SURVEILLANCE OF INJURIES AMONG KENYA RUGBY FOOTBALL UNION (KRFU) PLAYERS- SEASON 2010

A dissertation submitted in partial fulfillment for the requirements of the Degree of Master of Medicine in General Surgery (MMed General Surgery), University of Nairobi.

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1. CONTENTS

1. Supervisors: 2
2. Contents 3
3. Abbreviations 5
4. Abstract 6
5. Introduction 7
6. Literature Review 9
7. Study question 16
8. Study Justification and Utility 16
9. Objectives 17
   a. Primary objectives 17
   b. Secondary objectives 17
10. Methodology 18
   a. Study design 18
   b. Sample size calculation 18
   c. Setting 18
   d. Participants 19
   e. Inclusion criteria: 19
   f. Exclusion criteria: 19
11. Procedure and data Management 20
12. Statistical analysis 24
13. Ethical considerations 24
14. Results 25
   1) Anthropometric data for the sample population 26
      a. Anthropometric data in relation to level of play 26
      b. Anthropometry between injured and non-injured 27
   2) Injury characteristics 28
      a. Distribution of injury based on location of body 28
      b. Distribution of injury based on type. 29

c. Distribution of injury based on severity 30
d. Classification of injuries based on recurrence 31
e. Distribution of injuries based on mechanism of injury 32
f. Distribution of injury as a factor of time 33
g. Association to foul play 34
3) Injury and the pitch 34
4) Logistic regression model comparing the injury associated variables 35
15. Discussion 36
16. Study limitations 41
17. Conclusion 42
18. Recommendations 43
19. References 44
20. Appendices 48
A. Main groupings and categories of type of injury 48
B. Data sheet 49
C. Consent by participating athletes 50
D. The captains pitch categorisation table 51

2. ABBREVIATIONS

CI:	Confidence interval
ESS:	Eric Shirley Shield
JKUAT:	JomoKenyattaUniversityof Agriculture and Technology
IRB:	International Rugby Board
KCB:	Kenya Commercial Bank
KC:	Kenya Cup
KNH-ERC:	KenyattaNationalHospital Ethics and Research Committee
KRFU:	Kenya Rugby Football Union
MPH:	Match player hours
RFC:	RugbyFootball Club
RICG:	Rugby International Consensus Group
SPSS:	Statistical Package for Social Sciences
SD:	Standard deviation
USIU:	United StatesInternationalUniversity
WHO:	World Health Organization

4. ABSTRACT

Background:

The Kenya rugby scene is changing. There are now more players and stiffer competition with attendant rise in the standards of play.The increase in both public awareness and media attention makes the sport verycompetitive. Previous studies have associated higher standards of play with increased injury risk. In Kenya,sub-optimal pitch conditions, poorly conditioned players based on reduced playing time, smaller body mass indices and younger player ages create a unique environment for injury exposure and patterns.

Objective:

To survey the incidence and pattern of rugby injuries throughout the 2010 seasonamongKenya rugby football union (KRFU) registered players.

Subjects &Method:

A whole population prospective cohortstudy of injuries amongst352 registered Kenya rugby football union players was conductedthroughout the 2010 15-aside season. Data on player demographics, injury occurrence and recurrence, injury patterns and pitch characteristics were collected from all the games in the division one and two leagues played in Nakuru andNairobi. The study tool used was that developed for injury surveillance by the International RugbyBoard, the RugbyInternational ConsensusGroup (RICG)Statement.

Results:

There were a total of 60league games for the season recording 102 injuries for2400matchplayer hours. The incidence of injuries was 42.50/1000match player hours. (44.17for forwards and40.83for backs). Lower limb injuries were the most common (41.2% of all injuries). Most injuries (63.7%) were sustained in the tackling/tackled scenario. Players were most prone to injuries at the beginning of the season (47.1% of all injuries), in the last quarter (50%) of a game and on bad pitches (41.38 injuries per 1000mph versus 23.19 injuries per 1000mph).About one tenth (10.8%) of injuries were associated with a dangerous play.

Conclusion:

The injury incidence recorded here contrast the earlier Kenyan datum as well as professional an international level of play rates. However, the rate is comparabletoamateur level incidence, uniqueness of the Kenyan environment notwithstanding. The higher rates associated withthe tackle/tackled scenario, bad pitches, earlier part of the season and later part of the game, suggest interventions can target player conditioning, use of protective gear and pitch optimization,By providing the associated injury characteristics, the study has provided a platform for formulating interventions for injury prevention.

5. INTRODUCTION

Rugby in Kenyais becoming an increasingly popular sport. The player population is rapidly rising. In 2000 for example, eight teams were participating in the 15-aside rugby league as opposed to the current number of 10. At secondary school level, the number of participating teams is also higher dueto the sport being embraced in rural schools as well.[1]The level of play is much higher as evidenced by participation of Kenya in a number of world stage tournaments. The number of regional tournaments hosted has risen, from 1 in 2000 to 5 in 2009.[1]Higher level of play and the increasing media and public interest has made it a high stakes sport.[2]Consequently, an injury to any player in the team could significantly impact on the teams' performance.[2]

Rugbyis a body contact sport that involves tackling, srummaging rucking and mauling,typically played by young people. Such contact phases of play are associated with vulnerability toinjury as a result of extrinsic forces applied to the body.[3] Comparing rugby to the most popular sport, soccer, rugby has a much higher injury incidence i.e.2.7 timesmore match injuries than in soccer.[4]

Detailed information about the nature and causes ofrugby injuries is available at the professionallevel[5, 6, 7]and at the armature level, [6, 8, 9, 10] in developed countries. However, information in a developing nation's setting, where playing time may be significantly lower, players younger and pitch conditions below par is limited.

Studies from the past are available but inter-data comparison has been a challenge due to the variety in definitions of terms and methodologies used. Following examples from sports such as soccer, standardization in definitions and method of data collection has

made it easier for data management and comparison.[11]In the developing nation setting, the standardized instruments of data collection have not been utilized.

The sport participants are young players aged between 18 and 35years, most being school goers. To this end, this dependent populationmay struggle to acquire IRB (international rugby board) protective and proper playing gear (e.g. seasonal boots).This thus creates a unique risk for injury vulnerability. A high prevalence (50–64%) ofamateur rugby league players will participate in foul playand violence in an attempt to win a match.[12]

By and large the maintenance of Kenyan pitches is by natural weather phenomenon, with most watering by rain and drainage of excess water following rains by seepage (repetitive). Thus weather patterns have direct influence on the state of Kenyan playing pitches. Bad weather bad pitches, good weather good state of pitches i.e. extremes of weather conditions have a direct negative impact on the Kenyan pitches.

This study therefore evaluated the player and pitchfactors unique to the Kenyan rugby player and influence on the incidence and pattern of injury.

