injury meant that the player missed more than two weeks out of games, and rugby practices or training sessions.

Of the 145 rugby injuries recorded throughout the tournament, the highest number of injuries sustained by the players were minor injuries (n=64), and the least of the injuries sustained by the players were severe injuries (n=12).

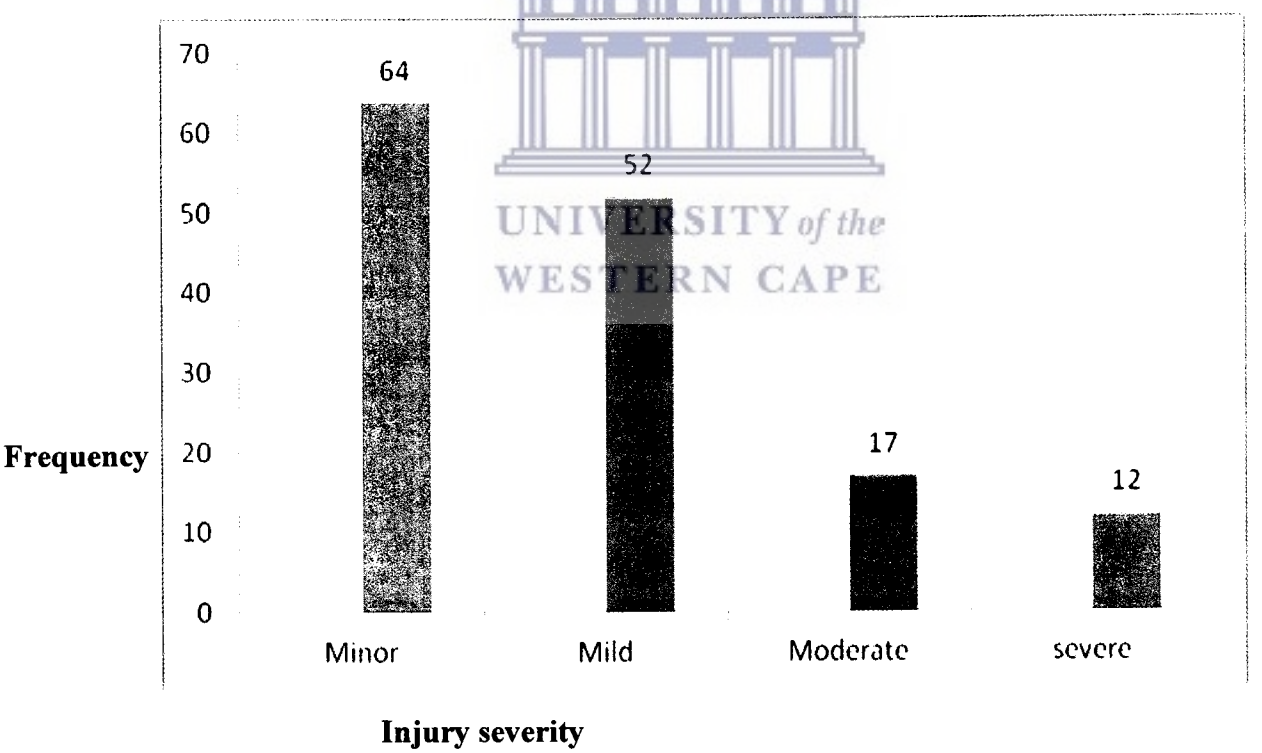


Figure 4.5 Injury severity (generally).

4.4.2.1 The severity of injuries to the Backs and Forward

There was no significant relationship between the severity of injuries according to broad player position ($\chi 2 = 3.496$, df = 3, $p > 0.05$). Most of the injuries during the tournament were minor to moderate respectively for the two groups of players. More severe cases occurred to the Forward players compared to the Backs as illustrated in **Figure 4.6**

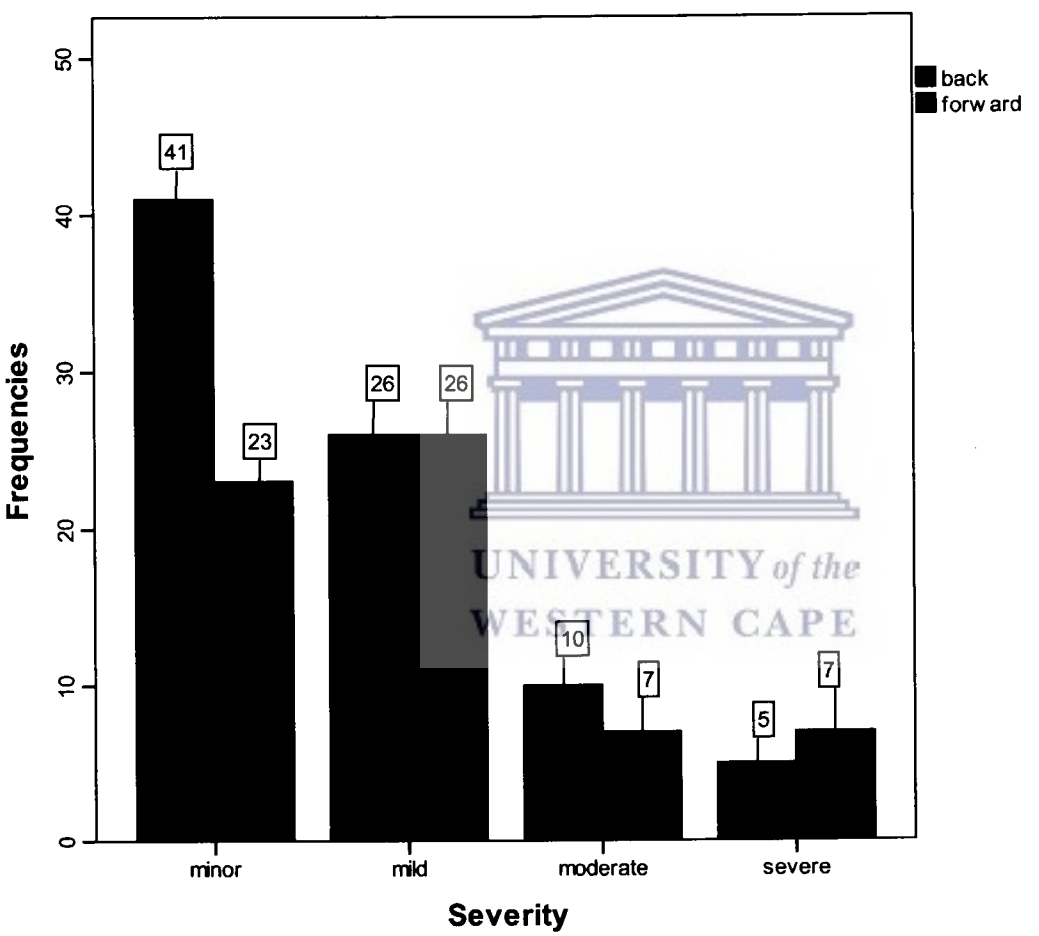


Figure 4.6. Severity of injuries according to the Backs and Forward (n=145)

4.4.3 Nature of the injuries

Of the total of 145 rugby injuries for the whole tournament, 88 of these injuries were muscle/tendon strains, and the least of the recorded injuries affected the CNS/ nerves (n=2), and bones (n=1) respectively. This is illustrated in the Table 4.6 below.

Table 4.6 Nature of injuries sustained by the players

Nature of injuries	Frequency (n)	Percentage
Bones	1	0.7
Joint/Ligaments	49	33.8
Muscle/Tendon	88	60.7
Skin	5	3.7
CNS/Nerves	2	1.4
Total	**145**	**100%**

CNS (brain and Spinal cord)

4.4.3.1 Nature of injuries to Backs and Forward players

The nature of injuries were mostly muscular injuries such as; muscle cramps, strains, sprains/ligament, tendon injuries and a few dislocations. There was no relationship between the nature of injury sustained between the Backs and Forward players during the tournament (χ^2 = 7.495, df = 4, p = 0.05).

In terms of the nature of injuries, 54 injuries were sustained by the Backs compared to 34 injuries sustained by the Forward on the muscle / tendons. Forward suffered more sprains than the Backs with 27 and 22 injuries respectively. They were no injuries to the bone on the Back players compared to one injury to a Forward player. Two injuries of CNS/Nerves occurred to the Backs compared to no injuries for the Forward.