6. LITERATURE REVIEW

DEFINITION AND INCIDENCE TRENDS

Rugby is a fast-moving contact sport, in which injuries to players arecommon. Prospective studies have identified a large number of factors thatappear to be associated with theincidence of rugby injury, including playingposition,[2]phase ofplay,[2,3]stage of the playing season, stage of the game,[2,12] gender of players,[5]level of play,[6] and previous injury.[10] There are other factors associatedwith the game that potentially affect the risk of injury, such as

warming up,[13] and ground and weather conditions.[14]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.However, as a result of the high number of physical collisions and the dynamic nature of rugby, musculoskeletal injuries are common.[2, 12]

Wide variations in the definitions and methodologies used forstudies of injuries in rugby union have created inconsistenciesin reported data and made inter-study comparisons of resultsdifficult. The International Rugby Board established a RugbyInjury Consensus Group (RICG) to reach an agreement on the appropriatedefinitions and methodologies to standardize the recording ofinjuries and reporting of studies in rugby union. Definitions for injury, recurrent injury, non-fatalcatastrophic injury, and training and match exposures, togetherwith criteria for classifying injuries in terms of severity,location, type, diagnosis and causation have now been standardized and currently, the consensus report or rugby international consensus group statement as known, is the document approved for methodology on rugby research by the international rugby board.[12]

Comparing rugby to other games, in 13 popular sporting activities in which there were sufficient numbers of injuries for the risk to be estimated reliably, rugby with a self-reported injury rate of 96.7/1000 occasions of participation had the highest risk of any exercise related morbidity. The risk of exercise related morbidity in soccer with a rate of 64.4/1000 occasions, which was similar to field hockey (62.6/1000 occasions), was approximately 50% less than in rugby. The difference in risk between rugby and other

activities was greater for substantive injury incidents (rugby 57.7/1000 occasions compared to 22.3/1000 occasions in martial arts and 19.5/1000 occasions in soccer).[15]

At the international level; in the 1995 rugby world cup finals an incidence of 32injuries per 1000match player hours (mph) was recorded.[16] Leading to the 2003 rugby world cup the incidence had tripled to 98 injuries per 1000mph[17]and in the same tournament amongst only the English players the incidence documented was 230injuries per 1000mph, [18] this was with the turn of armature to professional rugby. Comparing the two studies, there was higher incidence of injuries amongst the English rugby national team players who had been selected from a pool in a league that had already turned professional unlike most of the other countries participating in the tournament.

By the 2007 world cup final, most of the participating teams fielded professional players and the injury incidence reported was 83.9injuries per 1000mph.[2]The rising incidence of injuries through the years of rugby at the international scene could have been due to the turn of armature to professional rugby between 1995 and 1999.

Looking at different countries and their national leagues, a study of New Zealand rugby players showed incidence of 10.9injuries per 1000mph of both male and female, with a much higher injury rate in the male gender.[5]This demonstrated gender to be strong influence on the occurrence of injury with much higher rates in the male.In Australia a prospective study over period of 4 year demonstrated an incidence of 69injuries/1000mph[18]this was inclusive of the1995 and 1998 rugby world cups finals,still in the southern hemisphere, studying South African players shown to have participated in

the 2006 super 12 series, the overall incidence of injuries was 55.4 injuries/1,000 player game hours, and 4.3 injuries/1,000 player training hours.[19]

At armaturelevel, a study comparing injuries amongst schools and senior clubs showed it to be higher amongst the clubs.[6]Another study comparing era of armature and turn to professional rugby in the same population, same duration at different times, noted that theproportion of players who were injured almost doubled in 1997–1998 as compared 1993–1994, despite an overall reduction of 7% of the playing strength of participating club in 1997-1998 period.[9]

In the local/Regional scene, in the 1995 regional world cup qualifiers played in Kenya, an incidence of 196injuries/1000mph had been reported[8] much higher than at international level, yet most of the players in this tournament were armature players. This was in contrary to many studies which showed that armature rugby had a lower incidence of injury.

INJURY PATTERNS & DETERMINANTS

Many studies indicated the lower limb injuries to be most common[11, 17] and the knee being of severest form[21]due to the utility of the limbs in most activities of play. However, pattern of locational distribution was also significantly influenced by position of play probably due to the different phases of contact and game velocity amongst backs and forwards.[17]

The tackle was the activity/event responsible for the highest incidence of injury; however, in the recent studies, a much higher proportion of tackle injuries were the result of being tackled rather than from tackling.[2,7,11,19] This difference may indicate that from a personal

injury perspective,players' tackling techniques have improved over the last 10years.[2] After tackles, collisions, rucks and scrums were responsiblefor the highest incidence of match injuries but importantly,the incidence of collision injuries was almost four timeshigher than that reported for English professional rugby.[2,7]Foul play is a great contributor to the occurrence of injury in rugby and especially noted in armature rugby.[8]

Introduction of professionalism in the rugby union has coincided with an increase in injuries to both professional and armature players.Professional players have to adapt to the demands of increased physical and mental robustness, as well as show thestrength and pace expected of fulltime athletes.[20]

Time has been implicated as an influencing factor in the occurrence of injury. Injury incidence is higher at the beginning of the season, because the players are not yet at their fittest.[2, 3, 6, 7] A percentage as high as 70% of incidences of injuries in the second half of the game had been documented.[9]Game time biased distribution of injuries was with most injuries occurring in the last quarter of the game, fatigue being the factor postulated to be predisposing players to injury.[2, 15]

Environmental conditions as well as poor pitch conditions have been shown to influence occurrence of rugby injuries.[13, 14, 26] Apart from physical contact with the surface, ground hardness might be an important indirect factor in rugby union injuries owing to its influence on running speed and consequent impact force. Although it is recognized that a hard ground provides greater external force directly to the body when a player falls, a harder sports ground also produces faster and quicker movements, probably because of increased traction and less force attenuation.[25]

Various studies pointed that prevention strategies were possible either by warm up procedure, [17, 18]use of protective gear[19, 24]or preseason fitness and rest[10] as part of conditioning for players.

Specific conditioning sets have been recommended for specific injury.Example,the Nordic hamstring strengthening exercise may reduce the incidence and severity of hamstring muscle injuries sustained during training and competition.[22]

RUGBY AND INJURY DYNAMICS IN KENYA

In Kenya, rugby is played at armature level with most of the players, being engaged in full time employment or school. Training is usually in two week day afternoon sessions, followed by game day usually on Saturday afternoons. Comparing this to the developed country counterparts where the game is played at much higher level, the training exposure time is significantly less.

The playersaged between 18 and 35years, are mostly dependent and thusacquiring IRB recommended protective andplaying gear e.g. seasonal boots is financially grim.Kenyan rugby is armature rugby and since a high percentage (50–64%) ofamateur rugby league players will participate in foul playand violence in an attempt to win a match, [12] then this should impact on the occurrence of injury in the local scene.

Maintenance of Kenyan pitches is by natural weather phenomenon, with most watering by rain and drainage of excess water following rains by seepage. Thus weather patterns have direct influence on the state of Kenyan playing pitches. Bad weather bad pitches, good weather good state of pitches.

Pitch factors as well as the player factors in Kenya aforementioned might be contributory as unique factors that influence the incidence and pattern of injury.

The unique dynamics in Kenya just like in any developing nation that may influence the consistency of previously reported data are therefore:

- Suboptimal pitches not meeting IRB recommended standards,[31]
- A relatively lower body mass as compared to developed nation/professional players,
- Poor conditioning,
- Poor training skills,
- Foul play and
- Inaccessibility to proper playingandprotective gear, recommended by IRB.[27]

7. STUDY QUESTION

What is the incidence and pattern of injury amongst rugby players in Kenya?

8. STUDY JUSTIFICATION AND UTILITY

- The player population and playing conditions are unique in comparison with available data. Therefore generating local detailed data on incidence, pattern and distribution of rugby injuries will aid the Kenya rugby football union in formulating locally based injury prevention formulary.

- Doing a study in line with the RICG statement will ensure standardization of local data to internationally accepted standards thus easing inter-study comparisonof injury dynamics.

- There exist deficiencies of knowledge in pattern and incidence of rugby injuries in Kenya; bridging the gap between growth of the sport and medical sporting injury will aid in defining solutions of injury prevention thus improve team performance.

9. OBJECTIVES

A. PRIMARY OBJECTIVES

- To determine the incidence and pattern of rugby injuries.

B. SECONDARY OBJECTIVES

1) To determine the locationaland positional distribution of rugby injuries.

2) To determine the factors associated with injury severity including:

   a) Playerbio-profile.

   b) Mechanism of injury.

   c) Time of season and of game.

3) To evaluate the relationship between incidence of injuries and pitch condition.

10. METHODOLOGY

A. STUDY DESIGN

This was a prospective whole population cohort study.

It was conducted between MayandAugust 2010,to coincided with the 15-aside rugby season i.e. Kenya cup division one and Eric Shirley shield division two leagues.

B. SAMPLE SIZE CALCULATION

Sample size was calculated based on assumption that the proportion (p) of rugby players who would develop an injury would be 30%(based on the proportion of injured in 2007 world cup finals[2]) in which case, based on the Fishers (1998) sample size formula below for estimation of proportions for cohort studies, at 95% ($z=1.96$) confidence and an error margin (e) of 5% we needed 288 participants.

Sample size $n = z^2 * p\,(1-p)/e^2$

A sample size of 355players was used, based on RICG requirements of whole population study.[11]

C. SETTING

Kenya rugby affairs are run by KRFU; there are 20 registered clubs, with some of the clubs contributing two teams to the rugby calendar.Kenya rugby is armature level, played by young men aged between 18-35years.80percent of the players are based inNairobi province. The rest are in Nakuru accounting for majority of the players in the Rift Valley. There are also rugby players in Mombasa, Kisumu and Western province; however

financialconstrains result ininconsistentparticipation of the clubs the players are affiliated with in the KRFU calendar. Most rugby clubs have twice weekly evening training sessions, with a game every weekend.

D. PARTICIPANTS

Participants were all players registered by the various clubs and thus by KRFU. The inclusion and exclusion process was done by clinical officers.

E. INCLUSION CRITERIA

- Adults older than 18years.
- Players who had been registered with KRFU and playing in the season 2010games.

F. EXCLUSION CRITERIA

- Kenyan players registered and playing for other rugby leagues.
- Any registered player who did not anticipate playing in the 2010 season.
- Blood bin injuries: *A blood injury that required a player toleave the field of play for treatment under Law 3.11(a) was not included as an injury in the study unless the player subsequentlylost time from training or competition as a result of the injury.*
- Players on national assignment: Due to different levels of play and a different exposure environment, injuries acquired on national assignment were not considered. However, on return to the local league, if the same location and type of injury did occur during a match to same player it was recorded as a recurrence as opposed to new incident; this was to reduce its exaggerated influence on statistics.

11. PROCEDURE AND DATA MANAGEMENT

Baseline bio-datawas collected and recorded for all players registered by the Kenya rugby football union: These included: age, height, weight, injury status at that time, dominant hand and leg, and position played.

The participating fifteen players per team were clustered into two playing positions: forwards (positions 1 to 8) and backs (positions 9 to 15).

Ten clinical officers were recruited for purposes of data collection.Data from games played in Nakuru were collected by one clinical officer. Out of the ten, three were back-up clinical officers, two in Nairobi and one in Nakuru to cover up for unexpected deficiencies.

Injury was defined as any physical complaint sustained during a rugby match, which was caused by a transfer of energythat exceeded the body's ability to maintain its structuraland/or functional integrity, irrespective of theneed for medical attention or time-loss from rugby activities.[11]

An injury that resulted in a player receiving medical attentionwas referred to as a 'medical-attention' injury andan injury that results in a player being unable to take a fullpart in future rugby training or match play as a 'time-loss'injury.[11] .

A non-fatal catastrophic injurywas a brain or spinal cord injury that resulted in permanent severe (greater than12months) functional disability.[11]

Severe functional disability was defined as loss of greater than 50 percent of the capability of thestructure.[28]

Information regarding match fitness and return to play was forwarded by the team physiotherapist or medical representative.

The clinical officers undertook two weeks of rigorous training on utility of instrument of data collection followed by a proficiency exam and a practical test on the same, using one of the Kenya cup matches to familiarize them with the data tool.

The pitches were categorized into two: Category A representing the good-condition pitches and category B the bad-condition pitches.The criterion used was partly that developed by institute of good groundsmanship.[29]Theseincluded:

- Degree of evenness, undulations or depressions,
- Firmness, giving good grip(traction) for players especially during scrummage,
- Degree of coverage with sward of desirable grasses,
- Drainage system and degree of cushioning for players due to impact from tackling, being tackled or diving and
- General feeli.e. seasonal variation, affliction of pitch by extremes of weather.

The captains were used to grade the 8pitches used in the 2010 rugby season. Each was given a form with the above 5points, each having a maximum of four points and minimum of one point, the average of the points was taken, any score above 10 falls under category A pitches, and fewer than 10 will fall under category B.Two fell in the category A pitches and six fell in category B pitches.The teams in Nairobi were divided into four blocks for data collection by clinical officer:

BLOCK A:Nondescript RFC teams 1 and 2 and Impala RFC teams 1 and 2.

BLOCK B:StrathmoreUniversityRFC teams 1 and 2 and Harlequin RFC teams 1 and 2.

BLOCK C:Mean machine RFC 1 and 2 and MwambaRFC 1 and 2.

BLOCK D:Kenya Commercial Bank 1 and 2 and Home Boys.