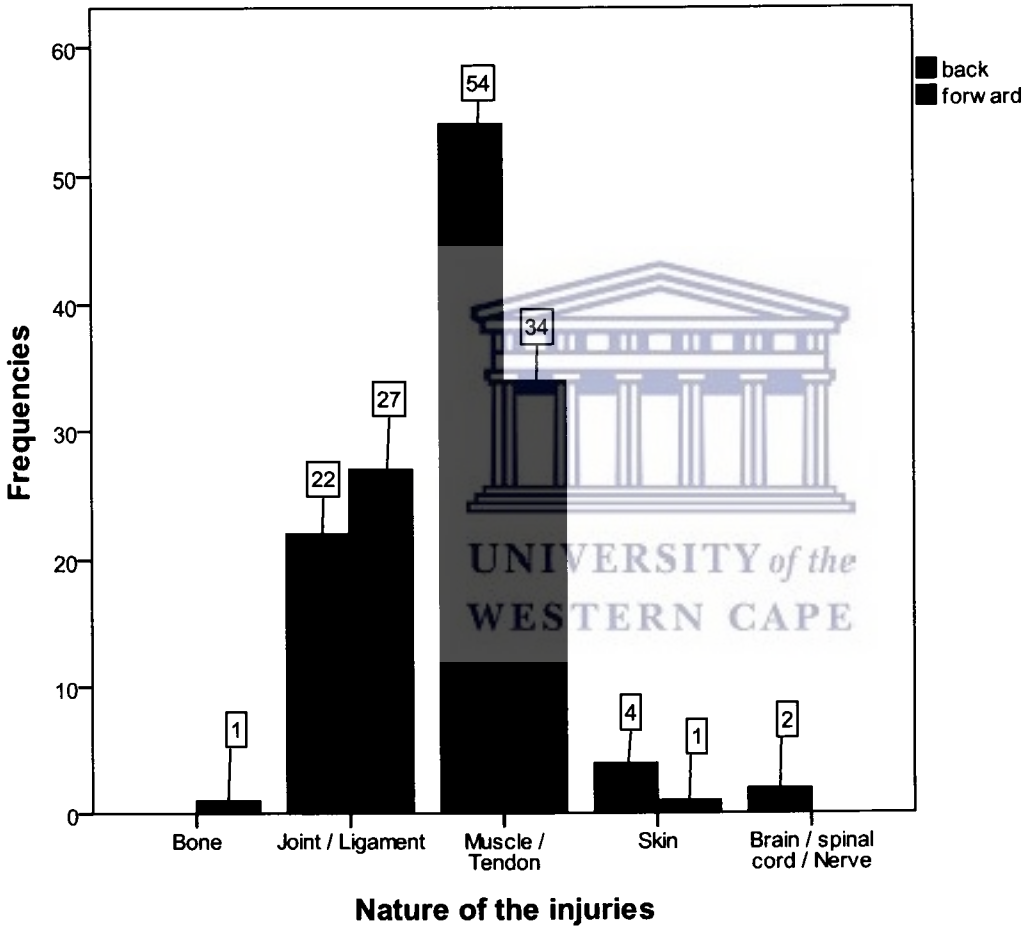


Figure 4.7 Nature of injuries according to broad player position (n=145).

4.4.4 Match compared to practice /training sessions.

Over the period of 60 days, more injuries were recorded during matches (n=82) compared to rugby training or practice sessions (n=63), as illustrated in the Table 4.4 below. In addition, the injury incident rate was 0.256 and 0.0266 injuries per playing-hours of play respectively.

Table 4.7 Number of injuries sustained during match and training periods (n=145).

Periods	Frequency (n)	percentages
Match	82	56.6
Training	63	43.4
Total	145	100%

4.4.5 Time of the tournament

Each game lasted for 80 minutes, with a break between two halves of 40 minutes each. However of the 89 rugby injuries recorded during 8 games, more injuries were sustained during the second half of the games (n=60), compared to first half (n=29), as illustrated in the Table 4.8 below.

Table 4.8 Showing injuries according to time of the game (n=82)

Game period	Frequencies (n)	Percentages
First half	22	27
Second half	60	73

Totals	82 match injuries	100 (match only)

4.4.6 Prevalence of the recurrent injuries

The total number of recurrent injuries throughout the tournament was 43 injuries. An injury of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury was recorded as a recurrent injury. A recurrent injury occurring within 2 months of a player's return to full participation is referred to as an 'early recurrence'; one occurring 2 to 12 months after a player's return to full participation as a 'late recurrence'; and one occurring more than 12 months after a player's return to full participation as a 'delayed recurrence. Due to the length of the tournament (i.e. 60 days) all the re-current injuries were considered to be early re-occurrence, as illustrated in Table 4.9. Therefore, most of rugby injuries sustained during the tournament were acute injuries (macro-trauma).

Table 4.9 Percentage of recurring injuries (n=145).

	Frequency (n)	percentage
Yes	43	29.7
No	102	70.3
Total	145	100

4.4.6.1 Re-occurrence of injuries in relations to back / forward players.

Most of the re-current injuries occurred to the Back players, with 29 compared to 14 for the Forward of total recurrence injuries as shown in Figure 4.8 below. There was no significant relationship for the injury re-occurrence between the Backs / Forward players ($\chi 2 = 2.95$, df =1, $P > 0.05$).

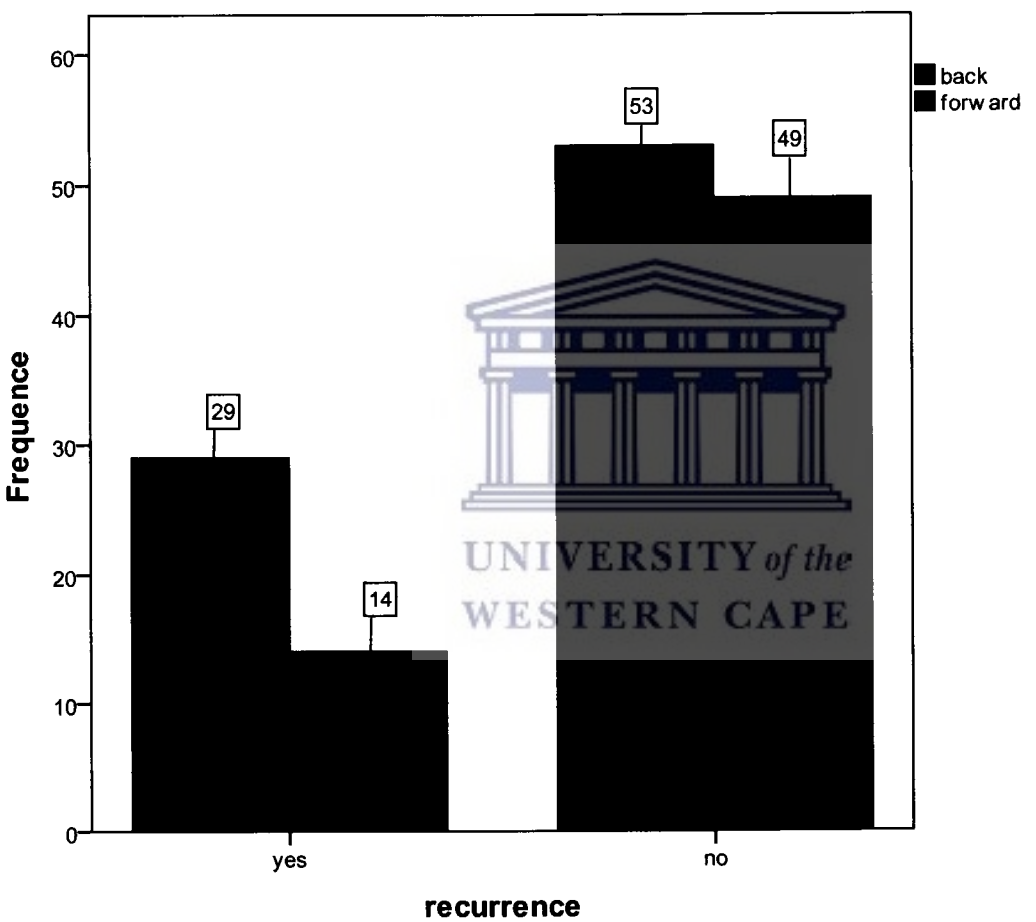


Figure 4.8 Recurring injuries according to broad player position (n=145)

4.4.7 Incidence rate

The incidence rate is a basic measure of injury occurrence in a specific time. During the 60 days of the study period, 145 rugby injuries were recorded. The number of rugby players at the beginning and the end of the study was 37.

Risk time = 37 X 60

= 2220 player-days

Therefore, the incidence rate (IR) = Number of cases of injuries during tournament divided by sum of each individual in the population of the length of time at risk.

= 145/ 2220

= 0.0653 injuries per day.

Therefore, the incident rate of the present study was thus 6.53 % injuries per day.

4.4.8 Cumulative incidence

The cumulative incidence (**CI**) is the proportion of individuals in the injury-free state at the beginning of the tournament that moves to injury state during the tournament.