The following were the events/variablesrecorded at time of injury;

1. Mechanism of injury classified as contact like tackling, tackled, maul, ruck, lineout, scrum,collisionor non-contact.
2. Whether injury was as a result of foul play as judged by referee/touch judges.
3. Location of injury, defined as categorization of injury according to anatomical entities as defined by the RICG injury questionnaire.[11]
4. Type of injury, which was based on tissue type affected.[11] This was recorded on the pitch in real time on the basis of clinical acumen, or following radiological investigations where needed.
5. Time of injury during game and season: divided into quarters.
6. Recurrence of injury based on RICG definitions.[11]

A recurrent injury was defined as an injury of the same type and locationas an index injury which occurred after a playerhad returned to full participation following recovery from the index injury.

An early recurrence was defined as an injury occurringwithin 2 months of a player's return to full participation.

Late recurrence was an injury within 2 to 12months of full recovery.

Delayed recurrence was any injury that occurred more than12 months after a player's return play.

Severity of injury was recorded once player resumed playing, and was defined as number of days that had elapsed from date of injury to date of player's return to full team training and availability for match selection.[12]

According to severity, injuries were thus grouped as follows; slight (0–1days), minimal (2–3 days), mild (4–7 days), moderate(8–28 days), severe (>28 days), "career-ending" and"non-fatal catastrophic injuries".

All datadocumentation was entered in a preformatted sheet

12. STATISTICAL ANALYSIS

Data werecollected using a preformatted data sheet with great care taken to preserve the confidentiality of participants. Data wereentered into a purpose designed database(Statistical Package for Social Sciences Version 17.0) with participants identified only by a study code. At the point of data entry, range and validity checks were incorporated to minimize data entry error.

Data analysis was performed using SPSS version 17 software: incidence was calculated as injuries per 1000 player-hours of exposure (95% CI) and severity of injury was reported as mean (95% CI) and median (95% CI) values and grouped within the categories: minimal (2-3 days), mild (4–7 days), moderate (8–28 days) and severe(28 days). For the secondary objectives, frequencies were reported as simple percentages and means were used for continuous data.

Student t-test was used to compare the means between injured and non-injured for continuous variables i.e. age, weight, height, BMI.

Match exposure wascalculated on the basis of 15 players (8 forwards, 7 backs) per team exposed for 80 minutes (first half 0–20, 20–40, second half 40–60, 60–80minutes).

13. ETHICAL CONSIDERATIONS

Approval to carry out the study wasobtained from theKenyatta National Hospital Ethics and Research Committeeand theKRFU board.

To ensure confidentiality every participant was allocated a study serial number linking them to their bio-database accessible to the principal investigator.

14. RESULTS

Three hundred and sixty four players were enrolled in the study(191 forwards and 173backs). There were a total of 16teams which participatedin the two leagues of season 2010; the level oneleague (Kenya Cup) and the level two league (Eric Shirley shield). All teams provided baseline information and informed consent from players.

There were 60 league games (30 Kenya cupand 30 Eric Shirley) constituting a total of 2400match player hours for the season of 2010. The season duration was 3months duringwhich time a total of 102 injuries were recorded. The incidence of injuries was42.50/1000match player hours(Forwards44.17; Backs40.83).

The ages of the players ranged from 18 to 40 years with a mean of 22.80 years (SD3.724). The mean weight of the players was 81.83kg (SD12.57) and mean height was 1.75metres (SD 0.70).The mean BMI was 26.59(SD 3.73).

From a level of play perspective; a total of 169 players (76 backs and 93 forwards) played in the Kenya cup and 195(97backs 98forwards) participated in the Eric Shirley league in the 2010 rugby season thus in the study.

The Kenya cup (division one) league accounted for a total of 64.6% of injuries which translated toan incidence of 55injuries/1000mph for Kenya cup and 30injuries /1000mph for the Eric Shirley league($p<0.0001$).There were no career ending or catastrophic injuries noted.

Out of the 8pitches, 6 fell in the poor category pitches and only two fell in the good category pitches.

1) ANTHROPOMETRIC DATA FOR THE SAMPLE POPULATION

A. Anthropometric data in relation to level of play

The Kenyan player's meanage was 22.80 years (SD 3.724)with amean weight of 81.83years (SD12.57) and mean height of 1.75(SD 0.70).The mean BMI was 26.59(SD 3.73).The comparative bio-profile of the player was as follows:

Table 1: Comparison of anthropometric measures between level 1 and level 2 players

Characteristic	KenyaCup(n=169) Mean(SD)	ESS (n=195) Mean(SD)	95% CI
Age	21.41 (3.071)	24.40 (3.778)	-3.69 to -2.28
Weight	78.29 (12.254)	85.91 (11.701)	-10.10 to -5.13
Height	1.7436(0.0720)	1.7662(.0679)	-0.037 to -0.01
BMI	25.757 (3.782)	27.5409 (3.438)	-2.53 to -1.03

The level one playerwasolder ($p < 0.001$), heavier ($p < 0.001$) and taller (p0.002)with a larger BMI($p < 0.001$).

B. Anthropometry between injured and non-injured

Table 2: Comparative anthropometry between injured and non-injured players

Characteristics	Non-injured(n= 92) Mean(SD)	Injured (n=273) Mean (SD)	95% CI
Age	22.57(3.771)	23.47 (3.516)	-1.777 to -0.018
Weight	80.89 (13.058)	84.62 (10.599)	-0.041 to -0.008
Height	1.74 (0.072)	1.77 (0.064)	-6.695 to -0.772
BMI	26.46 (3.872)	26.96 (3.260)	-1.380 to -0.389

The 102 injuries occurred amongst 92players (some players had multiple injuries in same incident or at different times of different games).The injured playerwas older(p 0.046), heavier (p 0.014), taller (p 0.004), and with a larger BMI (p 0.271).

2) INJURY CHARACTERISTICS

A. Distribution of injury based on location of body

Table 3: Incidence of injury as a function of location of body

Site	Backs			Forward			Total	
	Count	%	95%CI	Count	%	95%CI		%
Head face	11	10.78	4.7 to 16.8	12	11.8	5.5 to 18.0	23	22.5
Neck Cervical Spine	0	0.00	0.0	4	3.9	0.1 to 7.7	4	3.9
Sternum Ribs Upper Back	0	0.00	0.0	3	2.9	-0.4 to 6.2	3	2.9
Abdomen	0	0.00	0.0	1	1.0	-0.9 to 2.9	1	1.0
Lower back	1	0.98	-0.9 to 2.9	3	2.9	-0.4 to 6.2	4	3.9
Shoulder Clavicle	11	10.78	4.7 to 16.8	7	6.9	1.9 to 11.8	18	17.6
Upper Arm	1	0.98	-0.9 to 2.9	0	0.0	0.0	1	1.0
Elbow	0	0.00	0.0	1	1.0	-0.9 to 2.9	1	1.0
Forearm	0	0.00	0.0	2	2.0	-0.7 to 4.7	2	2.0
Wrist	0	0.00	0.0	1	1.0	-0.9 to 2.9	1	1.0
Hand Finger Thumb	1	0.98	-0.9 to 2.9	1	1.0	-0.9 to 2.9	2	2.0
Hip Groin	3	2.94	-0.4 to 6.2	1	1.0	-0.9 to 2.9	4	3.9
Posterior Thigh	2	1.96	-0.7 to 4.7	0	0.0	0.0	2	2.0
Knee	9	8.82	3.3 to 14.4	7	6.9	1.9 to 11.8	16	15.7
Ankle	10	9.80	4.0 to 15.6	6	5.9	1.3 to 10.5	16	15.7
Foot Toe	0	0.00	0.0	4	3.9	0.1 to 7.7	4	3.9
Total	**49**	**48.00**	**38.3 to 57.8**	**53**	**52.0**	**42.2 to 61.7**	**102**	**100.0**

The forwards had an injuryincidence of 44.17injuries per 1000mphcompared to 40.83injuries per 1000mph for the backs. The difference was not statistically significant (p 0.521). The most common regions injured were the lower limb(41.2%),upper limb had(24.6%),head and neck (26.4%) of injuries (table 3).Predominant single anatomical entities most injured were head and face, shoulder ankle and knee for both backs and forwards.

B. Distribution of injury based on type.

Table 4: Incidence of injury as a function of type of injury

Type	Backs			Forwards			Total	
	Count	%	95%CI	Count	%	95%CI	Count	%
Concussion	2	2.0	-0.7 – 4.7	5	4.9	0.7- 9.1	7	6.9
Fracture	2	2.0	-0.7- 4.7	3	2.9	-0.4- 6.2	5	4.9
Dislocation Subluxation	5	4.9	0.7- 9.1	3	2.9	-0.4- 6.2	8	7.8
Sprain Ligament Injury	21	20.6	12.7- 28.5	18	17.6	10.2- 25.1	39	38.2
Muscle Rupture Strain Tear Cramps	5	4.9	0.7- 9.1	8	7.8	2.6- 13.1	13	12.7
Tendon Injury/ Rupture/ Tendinopathy/ Bursitis	0	0.0	0.0	2	2.0	-0.7- 4.7	2	2.0
Hematoma/ Contusion/ Bruise	3	2.9	-0.4- 6.2	2	2.0	-0.7-4.7	5	4.9
Abrasion	2	2.0	-0.7- 4.7	0	0.0	0.0	2	2.0
Laceration	4	3.9	0.1- 7.7	6	5.9	1.3- 10.5	10	9.8
Visceral Injury	0	0.0	0.0	1	1.0	-0.9- 2.9	1	1.0
Mixed	5	4.9	0.7- 9.1	5	4.9	0.7- 9.1	10	9.8
Total	**49**	**48.0**	**38.3**	**53**	**52.0**	**42.2**	**102**	**100.0**

The most common types of injuries were Ligamentous (38.2%) and concussion (8.9%) (table4). The types of injuries were generally of similar distribution amongst the forwards and backs.

Most injuries were dominant side injuries, being right foot/hand in 75.9% of players. The bilateral injuries were those mainly associated with proximity to midline

C. Distribution of injury based on severity

Most injuries were of mild to moderate severity. There were no catastrophic or career ending injuries repeated. The cumulative percentage of mild to moderate injuries was 78percent for the backs versus 67.3percent for the forwards. Comparing the injury severity clustered into slight to the moderate group against severe injury for backs and forwards; position was not a statistically significant determinant of severity of injury (p 0.161).