CI = 32/37

= 0.865

The cumulative incidence is thus 86.5% over a 60 day period.

4.5 INJURY EXPOSURE TIME

The injury exposure time was determined as follows:

Match injury exposure time (MIE) = Number of team matches X Number of hours in each match X Number of players on the field.

MIE = 8 x 80/60 x 30 players

MIE = 320

Of the 145 injuries for the whole tournament, 82 of these injuries were sustained during the matches.

Therefore, Match Injury Rate (**MIR**) = Number of injuries of the matches / MIE

= 82/320

= 0.256 injuries per player-hours

Practice / Training Injury Exposure Time (**TIE**) = Total number of training session X hours per training session X total number of players

TIE = 32 x 2 x 37

TIE = 2368

Of the 145 injuries for the whole tournament, 63 injuries occurred during training.

Therefore, Training Injury Rates (**TIR**) = Number of injuries occurred during training / TIE

TIR = 63/2368

TIR = 0.0266 injuries per player-hours.

The total exposure time is **MIE** + **TIE,** therefore, the total exposure time is = 2688

Therefore, the **total injury rate** is = Total number of injuries for the total exposure time.

The **Total Injury Rate** = 145/2688

= 0.5394 injuries per player-hours

4.5.1 Incidences according to player position

The match injury and total injury rate were also analysed according to player positions.

The match injury incidence rate for **Backs** = 82/320

= 0.256 injuries per player-hour

The match injury rate for **Forward** = 63/320

= 0.197 injuries per player hour.

The Total Injury Rate were analysed by player's position

Backs = 82/2688

= 0.030 injuries per player-hours

Forward = 63/2688

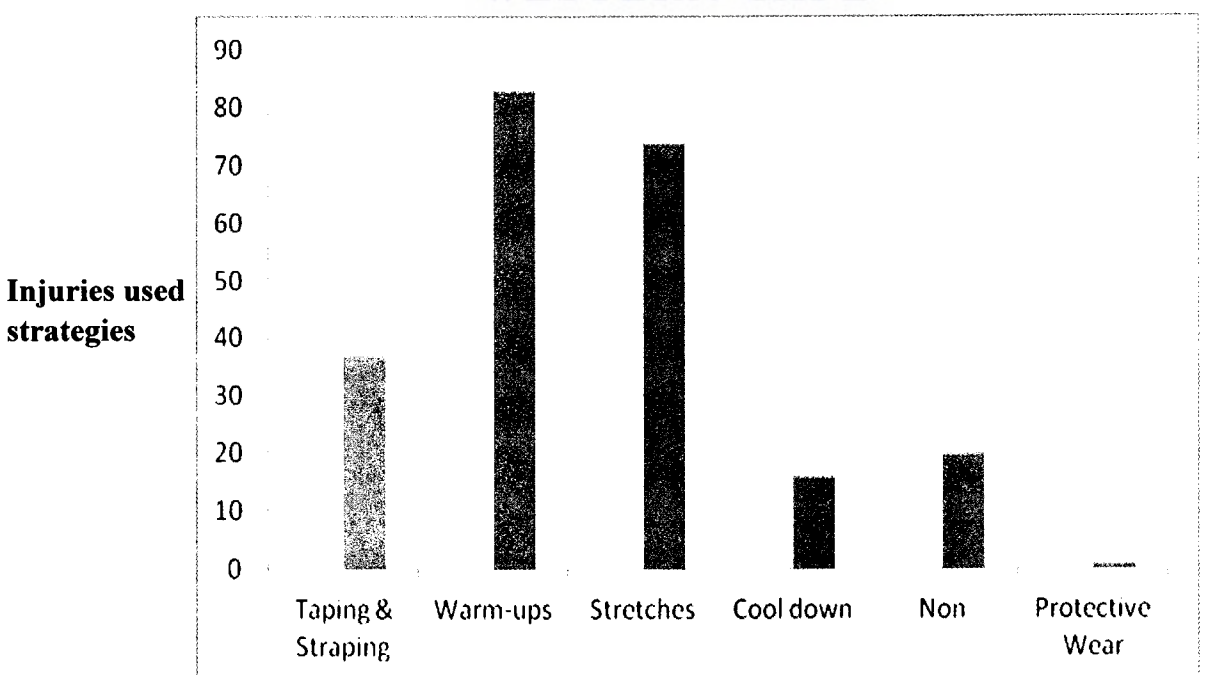
= 0.023 injuries per player-hours.

4.6 PREVENTION AND MANAGEMENT OF INJURIES DURING THE TOURNAMENT

This section presents the prevention strategies used for the period of 8 weeks such as; taping and strapping, warm-ups, cool down, exercise and stretches, protective and support materials. It will further present the treatment methods used such as cryotherapy, exercises and stretches, massage and orthopedic manipulations, wound dressing, surgery, resting, dry needles, medication and bandages. The section will end with referral details such for hospital referral as to attend specialist care to doctor's clinic, and lastly to the physiotherapist.

4.6.1 Prevention strategies used by players

Figure 4.9 below indicated the preventive strategy used by players. For each injury that occurred, players were requested to report on any injury prevention strategies used. For most of the injuries (83%), the players indicated that they warmed-up prior to matches or training. For one-fifth (20%) of the injuries, players indicated no preventive strategies used as illustrated in the Figure 4.9

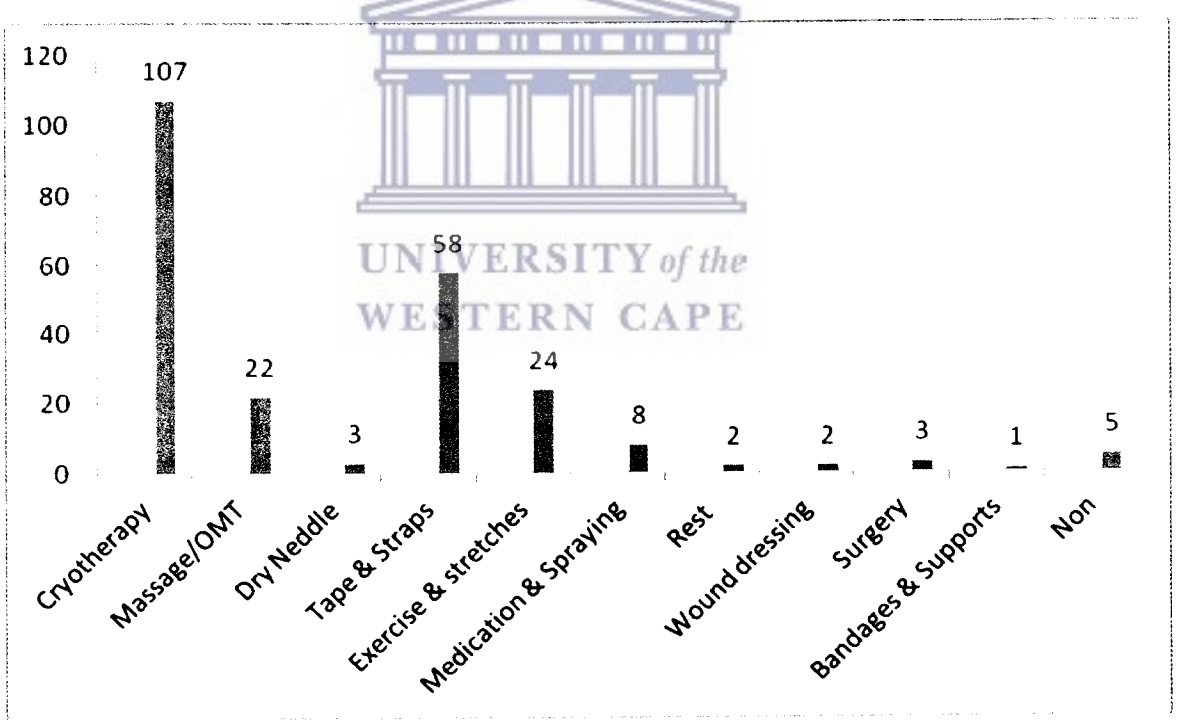


Prevention strategies used by players

Figure 4.9 Preventive strategies used by players

4.6.2 Treatment strategies used

Figure 4.10 below illustrates the treatment methods used to manage the injuries that were sustained by the players during the tournament. Cryotherapy was used the most (n=107) as treatment strategy. Strapping and taping were used for 58 of the injuries and 5 injuries had no treatment as illustrated in Figure 4.10