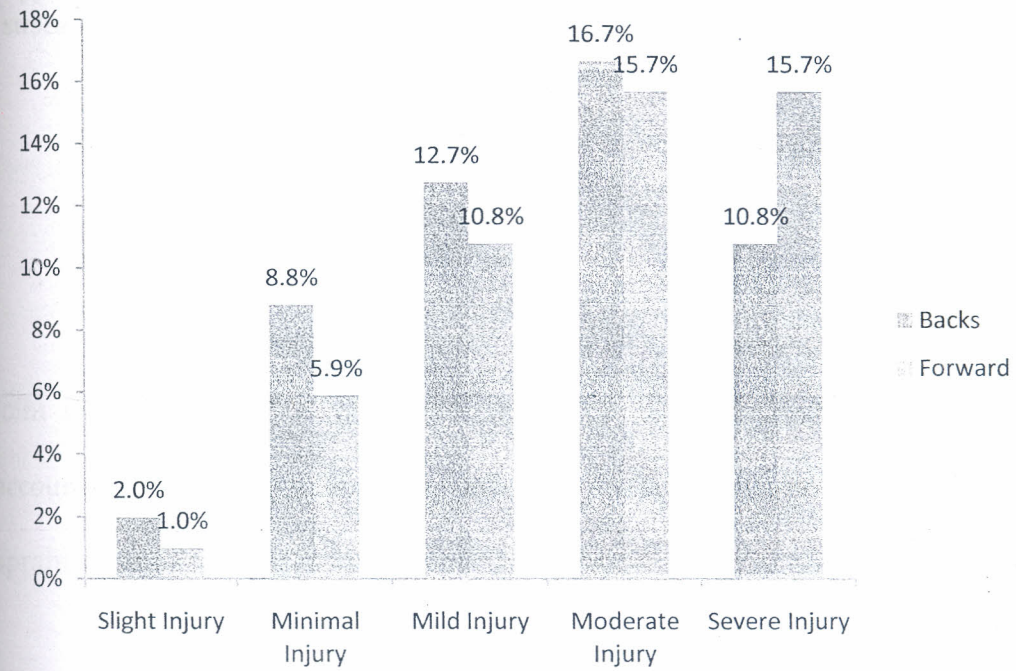


Figure 1: Relation of injury to severity

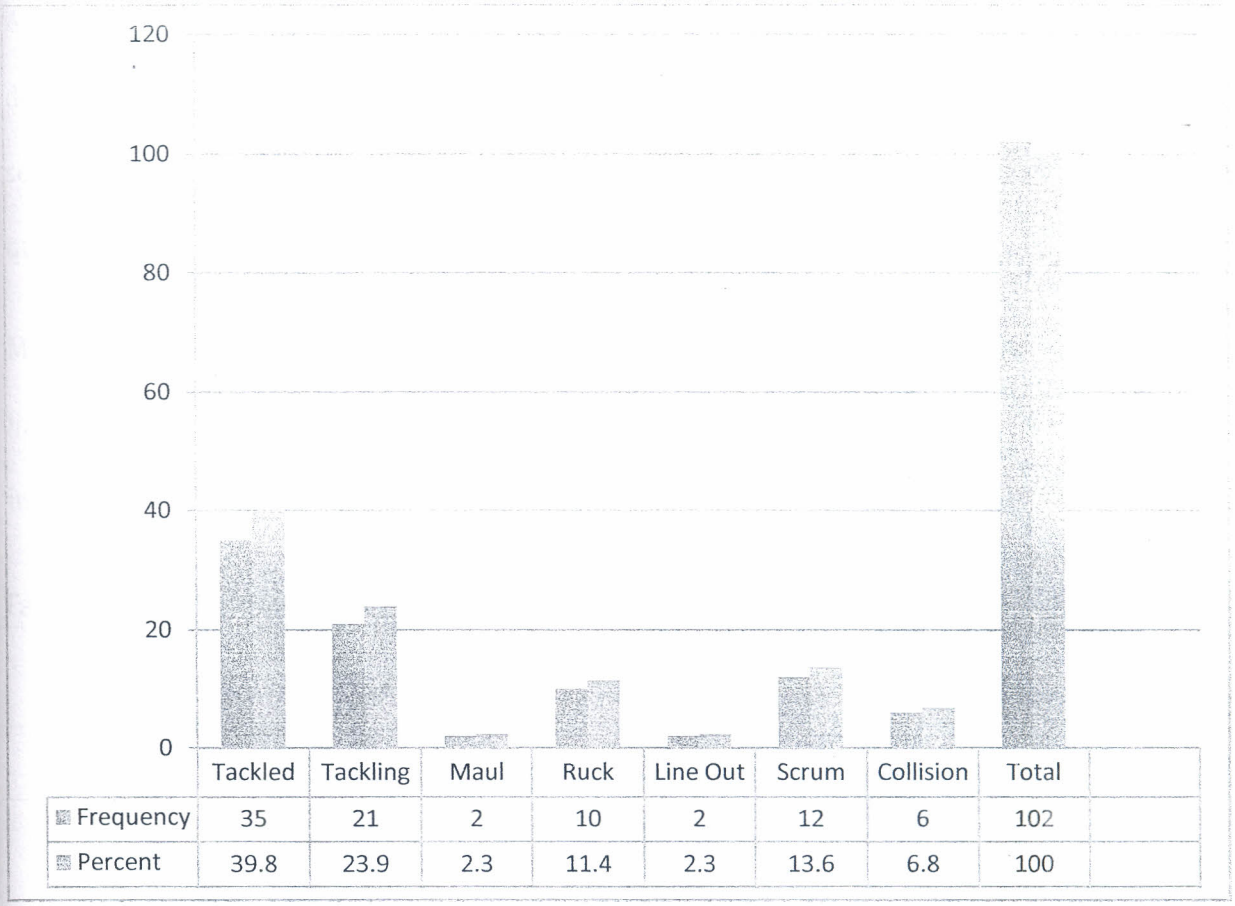
D. Classification of injuries based on recurrence

Table 5: Injury and relation to recurrence

		Early recurrence		Late recurrence	
		Count	Percent	Count	Percent
Injured Body Part	Head face			1	5.6%
	Neck Cervical Spine	1	5.6%		
	Shoulder Clavicle	4	22.2%	2	11.1%
	Wrist	1	5.6%		
	Hand Finger Thumb	1	5.6%		
	Posterior Thigh	1	5.6%		
	Knee	3	16.7%	2	11.1%
	Ankle	2	11.1%	2	11.1%
Type of Injury sustained	Fracture			1	5.6%
	Dislocation Subluxation	3	16.7%	1	5.6%
	Sprain Ligament	6	33.3%	4	22.2%
	Muscle Rupture Strain Tear Cramps	3	16.7%		
	Total	**12**	**66.7%**	**6**	**33.3%**

Joint injuries were the most recurrent. The shoulder had the highest recurrence rate accounting for 33.3% followed by knee 27.7% and ankle at 22.2% (table 5). Ligamentous sprain was the most common type of injury accounting for 55.5% of recurrences.

E. Distribution of injuries based on mechanism of injury



	Tackled	Tackling	Maul	Ruck	Line Out	Scrum	Collision	Total
Frequency	35	21	2	10	2	12	6	102
Percent	39.8	23.9	2.3	11.4	2.3	13.6	6.8	100

Figure 2: Association to trauma

Majority of the injuries, 94.9% were a result of trauma due to contact. The tackling/tackled scenario with a cumulative incidence of 63.7%, accounted for a majority of incidences in mechanism of injury. The line out and the maul accounted for the list incidence of trauma induced injury at 2.3% each.

F. Distribution of injury as a factor of time

As per seasonal distribution, the frequency of injuries in the first quarter was 47.1%, doubling any other quarter. The frequency of injuries was highest in the first half of the season with a cumulative percentage of 69.6 percent. Incidence was lowest in the third quarter.

Most injuries occurred in the last quarter of the game, and 73.5% of injuries were recorded in the extreme quarters of the game. Second quarter had the least frequency of injury incidence, a fifth of injuries the last quarter.

Table7: Incidence of injury as a function of time

	Seasonal distribution		**Game distribution**	
Time	**Frequency**	**Percentage**	**Frequency**	**Percentage**
First Quarter	48	47.1	24	23.5
Second Quarter	23	22.5	9	8.8
Third Quarter	12	11.8	18	17.6
Fourth Quarter	19	18.6	51	50.0
Total	**102**	**100.0**	**102**	**100**

G. Association to foul play

Table 8: Frequency of Foul Play in injuries

	Foul play		Dangerous play	
Occurrence	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Yes	12	11.76	11	10.78
No	90	88.24	91	89.22
Total	**102**	**100.0**	**102**	**100**

Though a majority of injuries were not associated with foul play, there was a significant proportion (11.6%) which were associated with injury occurrence.10.78% of injuries were associated with dangerous play.

3) INJURY AND THE PITCH

Table 9: Incidence of injury as a function of pitch status

	Distribution of games played		Distributions of injuries		Match player hour distribution	
	Number of games	**Percentage**	**Injuries(n)**	**Percentage**	**Total MPH**	**Incidence per 100mph**
Good	31	51.67	?31	30.31	1240	**25.00**
Bad	29	48.33	71	69.62	1160	**61.21**
Total	**60**	**100.0**	**102**	**100**	**2400**	

Out of the total number of games, 31 were played in the two good category pitches, and 29 were played in the bad category pitches.

Out of a total of 102 injuries, 71 were sustained in the bad category pitches and 31 in the good category pitches.The incidence of injuries was 61.21 injuries per 1000mph compared to incidence of 25.00 injuries per 1000mph.

4) LOGISTIC REGRESSION MODEL COMPARING THE INJURY ASSOCIATED VARIABLES

Players in the Kenya cup had increased ODDS/RISK of injury compared to players in ESS: ODDS ratio2.18, CI 0.263 to 0.802, and p value 0.006.Meaning that,KC players were 2 times more likely to be injured.

The mean height was 1.75m; players taller than the average height had increased ODDS/RISK of injury compared to those who were shorter: ODDS ratio 2.54, CI-0.914, p value 0.030. Meaning players taller players were2.5 times likelier to be injured.

There was no increase in the ODDS/RISK of injury with increasing age of players: ODDS RATIO 0.992, CI 0.921-1.069, and p value 0.841.

Weight and BMI did not show significant increase in risk for injury.

The player position divided to forwards and backs did not show significant increase in injury risk.

12% of the variation in this data is explained by this model.

15. DISCUSSION

The purpose of this study was to report the incidence, site, and nature of injuries in amateur rugby league in a developing nation.

Injury incidence was 42.50injuries per 1000mph. The average Kenyan player was smaller in size compared to counterparts at higher level of play. The lower limb was the most affected anatomical entity with ligaments being the most affected tissue. Most injuries occurred in the last quarter of the game and on the first half of the season. The pitch was a significant contributor of incidence of injury.

ANTHROPOMETRY

The division one league players were heavier, taller, older, larger as compared to counterparts of division two league. This was expected considering the division one player was likely to be the one who had played for longer. Though it appears that the heavier, taller and larger player was more vulnerable to injury, the relationship between anthropometric parameters and injury need further investigation.

The Kenyan rugby players were younger, lighter in weight and shorter as compared to counterparts in similar studies at international level of play.[2] The smaller size is consistent with data comparing professional to armature leagues, implying that body size is a factor of injury occurence.[20]This is supported by the fact that studies of higher level of play where players were older, heavier and taller had higher injury rates.[2,20]This is probably due to the fact that, players are faster, and energy dissipation and momentum much larger.

In the current study, it was noted that the lower league players were smaller and younger, probably a reflection of their post-school state and being initiated into the lower league. With a less stringent age of inclusion criteria, the differences may have been even more dramatic.

METHODOLOGY AND INCIDENCE REPORTING

The incidence of injury here is three times lower than that reported in the earlier Kenyan study.[8]We contend that the discrepancy is occasioned by the differences in terminologies and definitions between the two studies. The adherence to the RICG protocol in the current study reduced the markedly exaggerated power that minor injuries can have on the incidence of injury. Examples of such excluded injuries include blood bim injuries and minor lacerations that were sorted out at pitch side for player to resume play.[8]Our results also show much lower incidence than that reported by studies that utilized the same study instrument but done for higher level of play.[2] This verifies that despite the uniqueness of the Kenyan context, the lower incidence is consistent with reported rates for armature level of play.[9]

INJURY CHARACTERISTICS

The tackle/tackling scenario was responsible for the highest injury incidence. This was in keeping with what had been previously reported in a majority of studies.[2,7,11,19] Howeverin this study mostinjuries afflicted the tackler. This contrasts recent trends that show majority of injuries to involved the player being tackled.[2] Since the act of tackling is under control of the tackler, an entry point for prevention of such injuries would be the

acquisition of protective gear e.g. shoulder pads and coaching of skillful tackling techniques.[2,23]

Most injuries occurred in the first quarter of the season, with a cumulative incidence of 70% injuries occurring in the first half of the season. The high incidence in the first quarter is consistent with that reported in some studies, thought to be due to preseason fitness and conditioning.[5,10]In other studies however, a contrasting pattern where majority of the injuries happen in the last quarter of the season is reported. The latter pattern is attributable to fatigue and cumulative trauma.[3,7] Thus, proper preseason preparation for the looming season along with suitable preseason rehabilitation for the injured might be a solution to the high injury rate biased to the commencement of a new Kenyan rugby season.[10]

Further the result of the present study shows approximately 50% of injuries occur in the last quarter of the game, corroborating earlier data.[2,9,15]Injury frequency at this quarter of the game is ascribedto fatigue, reduced self-awareness and protection.[2,8,15]Thus to optimize the player in the last quarter, improving player endurance and conditioning might aid thus reduce injury incidence at this time of the game.

The incidence and pattern of match injuries was similar between forwards and backs inbroad categorization. Meaning that despite the different exposure environments the injuries are consistent with other reported data.[2]

The lower limb, as in previous reports, was most vulnerable to injuries.[2, 11, 17]Theprevalence of head, shoulder and ankle as single entities most vulnerable to injury is probably related to exposure and involvement in most phases of contact. There are data to

show that injuries occasioned by exposure and involvement of the head can be prevented by use of head gear. [24, 25]The shoulder is especially involved in tackling. Muscle strengthening exercises and drills integrated to phases of training and use of shoulder pads can reduce shoulder injuries.[24]The ankle on the other hand, is a weight bearing organ in a sport that involves a lot of running, shoving and ramming. Ankle injuries are possibly exacerbated by poor pitch conditions e.g. pitch undulation, a relationship not explored in this study.

The ligamentous injury/sprain and muscle pulls/cramps were the most common type of injuries documented. The latter injuries were probably due to association to knee and shoulder joints, both highly vulnerable to injury. Muscle pulls/cramps are occasioned by the high level of repeated motion and phases of acceleration deceleration.[2, 22]Thus prevention strategies to be emphasized couldbeaccenton pre-match warm up technique, conditioning and player sustenance as reported previously.

There weremany recurrent injuries, as well as many injuries which were documented to be severe in this study. It could be that the rehabilitation of these playersby specialized medical team conversant with sports medicine, integrated to coaching staff would reduce the numbers of recurrences as well as severity of injuries. Also noted in other studies, was reduced compliance of players to instructions by medical professionalsespecially in a set up as ours where the team medics had little influence on player's time of return to play.[10]However to establish the relationship between the injury severity and recurrence and medical input needs more studying.

The rate of 10-15% of foul play involvement in injuries is much lower compared with other studies.[7]This is probably due to introduction of more stringent measures to counter fouls and more importantly to counter dangerous play by the IRBin recent times e.g. the experimental law variations.[30] However, emphasis of the rules and regulation, and obdurate intolerance to foul/dangerous play may perhaps help in compounding the incidence further.

PITCH CHARACTERISTICS

Most of the Kenyan pitches were graded as being suboptimal. The injury incidence was higher in the suboptimal pitches as compared to the good conditioned pitches.The suboptimal pitches werecharacterized by uneven with depressions, very hard due to lack of constant watering, and had reduced sward of grass. The latter two could have resulted in reduced cushioning during falls, say from tackling and other phases of contact. The undulations resulting in pitch unevenness were harbingers for ankle and knee twists, as well as clumsy unanticipated falls which might have resulted to injuries in various body parts.Perhaps this is one area noted in Kenya from this study to be a significant contributor of preventable injuries.

Thus improving pitch conditions to IOCG[29] or IRB[31] approved standards would be one of the ways in which injury rates would be drastically reduced.

16. STUDY LIMITATIONS

i. Since training injuries were not recorded at time of occurrence, recall bias might have influenced as to whether subsequent injuries were being recorded as new incidences or recurrences. To mitigate this, physiotherapist were advised to monitor player during training sessions and record training injuries to any player for future reference.

ii. Some players resumed play after injury without clearance from the medical assessors; this thus had an influence on the recording of injury severity.

iii. Since it was a new season, the player database on player interclub transfers and incoming new players from schools was not up-to-date. As such the first task of the study was to update the player database in order to attain accurate information regarding each player and club.