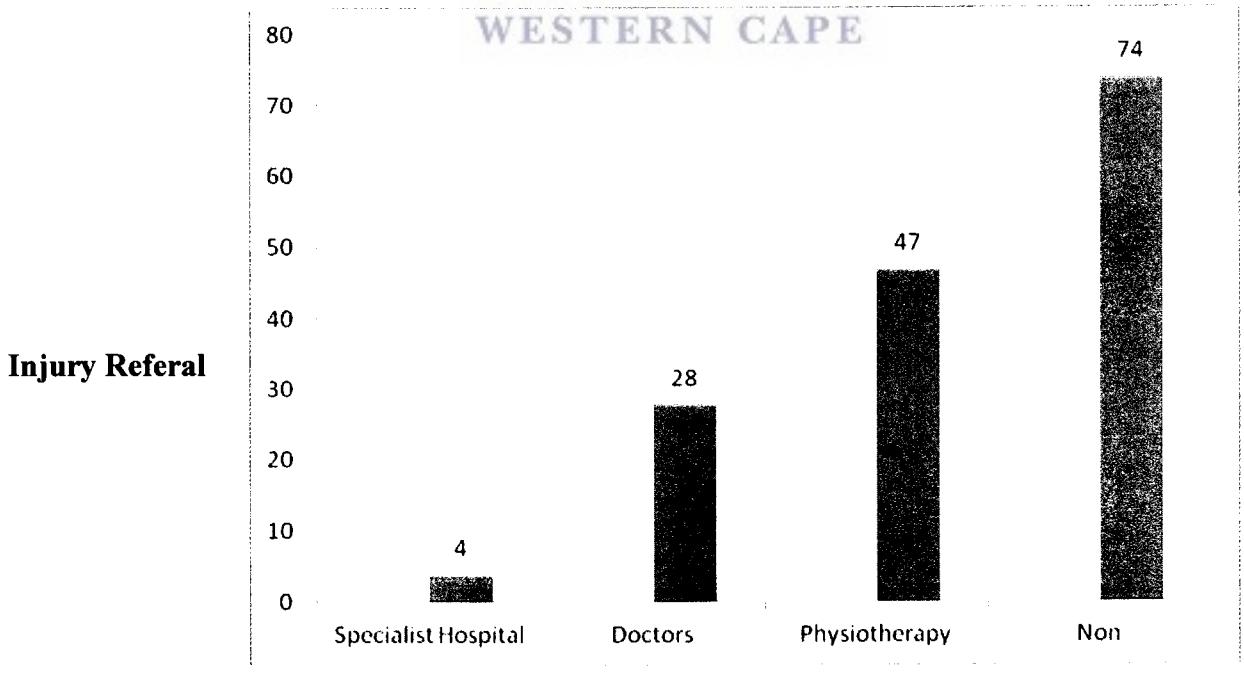


Treatment strategies

Figure 4.10 Treatment strategies to the injured players

4.6.3 The referral details

Figure 4.11 below describes the referral details. The coach, team manager, the first aid official and the physiotherapist effected the referrals. In addition, a doctor could refer players to specialists or to physiotherapy for rehabilitation services. Seventy-four of the injuries incurred by the players were not referred; the first aid officials and the physiotherapist managed the injuries on the field during match or training sessions. Forty-seven of the injuries were referred to the physiotherapist by the coach, team manager, first aid officials or the doctor himself after medication. Twenty-eight of the injuries were referred to the doctor, and four of these injuries were referred to the hospital for specialist attention such as radiology and orthopedic surgeons. Note, one injury depending on the severity can be referred to several medical staff, from the first aid officers to the physiotherapist for assessment, and further the physiotherapist can refer the same injury to the doctor.



Referred
specialists

Figure 4.11 Referral details for injuries sustained during tournament.

4.7 SUMMARY

This chapter presented the results of the data analysis. The prevalence and accumulative incidences of injuries during the tournament were described. In addition, the preventive and treatment strategies used were outlined. The findings are discussed in the next chapter.

CHAPTER FIVE

DISCUSSION

5.0 INTRODUCTION TO THE CHAPTER.

As highlighted in the introduction of this thesis, prevention of sports injuries requires an accurate and reliable understanding of the burden of these injuries. This study therefore aimed to determine the incidences and prevalence of injuries among rugby players at UWC during the 2011 FNB-Varsity Shield Cup tournament. The results of the analysis will be discussed in this chapter.

5.1 PREVALENCE AND INCIDENCES OF RUGBY INJURIES.

Rugby is a highly physical and contact sport. Researchers have drawn our attention to the fact that because of the intense physical nature of the game of rugby, injuries do occur (Gabbet, 2005; Gabbet, 2000). Furthermore, injuries are common because of the high number of body contact collisions and dynamic nature of the game (MacQueen & Dexter, 2010). Gabbet (2000) has shown that high injury incident rates are recurrent themes of injury epidemiological studies in rugby.

The above sentiments were supported by the current study, as the prevalence of rugby injuries recorded was 86.5% during the period of 8 weeks. This prevalence in this study is much higher when compared to the previous study of Mahaffey *et al.* (2006). These authors reported a prevalence of 26.4% from the inter-hostel season competition in the Free State University. The

difference in these prevalence rates could be due to a number of reasons. Firstly, the study sample of the current study and that of Mahaffey *et al.* (2006) were markedly different. The current study investigated injuries among elite rugby players at University level against other universities in a tournament, whereas Mahaffey *et al.* (2006) investigated injuries among students in the university residences competing amongst each other. The intensity of the competitions and duration could also be a contributing factor to the difference in prevalence. The current study identified injuries in a tournament that lasted for 8 weeks and that of Mahaffey *et al.* (2006) lasted for 6 months. Viljoen *et al.* (2009) has argued that short period competitions are associated with high match intensity, lack of sufficient time to rest, recover and completion of a reliable rehabilitation program; this increases the likelihood of sports injuries. However, in the retrospective study, Viljoen *et al.* (2009) reported a prevalence of 95% that is considerably higher than the current study. This was attributed to availability of enough medical staff during the study period, a comprehensive injury definition and likelihood of memory bias from the participants.

The total injury rate in the present study was found to be 540 injuries per 1000 playing-hours. This rate is considerably lower than 870 injuries per 1000 playing hours as reported by Gabbett (2003) among rugby league players in Australia. The possible explanations for this big difference could be the difference in length of exposure in the two studies. As mentioned earlier, the current study duration was 2 months while that of Gabbet (2003) was 9 months (i.e. two consecutive rugby league seasons). In addition, the athletic trainer collected the data in the study of Gabbet (2003). Garraway and Macleod (1995) argued that when using field staff to collect data concerning sports injuries, there is more likelihood for peak response.

The vast difference in prevalence and incidence rates among studies could be attributed to the variation in data collection methods. In some studies, sports injury data is collected by team physicians or physiotherapists (Viljoen, Saunders, Hechter, Aginsky & Millso, 2009; Holtzhausan et al., 2006; Brooks et al., 2005). In other studies, report data is collected by non-medical staff such as coaches, team captains and referees (Nicol, Pollock, Kirkwood, Parekh & Robson, 2011; Sharp, Murray & Macleod, 2007; Mahaffey *et al.*, 2006) or non-medical research assistant (Gabbett, 2003; Garraway & Macleod, 1994). This affects the injury details, hence possible variations in incident rates. Furthermore, the definition of the sports injury has varied significantly among the previous studies. Most of the studies use the miss-match or training injury definition while others used medical attention definition.

However, a study by Gabbett (2003) yielded higher incident rates compared to the current study because the researcher used a comprehensive sports injury definition. Other reasons for variations in the incident rates reported by studies are: inefficiency in the injury reporting regimens at lower levels of participation, levels of fitness, ball staying in the play for a longer period, higher playing intensity, inferior skills, access to rehabilitation services and pressure from the coach to return to play (Brooks., 2005; Gabbett, 2003). In the current study, the author preferred collecting sports injury data to avoid memory bias. Furthermore, a comprehensive sports injury definition was used. The advantage of using a broad injury definition is: the possibility to assess the effect of a full spectrum of injuries from mild contusions to even fractures. This helps in assessing the long-term consequences of injuries. King *et al.* (2010) have indicated that most of epidemiological studies concerning rugby footballs injuries, report a 65% of injuries being transient and mild generally. Such report indicates that, rugby players did not necessary need to miss a match to qualify as an injured player. However, the limitations of the

current study were the small sample size, study period and a single team, these affected comparisons with other studies.

A difference in match-incident and training incident rates was found in the current study. A higher match incident rate of 256 injuries per 1000 playing-hours, and training incident rate of 266 injuries per 1000 playing-hours was reported. This is lower than the previous studies (Nicol, Pollock, Kirkwood, Parekh & Robson, 2011; Viljoen et al., 2009; Brooks et al., 2005; Holtzhausan et al., 2006), who reported match incident rates of 10.8, 126.7, 91, and 55.4 per 1000 playing- hours respectively. This likely to be because of study periods, injury definitions, and data collection methods. The previous studies which have been carried out by medical professionals and further reporting longer study periods, coupled with a comprehensive injury definition have reported significantly higher injury incidences. Furthermore, Brooks, Fuller, Kemp and Redinn (2005) have mentioned that tournaments pose a tougher challenge to rugby players when compared to seasonal competitions. There are more injury incidences during tournament as compared to seasonal competition because of enough resting periods, recovery time and completion of rehabilitation programs. However, Gabbett (2003) reported a match incident rate of 824.7 and training incident rate of 45.3 per 1000 playing-hours. This is considerably higher than the current study because of the participation level, data collection methods, fitness levels, and study periods.

A different incident rate for different parts of the game has also been documented. These findings are similar to that reported by several other studies (Nicol et al., 2011; Sharp, Murray, and Macleod, 2007; Brooks et al., 2005). The higher injury rate in the second half could be related to player's fatigue.

In the present study, there were 15 players per side, typical of rugby union football, with eight Forward and seven Backs. MacQueen & Dexter (2010) have indicated the importance of understanding the various positions when considering each player's risk of injuries, with certain positions carrying a considerable rugby injury risks, particularly in the ball possession contested areas such as scrumage, tackles, and lineout. Therefore, Forward are responsible for acquiring and maintaining ball possessions, and includes the front row Forward such as Loose Head Prop (LHP), Tight Head Prop (THP), and Hookers.

Different incident rates were found for different player positions in this study. In the broad player positions, the Backs were found to have a higher injury incident rate of 256 compared to the Forward with 197 per 1000 playing-hours. These findings are similar to those reported by Nico, Pollock, Kirkwood, Parekh and Robson (2010) from Scottish schools, who reported an incident rate of 59.4% for the back and 40.6% for the Forward. Some of the reasons given for this have been over-use injuries, over-exertion, fatigue, and higher kinetic energy of the Backs predisposes them to severe injuries following a tackle (Gabbett, 2003). However, some studies found the opposite and reported a higher injury incident rate for the Forward than back players (King, Clark, & Kellmann, 2010; Gabbett, 2003; Garraway & Macleod, 1995). These authors speculated that some of the reasons for this differences could be:- many contacts and collisions, their body mass, offensive and defensive position roll, and greater distance cover, playing frequencies, coaching or contrasting styles of play among teams and scrummaging may be some of the reasons.

The recommendations for the prevention of the above varying prevalence and incidence rates may include the following: aerobic fitness could prevent injuries due to fatigue, which affects skill level and performance. Agility training to effect rapid change in direction will improve

change of direction speed. Defensive drills, correct tackling techniques should be emphasized and training programs for specific positions; this could assist in reducing high incidence of injuries in some positions. In addition, strengthening and conditioning specialists need to establish the optimal balance between volume and intensity of training without compromising the necessary improvements in physical fitness and performance. Furthermore, it is suggested that injury surveillance should be carried out for the whole season to avoid under reporting (Fuller *et al.*, 2006).

5.2 INJURY LOCATION

Studies concerning injuries among rugby players have highlighted various locations of injuries amongst this group of athletes (Mahaffey *et al.*, 2006; Garraway & Macleod, 1995). According to Fuller *et al* (2006) location of an injury should be either main grouping or categorical grouping. The current study indicated that in the main grouping, the lower limb had the highest incidence of injuries with 60.17%, followed by upper limb (18.6%), trunk (13.1%), and the head / neck with least injury incidences of 7.6%. In the categorical grouping, it was found to be the upper leg (hip, thigh and quadriceps) with the highest incidences of injuries at 28.9%, followed by lower leg (shin and calf) with 12.4%, the knee 11.7%, shoulder 10.34%, and the least was the fingers 0.6% respectively. In addition, these injuries affected mostly muscle/tendons, and joint ligaments, with only one fracture of the lower limb bones. In the upper leg, it was mostly the groin and the hamstrings, and in the lower leg, the shin and the calf muscles was found to be mostly affected. These results are consistent with the previous studies (Nicol et al., 2011; Holtzhausan et al., 2006; Mahaffey *et al.*, 2006; Gabbette, 2003).

According to Brooks et al. (2005) reported that most injuries occurred on the lower limbs, to the thigh and knee specifically, causing hematomas and muscle contusions. In another study by

Garraway and Macleod (1995), the authors reported that injuries occurred on the upper limb mostly, affecting the shoulder, well as the study by Mahaffey *et al.* (2006), reported injuries occurring mostly on the lower limb, and to the face in the form of skin lacerations. In all the studies, contact situations such as tackles, collisions, rucking and maul mechanisms have been implicated for most of the injuries, which is similar to the present study. Such injuries can be prevented through optimal hamstring conditioning to the Backs. In addition, for the prevention of high contact injury incidences, tackling techniques should be improved as previously mentioned in this report.

5.2.1 Mechanisms of injuries

The cause of injury has been an area of serious debate in the sport of rugby. Factors leading to an injury are usually complex, but understanding the mechanisms of sports injury is critical to advances in planning prevention strategies (Gerrald, Waller & Bird, 1994). Therefore, mechanisms leading to an injury can be internal, such as muscle fatigue, over-use, and over-exertion or external such as tackles, rucks, mauls, and collisions mostly leading to injuries because of excessive force applied to the defending sides or high kinetic energy as in running (Brooks et al., 2005). However, there are other mechanisms that can lead to injury such as stumbling, falls due to playing field or type of shoe worn, among other things (Gabbett, 2003). In the current study, most of the injuries were as a result of other mechanisms (overexertion, overuse, falls, stumbles, twists, slipping, muscle fatigues and aggravations of previous injuries) this contributed to 50.3% of the total number of injuries, tackles (tackling and being tackled) 31.0%, rucks 15.5%, scrimmage 4.8%, mauls and collision mechanisms being 4.1% each. In the study done by Brooks *et al.* (2005) 70% of injuries were due to contact situations such as tackles, mauls, rucks, collisions and during lineout mechanisms, affecting mostly Forward. However,

Gabbett (2005) identified over-exertion, which caused most the players' injuries during training sessions, due to the intensity and volume of training. The author further reported that contact situations caused most of the injuries during the match, in addition, the same author indicated that the Forward specifically Props, Hookers, and No.8 suffered overuse injuries. Gabbett (2005) has highlighted that in a power based game, where defensive and offensive work rates are high, coupled with speed, high intensity acceleration and deceleration, in addition to change of direction as players defend at different angles, injuries cannot be ruled out. Such situations is the highest cause of falls, stumbling, twists, slipping and muscle fatigue, thus aggravating previous injuries (Gabbett, 2005; King *et al.*, 2010). Similar circumstances were identified among the UWC FNB team players during the Varsity Shield Cup tournament. Players suffered more overuse, over-exertion, and muscle fatigue-related injuries, especially in the case of Backs. However, a significant number of injuries occurred due to contact situations (tackles collisions, rucks, mauls and line-out) and these cannot be ignored, hence prevention strategies should be identified.

The prevention strategies should thus emphasize aerobic fitness training programmes. This would prevent muscle fatigue. The managers and coaches should work on the most effective coaching styles. The coach should also focus more on conditioning of players, speed, and agility according to specific players positions, in addition to game rule change, for example: an attacking player is given 10M distance, this allows the player to generate a lot of force that produce an effective tackle.

5.2.2 Re-occurrence of injuries

The re-occurrence of an injury is another area of serious debate by sports injury epidemiologists. The definition of re-current injury used in this study was the one suggested by Fuller *et al.*

(2006) stating that a recurrent injury is the injury of the same type and at the same site as the index injury, and which occurs after a player's return to full participation from the index injury. In the current study, 102 (70.3%) of the injuries were identified as acute injuries (macro-traumas), and 43 (29.7%) of the total injuries were re-occurring. There are few studies generally which report on recurrent injuries, however, the few studies published with the same re-current injury definition have indicated similar ratios (Holtzhausan et al., 2010; Viljoen *et al.*, 2009; Brooks *et al.*, 2005; Garraway & Macleod, 1994).

An experimental study carried out by Erasmus and Spamer (2007) to investigate the effect of a preventive programme on the incidences of rugby injuries among 15 and 16-year-old schoolboys in South Africa, reported that 80% of the recurrent injuries were in the first half of the season. These authors are of the view that the players seem to have failed to comply with the injury rehabilitation programme, and sometimes coaches force young players to participate as they risk losing position in the team. Furthermore, Gobler (2004) reported that, the age groups 14-19 had 35% re-current injuries and those below 35 had 58% of their injuries recurring. This shows that re-current injuries were positively associated with age. Furthermore, in the study by Erasmus and Spamer (2007), the reasons identified for the recurring injuries include inaccessible rehabilitation medical staff and services and new players joined for the tournament with previous injuries who lacked enough time to recover or rest (Viljoen *et al.*, 2009). Other authors have reported pressure from the coach to return to play early before full recovery, lack of knowledge about their injuries, and lack of an effective rehabilitation program (Brooks *et al.*, 2005). In the literature, the authors have identified consequences such as lost time from play, coaching and match preparations are significantly affected and incapacitation causing loss of work and education time (Garraway & Macleod, 1995).