17. CONCLUSION

i. The study has provided benchmark values for the injury incidence and characteristics in a unique injury exposure environment.

   - An injury rate of 42.50 injuries per 1000mph recorded is much lower than that of local data previously reported and higher level of play.
   - The level one player has higher injury incidence compared to level two player.
   - Lower limb was the most afflicted anatomical entity and ligament the most affected tissue type.
   - Most injuries occurred at the beginning of the season and at the last quarter of the game.
   - Sub-optimal pitch conditions contribute significantly to injury in this environment, which if improved can be a platform for injury prevention.

ii. The study utilized the RICG protocol, thus ensuring a document comparable to studies of similar nature internationally. This is not a conclusion

iii. By providing the associated injury characteristics the study has provided a platform for formulating interventions for injury prevention.

Already known:

- *The injury rate in armature rugby is lower in comparison to higher level of play.*

- *Pattern of injuries in rugby.*

What this study adds:

- *The local incidence and pattern of injury using the RICG study tool as a benchmark for future studies.*

18. RECOMMENDATIONS

- Improving pitch conditions to IRB acceptable standards will significantly impact on the occurrence of injury in this environment.

- Use of protective gear e.g. shoulder-pads and head gear will reduce injury occurrence.

- Conditioning of players as well as coaching on contact and tackling techniques will enhance player protection and reduce injury rates.

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20. APPENDICES

A. MAIN GROUPINGS AND CATEGORIES OF TYPE OF INJURY

Main grouping	Category
Bone	Fracture
	Other bone injuries
Joint (non-bone) and ligament	Dislocation/subluxation
	Sprain/ligament injury
	Lesion of meniscus, cartilage or disc
Muscle and tendon	Muscle rupture/tear/strain/cramps
	Tendon injury/rupture/tendinopathy/bursitis
	Haematoma/contusion/bruise
Skin	Abrasion
	Laceration
Brain/spinal cord/ peripheral nervous system	Concussion (with or without loss of consciousness)
	Structural brain injury
	Spinal cord compression/transaction
	Nerve injury
Other	Dental injuries
	Visceral injuries
	Other injuries

Injury Report Form for Rugby Union

(Team) Player-code: ..... Date:.....

1A. Date of injury: .....1B. Time of injury (during match): .....

2. Date of return to full participation: .....

3. Playing position at the time of injury: ..... ☐ Not applicable

4. Injured body part:

☐ head/face	☐ upper arm	☐ anterior thigh
☐ neck/cervical spine	☐ elbow	☐ posterior thigh
☐ sternum/ribs/ upper back	☐ forearm	☐ knee
☐ abdomen	☐ wrist	☐ lower leg/ Achilles tendon
☐ low back	☐ hand/finger/ thumb	☐ ankle
☐ sacrum/pelvis	☐ hip/groin	☐ foot/toe
☐ shoulder/clavicle		

5. Side of body injured: ☐ left ☐ right ☐ bilateral ☐ not applicable

6. Type of injury:

☐ concussion (with or without loss of consciousness)	☐ sprain/ ligament injury	☐ haematoma/contusion/ bruise
☐ structural brain injury	☐ lesion of meniscus, cartilage or disc	☐ abrasion
☐ spinal cord compression/ transection	☐ muscle rupture/ strain/tear/cramps	☐ laceration
☐ fracture	☐ tendon injury/ rupture/ tendinopathy/ bursitis	☐ nerve injury
☐ other bone injury		☐ dental injury
☐ dislocation/subluxation		☐ visceral injury

☐ other injury (please specify): .....

7. Diagnosis of injury (text or code): .....

8. Has the player had a previous injury of the same type at the same site (i.e. this injury is a recurrence)?

☐ no ☐ yes

If YES, specify date of player's return to full participation from the previous injury: .....

9. Was the injury caused by: ☐ overuse ☐ trauma?

10. Did the injury occur during: ☐ training ☐ match?

11. Was the injury caused by contact? ☐ no ☐ yes

If YES, specify the activity: ☐ tackled ☐ tackling ☐ maul ☐ ruck ☐ lineout ☐ scrum ☐ collision ☐ other

12A. Did the referee indicate that the action leading to the injury was a violation of the Laws?

☐ no ☐ yes

12B. Did the referee indicate that the action leading to the injury was dangerous play (Law 10.4)?

☐ no ☐ yes

C. CONSENT BY PARTICIPATING ATHLETES

Study number.....

Purpose of study:

Research on incidence and pattern of injury in KRFU players throughout the 2010 season.

Individual Benefits:

Medical management of participants shall remain under the team medic appointed by the club. The research team will assist where necessary and on request in resuscitation and stabilization. However the management of injury beyond the pitch e.g. hospital and club training day injuries will be at the jurisdiction of the club and the player.

Access to information:

The research team will on request access the information of participants' game day injuries, including secondary and tertiary management plan i.e.: investigation modalities, treatment (inclusive of operations) and rehabilitation and game fitness assessment.

Benefits to the rugby community:

The study aims at exploring the incidence, pattern, and mechanisms of acquired injury which will be useful in coming up with prevention plan for the local/regional rugby community.

Voluntary participation:

Participation is under free will.

That player has the right to disclose only part of injury information ie player may choose decline disclosing injury management outside the pitch.

Confidentiality:

Your identity and information remain confidential. No information linking you to the study will be published

I _____ have been explained to and understood the above and willingly accept to participate in the study

Signature_____ date_____

I the investigator, having explained in detail the purpose of this study, hereby submit that privacy of data collected will be maintained and only details relevant to the study revealed

Signature_____ Date_____

D. THE CAPTAINS PITCH CATEGORISATION TABLE

	1	2	3	4
Degree of evenness, undulations, depressions				
Firmness, giving good grip(traction) for players especially during scrummage				
Degree of coverage with sward of desirable grasses				
Drainage system and degree of cushioning for player due to impact from tackling, being tackled or diving				
General feel i.e. seasonal variation, affliction of pitch by extremes of weather				
Total				

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP", Nairobi.
Email: KNHplan@Ken.Healthnet.org

Ref: KNH-ERC/ A/468

27th April 2010

Dr. Muma Nyagetuba
Dept.of Surgery
School of Medicine
University of Nairobi

Dear Dr. Muma

RESEARCH PROPOSAL: "SURVEILLANCE OF INJURIES AMONG KENYA RUGBY FOOTBALL UNION (KRFU) PLAYERS-SEASON 2010" (P27/2/2010)

This is to inform you that the KNH/UON-Ethics & Research Committee has reviewed and **approved** your above revised research proposal for the period 27th April 2010 to 26th April 2011.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimens must also be obtained from KNH/UON-Ethics & Research Committee for each batch.

On behalf of the Committee, I wish you a fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of the data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

DR. L. W. MUCHIRI
AG. SECRETARY, KNH/UON-ERC

c.c. Prof. K. M. Bhatt, Chairperson, KNH/UON-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Surgery, UON
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