5.2.3 Nature of the injuries

Several studies concerning sports injuries have indicated that most of the injuries are acute, and occur on the field or when an athlete is involved in any form of sporting activity. Therefore, due to lack of proper diagnostic equipment or specialized staff on the field, Fuller *et al.* (2006) suggested referring to such injuries as type or nature of sports injury not a diagnosis. Furthermore, Orchard cited by Fuller *et al.* (2007) highlighted that the medical diagnosis of injuries can be classified as main group or category of a sport injury. In the current study, the main grouping or classification of injuries was preferred due to the lack of immediate and fast diagnostic equipment and having few types of injuries. Therefore, the nature of injuries suffered by players were mainly muscle/tendon strains at 60.7%, followed by joint-ligament sprains at 33.8% and the least was CNS injuries at 0.7%. Despite of the lack of relationship between the broad players positions (Backs and Forward) and to the nature of injuries, Backs suffered more muscle/tendon strains, and the Forward suffered mostly joint ligament sprains.

In the literature, several authors have reported most injuries occurring are due to joint ligament problems, specifically the knee, and Forward are reported to be more at risk of these injuries (Nicol *et al.,* 2011; Holtzhausan *et al.*, 2006; Mahaffey *et al.*, 2006; Brooks *et al.*, 2005). However, King, Clark, and Kellmann (2010) and Gabbett (2003) reported similar results to the current study, but indicated that, Forward were more affected by muscle/tendon injuries than Backs. The reason for muscle, tendon, and ligament injuries have been mentioned in the previous section of this report. This has serious implications when it comes to injury rehabilitation as, ligaments take longer time and sometime fail to fully recover.

5.3 PREVENTION STRATEGIES

Sports injuries are considered a major public health concern. The consequences of sports injuries are far reaching for both players and the economy. For these reasons, it is of importance to investigate prevention strategies in place for different sporting codes. In the present study, the players reported several prevention strategies. These included warm-ups prior to match or training; taping and strapping; stretching; cool down exercises, and wearing protective equipment (knee brace). Some players however indicated no prevention strategies. It is likely that these players may have lacked the knowledge on how to use them or generally the significance of prevention strategies. Furthermore, financial constrains to afford such protective equipment; being amateur university students, is also a possibility.

In the study to establish a relationship between stretching and prevention of injuries, Witvrouwe, Mahieu, Danneel and McNair (2004), indicated that, an increased muscle-tendon flexibility unit, promotes better performance and reduces the risks of sports injuries. The warm-ups increase blood flow to the working muscles, causing the muscle to relax and this reduces muscle stiffness (Brukner & Khan, 2010). This lessens the risk of musculoskeletal injuries found common in the sport of rugby (King *et al.*, 2010, Gabbette, 2003; Garraway & Macleod, 1995). Marshall *et al.* (2005) in a study to evaluate the effectiveness of the use of protective equipment in the rugby union football, reported that mouth guards lowered the risk of oral-facial injuries, padded headgear tended to reduce damage to the scalp and ears, support sleeves tended to reduce the risk of strains and sprains. However, they concluded that the effectiveness of taping, shin guards, and grease need further investigation.

After athletic competition or engagement in a hard work out, the study by Erasmus and Spamer (2007) recommended active recovery, (cool-down) as part of the prevention strategies for the high school rugby union players in South Africa. This involve, low intensity exercise such as stretches, carried out to reduce the accumulation of lactate acid in the blood, reported to cause muscle fibre damage.

5.4 MANAGEMENT STRATEGIES OF THE INJURIES

As highlighted in chapter two of this work, there is little published information regarding event or sideline medical care of sports injuries especially at amateur or collegiate sports events. However, the available information indicate that most of the student amateur players, to manage their injuries on the field during events or immediate care after events heavily rely on their parents, partners or volunteers (Gerrald, Waller & Bird, 1994).

5.4.1 Treatments given

In the current study, it was found that the sideline medical staff treated injuries with the following modalities, such as ice therapy methods, strapping and kinesio-taping, exercises and stretches, massage and orthopedic manipulations. Supports such as bandages were not often used and the reason could be the lack of information or knowledge on the uses of bandages or inaccessibility of the bandages. Other injuries were treated using medication, dry needling, surgery, rest and wound dressing and suturing. The reasons could be that their injuries could have been not too severe to seek medical care, or lack of adequate medical staff, inaccessible medical services, in addition to lack of knowledge about their injuries.

However, there is paucity of published literature with regard to prevention and management of rugby footballs injuries, before and after sports events. As previously mentioned by McGrath & Ozanne-Smith (1997), sports injury prevention research requires a monitoring of participants before, during and immediately after the event. A study by Jelsma *et al* (1997) reported cryocuff (cryotherapy), ultra sound, and trigger point massage as the most used form of treatment of injuries in multiple-sports codes. The coverage was based only at the event, making comparison on the best management strategy of rugby injuries incomparable. A similar attempt to cover events management strategies of sports injuries in Nigeria at a national multiple sport tournament, revealed the use of ice, bandages and anti-inflammatory gel/creams, as in form of massaging. The authors further highlighted the work of physiotherapists being critical to be part of the medical team since they command respect in the use of such modalities (Oluwatoyosi & Owoeye, 2010; Bennell *et al.,* 2005). Several authors have supported the use of ice-therapy during and after events with aim to treat and even prevent further deterioration of the injured tissues (Tippet, 1990). The authors indicate that this form of modality reduces inflammation cardinal signs and symptoms, and cell/tissue deaths and in addition, can be used immediately after injury, and beyond, for several days. It is easy to use, and it is cost effective, especially among the amateur teams/clubs.

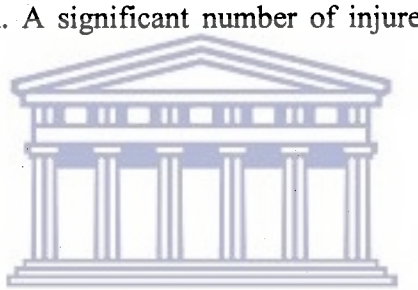
Other modalities supported in the literature included; TENS (Brukner & Khan, 2010; Vincenzino & Wright, 1995; Johnsson *et al,* 1991), exercise-therapy (Purcell, 2010; Malliaropoulos *et al.*, 2004; Vicenzino *et al.*, 2001; Jull, 2000; Hunter, 1994; Cyriax,1993;), heat-therapy (Dies Lopez *et al.*, 2008), Ultra-sounds (Gerald, Waller, and Bird, 1994; Tippet, 1990; Purcell, 2010), supports in form of bandages, straps and tapes (Osterhues, 2004; Birrer, 1996; Host, 1995; Kneeshaw, 2002 cited by Thelen, Dauder, & Stoneman, 2008).

5.4.2 Referrals

The study identified some referral details. The referral of the players was found to be effected by the coach, team manager, first aid officials, physiotherapist, and the team doctor to other medical specialists such as radiologists, orthopedic surgeons and rehabilitation experts. For 74 of the injuries reported in this study, the researcher did not find any referral details. This could have been due to the fact that these injuries were managed on the field by the physiotherapist, Emergency Medical Service team from the hospital (EMS) or first aid officials or relatives and friends. In addition, these injuries could also have been less severe, therefore not in need of medical attention. Then the coach, and team manager referred 47 of the injuries to first aid officials, for assessment and management by the physiotherapist. In addition, the team doctor referred injuries to the physiotherapist too. Some of the injuries (28 injuries) were referred to the team doctor, and four injuries were referred to the hospital for specialist attention such radiologists and orthopedic surgeons. However, in literature, there is no information concerning referral details of the injured players during sports events, the available literature only indicates that sports injuries are mainly referred to hospital emergency departments (King et al, 2010), and few mention of injured players consulting directly with the physiotherapist (Oluwatoyosi & Owoeye, 2010; Brukner & Khan, 2010; Bennell *et al.*, 2005).

5.5 SUMMARY

Sports injury prevention and management during competition or training sessions is part of the duty of care to the participants, and helps to make the events safer both in present times, and for the future. In the present study, the author has shown that the preventive strategies used were warm-ups exercises, stretching exercises, straps and taping; cool-down exercises, knee braces. A significant number of the athletes did not use any protective equipment prior to the sports injury ailments. These injuries were further managed mostly using ice therapy, kinesio-taping; straps and exercises, and those who could not be managed effectively on the field were referred to the physiotherapist and sports physician. A significant number of injured players did not receive referral for further medical care.



CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 INTRODUCTION TO THE CHAPTER

The previous chapters outline the rationale for the study and the available literature related to it. Furthermore, the research methods and the results of the data analysis were outlined. The results were discussed and compared with other studies in the field. This chapter will provide a summary and conclusion of the study. Furthermore, recommendations based on the findings will be outlined. And finally the study limitations are outlined.

6.1 SUMMARY

The world of sports is continuously growing and evolving. The popularity of different sports activities such as soccer, rugby football, basketball, tennis, golf and athletics have increased in the last three decades. It is often claimed that sports or any other form of physical activity, when performed regularly, helps to reduce the risks of premature mortality rate, and several other health challenges. In addition, participation in sports, aims at achieving elite and professional level of sporting. The above benefits have contributed to the increase in the sports support and participation, especially at collegiate level. The rugby football sport is a contact sport recognized worldwide and heavily supported in Europe, Canada, the Pacific nations and Africa. The sport of rugby football has been identified as being one of the highest contributors of sports injuries at the

University of the Western Cape physiotherapy clinic. Rugby at UWC is primarily an amateur sport, and in 2011, the UWC rugby team participated in the FNB Varsity Shield Cup tournament for the first time in history.

The aims of the present study were to determine the incidences and prevalence of injuries among rugby players of UWC during the FNB Varsity Shield Cup tournament. The specific objectives of this study included the following: establishing the cumulative incidences of injuries, establishing the prevalence of injuries among the rugby players during the FNB-Varsity Shield Cup tournament, identifying location and recurrence of these injuries, mechanisms of injuries, preventive and management strategies used during the tournament. Since this was the first study concerning rugby injuries of the UWC rugby club, the findings will support the available information regarding prevention and management of rugby injuries at UWC rugby club in order to make the future events safer.

After obtaining ethical clearance from Senate for Research Grant and Study Leave Committee of the University of the Western Cape, a prospective quantitative cohort study was used, data was collected using a standardized injury report form and demographic questionnaire during the training sessions and matches for the duration of the tournament. The research instrument collected information concerning players' socio-demographic data, information concerning sustained injuries and action taken after the injury. The sports injury definition used in this study was "any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, which was sustained by a player during a rugby match or rugby training, irrespective of the need for medical attention or time-loss from rugby activities". The Statistical Package for Social Scientists (SPSS) version 19.0 was used to analyze the data.

The injury prevalence among the 37 rugby players for the tournament was 86.5%, and the total incident rate was 540 injuries per 1000 playing- hour. The match injury incident rate was 256 injuries per 1000 playing- hour, well as for training was 26.6 injuries per 1000 playing hour, in addition, the Backs suffered more injuries compared to the Forward with an injury prevalence of 56.6% (N=82) and 43.4% (N=63) respectively. Most of the injuries were in the second half, with second half injury prevalence of 73% (n= 60) compared to first half with injury prevalence of 27%, (n= 22) and these injuries were mostly minor and moderate. The lower limb suffered most of the injuries 88 (60.17%), specifically the upper leg 27 (18.6%) injuries throughout the tournament. Furthermore, the re-occurrence of injuries was 43 (29.7%). The most preventive strategies used were the warm-ups, stretches, straps and taping, in addition, the medical staff used mostly ice therapy, exercises, taping and straps to manage the injuries sustained during the tournament.

Rugby being a highly physical and contact sport, coupled with high number of physical contacts, injuries are quite inevitable. The prevalence and incidences of injuries for the current study was much higher than most of other studies found in literature. This is likely due to injury definition, methods of data collections and level of participation. Most of the injuries were located on the lower limb; this is consistent with several of other studies found in literature. The rugby players mostly suffered from acute soft tissue injuries such as muscles, tendons, ligaments and skin, few injuries affected the spine and the nervous system as it has been reported in the previous studies (Neil Dunn & Dirk vander Spuy, 2010). Most of the injuries were caused by other mechanisms such as muscle fatigue, overuse, overexertion, stumbling and falls. This is similar to the report by Gabbett (2003). However, several studies in literature have indicated that injuries in rugby are mostly caused by tackles (King *et al.*, 2010; Garraway & Macloed 1995). Most of the injuries

players indicated the use of warm-ups as a preventive measure and few of the players indicated the use of protective equipments prior to these injuries. The ice therapy was mostly used during the event to treat the soft tissue ailments; this is consistent with other studies literature by Oluwatoyosi & Owoeye (2010) and Jelsma *et al.* (1997). In conclusion, there is a need for more awareness with regards to the importance of safe –playing in rugby football at UWC rugby club and injury prevention strategies. This will significantly lower the cost of managing injuries and preserve more players to compete at national and international level.

6.2 RECOMMENDATIONS

This study was the first study on the University of the Western Cape Rugby team players. The study highlights the need for more support as far as sports injury surveillances, physiotherapy, and rehabilitation services are concerned, therefore the following recommendations are suggested based on the findings.

1. The UWC Sports Department should encourage sports injury surveillance programmes within every sports code; this will allow comparison and help to develop appropriate sports injury preventive programs.

2. The medical staff should support the players before the event, during the event and after the sports event. This will minimize the over-use and recurring injuries, which were identified during this study. Such support would include injury prevention workshops before the events, and follow up players after injuries until full recovery

3. During this study, the researcher collected data using an open-ended questionnaire. For future studies I would encourage the researcher to obtain stakeholders such as the

participants, coaches, managers and promoters of the sport input on what the risks of sports injuries to participants, and their perceptions on what are the constraints towards the injury prevention strategies.

4. The medical section at the Sports Department need more financial support, as it was identified that players lacked supportive equipment such as mouth guards, knee or ankle braces, straps, bandages and kinesio-tapes.

5. The physiotherapist needs to carry out awareness programmes to improve on the knowledge of the players on how to use some of these equipment, and their ailments due to these injuries.

6. The researchers need to get big samples compared to the current study.

6.3 STUDY LIMITATIONS

I. The recording of the details concerning causes and mechanisms of injuries is still a very challenging issue, since most of the players do not remember concisely what caused their injuries. In addition, during training, there is no video coverage for clarification.

II. The sample size was very small for a quantitative study, this affects the results and recommendations to be made at the end of the study.

III. The researcher encountered financial constraints, and as such, he could not travel with the team to study for the away training sessions and matches, and had to rely on the trained biokineticist as a research assistant.

IV. The current study was carried out on one rugby team, which is not advisable by the IRB injury surveillance section (Fuller *et al.*, 2006). Therefore, the study cannot be generalized for the UWC Rugby club.

V. Investigating the prevalence and incidences of injuries, location and management of injuries among University students is a very challenging task. Even after consenting to the study, it was not easy to follow them up for clarification as required in cohort studies.

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APPENDIX A: Injury report form.

INJURY REPORT FORM.

A SOCIO- DEMOGRAPHIC QUESTIONNIARE

1. **No_ years played rugby** .....2. **Age**..... 3. **Gender**... Male/ Female

4. **Players Name**:-.....5. **Contacts; email**..... **cellphone** .....

6. **Marital status**. Student/ Married/ Single/ Others....

12. **Education level.** Completed secondary school/ University/ Others....

13. **Any history of Injury before the game.** Yes / NO.

14. **Training sessions a week.** 1. 2. 3. 4. 5. 6. 7.

15. **Anthropometric studies:-**

16. Height.....meters. II. Body Mass Index..... Kg/m² III.

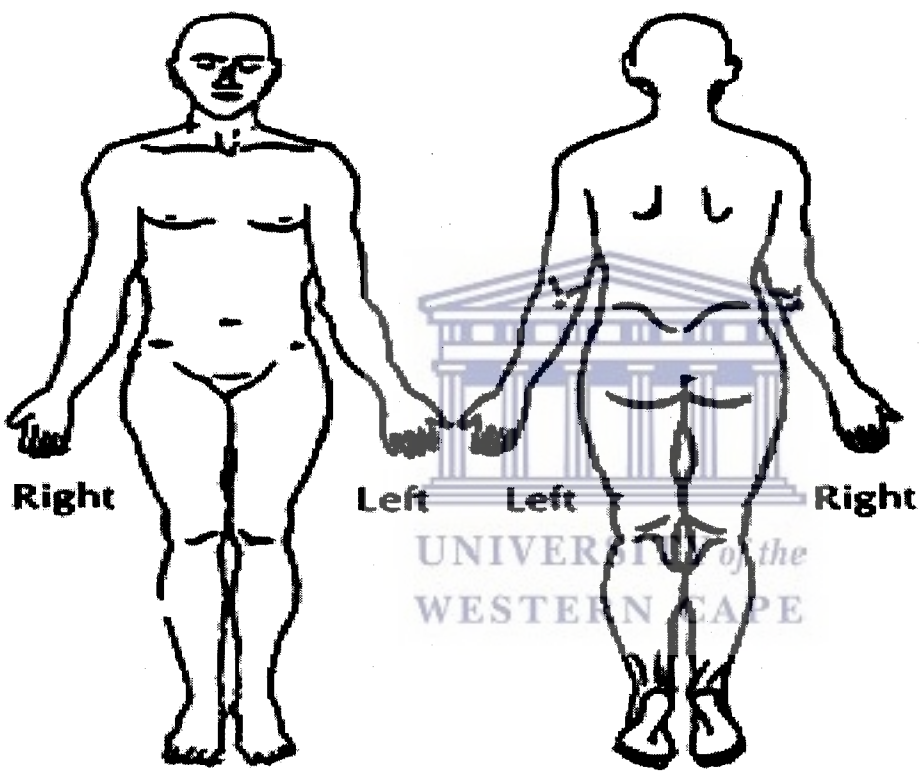
Weight.....kgs.

1. Name. ..... 2. Date. ..... 3.Time.....am/pm.

4. Age..... 5. Venue ...Home/away.6.Event. Game/ Training

Circle the appropriate response.

4. **Site of injury: - BODY CHART.**



5. **Severity of injury.** Minor/ mild/ moderate / severe.

6. **Phase of play OR aspect of training.**Scrum, lineout, Ruck, Maul, Tackle, Pileup,Collision, Others .....

7. **Terrain a factor of injury.** Hard /soft /muddy /others…….

8. **Weather a factor of injury.** Hot / cold / wet / Other…….

If injured in the game or match continue to question 9. If at training, go to question 14.

9. **Time of game.** 1st half /2nd half /time on…

10. **Relationship of ball and injured player** Near ball / Behind play.

11. **Rule.** Legal / Illegal.

12. **Position played.** LHP H THP LL RL LF RF8
HB5/8 LW IC RW FB.

13. **Back or forward** (circle) B/F

Question 14: CLASSIFICATION OF INJURY.

Assessment.

Treatment.

Instruction to player/carer.

Referred to.

Other information.

NOTE.

SEVERITY OF INJURY:-

Minor – if able to return to game/training in which injury occurred.

Mild - if missed one week.

Moderate - if missed two weeks.

Severe - if missed more than two weeks.

POSITION PLAYED – 1. LHP- loose head prop, 2. H –Hookers, 3. THP- Tight head prop

4. LL- Left lock, 5. RL- Right lock, 6. LF- Left franker,

7. RF- Right franker, 8.No. 8, 9.9. HB- Half back, 10. 5/8 Five eight

11. LW – Left wing, 12. IC – Inside centre, 13. OC – Outside center,

14. RW- Right wing, 15. FB- Fullback.

Medic / Sports Trainer's Name..... **Signature**.....

APPENDIX B: The consent form.

Appendix E

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959, Fax: 27 21-959

E-mail:

CONSENT FORM

Title of Research Project: THE PREVALENCE OF SPORTS INJURIES AMONG THE UNIVERSITY OF THE WESTERN CAPE RUGBY FOOTBALL CLUB.

The study has been described to me in the language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way.

Participant's name.....

Participant's signature.....

Witness Signature.....

Date.....

This research project will involve making videotapes/photographs of you. This will help in understanding the mechanisms of the injury, type, location and improve on the reliability of the data collected at the venue. We shall do our best to protect this records and photographs, this will help protect your confidentiality, these recordings will be kept and locked in a safe place, and if we write a report or article about the research findings, your identity will be protected to a maximum extent possible.

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact the study coordinator:

Study Coordinator's Name: Prof. Julie Phillips.

University of the Western Cape

Private Bag X17, Belville 7535

APPENDIX C: The information sheet

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa

Tel: +27 21-959, Fax: 27 21-959

E-mail:

INFORMATION SHEET

Dear Participant, greetings.

I am **Samuel Lubega Kiwanuka**, a postgraduate student, currently pursuing a Masters degree in Physiotherapy at the University of The Western Cape (UWC) in the Republic of South Africa. As part of the programme, I am required to conduct a research project to fulfil the requirements for the Master of Science degree in Physiotherapy.

TITLE FOR MY RESEARCH:The prevalence of sports injuries among University of the Western Cape rugby football club.

This is a research project being conducted by Samuel at the University of the Western Cape. We are inviting you to participate in this research project because you will assist in determining the prevalence of sports injuries among the University of the Western Cape rugby football players. This will assist to challenge health professionals especially physiotherapists for future strategic approaches in prevention and management of sports injuries among rugby football players. It will also add value to the scanty literature available.

The purpose of this research project is to assist in determining the prevalence of sports injuries among the University of the Western Cape rugby football players. It will also be a challenge to health workers such as physicians, surgeons, first aiders and physiotherapists to focus beyond treatment and emphasize on the importance of prevention. Generally, rugby is highly collision sport, possibly contributing to high different severe injury profiles in the sport, and it's evident that data concerning player's injury at this level, in the institutions of higher learning is not enough to enhance quality preventive and management strategies, hence the serious need to address the issues of the risks involved.

The researcher and his assistants will record all the injuries incurred by the players during the games, and also in the training sessions. The researcher will be available at all the venues where

the sports activities involving your participation (games & training sessions) will be taking place. We shall be using an injury report form, and will consist of four sections; section one is about whether it's initial/ new, or aggravation of the old injury, furthermore you will let us know about your injury experience, knowledge on protective equipments, and we shall check whether it's properly used before the injury. The researcher will indicate the nature of injury, and the risk factors involved. The second section is concerned about the mechanisms such as collision with a person or fixed objects, fall from height or same level, heat exhaustion, struck by a person or object. The third section we shall indicated the body part injured before and during your participation in the sport. The fourth section will be concern with the treatment given to you or any action taken after the injury. The study will be conducted at all the venues where the players will be conducting training sessions or competing. This investigation will take 2 months, where we shall be investigating about your injuries due to rugby football.

We will do our best to keep your personal information confidential. To help protect your confidentiality, your form will be kept and locked in a safe place, the survey is anonymous and will not contain information that may personally identify you, your name will not be included anywhere, a code will be placed on the survey and other collected data, through the use of an identification key, the researcher will be able to link your survey to your identity and only the researcher will have access to the identification key.

If we write a report or article about this research project, your identity will be protected to the maximum extent possible. In accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning potential harm to you or others. There are no known risks associated with participating in this research project.

The benefits to you will be that more emphasis in quality prevention and management will be highlighted depending on the outcomes. This research is not designed to help you personally, but the results may help the investigator learn more about, the prevalence, and risk factors of the sports injuries among the rugby football players at the University of the Western Cape (UWC). We hope that, in the future, other people might benefit from this study through improved understanding of the problem as health professionals especially physiotherapist as they will be challenged to implement highly informed strategic approaches towards quality prevention and management injuries towards the UWC rugby football players. It will also add value to the scanty literature available.

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you

decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.

This research is being conducted at the University of the Western Cape. If you have any questions about the research study itself, please contact:

Samuel Lubega Kiwanuka

Physiotherapy Department,

University of the Western Cape,

Private Bag X17,

Bellville 7535.

Tell +27 21 959 2542 (department),

Cell 0710162449

Email: lubegasmlk41@gmail.com/3074911@uwc.ac.za

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please contact:

Professor J. Phillips,

Head of Physiotherapy Department,

University of the Western Cape,

Private Bag X17,

Bellville 7535,

Tel: +27 21 959 2546,

Email:jphillips@uwc.ac.za.

Professor R. Mpofu,

Dean of the Faculty of Community and Health Sciences,

University of the Western Cape,

Private Bag X17,

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Tel: +27 21 959 2631,

Email:rmpofu@uwc.ac.za.

This research has been approved by the University of the Western Cape's Senate Research Committee and Ethics Committee.

APPENDIX D: The Ethical clearance letter

OFFICE OF THE DEAN
DEPARTMENT OF RESEARCH DEVELOPMENT

Private Bag X17, Bellville 7535
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Fax: +27 21 959 3170
Website: www.uwc.ac.za

21 February 2011

To Whom It May Concern

I hereby certify that the Senate Research Committee of the University of the Western Cape has approved the methodology and the ethics of the following research project by:
Mr. S Lubega (Physiotherapy)

Research Project: Incidence and prevalence of injuries among rugby players during a rugby tournament

Registration no: 11/1/26

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape