THE EPIDEMIOLOGY OF INJURIES

IN

PROFESSIONAL RUGBY UNION

IN

SOUTH AFRICA

A dissertation prepared by
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(Student no. HLTLOU002) in partial fulfilment of the requirements for the Master of Philosophy degree in Sports Medicine (MPhil Sports Medicine) from the University of Cape Town

21 September 2001

DECLARATION

I, Louis Johannes Holtzhausen, hereby declare that the work on which this dissertation is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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(Date)

ACKNOWLEDGEMENTS

I wish to thank the following persons for their help and support in undertaking this study:

- My wife, Elizbé, for love, encouragement and support, for many hours at the computer, and for often being a mother and father to Johann and Lisa.
- My parents, Klaas and Marina Holtzhausen, for always being there and for believing in me.
- Dr. Ismail Jakoet and SARFU, for valuable assistance and for allowing me to do this study on rugby teams under their jurisdiction.
- Drs. Glen Hagemann and Francois Majoos, for providing a large portion of the data used in this study.
- My study leader, Professor Martin Schwellnus, for his encouragement and very capable guidance.
- Professor Tim Noakes, for convincing me to undertake this line of research.
- Dr. Nicolas Theron, for valuable input and support.
- Dr Derik Coetzee, for providing new references, support and advice.
- Ms. Delsia Overberg, for collecting the questionnaires and reports diligently.
- My office staff, especially Arina Louw and Marietha de Villiers, for putting up with me.

I dedicate this study to God Almighty, through which strength I am able to do anything.

TABLE OF CONTENTS

Declaration 2

Acknowledgements 3

List of Tables 6

List of Figures 7

List of abbreviations 8

CHAPTER 1 9

REFERENCES 11

CHAPTER 2 12

ABSTRACT 14

KEY POINTS 15

INTRODUCTION 16

THE INCIDENCE OF RUGBY INJURIES 19

NATURE AND SITE OF INJURY 22

SEVERITY OF INJURIES 23

MECHANISM OF INJURY 26

PLAYER POSITION 29

DISCUSSION AND RECOMMENDATIONS 29

REFERENCES 32

CHAPTER 3 34

ABSTRACT 36

MATERIALS AND METHODS 39

RESULTS 41

USE OF MEDICATION 42

USE OF DIETARY SUPPLEMENTS 42

PROTECTIVE GEAR AND STRAPPING 43

PREVIOUS INJURIES 43

DISCUSSION 45

CONCLUSIONS 58

CHAPTER 4 70

ABSTRACT 72

INTRODUCTION 74

METHODS 75

RESULTS 78

Injury rates 78

Positions injured 79

Injury type 80

Injury site 80

Mechanism of injury 81

Time of injury 82

DISCUSSION 83

Methodology 83

Injury rates 84

POSITIONS INJURED AND MECHANISM OF INJURY 87

Injury type and anatomical site 88

Time of injury 90

CONCLUSIONS 91

REFERENCES 93

Chapter 5 107

Appendices 110

APPENDIX 1 110

APPENDIX 2 116

APPENDIX 3 118

APPENDIX 4 120

LIST OF TABLES

CHAPTER 2

PAGE

Table 1: Summary of study design of prospective cohort studies on injury rates in professional rugby union ____ 18

Table 2: The incidence of injuries recorded in professional rugby union ____ 21

Table 3: Severity of injuries in two prospective cohort studies of Super 12 rugby players. ____ 25

Table 4: Mechanism (phase of play) and severity of injuries in two prospective cohort studies of Super 12 rugby players. ____ 28

CHAPTER 3

Table 1: Previous injuries recorded in a group of professional rugby players before the 1999 Super 12 competition ____ 62

CHAPTER 4

Table 1: Injury rates of professional rugby union players during the 1999 Rugby Super 12 tournament ____ 97

Table 2: Injuries to professional Rugby Union players by playing position ____ 98

Table 3: Types of injuries sustained during the 1999 Rugby Super 12 competition ____ 99

Table 4: Injuries to professional Rugby Union players by anatomical site and severity ____ 100

Table 5: Mechanism of acute injuries sustained during training in the 1999 Super 12 season ____ 101

Table 6: Diagnosis and severity of chronic overuse injuries in a group of professional Rugby Union players during the 1999 Super 12 competition ____ 102

LIST OF FIGURES

CHAPTER 3

PAGE

Figure 1: Distribution of use of dietary supplements by a group of Super 12 rugby players before the 1999 Super 12 competition ___ **63**

Figure 2: The prevalence of use of protective gear in a group of rugby players during the 1999 Super 12 competition _____ **64**

Figure 3: Regular use of strapping in a group of rugby players during the 1999 Super 12 competition _____ **65**

Figure 4: Anatomical distribution of previous injuries in a group of professional rugby players before the start of the 1999 Super 12 competition _____ **66**

Figure 5: The prevalence of acute and chronic injuries in a group of Super 12 rugby players per anatomical site _____ **67**

Figure 6: Surgical vs. non-operative treatment of previous injuries of a group of Super 12 rugby players _____ **68**

Figure 7: Distribution of previous concussions in a group of Super 12 rugby players _____ **69**

Chapter 4

Figure 1: Mechanism of injury to professional Rugby Union players during matches _____ **103**

Figure 2: Incidence of injuries during different quarters of the game _____ **104**

Figure 3: Incidence of injuries during matches in different phases of the season _____ **105**

Figure 4: Incidence of injuries during training sessions in different phases of the season _____ **106**

LIST OF ABBREVIATIONS

ACT	(Australian Capital Territories)
ACTRU	(Australian Capital Territories Rugby Union)
IRB	(International Rugby Board)
RIPP	(New Zealand Rugby Injuries and Performance Project)
SARFU	(South African Rugby Football Union)
EIA	(Exercise Induced Asthma)
BCAA	(Branched Chain Amino Acids)
ROM	(Range of Movement)
SANZAR	(Combined South African, New Zealand and Australian governing body of Rugby Super 12 and the Tri-Nations series)

CHAPTER 1

INTRODUCTION AND SCOPE OF THE THESIS

Rugby is a popular sport played in more countries than any other sport except soccer [1]. It is a collision sport with a high injury rate [2,3]. It has been documented that identification of mechanisms of sporting injury can facilitate specific interventions that can ultimately lead to a decrease in the incidence of injury [1,4]. It is therefore important for medical professionals dealing with rugby and rugby injuries to have good scientific data concerning rugby players and rugby injuries available in order to suggest possible ways of reducing the incidence injuries, reducing recovery time and optimising performance.

The input of medical professionals in this regard became even more important when rugby union turned into a professional sport in 1995. It has been documented that a higher level of play is associated with a higher incidence of injuries [2,3,5]. It is therefore of great concern that very few epidemiological studies describing incidence, patterns and ways of preventing injuries in professional rugby, the highest level of the sport, can be found in the literature. Of even greater concern is that no studies of this nature have been published on professional rugby in South Africa, where rugby is regarded by many as the "national sport".

The first aim of this study was therefore to review the available literature on the epidemiology of injuries in professional rugby. The second aim was to collect data on medical profiles, previous injuries, use of protective gear, medication and nutritional supplements in South African professional rugby players. Thirdly, the incidence, nature and circumstances surrounding injuries in a cohort of professional South African rugby players were documented. The data collected was compared with available literature.

The epidemiological studies in this thesis were conducted on professional rugby players that competed in the 1999 Rugby Super 12 competition. This was the world's first fully professional rugby union competition [5] and is played annually between five teams from New Zealand, four from South Africa and three from Australia. It is generally regarded as one of the most gruelling rugby competitions in the world and places exceptional physical and emotional stresses on the players involved. The twelve teams all play against each other in a "round robin" tournament, with a knockout semi-final and a final match, over a period of fourteen weeks. This implies that all teams play virtually one international match per week, with only one "bye" in between. An additional challenge is that teams have to travel internationally during the course of the competition. A high incidence of injuries is expected in a competition of this calibre. It is therefore of great importance to collect scientific medical data on players competing in the Super 12 to establish patterns surrounding injury, in order to provide advice to policy makers, coaches, team management and

medical professionals on possible ways of preventing and optimising management of injuries.

As team doctor of one of the South African Super 12 teams, I experienced the need for scientific data as described and found myself in an ideal position to conduct a study of this nature.

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CHAPTER 2

THE EPIDEMIOLOGY OF INJURIES IN PROFESSIONAL RUGBY UNION

Published in the International SportsMed Journal **2**(2), June 2001.

THE EPIDEMIOLOGY OF INJURIES IN PROFESSIONAL RUGBY UNION

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ABSTRACT

Only three studies have recorded injuries in professional rugby-union players to date, representing only a fraction of the professional rugby played since its inception in 1995. Comparison of data in these studies has been complicated because of lack of uniformity in study design.

The mean incidence of all recorded injuries in professional rugby union is 86,4 injuries per 1000 player game hours, ranging between 67,8 and 150 injuries per 1000 player game hours. The lower limb is the most often affected anatomical site. Musculo-tendinous strains, contusions and ligament sprains were the most common types of injury recorded. A low incidence of chronic overuse injuries was recorded, possibly because of using definitions of injury more suited to acute injuries. A higher incidence of re-injury was found in professional rugby players than in amateur players. Most injuries recorded in professional rugby union were mild (less than 7 days to return to training/play). The tackle caused the highest incidence of injuries in all levels of rugby and the scrum and lineout, the lowest. A standardised format of recording of injuries in rugby union is recommended. Further research is necessary to obtain more representative data of injuries in professional rugby union.

Keywords: Rugby union, professional, incidence, distribution, injury.

KEY POINTS

The mean incidence of injuries recorded in professional rugby is 86,4 injuries per 1000 player hours of participation

The highest injury rates were to the lower limb, particularly the knee and ankle, and these were mainly ligament sprains (26%) and musculo-tendinous tears (24%).

The tackle is the most frequent cause of injury in professional rugby.

There are no significant trends in the proportion of injury episodes according to player position.

INTRODUCTION

Rugby Union is a collision sport with a high injury rate [1,2] ,which became a professional sport in 1995. Little is known about the level and pattern of injuries in professional rugby. The Super 12 competition was the first fully professional rugby tournament to commence and is played annually between five teams from New Zealand, four from South Africa, and three from Australia. The competition runs over thirteen weeks between February and May of each year. The only studies reporting injury rates in professional rugby union described injuries in a Super 12 squad during the 1997 competition [3], and injuries among professional players playing in the Border Reivers District of Scotland during the 1997-1998 season [4]. We have conducted a survey of injuries in three Super 12 teams during the 1999 competition [5]. The three available studies on injuries in professional rugby injuries are reviewed. These are compared with epidemiological studies on injuries in amateur rugby union.

Ten epidemiological studies on injuries in senior rugby have been conducted since 1990. Three prospective cohort studies included injury rates of professional rugby players [3,4,5]. Of the remaining seven studies, four are prospective cohort studies conducted over one season, including senior club and regional teams [2,6,7,8], and two are prospective cohort studies, reporting injuries sustained by all players competing in a single tournament [1,9]. One study is a survey of all injuries sustained in Argentina over one weekend per year over seven years [10].

Of the three studies that include injury rates in professional rugby, the study designs of the two Super 12 studies were similar, making comparison of results possible. The third study, which included professional rugby players playing

club rugby in the Border Reivers district in Scotland, used a different definition of injury and method of reporting incidence, type, and anatomical site of injury. A summary of similarities and differences between the three studies is given in Table 1. Injuries sustained during training were included as a total of match injuries in two studies, and the third differentiated between match and practice injuries. Figures that are compared in this review are incidence of all incidents of injury sustained during matches and practice sessions, per 1000 player match hours. In the study conducted in Scotland, the incidence of all new injuries was reported. The Super 12 studies, however, recorded all incidents that prevented a player from participating in a training session or match as an injury, including re-injury. Therefore the incidence of injuries in the two Super 12 studies is comparable to the period prevalence of injuries reported in the Scottish study. The second important difference in study design is the method of data collection. Data was collected by team doctors in the Super 12 studies who were in daily contact with the squad and examined all injuries, while linkmen with questionnaires were used to collect data in the Scottish study. Incidence of injuries in the studies on amateur rugby are not directly comparable with one another or with the studies on professional rugby because of lack of uniformity in study design, including study population, definition of injury, method of data collection, and format of expressing results. Trends in anatomical distribution, type and severity of injuries, and player position of injured players can, however, be compared in terms of percentage of total number of injuries recorded in each study.

Table 1: Summary of study design of prospective cohort studies on injury rates in professional rugby union

Author and title	Garraway WM, Lee AJ, Hutton SJ, Russell EBAW, Macleod DAD. Impact of professionalism on injuries in rugby union. *Br J Sports Med* 2000;**34**: 348-351.	Targett SGR. Injuries in Professional Rugby Union. *Clin J Sport Med* 1998; **8**: 820-825.	Holtzhausen LJ, Schwellnus MW, Jakoet I, Pretorius AL. The Incidence and Nature of Injuries in South African Rugby Teams during the 1999 Rugby Super 12 Competition. Unpublished.
Type of study	Prospective cohort study	Prospective cohort study	Prospective cohort study
Study population	All rugby players registered with Scottish Rugby Union (SRU) affiliated senior clubs in the Border Reivers District, including all 30 adult professionals contracted to the SRU or Border Reivers District.	One Super 12 rugby squad	Three Super 12 rugby squads
Duration of study	One season (1997-1998)	One Super 12 competition (4 months)	One Super 12 competition (4 months)
Method of data collection	Linkmen, completing standard closed questionnaires	Team doctor	Team doctors
Definition of injury	A rugby injury was defined as an injury sustained on the field during a competitive match, during a practice game, or during training activity directly associated with rugby football, which prevented the player from training or playing rugby football from the time of the injury or the end of the match or practice in which the injury was sustained. Rugby injuries sustained during training were those sustained during practice scrums or manoeuvres involving a rugby ball (not circuit training or activities undertaken to achieve fitness). Transient: missed less than 7 days ♦ Mild: 7-28 days ♦ Moderate: 29-84 days ♦ Severe: >84 days Only new injuries were included in incidence, and recurrent injuries were included in period prevalence.	That which prevented a player from taking full part in two training sessions, from playing the next week, or one that required special medical treatment (such as suturing or special investigation).*** ♦ Minor: Miss less than 1 week ♦ Moderate: Miss 1 to 3 weeks ♦ Severe: Miss more than 3 weeks Re-injury was included as a new incident of injury, and included in incidence of injury events.	That which prevented a player from playing or participating in squad training, or that required special medical treatment (such as suturing or special investigation). Severity calculated in number of sessions missed. A session is a match or training session. One match and two training sessions (3 sessions) took place per week.*** ♦ Mild: 1-3 sessions (1 week or less) ♦ Moderate: 4-9 sessions (1-3 weeks) ♦ Severe: 10 and more sessions (>3 weeks) Re-injury was included as a new incident of injury, and included in incidence of injury events.
Expression of injury rates	♦ Total game hours recorded ♦ Training injuries expressed as a percentage of total injuries, but training hours not quoted. ♦ Site and nature of injuries presented for injuries sustained in games only. ♦ Site and nature of injuries not differentiated in age groups, but presented as total of all players included in the study ♦ Injury episodes expressed in episode rate per 1000 playing hours, quoting incidence of new injuries, and period prevalence.	♦ Injury rate expressed as number of injuries per hours of game time and injuries per player per game ♦ Total game hours can be calculated ♦ Total training time not presented ♦ Incidence of injuries per anatomical site, injury type, and severity not differentiated between game and training injuries	♦ Incidence of injuries expressed in number of injuries per 1000 game hours and number of injuries per 1000 training hours ♦ Game and training injuries reported separately[1]

[1] Sum of training and game injuries per 1000 player game hours used for comparison with other studies

THE INCIDENCE OF RUGBY INJURIES

The incidence of injuries in professional rugby union is summarised in Table 2. Incidence is expressed as number of injury incidents per 1000 player game hours. The studies available in the literature do not allow for seasonal or annual incidence to be compared. The three studies represent a very small fraction of professional rugby played since 1995, and may not reflect the true incidence or trends of injury patterns in professional rugby union. The average incidence/period prevalence of injuries recorded in professional rugby union is 86.4 injuries per 1000 player hours of participation, and ranges between 67.8 and 150 injuries per 1000 player hours. Incidence in the two Super 12 studies [3,5] correspond with period prevalence in the Scottish study [4], because of differences in definition of injury. The incidence of injuries in one squad of 25 Super 12 players during the 1997 Super 12 competition, was 150 injuries per 1000 player game hours [3]. This represents the highest injury rates reported in rugby union to date. Three Super 12 squads suffered 84 injuries per 1000 player game hours during the 1999 Super 12 competition [5], while the period prevalence of injuries among 30 professional rugby players in the Scottish Border Reivers club competition was 67,8 injuries per 1000 player game hours. The incidence of new injuries in this group was 29,9 injuries per 1000 player game hours [4].

Previous studies have reported a wide range of injury rates in senior amateur rugby union. A period prevalence of 14,8 injuries per 1000 player hours was reported among the same 26 Scottish clubs during the 1993-1994 season[4,8,11]. In a prospective survey of injuries to first class rugby union

players in the Australian Capital Territories (ACT) during the 1992 ACTRU competition, an injury rate of 48,8 injuries per 1000 player hours was recorded[7]. A study comparing injuries in three codes of football at the elite level in Australia, reported an overall injury rate of 62 injuries per 1000 player hours among first grade players[6]. A survey of the incidence, nature and circumstances of injuries during a season in Dunedin, New Zealand, described injury rates of 14 injuries per 100 player games in the senior male A league[2]. This corresponds to an injury rate of 105 injuries per 1000 player hours. The overall injury rate recorded during the 1995 Rugby World Cup was 32 per 1000 player hours[1].

The only comparison between injury rates in amateur and professional rugby to date, was made between amateur and professional players in the Scottish Border Reivers club competition. The period prevalence of injuries in professional players during the 1997-98 season was 67,8/1000 player game hours, while that in senior amateur club players was 22,6/1000 player game hours. Period prevalence of injuries in senior club players in the same competition during the 1993-1994 season was 14,8/1000 player game hours, indicating an increase in injury rates. The overall population of players who were injured increased from 27% in 1993-1994 to 47% in 1997-1998. Ninety per cent of professional players were injured during the 1997-1998 season in only 15% more hours of competitive play than amateurs [4].

Table 2: The incidence of injuries recorded in professional rugby union

Main	Acute general	Acute seasonal	No. of injuries in one squad during the 1997 Super 12 competition [3] (Injuries per 1000 playing hours in brackets)	No. of injuries in three squads during the 1999 Super 12 competition [5] (Injuries per 1000 playing hours in brackets)	No. of injuries in professional rugby players competing in the Border Reivers club competition in Scotland during the 1997-1998 season [4] (Injuries per 1000 playing hours in brackets)	Total no of injuries	Incidence/ 1000 hrs participation
Overall			49 (150)	62 (84)	68 (67,8)[8]	179	86,4[1]
Regional (anatomical)							
	Head	All	13 (40)	8 (11)	-	21	10,1
	Neck	All	3 (9)	3 (4)	2 (1,99)[7]	7[7]	3,4[7]
	Upper limb	All	10 (30)	7 (10)	6 (5,98)[7]	20[7]	9,7[7]
		Shoulder	4 (12)	4 (5)	4 (3,99)[7]	9[7]	4,3[7]
		Elbow	3 (9)	-[3]	-	-[3]	
		Forearm	-	-[3]	-	-[3]	
		Wrist	-[2]	-[3]	-	-[3]	
		Hand	-[2]	-[3]	-	-[3]	
	Trunk		3 (9)	5 (7)	1[7]	9[7]	7,5[7]
		Chest	-	-	-	-[4]	
		Thoracic spine	-	-	-	-[4]	
		Lumbar spine	3 (9)	-	-	-[4]	
		Abdominal	-	-	-		
	Lower limb		20 (60)	39 (53)	35 (34,86)[7]	71[7]	34,3[7]
		Hip	-[5]	-[5]	-[5]	-	
		Pelvis	4 (12)	-[5]	-[5]	-	
		Thigh	-[5]	7 (10)	-[5]	-	
		Knee	6 (18)	8 (11)	16 (15,96)	30[7]	14,5[7]
		Lower leg	2 (6)	4 (5)	-	-	-
		Ankle	5 (15)	7 (10)	-[8]	-	-
		Foot	-	1 (1,5)	-[8]	-	-

[1]Total number of playing hours: 2071 (Garraway – 1004 playing hours; Holtzhausen – 740 playing hours; Targett – 327 playing hours)
[2]Hand/wrist injuries (Targett): 2 (6/1000 playing hours); Upper arm injuries: 1 (3/1000 playing hours)
[3]Arm/hand injuries (Holtzhausen): 3 (4/1000 playing hours)
[4]Trunk injuries (Holtzhausen): 3 (4/1000 playing hours); Back injuries: 2 (3/1000 playing hours)
[5]Targett: Groin: 4 injuries (12/1000 playing hours), Thigh/hip: 3 injuries (9/1000 playing hours). Holtzhausen: Pelvis/hip: 12 injuries (16/1000 playing hours), Thigh: 7 injuries (9/1000 playing hours). Garraway: Hip/thigh: 4 injuries (3,99/1000 playing hours).
[6]Ankle and foot injuries (Garraway): 4 (3.99/1000 playing hours)
[7]Only dislocations, sprains and strains reported.
[8]Period prevalence of this study corresponds with incidence of injuries in other studies

NATURE AND SITE OF INJURY

The regional distribution of injuries in professional rugby is shown in Table 2. The highest injury rates were recorded in the lower limb, where the knee and ankle were the most commonly injured structures. The 1997 Super 12 squad reported musculo-tendinous sprains and strains as the most common type of injury (29% of injuries; 43 injuries per 1000 player game hours), and contusions as the second most common (22%; 34 injuries per 1000 player game hours) [3]. The three Super 12 squads of 1999 reported ligament sprains (26%; 22 injuries per 1000 player game hours) and musculo-tendinous tears (24%; 20 injuries per 1000 player game hours) as the most common types of injury [5].

In amateur rugby, the highest injury rates were reported in the lower limb, the head and face and the shoulder. Musculo-tendinous muscle strains and ligament sprains were the most common types of injury. Injuries to the head and face were mostly minor injuries, with facial lacerations making up the largest portion [1,2,7].

A low incidence of chronic overuse type injuries were reported in professional rugby. Two studies discussed chronic overuse type injuries. During the 1999 Super 12 competition, the cohort of 3 squads reported six chronic overuse injuries that fit the definition of an injury used in that study [5]. These injuries could not be expressed in terms of injury per 1000 hours exposure, because of the chronic nature of these conditions. Most of these were carried over from the previous season. The 1997 Super 12 squad reported two chronic

overuse injuries, that did not prevent training, therefore not qualifying as "injuries" in the study design. Both required surgery after the Super 12 competition [3], emphasising the serious nature of these injuries. Underreporting of this type of injury may have taken place because of the definitions of injury used in most rugby injury surveys, which are more suited to describing acute injuries.

During the 1999 Super 12 competition, three squads reported 11 recurrent injuries per 1000 player game hours (13% of injuries) [5]. In the Scottish Border Reivers competition, 56% of all injury episodes for professional players in 1997-1998 were recurrent, compared with 29% for amateurs in 1997-1998 and 18% for all players in 1993-1994 [4,8,11], indicating an alarming escalation in recurrent injury rates in those studies.

SEVERITY OF INJURIES

During the 1996 Super 12 competition, one squad recorded 70% (110/1000 player game hours) minor injuries (missed less than 1 week training/game), 20% (28/1000 player game hours) intermediate injuries (missed 1 to 3 weeks training/games), and 11% (18/1000 player game hours) serious injuries (missed more than 3 weeks) [3]. During the 1999 Super 12, three squads recorded 39% (32/1000 player game hours) minor injuries, 27% (23/1000 player game hours) intermediate injuries and 33% (28/1000 player game hours) severe injuries (missed more than 3 weeks) [5]. A comparison between the severity of injuries in the two studies is shown in Table 3. The number of moderate and serious injuries in the two studies have a strong correlation,

while the 1997 Super 12 study [3] reported a higher incidence of mild injuries than that reported in the 1999 Super 12 [5]. Minor injuries may have been underreported in the other studies [4,5], and may explain the large difference in incidence of injuries reported in the three studies.

Table 3: Severity of injuries in two prospective cohort studies of Super 12 rugby players.

Severity of injuries	MILD Number of injuries (injuries/1000 player game hours in brackets)	MODERATE Number of injuries (injuries/1000 player game hours in brackets)	SEVERE Number of injuries (injuries/1000 player game hours in brackets)
One Super 12 squad in 1997 [3]	36 (110/1000 player hours) [1]	9 (28/1000 player hours) [1]	6 (18/1000 player hours) [1]
Three Super 12 squads in 1999 [5]	24 (32/1000 player hours) [2]	17 (23/1000 player hours) [2]	21 (28/1000 player hours) [2]
TOTAL:	60 (56/1000 player hours) [3]	26 (24/1000 player hours) [3]	27 (25/1000 player hours) [3]

[1] 327 player game hours recorded
[2] 740 player game hours recorded
[3] Combined total of 1067 player game hours

MECHANISM OF INJURY

The two studies on Super 12 squads reported the tackle as the most frequent cause of injuries, as well as the most frequent cause of severe injuries in professional rugby (Table 4). In these two studies, a total of 41 injuries per 1000 player game hours were sustained in the tackle, of which 22 injuries per 1000 player game hours were moderate or serious injuries. The ruck and maul phases were responsible for the second most injuries in both studies, totalling 20 injuries per 1000 player game hours, of which 6 injuries per 1000 hours were of moderate and severe nature. The set phases of play, where a number of law changes have been implemented over the years to improve the safety of the game, were responsible for a low incidence of injuries. Scrums accounted for 2 moderate and serious injuries per 1000 hours, while lineouts caused 1 serious injury per 1000 player game hours [3,5].

In all prospective cohort studies reporting on mechanism of injury since 1990, the tackle was reported the phase of play where most injuries were sustained [1,2,3,4,5,7,8,11]. The tackle was responsible for 56% of injuries during the 1995 Rugby World Cup, of which 29% were caused by being tackled, and 27% by tackling. The second most dangerous phase of play in the competition was the loose scrum (rucks and mauls), causing 23% of injuries. The scrums (1% of injuries) and lineouts (0% of injuries) were the safest phases of play [1]. In the study on amateur and professional players in the Border Reivers competition, 48% of injuries were sustained in the tackle. More professional players were injured while being tackled (37%) than amateurs (26%)[4]. In a

study involving 8 amateur clubs competing in the Australian Capital Territories First League during the 1992 season, tackling was responsible for 50% of all injuries, while rucks and mauls were the second most common cause of injury, causing 23% of injuries. The set phases were relatively safe in this study too, with 5% of injuries sustained in scrums, and 2% of injuries sustained in lineouts [7]. In the survey of the incidence, nature and circumstances of injuries during the 1993 season in Dunedin, New Zealand, the tackle was responsible for the most injuries (40%) in all age groups, while rucks and mauls were again responsible for the second most injuries (29%). Scrums were relatively safe, causing 7% of injuries [2].

The incidence of injuries in professional rugby union sustained during training has not been well described. True incidence could only be determined in one study, where actual training time was reported. During the 1999 Super 12 competition, three squads reported twenty-one injuries in 4900 player training hours, or 4,3 injuries per 1000 player training hours [5]. If this number of injuries is expressed per 1000 player game hours in order to compare it with the other Super 12 study, a relatively high incidence of 28 training injuries per 1000 player game hours is found. This represents 34% of all injuries reported in the study. During the 1997 Super 12, one squad reported the equivalent of 30 training injuries per 1000 player game hours, representing 20% of injuries reported [3].

Table 4: Mechanism (phase of play) and severity of injuries in two prospective cohort studies of Super 12 rugby players.

PHASE OF PLAY		TACKLE Number of injuries (injuries per 1000 player game hours in brackets)	RUCK/MAUL Number of injuries (injuries per 1000 player game hours in brackets)	SCRUM Number of injuries (injuries per 1000 player game hours in brackets)	LINEOUT Number of injuries (injuries per 1000 player game hours in brackets)
One 1997 Super 12 squad [(3)] [1]	Mild	11 (34/1000)	13 (40/1000)	1 (3/1000)	1 (3/1000)
	Intermediate	2 (6/1000)	1(3/1000)	2 (6/1000)	0
	Severe	5 (15/1000)	0	0	1 (3/1000)
Three 1999 Super 12 squads [(5)] [2]	Mild	9 (12/1000)	2 (3/1000)	2 (3/1000)	2 (3/1000)
	Moderate	6 (8/1000)	2 (3/1000)	0	0
	Severe	10 (14/1000)	3 (4/1000)	0	0
TOTAL[3]:		**44 (41/1000)**	**21 (20/1000)**	**5 (5/1000)**	**4 (4/1000)**
TOTAL OF MODERATE AND SEVERE INJURIES PER PHASE OF PLAY[3]:		**23 (22/1000)**	**6 (6/1000)**	**2 (2/1000)**	**1 (1/1000)**

[1] 327 player game hours recorded
[2] 740 player game hours recorded
[3] 1067 player game hours

PLAYER POSITION

No significant trends in the proportion of injury episodes according to player position could be found in the literature for professional and amateur rugby union. In the 1997 Super 12 study, number eight was the most commonly injured position, followed by fullback and lock [3]. In the 1999 Super 12 study, fullback and centre were most commonly injured position, followed by hooker [5]. In the 1995 Rugby World Cup, loose forwards were most commonly injured, followed by inside backs (scrumhalf and flyhalf), with hookers and locks as the third most commonly injured position [1]. In the 1992 ACT club league, no 8 was most commonly injured, followed by centre and flanker [7]. Differences in grouping of injuries per player position and lack of correction for positions of which two exist in a team made comparison of studies difficult, in addition to the lack of uniformity in study design already discussed.

DISCUSSION AND RECOMMENDATIONS

This article attempted to present the epidemiology of injuries in professional rugby union and compare that with epidemiological studies on injuries in senior amateur rugby union since 1990. Certain difficulties were encountered, from which a number of recommendations regarding study design are made. A uniform method of reporting of injuries should be made available for future researchers. This should include reporting of injury rates as number of injuries per player exposure time, such as injuries per 1000 player game hours. Injuries sustained during training should also be expressed as number of injuries per

player training time. Definition of an injury incident should be standardised for acute and chronic overuse injuries. Re-injury should be clearly defined and reported. Player position should be standardised for purposes of reporting injury rates per player position, and corrections should be made for positions of which there are two per team. Description of the pathological type of injury needs clear description, as terms such as sprains and strains have been used in different context in different studies. The International Rugby Board (IRB) is the international governing body of rugby union, and is in an ideal position to recommend standardised research methods in rugby union.

Certain observations could be made regarding the epidemiology of rugby injuries. A high incidence of injuries exists in rugby union. There is no clear indication of a difference in incidence of injuries between professional and amateur rugby. Only one study made a comparison between re-injury rates between amateur and professional rugby, and described an alarmingly high re-injury rate in professional rugby players. This trend needs further research and possible action from rugby administrators. A consistent finding in the literature is that the tackle is the most dangerous phase of play, with no clear difference between tackling and being tackled. Coaching and training staff should teach players proper tackling techniques, and ensure proper physical conditioning for that phase of play. Existing rules regarding legal tackling should be enforced. Rule changes regarding the tackle may be difficult without changing the nature of the game. The set phases of the game, where stringent rules have been introduced, have the lowest injury rates in professional and amateur rugby. All studies reviewed recorded injuries during a season or competition. Recording

of pre-, post- and off-season injury rates could give an indication of the nature and severity of chronic injuries and the possible need for rehabilitation during the off-season.

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CHAPTER 3

PRE-SEASON ASSESSMENTS OF SOUTH AFRICAN RUGBY PLAYERS IN THE 1999 RUGBY SUPER 12 COMPETITION

Submitted to the South African Journal of Sports Medicine

PRE-SEASON ASSESSMENTS OF SOUTH AFRICAN PLAYERS IN THE 1999 RUGBY SUPER 12 COMPETITION

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ABSTRACT

Background: There are no data available on pre-season medical profiles, previous injuries and management, use of medication and supplements, or use of protective gear in professional rugby players playing in the Super 12 Rugby competition.

Aim: The aim of the study was to describe the use of medication, supplement use, injuries and possible risk factors for injury, and use of protective gear in professional rugby players playing in the Super 12 Rugby competition.

Methods: A retrospective cohort study collected pre-season data from 74 professional players (mean age 26 $\pm$ 3 years, mean number of first class games = 72) representing three South African teams before the 1999 Super 12 competition. Information was collected by means of medical profile questionnaires and a pre-season medical examination.

Results: No regular medication was taken by 85% of players. Anti-asthmatics were taken by 10% and nasal corticosteroids by 5% of players. Dietary supplements were used by 81% of players, of which 46% used vitamins and minerals, 61% used creatine and 38% used protein supplementation. 90% of players used protective gear, including mouth guards (73%), shoulder padding (62%), ankle braces (15%), shin pads (15%), headgear (5%), and thermal pants (1%). Regular strapping was used by 58% of players, including ankle strapping (31%), finger strapping ("buddy taping) (23%), wrist strapping (16%), knee strapping (4%) and protective ear strapping (8%). An average of 5 previous injuries per player were recorded. The most common previous injury was concussion (20%), followed by shoulder (16%), ankle (13%), and knee injuries (12%). Chronic overuse injuries represented 12% of injuries. Fourteen per cent of previous injuries were still symptomatic at the beginning of the season.

Conclusion: There is a high prevalence of injuries in professional rugby players, and most players use protective equipment to decrease the risk of injury. Nutritional supplement use is very common among this group of players but medication use is rare.

Key words: professional rugby union, injuries, protective gear, medication, supplements, strapping.

INTRODUCTION

The Rugby Super 12 competition, which started in March 1996, was the world's first fully professional Rugby Union competition [41]. Twelve teams (5 from New Zealand, 4 from South Africa, and 3 from Australia) compete in this prestigious tournament between the top teams of three of the world's strongest rugby playing countries. It is regarded by players, coaches, and administrators as one of the most gruelling rugby competitions to date and places exceptional physical and emotional stresses on the players involved. There is concern from the media, rugby administrators and the medical fraternity about the seemingly high injury rate among these players.

There is also concern about the possible harmful effects of non-stop rugby for most months of the year for a large group of these players. Preparation for the Super 12 starts in November and the competition ends in May of the following year. An international season of two to three months then follows for the players chosen for the respective national sides, while the remainder of the players compete in the first part of the local provincial competitions. After completing their international competitions, the national squads immediately join the remainder of the provincial season. After completion of the provincial season the South African national side usually undertakes a tour to the northern hemisphere and returns just in time for the players to start preparing for the next Super 12 competition. Being professional, with income depending on performance, most players are unable to take time off for recovery and treatment of injuries.

Only one prospective study on injury rates in professional rugby has been published, and was done on the Super 12 competition[41]. A number of injury studies have been published on other senior rugby [2,7,9, 10,13,14,17,28,36,40,44].

This study is part of a study on three South African teams during the 1999 Super 12 competition, and describes aspects of pre-season information and assessments, including age, experience of the players, previous injury profiles, residual injuries from previous seasons, medication, supplements used, and use of protective gear

The New Zealand Rugby Injury and Performance Project (RIPP) undertook a comprehensive prospective cohort study of this nature on club and secondary school level during the 1993 season[13], but to date no such data have been published on professional rugby payers.

The aim of the study was to describe the use of medication, supplement use, injuries and possible risk factors for injury, and use of protective gear in professional rugby players playing in the Super 12 Rugby competition.

MATERIALS AND METHODS

This study is a descriptive retrospective cohort study consisting of pre-season assessments of 74 players who represented 3 South African teams during the 1999 Super 12 competition. The data were collected by means of player medical profile questionnaires that were completed by team doctors from the three teams. Information collected included the age of players, playing position, provincial and "first class" experience, regular use of medication and

supplements, previous injuries and the use of protective devices or strapping. This was followed by a thorough medical examination of each player by the team doctor. The data were recorded on a medical examination form. Of particular importance during the medical examination was to establish the status of old injuries and medical conditions recorded in the player medical profile questionnaires. Injuries that caused a player to have medical treatment and miss at least one match, any injury that became chronic (more than 6 weeks duration), resulted in surgery or that had not fully recovered at the time of examination (start of new season) were recorded. All previous cases of concussion were recorded. Players found it difficult to remember all their previous injuries, especially the less severe ones, which may have caused recall bias in this part of the study.

All players in the three teams could not be included in the study. Team doctors found it difficult to comply with the research protocol and the researcher could only use what was made available from them. The initial research protocol included the final squads of all four South African teams, a total of 112 players, of which 74 could be used. Players were excluded where incomplete data were obtained or where a player was excluded from the team before commencement of the competition. All the data on replacements were not received by the researcher because of difficulty in contacting team doctors during the course of the competition. Collection of data was complicated further by coaches and team management being reluctant to divulge any information on their players, seemingly in fear of other teams getting hold of information that could be used against them during matches and also to protect some of their "trade secrets".

Questionnaires and examination forms were distributed to the team physicians by the South African Rugby Football Union (SARFU), who were given personal instructions by the researcher in order to standardize data as far as possible. The researcher coded the completed questionnaires.

Statistical analysis of data was conducted at the Department of Mathematical Statistics of the University of the Free State. Central tendency, variability and other important characteristics of the questionnaire data were explored using frequency distributions, graphical tools and, most importantly, descriptive statistics. Due to the nature of the research no formal hypothesis testing was conducted. All conclusions and recommendations were based on the aforementioned statistical tools.

RESULTS

A total of seventy-four questionnaires and examination forms were obtained, of which 29 were from one team, 28 from another and 17 from the third participating team. The number of players in different positions studied is as follows: 16 prop forwards, 4 hookers, 3 locks, 15 loose forwards, 7 scrumhalfs, 5 flyhalfs, 9 centres, 8 wings and 7 fullbacks.

The mean ± SD age of the group of players included was 25,7 ± 2,9 years and ranged from 20 to 35 years old. The mean number of first class games was 71,5 games and ranged from 8 to 175 games. The number of years experience at provincial and higher levels of rugby ranged from one to twelve years, with a mean of 4,6 ± 2,8 years experience at that level.

USE OF MEDICATION

Sixty-three players (85%) did not take any medication on a regular basis. Seven (10%) players used inhaled anti-asthma medication. This ranged from pre-exercise beta-2 stimulants, to combinations of beta-2 stimulants and ipratropium, with or without inhaled corticosteroids. No player reported the use of a leucotriene antagonist. Four players (5%) reported regular use of nasal corticosteroids for allergic rhinitis. All players take non-steroidal anti-inflammatory medication intermittently. No use of other regular medication was reported.

USE OF DIETARY SUPPLEMENTS

The distribution of dietary supplement usage is demonstrated in Figure 1. Sixty players (81%) made use of some form of dietary supplement while fourteen (19%) did not make use of any supplements. Supplements were divided into vitamins and minerals, creatine and protein. Carbohydrate drinks were not categorized as a supplement as all players studied take carbohydrate drinks on a regular basis before, during and after training sessions. Thirty-four players (46%) took vitamin and mineral supplements. These could not be subdivided into specific substances, as many of the preparations used were combinations. Forty-five players (61%) made use of creatine supplementation, while twenty-eight players (38%) took some form of protein supplement. Twenty-five of these players made use of a combination of protein and creatine, as are generally advised by manufacturers and by certain fitness trainers.

PROTECTIVE GEAR AND STRAPPING

Sixty-seven players in the group (90%) use some form of protective gear. The distribution of use of protective gear by anatomical area is illustrated in Figure 2. Fifty-four players (73%) used mouth guards during matches, forty-six (62%) used shoulder padding, eleven (15%) wore ankle braces, eleven (15%) wore shin pads, four (5%) wore protective headgear, and only one (1%) indicated the use of thermal pants.

Regular strapping of some kind was used by 43 players (58%), while 31 (42%) indicated no use of strapping. The distribution of regular use of strapping is illustrated in Figure 3. Twenty-three players (31%) used ankle strapping on a regular basis, seventeen (23%) strapped fingers ("buddy" strapping of digits and metacarpo-phalangeal joint of the thumb), twelve players (16%) used wrist strapping, three players (4%) used some form of strapping on their knees and six players (8%) protected their ears with strapping. Strapping was mostly used for protection of old injuries such as chronic ligament laxity, or unloading of certain structures. The only preventive use of strapping was for protection of the ears of certain forwards.

PREVIOUS INJURIES

A total of 348 previous injuries, which fitted the described criteria, were recorded. This represents an average of 5 previous injuries per player. A summary of previous injuries recorded is presented in Table 1.

The anatomical distribution of previous injuries is demonstrated in Figure 4. There were sixty-eight previous episodes of concussion (20% of injuries),

fourteen previous neck injuries (4% of injuries); fifty-four shoulder injuries (16%); twenty-eight injuries to the arm, wrist and hand (8%); fourteen to the ribcage and sternum (4%); thirteen back injuries (4%), sixteen injuries to the hip and groin area (5%); eighteen thigh injuries (5%); forty-one knee injuries (12%); fourteen lower leg injuries (4%); forty-five ankle injuries (13%); twelve foot injuries (3%); four injuries to the abdominal area (1%); and six mouth injuries that resulted in crowned or bridged teeth (2%). Forty (12%) of these injuries were of the chronic overuse type, while 308 were acute traumatic injuries (89%). The anatomical distribution of acute and chronic overuse injuries is demonstrated in Figure 5. The highest numbers of chronic overuse injuries are from the lower leg, hip and groin, lower back, shoulder and foot.

Forty-nine (14%) of all recorded injuries were still active at the start of the season and prevented normal training. Of these, fifteen (4%) were chronic overuse type injuries, and thirty-four (10%) were acute injuries sustained during the previous season. One hundred and ten (32%) of the recorded injuries were second (48), third (24), and fourth or more (38) injuries to the same structure.

Of the recorded injuries, sixty (17%) were treated surgically, while the others were treated by the team physicians, team physiotherapists and biokineticists or fitness trainers, using medication such as non-steroidal anti-inflammatory agents, therapeutic modalities such as ultrasound, soft tissue mobilization techniques and dry needling, as well as exercise rehabilitation. The distribution of surgically treated versus non-operative treatment for an injury is demonstrated per anatomical structure in Figure 6.

Previous cases of concussion are demonstrated in Figure 7. Concussion was the most common previous injury recorded. Forty-two per cent of the players included in the study suffered one or more previous bouts of concussion that constitutes 20% (68 injuries) of the total number of injuries recorded. Fifteen players suffered one previous concussion, while four suffered two previous concussions, five had three previous concussions, five had four previous concussions and two players suffered more than four previous incidents of concussion. No skull fractures were reported.

DISCUSSION

Professional rugby at the Super 12 level is physically very challenging. It is expected of professional rugby players to produce peak performance week after week for a large part of the year. This requires optimal preparation, treatment of medical conditions, nutrition, use of appropriate supplements and management of injuries. No data on most of these aspects in professional rugby union has been published to date. This study aimed to provide demographic data, medication and supplement use, use of protective gear and strapping and an injury profile as baseline information for further research. In a

previous study, problems were encountered with handling of data and it was mentioned that amateur rugby union doctors were less compliant than their colleagues in the professional codes of rugby league and Australian Rules[36]. This study experienced a similar lack of compliance from team doctors in professional rugby union, which makes the group studied difficult to define.

The mean age of the group of players studied was 25,6 years, with mean first class experience of 71,5 matches. This indicates that a relatively experienced group of players represented South Africa in the 1999 Super 12 competition.

The only regular use of medication in the group studied was used for hypersensitive airways. Anti-asthma medication use was reported by 10% of players. This figure is lower than the 12-15% of the general population affected by exercise-induced asthma (EIA) only [31]. Of particular interest in this study is that all but one of the players using anti-asthma medication came from one province. This may indicate under diagnosis of asthma and EIA. It has been suggested that when the disease is identified and well managed, the results could be remarkable for patients of all activity levels[31]. Further research on the incidence and management of EIA and asthma in professional rugby players is therefore advised.

A number of players reported regular use of non-steroidal anti-inflammatory medication. These were not specifically identified, as the purpose of this question was to establish regular use of medication for chronic medical conditions. It is, however, a well-known fact that rugby players use high amounts of non-steroidal anti-inflammatories, often on own initiative, and without recommendation or guidance from a doctor. This is certainly not a

responsible or effective way to use medication, as non-steroidal anti-inflammatories have only limited use in the management of sports injuries, and can be harmful[22, 43]. Better control and advice from team doctors regarding the use of these agents is therefore advised.

Eighty-one per cent of players used some form of dietary supplement. From the data received, supplements could only be categorized into vitamins and minerals, creatine and protein preparations. The vitamins and minerals group included a variety of multivitamins, minerals and anti-oxidants. Players, who used these, did so on recommendation of other players, parents, trainers, team doctors and a variety of other people. They were mostly unsure of the content or benefit of the preparations. Although not listed as a supplement, all players in the assessed squads make use of carbohydrate or sports drinks before, during and after exercise. The team staff generally provides this. No previous published data on supplement profiles in professional rugby players could be found in the literature. From this study, it seems that supplements are not taken systematically, but that professional rugby players are rather left to their own mercy and that of merchants wanting professional athletes to use and endorse their products. Rugby players seem to use supplements for two reasons, firstly for the supposed ergogenic effect and secondly to enhance the immune system to prevent infections. Only three nutritional ergogenic aids have been mentioned for which ergogenic effect there is some scientific support. These include caffeine in endurance exercise, bicarbonate in high intensity short-duration exercise and creatine in maximal effort exercise under ten seconds[3]. The ergogenic role of creatine has been partially supported in a review of "physiological anecdotes" concerning creatine supplementation,

where the conclusions were reached that there is approximately a 2:1 chance that creatine loading may be successful in enhancing the athlete's total muscle creatine content. Creatine may also assist in enhancing lean muscle mass over 6 to 8 weeks and may be of secondary benefit to sports performance[24]. Protein and amino-acid supplementations are also popular in the group of professional rugby players studied. Amino-acids are supplemented for strength work, to increase the availability of essential amino-acids, enhance anabolic processes promoting tissue accretion, and accelerate the rate of recovery during training [21]. For endurance work, branched chain amino-acids (BCAAs) were proposed to produce an extra source of carbohydrate via breakdown of alanine, and to alter the free tryptophan: BCAA ratio to reduce "central fatigue"[21]. No conclusive evidence in the literature indicates a definite benefit from amino-acid or protein supplementation, as long as a balanced diet is followed with a minimum of 15% protein content [3, 21,26].

Vitamin and mineral supplementation have also not shown any measurable ergogenic enhancement [8]. A recent review reporting on the influence of nutritional supplements, primarily zinc, vitamin C, glutamine and carbohydrate on the acute immune response to prolonged exercise in endurance athletes made a number of observations. Vitamin C and glutamine have received much attention, but data thus far are inconclusive. The most impressive results have been reported with carbohydrate supplementation[26]. In a review on the role and functions of dietary anti-oxidants in relation to human health, it was concluded that anti-oxidants might have an important role to play in the aetiology and prevention of diseases. A high dietary intake of anti-oxidants, such as fruit and vegetables, however, must always be the first rational approach. Benefits of

anti-oxidant supplementation have only been proven in populations where food and nutrient intake is inadequate. Anti-oxidant supplementation may also not be without harmful effects [1]. Vitamin toxicity does not only occur after excessive intake of fat soluble vitamins A, D, E and K as commonly believed, but retention and toxicity also occur with the water soluble vitamins B and C [8]. Better control and advice on the use of supplements to professional rugby players are therefore also recommended.

The recommendations regarding the use of nutritional supplements are supported by a policy document of the Scientific and Research Group of SA Rugby (Pty) Ltd, the professional component of the South African Rugby Football Union (SARFU) [32]. In this document the increased interest in and availability of nutritional supplements are noted. Elite athletes are often targeted to use products for marketing purposes of the distributors of these products, many of which the beneficial or ergogenic effect have not been established. It is the contention of SA Rugby that especially the professional sporting codes in South Africa have a special responsibility both to their athletes and to the general public to ensure that athletes receive the best advice that is based on the most current scientific evidence and that neither athletes nor the general public are exploited for the commercial benefit of third parties. The following guidelines are therefore proposed by SA Rugby:

- Nutritional support, including supplementation to South African rugby Players must be based on an individualised, and systematic approach. Nutritional screening needs to be introduced for all players who need a consistent, holistic and career-long programme to ensure that they

receive scientifically-valid nutritional advice of international standing that will optimise their performance.

- A strategy needs to be put in place to educate the players, coaches and administrators on all aspects of nutritional support for players.
- SA Rugby (Pty) Ltd / Provinces need to consider taking control of all contractual arrangements between the manufacturers of supplements and teams and players to insure that the interest of SARFU and the players are protected and not abused by the manufacturers and marketers of these products.
- SA Rugby (Pty) Ltd is not apposed to the use of supplementation that conforms to the criteria outlined in the preamble.
- In particular, any supplementation must be individualised and may be considered only after a thorough nutritional evaluation of each player.
- There is no place for the mass prescription of supplements for all players, all of whom receive identical prescription without attention to the specific needs of the individual players.
- In keeping with SA Rugby (Pry) Ltd and IRB Policy, players assume full legal responsibility for whichever supplements they use, under the anti-doping "strict liability" clause.
- All nutritional supplements available in South Africa are not regulated by a controlling body such as the Medicines Control Council. As a result, they are not bound by law to display on their labels, a full list of their contained substances.
- The result is that some or all of these products may contain banned substances such as prohormones, nandrolone or ephedrine, amongst others.

- SA Rugby (Pty) Ltd nor any other organization is in the position to endorse these products until their contents are regulated and controlled by the Medicines Control Council of South Africa [32].

Only 5% of players in the group made use of protective headgear. This was before the 1999 season, which was also the first season when the use of headgear became more popular. A recent review on the use of headgear in rugby union concluded that protection from the range of impacts that can be generated in contact sports does not seem to be attainable by using protective helmets or protective rugby headgear. The use of headgear for protection from lacerations and abrasions and to provide only limited protection from impact injury was recommended [45]. Further research is recommended to determine the effectiveness of protective headgear in reducing the risk of injury in rugby, and also to determine whether headgear use places the wearer at greater risk of injury through altered player behaviour.

Mouth guards were used regularly by 73% of players studied. Only six players reported serious dental injury in this study. This does not correlate well with a previous study among Scottish club rugby players, where 30% of players had previous teeth fractures, and 19% had teeth completely knocked out [19]. Oro-facial and dental injuries are of particular importance as dental tissues have a low potential for recovery when damaged, and such injuries can give rise to functional, aesthetic, and psychological disfigurement. In a review on the use of mouth guards in rugby union, it was concluded that there is clear support in the scientific literature for the use of mouth guards in contact sports such as rugby, for protection against injuries to the teeth, jaw and surrounding tissues [5].

Moreover, the literature provides evidence that mouth guards are effective in protecting against concussion and injuries to the cervical spine, through the repositioning of anatomical structures in the head and neck [5]. The efficacy of gum shields was supported in a report on numerous studies that have shown between 90 and 100 per cent reduction in dental injuries by wearing custom made gum shields. This study concluded that it is up to the individual player to make an informed decision about wearing a gum shield or not and that it would seem that many rugby players are not well informed. Unfortunately, even in the elite groups who seem more informed of the benefits of wearing a gum shield, the numbers actually wearing mouth guards are still unsatisfactory [18]. Based on this evidence, however, Compulsory use of custom-made mouth guards during matches and contact training sessions in professional rugby is recommended.

Shoulder padding is a popular form of protection (62%) among the group studied. A recent overview on the use of padding in rugby union argued that shoulder pads would do little to minimize major injuries such as fractures or dislocations. He presented arguments that injury from falling on the tip of the shoulder is generally benign in nature, and that shoulder padding may be used as an "offensive weapon" and not within the spirit of the game [12]. These arguments may well be true in this study, where shoulder injuries were the second highest injured anatomical structure (16%) in spite of 62% of players using shoulder padding. For this reason, the use of certain types of shoulder padding had been banned by the International Rugby Board in 1993 [16].These restrictions have since been relaxed.

Shin guards were used by 15% of players studied. Shin guards were found to be effective by reducing peak loads in dummies by 41,2 to 71,1% [12]. In this study, however, most injuries recorded to the lower leg were of the chronic overuse type, and not caused by direct blows to the shin.

Fifteen per cent of players studied made use of ankle bracing, while thirty-one per cent of players used regular ankle taping. The South African national rugby team use routine preventive strapping of ankles for all matches. In a review on the effectiveness of external ankle epidemiological evidence that external ankle support causes a decrease in the incidence of ankle injury was presented. It was concluded that the use of braces is more effective than taping in reducing ankle range of movement (ROM) and loading rate. Taping is also known to loosen during exercise and lose its efficacy[15]. Ankle injuries are common in rugby. An incidence of ankle injuries of 7,5% was documented among first grade rugby union players in the Australian Capital Territories Rugby Union competition in one season[14] and 3% of all injuries documented in the 1995 Rugby World Cup were ankle injuries[17]. The prevalence of previous ankle injuries in this study was 13%. There is resistance from players to wear ankle braces, as some of these braces are uncomfortable and make the players feel clumsy. Further research into acceptable ankle bracing is recommended based on the evidence that ankle bracing is more effective than strapping in reducing injuries[15].

In a study among 44 club rugby players in the Cape Province, South Africa, it was concluded that thermal pants may have a role in preventing recurrent hamstring injuries [42]. Other factors such as inadequate pre-season training and

incomplete rehabilitation after injury are likely to be more significant risk factors for injury. Only 5% of players reported thigh injuries in this study, and are probably underreported for reasons discussed elsewhere. Other studies, however, reported a high incidence of hamstring strains [2,9,10,13,44]. Ways of preventing these should be investigated further.

Rugby has a high injury rate. One injury in every 8,3 player hours was reported in one squad during the 1996 Super 12 competition, which converts to 120,5 injuries per 1000 player game hours [41]. Thirty-two injuries per 1000 player game hours were reported during the 1995 Rugby World Cup, the last Rugby World Cup before the start of the "professional era" [17]. During the 1992 season, 62 injuries per 1000 playing hours were reported in first grade players, and 53/1000 playing hours among all grades in rugby union in Australia [36]. An injury rate of 48,8/1000 playing hours were reported in eight first grade teams in Australia during the same season [14]. Only 13,95 injuries per 1000 playing hours, or an injury per every 1,8 matches were reported in Scottish clubs during the 1993-4 season, while injury rates as high as 160,6 per 1000 player position game hours were reported among 600 amateur rugby league players in Australia over three seasons [9]. The results in these and other epidemiological studies on rugby injuries vary considerably, because of different methods of reporting, but mainly because of different definitions of injuries used [2,7,14,36,40,41]. This makes most of the available data on rugby injuries, incomparable. This study recorded an average of 4,7 previous injuries per player career. This amounts to 49,4 injuries per 1000 previous player hours if average number of matches is divided by the total number of previous injuries recorded. This figure correlates well with data from the previous studies mentioned, but seems to

represent a low figure for this particular group of players. The first possible reason for this is recall bias, which is generally a problem in retrospective studies such as this [20]. The players seemed to forget injuries that occurred more than a season before. The other reason is that players are unwilling to make team doctors aware of too many previous injuries, from fear of jeopardizing their chances for selection.

The aim of recording previous injuries was to establish the pre-season injury status of a group of professional rugby players. To our knowledge, this is the first time that such data have been published. That, and the fact that an attempt was made to record career injury profiles, makes the data difficult to compare to injury rates recorded over specific time periods in other studies. It seems that chronic overuse injuries are not nearly as big a problem in professional rugby as acute traumatic injuries, which constitutes 89% of previous injuries recorded. As in many other studies mentioned, most injuries occurred to the head and lower limbs. Shoulder injuries also occurred commonly. Other injuries that occurred commonly in other studies [2,44] are lacerations and muscle strains. Lacerations were not recorded in this study, while muscle strains were probably underreported, as players did not regard those as serious injuries. A total of forty-nine (14%) injuries were still current at the beginning of the season. These statistics may indicate a lack of sufficient recovery time before the start of the new season. A sensible way of preventing this is to perform routine end-of-season medicals in the same way as pre-season medicals are done. Seventeen of the 41 knee injuries reported, or 41%, required surgery. The high prevalence of knee surgery is probably due to the nature of the injuries,

available technology and skill in arthroscopic knee surgery, and the more frequent use of diagnostic arthroscopy by some orthopaedic surgeons.

The high incidence of previous concussion and high percentage of players affected (20% of injuries from 48% of the players) in this study and others [10,14,36,41] is a major concern. After recovery, a player's chance of suffering another concussion may be four times as high as that of a player who has never had a concussion, and repeated concussions could cause cumulative, permanent neurological damage – like the punch-drunk syndrome seen in some boxers [30]. Seventy-two per cent of concussions recorded in this study, were repeated insults, which correlates with the above statement. The current management of concussion in rugby union is unsatisfactory [41]. The International Rugby Board rules a 21 day rest from contact sport after a first concussion, six weeks after a second concussion in the same season, and a ban for the rest of the particular season for more than two concussions in one season. A compulsory neurological examination is also required before return to play. The first problem in implementing these sensible guidelines is a lack of specific diagnostic criteria for concussion[30, 41]. The diagnostic problem has been described in the literature [4]. Recognition of a head injury is easy in the presence of loss of consciousness. The far more frequent head injuries in which there are no loss of consciousness but rather only a transient loss of alertness, however, are much more difficult to recognize. More than 90% of all cerebral concussions fall into this most mild category where there has not been a loss of consciousness but rather only a brief period of post-traumatic amnesia or loss of mental alertness. Because the dreaded second impact syndrome can occur after a grade I concussion, just as it can after more serious head injuries,

it becomes very important to recognize all grades of concussion [4]. The second problem is that of underreporting of symptoms by players and team management in professional and first grade rugby, with subsequent early return to play [14, 41]. It is also extremely difficult to examine a player with possible concussion in the limited time available on the field. More specific guidelines from the International Rugby Board on diagnosis and on-field assessment of head injuries are urgently required.

Fourteen previous neck injuries were recorded, of which two were treated surgically. Neck injuries are dangerous and injuries to the spinal cord have been described as the most tragic of sporting injuries, frequently leading to tetraplegia with loss of bowel, bladder and sexual functions [20]. Many studies had been published on the incidence and consequences of neck injuries in rugby union[20, 27, 29, 33,34,35,37, 38, 39]. High tackling, scrum engagement, "popping" of the scrum and scrum collapse are the main causes of neck injuries. At least half of all neck injuries could have been prevented by the elimination of high tackling and by more rigorous control of the scrum [25 27]. Law changes have been implemented on a number of occasions[27, 33, 39]. These seemed to have reduced the incidence of serious neck injury in the competitions they were implemented in. It has been suggested on the other hand that the reported reduction in neck injuries in New Zealand, Australia and the UK may be false due to study limitations [27]. It is the ongoing duty of the rugby medical fraternity to keep researching and finding ways to limit neck injuries, and especially in professional rugby, as more neck injuries occur with higher intensity and speed of the game. Another form of neck injury described in rugby players is premature onset of degenerative disease of the cervical spine [29, 34]

CONCLUSIONS

Despite difficulty in recording data to establish certain trends in preparation, prevention of injury and previous injuries with consequent obvious statistical shortcomings, this study attempted to provide a starting point for further research on professional rugby players. Although certain recommendations are made, only good, current, statistical data can be used to introduce measures to make the game safer for the player and to make recommendations regarding supplementation, medication and management of injuries. Continuous recording and publication of data of this nature on professional rugby players is advised to keep monitoring changing trends and to provide team medical and coaching staff with recommendations based on current data. Player data banks should be considered for medical staff dealing with professional rugby players.

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Table 1: Previous injuries recorded in a group of professional rugby players before the 1999 Super 12 competition

	Conc	Neck	Shoulder	Arm/Wrist/ Hand	Chest	Back	Abdomen	Hip/ Groin	Thigh	Knee	Lower leg	Ankle	Foot	Teeth	TOTAL
Acute recovered	68	11	37	24	14	7	3	8	17	33	2	38	6	6	**274**
Acute active		2	12	4	-	1	-	1	1	5	-	7	1	-	**34**
Chronic recovered		1	4	-	-	2	1	4	-	1	11	-	1	-	**25**
Chronic active		-	1	-	-	3	-	3	-	2	1	1	4	-	**15**
TOTAL	**68**	**14**	**54**	**28**	**14**	**13**	**4**	**16**	**18**	**41**	**14**	**45**	**12**	**6**	**348**
Surgery		2	12	-	-	1	-	-	2	17	-	9	1	6	**60**
2nd	14	-	11	3	-	3	-	2	3	7	-	9	3	-	**48**
3rd	19	-	2	2	-	-	-	-	2	2	-	2	-	-	**24**
4th +	9	-	3	-	-	-	-	-	-	-	-	7	-	-	**38**

Figure 1: **Distribution of use of dietary supplements by a group of Super 12 rugby players before the 1999 Super 12 competition**

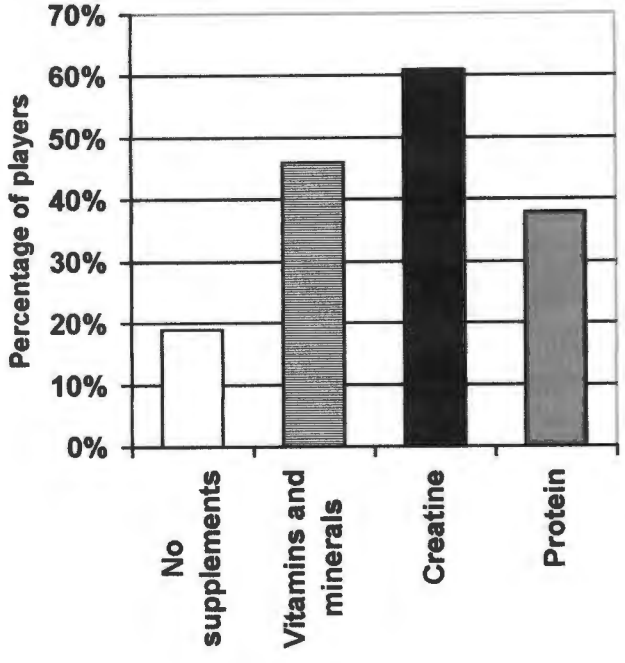


Figure 2: **The prevalence of use of protective gear in a group of rugby players during the 1999 Super 12 competition**

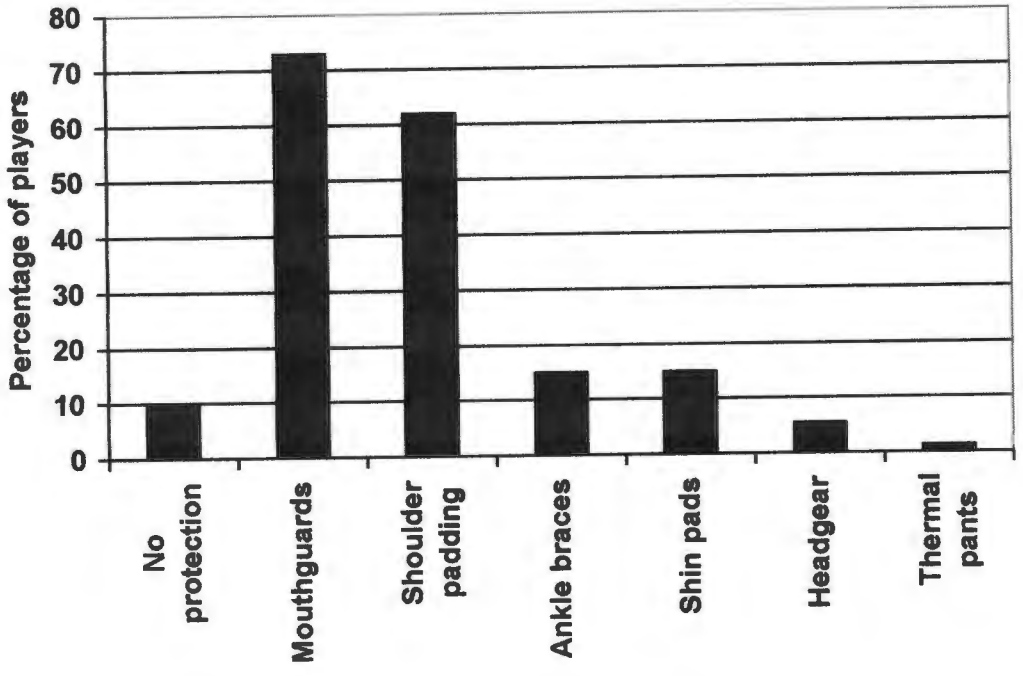


Figure 3: **Regular use of strapping in a group of rugby players during the 1999 Super 12 competition**

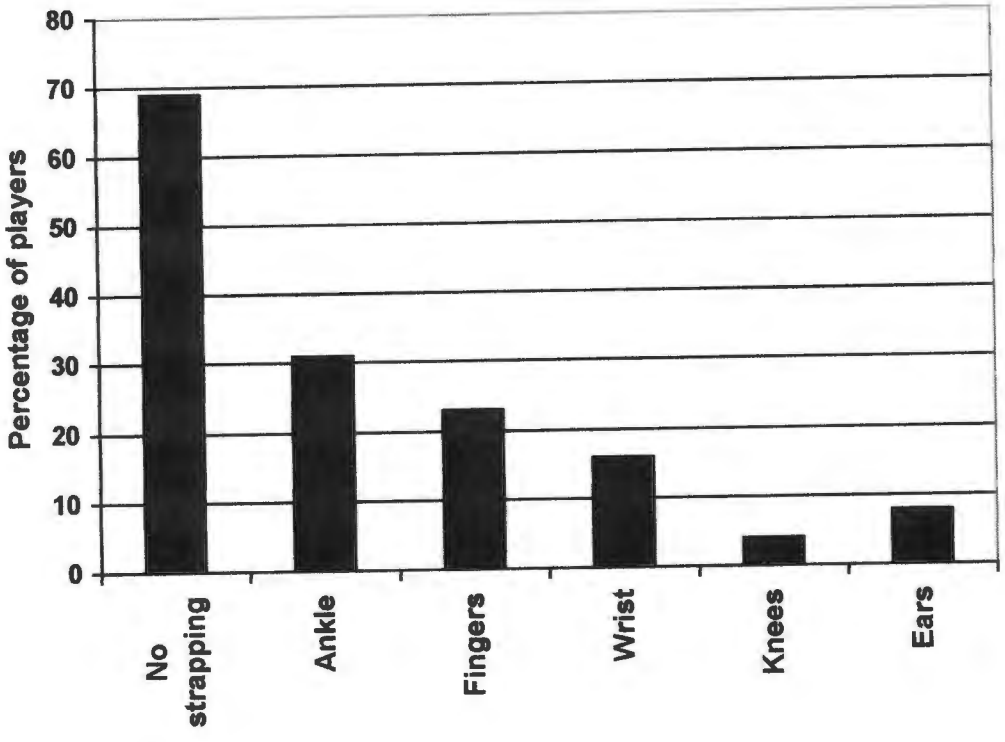


Figure 4: **Anatomical distribution of previous injuries in a group of professional rugby players before the start of the 1999 Super 12 competition**

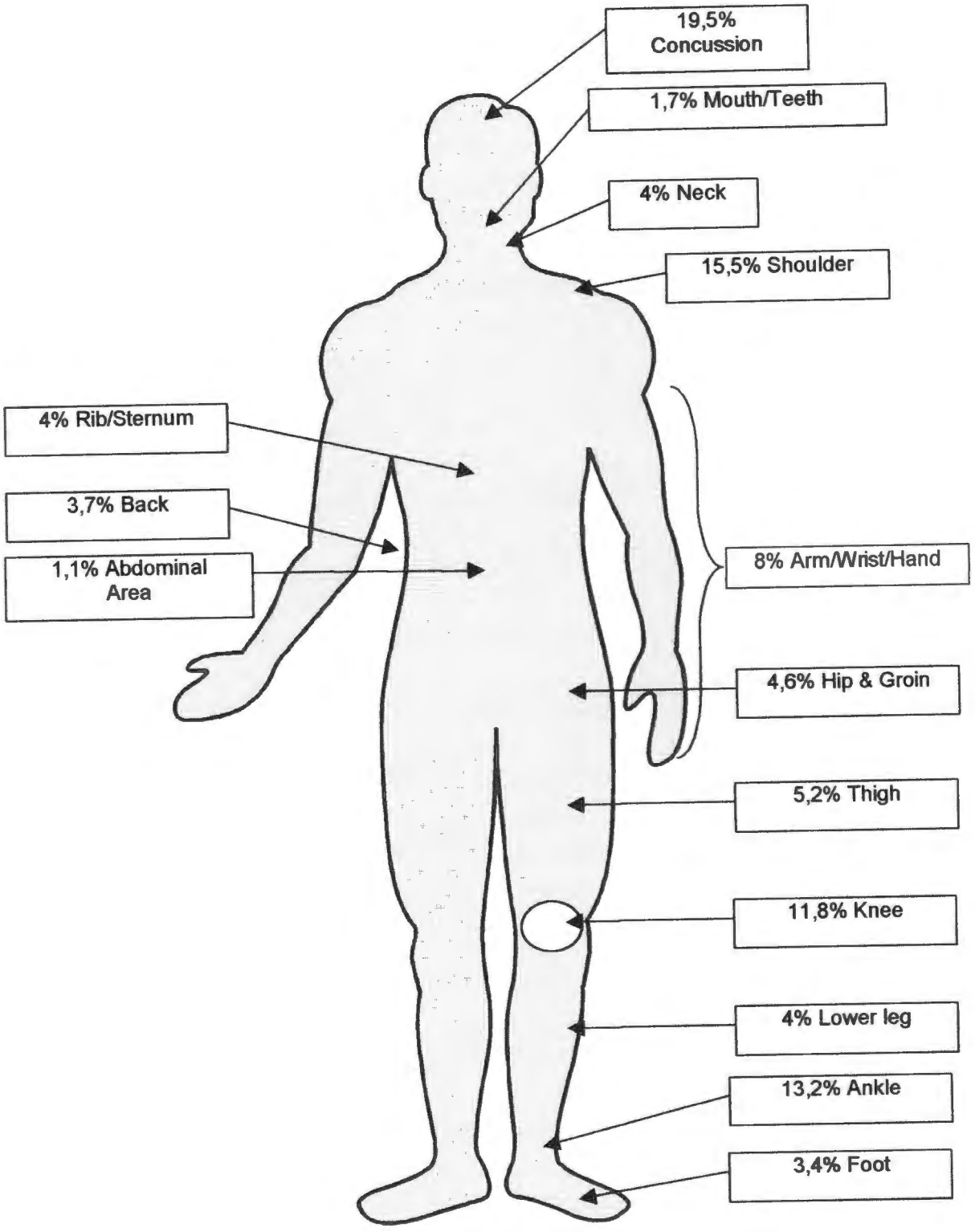


Figure 5: **The prevalence of acute and chronic injuries in a group of Super 12 rugby players per anatomical site**

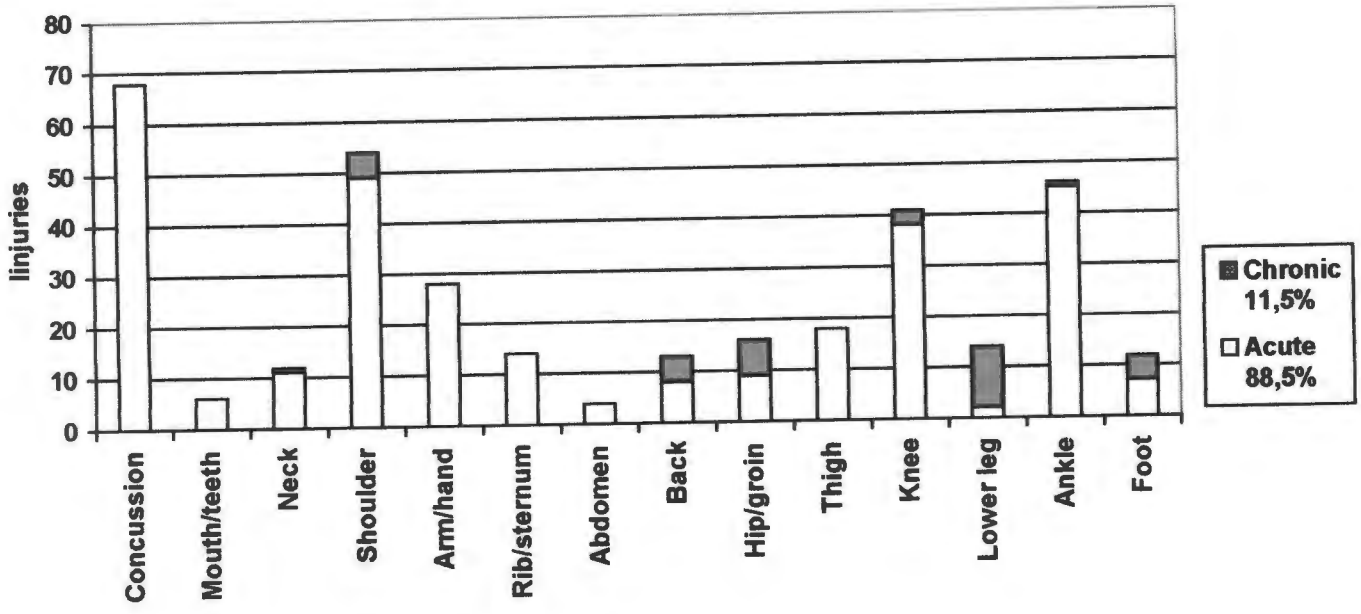


Figure 6: **Surgical vs. non-operative treatment of previous injuries of a group of Super 12 rugby players**

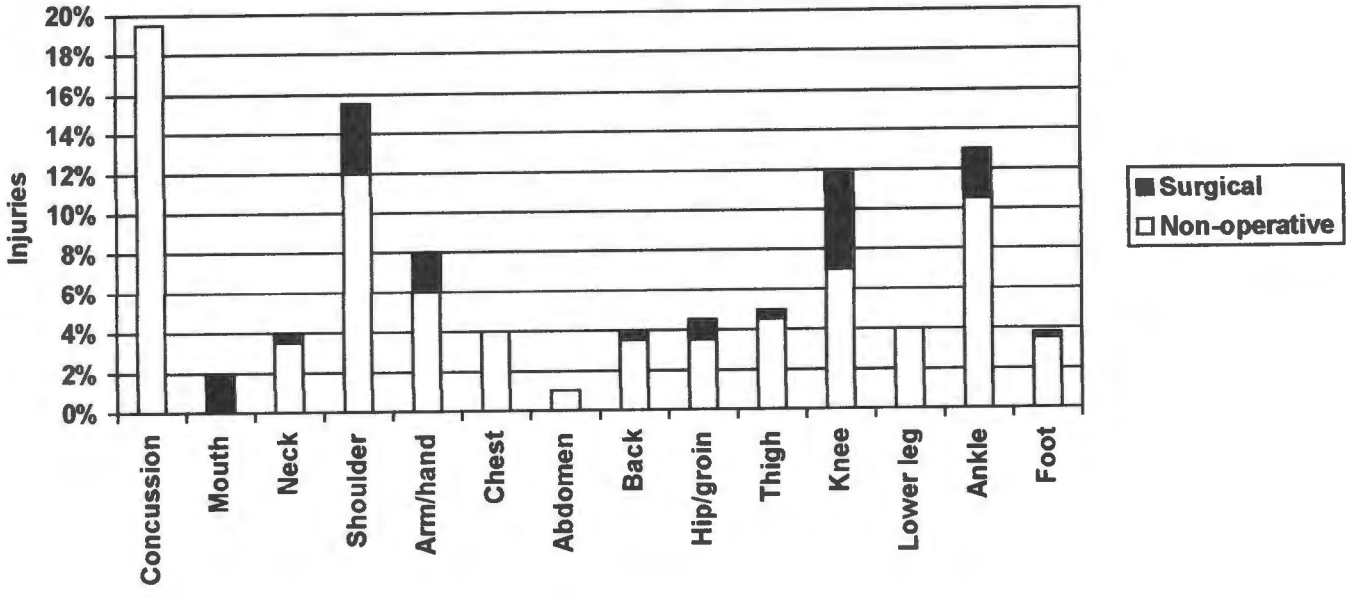
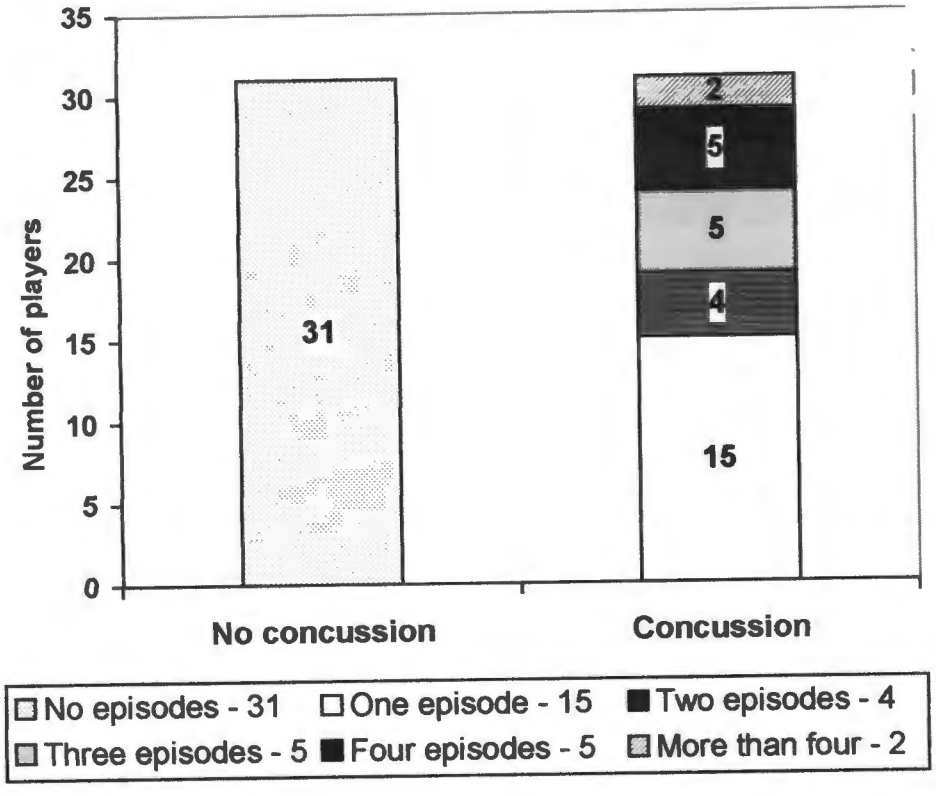


Figure 7: **Distribution of previous concussions in a group of Super 12 rugby players**



CHAPTER 4

THE INCIDENCE AND NATURE OF INJURIES IN SOUTH AFRICAN RUGBY PLAYERS DURING THE 1999 RUGBY SUPER 12 COMPETITION

Submitted to the British Journal of Sports Medicine for publication.

THE INCIDENCE AND NATURE OF INJURIES IN SOUTH AFRICAN TEAMS DURING THE 1999 RUGBY SUPER 12 COMPETITION

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THE INCIDENCE AND NATURE OF INJURIES IN SOUTH AFRICAN RUGBY TEAMS DURING THE 1999 RUGBY SUPER 12 COMPETITION

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ABSTRACT

Background: There are almost no scientific data concerning etiology and incidence of injuries in the Super 12 rugby competition.

Aim: The aim of the study was to document the incidence, nature and risk factors associated with injuries during the 1999 Super 12 rugby competition.

Methods: Injuries defined as injuries preventing playing or training, or requiring medical treatment were recorded in a cohort of 75 SA Super 12 players. Severity was graded according to sessions missed as minor (1-3 missed), intermediate (4–9) and severe (>9). Descriptive statistical tools aided in documenting the findings.

Results: A total of 740 player game hours and 4900 player training hours were recorded. The overall incidence of injuries was 55,4 injuries/1000 player game hours, and 4,3 injuries/1000 player training hours. Players most commonly injured were centres (10%), and fullbacks (10%). The most common injury types were: ligament sprains (26%), musculo-tendinous strains/tears (24%). The most common injured sites were: pelvis, hip (19%), head and knee (13% each). The tackle caused 40%, and rucks and mauls 11% of injuries. 24% of injuries were sustained during training, and chronic overuse injuries accounted for 10% of injuries.

Conclusions: There was a high injury rate during the 1999 Super 12 competition. A large percentage of injuries resulted from minor injuries. The most dangerous phase of play was the tackle. Training in tackling and rucking techniques, and rule enforcement are therefore recommended to reduce risk of injury. Injuries tended to occur late in games and early in the season, suggesting lack of physical conditioning and fatigue as possible causes of injury.

Key terms: injury, epidemiology, rugby union

INTRODUCTION

Many epidemiological studies on injuries in rugby union have concluded that a higher level of play is associated with a higher incidence of injuries[1,2,3]. Possible explanations for this include increased strength and body size of players, higher level of competitiveness, longer seasons, and the fact that the ball may be in play for longer in higher levels of the game[2,3]. The Rugby Super 12 Competition is widely regarded as one of the most gruelling rugby competitions in the world, played by the best teams from three of the best rugby playing countries in the world, namely Australia, New Zealand and South Africa [3]. It is also a fully professional competition. A high incidence of injuries is therefore expected in a competition of this calibre. Scientific data concerning etiology and incidence of injuries is essential for medical staff to provide appropriate advice to policy makers, team management, coaching staff and players, in order to prevent and manage injuries. Only one such study has been published on the Rugby Super 12 Competition. In this study, an overall injury rate of 120 injuries per 1000 playing hours has been documented [3]. In a study on professional rugby players participating in the Scottish Border Reivers club competition, the period prevalence of injuries among thirty players was 67,8 per 1000 game hours [4]. These studies confirm the expected high injury rate in professional rugby players. No other studies on professional rugby union since its inception in 1995 could be sourced in the literature.

The 1999 Super 12 competition was played between twelve professional rugby union teams - three from Australia, four from South Africa and five from New Zealand. These teams all played against each other in a "round robin" tournament,

with a knockout semi-final and a final match, over a period of fourteen weeks, between February and May 1999. This implies that all teams played virtually one match per week for the duration of the competition, with only one "bye" in between. An additional challenge was that South African teams had to travel between South Africa and Australasia for a four-week tour of "away" games. The time difference of 8 to 10 hours between South Africa and Australasia required rapid acclimatisation, as games were sometimes played only four or five days after arrival.

The aim of this study was to document the incidence and nature of injuries to players in the four South African teams competing in the 1999 Super 12 competition and to investigate possible factors associated with injury. The study is novel because there are very few injury epidemiological studies on professional rugby players. The results of this study will add to the small amount of scientific data available on this level of rugby union.

METHODS

The cohort studied consisted of the player squads of three of the four South African teams that competed in the 1999 Rugby Super 12 Competition. Medical staff of all four teams were approached and informed on the research protocol. One team did not wish to participate in the project. A number of players from all three squads studied were replaced during the course of the competition. An attempt was made to collect data on players leaving and joining squads, but this proved to be a very difficult task, as players were included and excluded from squads on a regular basis, sometimes just for one training session, and on very short notice. Team

officials did not comply with this request. A number of players were therefore included and excluded from the cohort during the course of the study. The final cohort studied was three squads of twenty-five players per squad, as stipulated by the organising body of the competition. Twenty-five players participated in each training session, and fifteen were on the field per game. The same problem defining the cohort was encountered in the other study on injuries in the 1997 Super 12[3].

The survey started 3 weeks before the commencement of the 1999 Super 12. Three teams were involved in 37 matches (3 pre-season, 33 round robin and 1 semi-final), which accounts for 740 player-hours of game time. Training hours were calculated at 2 sessions of two hours each per week during competition. One team prepared for a semi-final match. Pre-competition training was calculated at three team-training sessions of two hours each for the first two weeks of February. A total of 4900 player-training hours were thus included in the study. Injuries sustained during games were documented as injuries per 1000 player game hours, and injuries during training as injuries per 1000 player training hours. The sum of injuries sustained during games and training were documented as injuries per 1000 hours of exposure. Injuries that had not healed since the previous season were not included.

For the purposes of this study, an injury was defined as one which prevented a player from playing or participate in squad training, or one that required special medical treatment (medication, suturing, radiographs). All cases of concussion were recorded. Acute and chronic overuse injuries were included if these criteria

were met. The severity of an injury was assessed by recording of the number of games and training sessions missed due to an injury. A player, who was unable to participate for a week, was recorded to have missed three sessions (two training sessions and a game). Injuries were classified as minor if three or less sessions were missed, intermediate if four to nine sessions were missed and serious if 10 or more sessions were missed. This definition was chosen to allow comparison with a study on injuries to first-grade players in the Australian Capital Territories Rugby Union (ACTRU) competition, as it allows recording of minor injuries, which they found to be the most prevalent (58,7%) group of injuries [5]. This definition is similar to, but not exactly the same as the one used in the only other study on injuries in Super 12[3], as the protocol for this study was finalised before publication of the only other published study on the epidemiology of injuries in Super 12 rugby.

Pre-season medical examinations by the three participating team doctors were performed on all players included in the study, to document previous and current injuries. Information collected on an injury form included the following: Date, player position, team, injured during match or practice session, anatomical site, type and mechanism of injury, first or recurrent injury to the same structure and number of sessions missed as a result of the injury. The information was documented by the team doctor of each team, as instructed personally by the researcher and requested by the South African Rugby Football Union (SARFU). The team doctors were contacted telephonically on a weekly basis during the course of the competition to confirm that all injuries were being recorded. Completed injury forms were forwarded to SARFU.

Statistical analysis was done at the Department of Mathematical Statistics of the University of the Free State. Central tendency, variability, and other important characteristics of the questionnaire data were explored using frequency distributions, graphical tools, descriptive statistics and hypothesis testing. The Chi-square goodness-of-fit test was used to compare incidences of injuries. A 5% level of significance was used throughout the study. All conclusions and recommendations were based on aforementioned statistical tools.

Approval of the research protocol was obtained from the Ethics and Research Committee of the University of Cape Town before commencement of the study. Informed consent to participate in the study was obtained from all players included in the study. The study was undertaken with the assistance of SARFU.

RESULTS

INJURY RATES

Injury rates according to exposure are shown in Table 1. A total of sixty-two injuries were recorded in forty-eight players over a period of 14 weeks. Forty-one of these occurred during games, which represent 55,4 injuries per 1000 player game hours. Twenty-three of these (31/1000 player game hours, 56% of game injuries, 37% of total injuries) were of intermediate or severe nature. Twenty-one injuries (4,3/1000 player training hours) were recorded during training, which is significantly less than those that occurred during games ($p < 0,05$). Fifteen (3/1000 player training hours) of the injuries sustained during training, representing 71% of training injuries and 24% of total injuries recorded, were of intermediate severity or

severe injuries. There is no statistical difference between severity of injuries sustained during games or practices (p = 0,82). The total injury rate for training and games was 11 injuries per 1000 hours of exposure. If the total number of injuries sustained during games and training is expressed as injuries per player game hours, as was done in previous studies of this nature [6], the overall injury rate is 84 injuries per 1000 player game hours. Twenty-four injuries (39%) were minor injuries, seventeen (27%) were of intermediate severity and twenty-one (34%) were severe injuries. Injuries of intermediate severity and serious injuries were therefore responsible for 6,7 injuries/1000 hours of total exposure, or 61% of injuries recorded. Of the severe injuries recorded, three (5% of total injuries) caused players to miss the remainder of the rugby season. Of the total number of injuries recorded, fifty-four (87%) were first injuries and eight (13%) were recurrent injuries to the same structure.

POSITIONS INJURED

The total number of injuries per player position and the severity is shown in Table 2. The column for injuries "corrected" reflects the fact that some player positions are represented by two players in the team, whereas others have only one player. Centres and fullbacks were the most commonly injured positions with 10% of injuries each, with hooker and wing the next two most commonly injured positions. These results fail to indicate statistical significance between the incidence of injury and playing position (p = 0,712). Backs, comprising of 47% of a team, were responsible for 56% of the injuries, while the forwards comprised of 53% of a team and had only 44% of the injuries recorded. Of the 38 intermediate

and serious injuries recorded, 21 (55%) were from backs and 17 (45%) were from forwards. Centres and wings recorded the most intermediate and serious injuries.

INJURY TYPE

Ligament sprains (26%) and musculo-tendinous strains/tears (24%) accounted for 50% of the injuries recorded, which is significantly more than any other types of injury ($p = 0,000006$). Twelve of the ligament sprains (16,2 injuries/1000 player game hours) occurred during games and 4 (0,8 injuries per 1000 training hours) occurred during training. Of the musculo-tendinous strains/tears, 6 (40%, 8,1 injuries/1000 player game hours) occurred during games, and 9 (60%, 1,8 injuries/1000 player training hours) occurred during training. Other significant injuries were contusions/haematomas, lacerations and chronic overuse injuries (10% each). Fractures accounted for 8% of injuries. Dislocations/subluxations were responsible for 7%, and intervertebral disk herniations for 3% of injuries. Only one case of concussion (2%) was reported. The injury types are shown in Table 3.

INJURY SITE

The distribution of injuries according to anatomical site is shown in Table 4. The pelvis and hip area was the most commonly injured site, accounting for 12 (19%, or 2,1 injuries/1000 player hours of total exposure) of injuries. The head and knee were the next most commonly injured sites with 8 injuries (13%, or 1,4 injuries/1000 player hours of exposure) each, followed by the thigh and ankle with 7 injuries (11%, or 1,2 injuries/1000 player hours of total exposure) each. Most of the head injuries were minor injuries, including lacerations of the face and scalp.

The pelvis and ankle were responsible for the most intermediate and serious injuries (6 each), followed by the knee and thigh (5 each). The intermediate and serious hip and pelvis injuries consisted of three cases of osteïtis pubis (from one team), two hip adductor strains and one "hip pointer". The intermediate and serious ankle injuries were all ligament sprains. The intermediate and serious knee injuries were one anterior cruciate ligament rupture, two medial collateral ligament sprains, one lateral collateral ligament sprain and one avulsion fracture of the tibial plateau. The intermediate and serious thigh injuries consisted of three hamstring tears, one quadriceps tear and one haematoma in the quadriceps. All injuries to the head and knee occurred during games.

MECHANISM OF INJURY

Contact between players accounted for 40 injuries (65% of all injuries). Of these, 58% were intermediate or serious injuries. The most dangerous phase of play during matches was being tackled, accounting for 19 of the injuries sustained during games (46% of game injuries, or 25,7 injuries/1000 player game hours), which is also statistically very significant ($p = 0,0000$). Of these, 23 (56% or 31 injuries/ 1000 player game hours were of intermediate or serious nature, and consisted mostly of ligament sprains or tears. Rucks and mauls were responsible for seven (17%, or 23 injuries/1000 player game hours) of game injuries, while tackling caused six (15%, or 8,1/1000 player game hours) injuries during games. The tackle was therefore responsible for 40% of total injuries recorded, representing 33 injuries/1000 player game hours. The distribution of injuries during games by mechanism is shown in Figure 1. Fifteen acute injuries were sustained

during training, which represents 24% of the total number of injuries recorded, or 2,7injuries/1000 hours of exposure. The distribution of injuries sustained during the phases of training is shown in Table 5. Six chronic overuse injuries (10% or 1 injury/1000 player hours of exposure) were recorded during the competition, as described in Table 6. Five of these (80% of total injuries) were serious and one was of intermediate severity. A total number of 15 intermediate and serious injuries were sustained during training and because of chronic overuse, which represents 24% of the injuries recorded, or 2,7 injuries/1000 player hours of total exposure.

TIME OF INJURY

Of the 41 match injuries, one (2%) occurred during the first 20 minutes of play, fifteen (37%) during the second 20 minutes, thirteen (32%) during the third 20 minutes and twelve (29%) during the final 20 minutes as demonstrated in Figure 2. The low incidence of injury in the first quarter is statistically significant ($p = 0,000003$). Twenty injuries (31%) occurred during the pre-competition preparation, of which 12 injuries occurred during training and 8 during pre-competition matches. After the start of the competition, only 9 injuries occurred during training, while 13 injuries occurred in matches during the first third of the competition, 7 in matches during the middle third and 13 in matches during the final third of the competition. Match injuries converted to injuries per 1000 player playing hours equal 133/1000 for pre-competition preparatory matches, which are significantly more than the 59/1000 for the first third, 32/1000 for the middle third and 59/1000 for the final third of the competition ($p = 0,00000$). The comparison is demonstrated in Figure

3. Injuries sustained during training sessions converted to injuries per 1000 player training hours are demonstrated in Figure 4. Pre-season training was responsible for 8 injuries per 1000 player training hours, while the early, middle and final thirds of the competition only produced 2,2, 3,3 and 2,3 injuries per 1000 player training hours each. Although a trend can be seen, no statistical significance could be demonstrated between training injuries and part of the season (p = 0,125).

DISCUSSION

METHODOLOGY

The need to limit injuries in rugby union has been expressed in the literature [1,7,8]. Identification of mechanisms of sporting injury can facilitate specific interventions and has been shown to ultimately lead to a decrease in the incidence of injury [5,9]. Therefore, accurate, current data on the incidence, nature and factors associated with injury in first-grade and professional rugby is essential [1,3,5,10]. The available research is often of limited value because of differences in study design, such as methods of data collection, definition of injury, and differences in expression of injury rates [1,10,11]. Apart from the variety of study designs used in previous epidemiological studies on amateur rugby [1,2,4,5,6,7,8,11,12,13,14,15], the only two studies to date that included professional rugby, also differed vastly in study design, thus complicating comparison and acquiring of collective data on injuries in professional rugby union [3,4,10]. A measurement instrument for injury data collection in rugby union was recently developed and validated [16]. This will certainly assist in standardising data in studies of this nature.

Defining the cohort of players included in the study, proved to be a difficult task, as experienced in previous studies [3]. Previous prospective studies on injuries in rugby union rather used the number of players in a training squad, or the number of players on the field during a game, as basis to express player exposure to rugby. New players admitted to a squad or team were automatically included in the cohort, while players leaving the team or squad because of injury or lack of form, were automatically excluded [3,4,5,6,13]. Injury rates per time of exposure to rugby were therefore studied, rather than the number of injuries documented in a cohort of players.

INJURY RATES

In this study, 55,4 injuries per 1000 hours of player game time have been recorded. In the other available study on injuries in the Super 12 competition, 120 injuries per 1000 hours of player game time was recorded [3]. This is much higher than the injury rates recorded in this study. A possible explanation for this is that the researcher in the previous study was the team doctor for the entire group studied, and that injury reporting and documentation was therefore optimal, whereas in this study, injuries in two thirds of the group studied were documented by team doctors with no direct involvement in the study. In the injury survey in club rugby in the Scottish Border Reivers district, a period prevalence of 43,88 injuries per 1000 player hours was documented among professional rugby players [4]. Reporting in this study was done through linkmen at each club involved. Other studies with similar definitions of injury reported similar injury rates. In a study comparing the three popular codes of football in Australia, an overall injury rate of 62 injuries/1000

player hours was documented among first grade players and 53 injuries/1000 player hours in all grades of rugby union [6]. These figures are probably inflated compared to other studies, because injuries sustained during games and training were included, but expressed in hours of game time only. If the injury rates in this study are expressed in a similar way, a higher total injury rate of 84 injuries/1000 player game hours is seen. In the study among first grade players in the ACTRU competition, an injury rate of 48,8/1000 player game hours was recorded [5]. The same definition of injury was used in our study, but questionnaires were used in the ACTRU study, which made comparison difficult. The high incidence of injuries in professional rugby was confirmed in this study, but an expected higher injury rate than in amateur rugby could not be confirmed, partly due to differences in study design. Lower injury rates has been recorded in Swedish elite ice hockey (12,7 game hours per injury) [17] and in soccer, where only 3,13 injuries/1000 player game hours has been recorded in a semi-professional squad over one season [18]. Injury rates between different types of sport are even more difficult to compare because of differences in expression of injury rates and study design.

Only 39% of injuries in this study were of mild nature (unable to play for a week or less). This was lower than the 69,6% recorded in the other Super 12 study [3] and the 58,7% of mild injuries recorded in the ACTRU competition [5]. The reason for this may be underreporting due to players' reluctance to report mild injuries in the group studied, as experienced subjectively by the team doctors involved. The fierce competition amongst players for a berth in the respective starting line-ups could possibly be blamed for this finding. The number of injuries sustained during training was low if expressed per hours of exposure to training, but still made up

34% of all injuries recorded, of which 67% were of intermediate or severe nature. This seems to be exceptionally high rates of training injuries, compared to the 26% training injuries reported in the other Super 12 study [3], and does not support the postulate that training sessions appear to be a safe activity in rugby [5]. Unlike rugby games, training sessions can be controlled to a large extent. Further research in the nature and circumstances surrounding training injuries could result in measures to reduce injuries during training sessions.

Recurrent injuries to the same structure were responsible for 13% of injuries. This compares well with the 15% of recurrent injuries recorded in the ACTRU competition [5]. These are, however, much lower percentages than the 56% of recurrent injuries recorded among professional rugby players competing in the Border Reivers district club competition. The high level of recurrent injuries in this study was attributed to the lack of a preseason break from the sport, overtraining and early return to play after injury [4]. The reason for the large discrepancy between recurrent injury rates is unclear. The cumulative effect of recurrent injury and long-term sequelae thereof needs to be studied over time. Premature degeneration of the cervical spine has already been documented in rugby players [19,20]. In a study documenting the influence of rugby injuries on players' subsequent health and lifestyle, a small proportion of players have been found to suffer significant after effects of rugby injuries. At least a further 20 years follow-up has been proposed to determine further long-term sequelae [21].

POSITIONS INJURED AND MECHANISM OF INJURY

The most commonly injured player positions were centres and fullbacks. Among backline players, wings also had a high injury rate. This finding correlates with the fact that centres have the most physical contact with the opposition due to their offensive and defensive roles, and that fullbacks and wings are required to beat the opposition with a combination of speed and strength [22]. The high injury rates recorded among fullbacks and wings therefore supports the earlier postulate that the speed of the game is the single major etiological factor in rugby injuries [15,23]. Although the incidence of injuries according to player position did not show statistical significance, the trends correspond with other studies [3,5]. Further studies and larger numbers of injuries are required to reach a conclusion regarding the risk of playing positions. This study and others have demonstrated convincingly that the tackle is the most dangerous phase of the game. Being tackled is more dangerous than tackling in most studies consulted [1,2,3,4,5,11,12,13,14]. The high injury rate amongst centers, fullbacks and wings is therefore not surprising. This study could not support the high incidence of injury among loose forwards in other studies [3,4,5], who are also often involved in the tackle, as well as in rucking and mauling, which accounts for the second most dangerous phase of play in this study and others [3,5,14].

Whereas safety in rucks and mauls can be controlled to an extent by applying stricter laws, it will be difficult to make the tackle much safer through law changes without changing the nature of the game. A study examining the nature and circumstances of tackle injuries in rugby union concluded that a high number of injuries in the tackle occurred when the player was going to ground. Tackle injuries

were also most often associated with tackles to the trunk from the front. It was suggested that players be coached in falling technique and in tackling technique from the front, or that law changes are introduced to reduce the likelihood, or prohibit front-on tackles to the trunk [24].

The low incidence of injuries in scrums and lineouts reflects the lower velocities and greater control in these phases of play.

INJURY TYPE AND ANATOMICAL SITE

The high incidence of ligament sprains and musculo-tendinous strains/tears correlates well with findings in other comparable studies [2,3,5]. The high number of injuries to the head and lower limb also confirms findings in previous studies [2,3,5,6]. All lacerations documented in this study, occurred to the head region, as also recorded in two previous studies [5,6]. As also recorded in previous studies, joints of the lower limb were responsible for the most acute, serious injuries [1,2,3].

The hip and groin areas were responsible for the most severe chronic overuse injuries. Chronic overuse injuries accounted for 10% of injuries, of which 20% were of intermediate severity and 80% of severe nature. This represents a high percentage of injuries and has not been recorded as a separate entity in previous studies of this nature. The high percentage of recurrent injuries recorded in early season among professional players in the Border Reivers district of Scotland may reflect the same trend [4]. Long seasons and lack of a proper end of season break for many professional players, may be partly responsible for the high occurrence of

overuse injuries. Pre-season training programs may also have had an influence, as most of the chronic overuse injuries were recorded in the first third of the season. Patterns and prevalence of recurrent and chronic overuse injuries in professional rugby must be studied further in order to make appropriate recommendations to players and rugby authorities.

Only one case of concussion was recorded, confirming the previously recorded low incidence of this serious, and often neglected injury [1,2,3,5]. All other injuries to the head and neck were of mild nature, as also recorded previously [3,5]. Only one degenerative condition of the cervical spine was recorded in this study, but early degeneration of the cervical spine in rugby players has been recorded before [19,20]. A changing injury pattern from earlier studies where a higher incidence of serious, scrum-related neck injuries was reported, is noted [13,23,25,26]. One of the reasons for this may be the application of stricter rules in engaging, rotation and collapsing of the scrum [27,28]. Although acute neck injuries have been reduced by these measures, data indicating chronic damage to the cervical spine is increasing. The reason for this type of injury may be the large forces experienced by front-row players during engagement of the scrum, which can exceed the threshold of injury to the spine [29,30,31]. These large forces are a consequence of the speed of engagement and the weight and number of players involved in the scrum [29,30]. Although the "crouch-pause-engage" sequence of engaging the scrum has seemingly been effective to reduce the number of acute neck injuries, the forces involved are still high enough to cause chronic damage to the cervical spine. A possible way of reducing these forces would be the introduction of a "staggered scrum", where the first, second and third rows engage in succession.

TIME OF INJURY

A high injury rate was recorded during pre-season training and pre-season matches. Similar observations were made in previous studies, suggesting lack of match fitness, lack of general conditioning and inadequate off-season recovery time in professional rugby players [3,4,5,11,13,14]. An appropriate level of exercise tolerance, as well as reintroduction to the physical contact of the game well before the first games of the season has been suggested [5]. In a review of anthropometric and physiological characteristics of rugby players, reduction in adiposity, improvement in flexibility, strength and aerobic capacity during the course of a season was reported during the course of a season [22]. This adds circumstantial evidence that lack of physical conditioning may contribute to the high incidence of injuries early in a season.

Few injuries occurred during the first quarter of games. The finding in previous studies that most injuries occurred during the final quarter of games was not shown in the current study [5,7,12,32,33]. The evidence still suggests that injuries occur more frequently as a game progresses, suggesting that fatigue may be an important factor in injury etiology. Attention should be given to factors contributing to fatigue during a game, such as lack of fitness, nutrition and hydration [5]. The failure to indicate higher injury rates in this study may be subsequent to the introduction of substitution of players in 1997, giving coaches the opportunity to substitute fatigued players [34].

CONCLUSIONS

This study has confirmed the suspected high incidence of injuries in professional rugby in South African teams. It has also confirmed the previously recorded high incidence of musculo-tendinous strains and ligament sprains in rugby. The tackle has been confirmed as the most dangerous phase of play by far. Ways of reducing the high incidence of injury in the tackle phase include changing laws to prevent front-on tackling and to condition rugby players in techniques of going to ground in the tackle. Changing tackle laws may prove to be difficult without changing the nature of the game and should be approached cautiously. This study also confirmed previous findings of higher injury rates early in a season and late in games. The high incidence of injury early in a season may indicate lack of physical conditioning and lack of exposure to contact rugby. Gradual introduction to contact phases in pre-season training should be suggested to coaches. Higher injury rates later in games suggest fatigue as a cause of injury. The importance of proper physical fitness, proper nutrition and hydration, as well as the benefit of substituting fatigued players as measures to reduce injury is postulated.

This study is the first to document injuries in professional rugby players in South Africa. Few studies providing good scientific data on injuries in professional rugby union are available. With rugby being a popular sport with a high incidence of injury, more should be done to collect epidemiological data on rugby injuries, in order to provide scientifically based information and suggestions to coaches and administrators to reduce the risk of injury. The national rugby unions, regional organizing bodies such as Sanzar, which is the organizing body of both the Super 12 and the Tri-Nations competitions between South Africa, Australia and

New-Zealand, and the International Rugby Board are ideally situated to co-ordinate ongoing research of this kind. Research committees should also co-ordinate the study designs of future studies in order to provide more comparable data and to add to a collective data bank of injuries in professional rugby.

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TABLES AND FIGURES

Table 1: Injury rates of professional rugby union players during the 1999 Rugby Super 12 tournament

♦ $p < 0,05$

	Hours exposure	Mild injuries		Intermediate injuries		Severe injuries		Total injuries	
		Number of players injured	Injuries per 1000 player game hours	Number of players injured	Injuries per 1000 player game hours	Number of players injured	Injuries per 1000 player game hours	Number of players injured	Injuries per 1000 player game hours
Games	740	18	24	9	12,2	14	19	41♦	55,4♦
Training	4900	6	1,2	8	1,6	7	1,4	21♦	4,3♦
Total exposure	5640	24	4,3	17	3	21	3,7	62	11

Table 2: Injuries to professional Rugby Union players by playing position

* Corrected for positions of which two exist in a team.

♦ No statistical significance between player position and incidence of injury (p = 0,712)

POSITION♦	No. in team	No. of injuries	Injuries per 1000 hours of exposure	No. of injuries*	Minor	Intermediate	Serious
Centers	2	12	2	6	5	5	2
Fullback	1	6	1	6	3	2	1
Hooker	1	5	0,9	5	2	1	2
Wings	2	9	1	4,5	2	2	5
Flyhalf	1	4	0,7	4	1	0	3
Scrumhalf	1	4	0,7	4	3	0	1
Flankers	2	8	1,4	4	3	3	2
Locks	2	8	1,4	4	4	2	2
No.8	1	2	0,2	2	0	0	2
Props	2	4	0,7	2	1	2	1
TOTAL:	15	62	11	-	24 (39%)	17 (27%)	21 (33%)

Table 3: Types of injuries sustained during the 1999 Rugby Super 12 competition

♦ $p<0,05$

INJURY TYPE	TOTAL NUMBER OF INJURIES		MATCH INJURIES		TRAINING INJURIES		% OF TOTAL INJURIES
	Number of injuries	Injuries per 1000 hours of exposure	Number of injuries	Injuries per 1000 player game hours	Number of injuries	Injuries per 1000 player training hours	
Ligament sprains	16♦	2,8	12	16,2	4	0,8	26%
Muscle/tendon strain/tears	15♦	2,7	6	8,1	9	1,8	24%
Contusion/haematomas	6	1	6	8,1	-	-	10%
Lacerations	6	1	6	8,1	-	-	10%
Chronic overuse injuries *	6	1	1	1,4	5	1	10%
Fractures	5	0,9	4	5,4	1	0,2	8%
Dislocation/subluxations	4	0,7	3	4	1	0,2	7%
Intervertebral disk herniation	2	0,3	1	1,4	1	0,2	3%
Concussion	1	0,2	1	1,4	-	-	2%
Muscle cramping	1	0,2	1	1,4	-	-	2%

Table 4: Injuries to professional Rugby Union players by anatomical site and severity

REGION	Total no. of injuries		Game injuries		Training injuries		Minor	Intermediate	Serious	%of total injuries
	Number of injuries	Injuries per 1000 hours of exposure	Number of injuries	Injuries per 1000 player game hours	Number of injuries	Injuries per 1000 player training hours				
Head	8	1,4	8	10,8	-	-	6	1	1	13%
Neck	3	0,5	1	1,4	2	0,4	3	0	0	5%
Shoulder	4	0,7	3	4	1	0,2	1	2	1	7%
Arm/hand	3	0,5	3	4	-	-	0	2	1	5%
Trunk	3	0,5	3	4	-	-	1	0	2	5%
Back	2	0,3	-	-	2	0,4	0	2	0	3%
Pelvis/hip	12	2,1	4	5,4	8	1,6	6	2	4	19%
Thigh	7	1,2	4	5,4	3	0,6	2	2	3	11%
Knee	8	1,4	8	10,8	-	-	3	1	4	13%
Lower leg	4	0,7	3	4	1	0,2	1	2	1	7%
Ankle	7	1,2	3	4	4	0,8	1	3	3	11%
Foot	1	0,2	1	1,4	-	-	0	0	1	2%
TOTAL:	62	11	41	55,4	21	4,3	24	17	21	100%

Table 5: Mechanism of acute injuries sustained during training in the 1999 Super 12 season

TRAINING	Mild	Intermed.	Severe	Total	% of total injuries
Speed	4	1	-	5	33%
Skills	-	3	1	4	27%
Contact	1	2	-	3	20%
Endurance	1	1	-	2	13%
Strength	-	-	1	1	7%
TOTAL:	6	7	2	15	100%

Table 6: **Diagnosis and severity of chronic overuse injuries in a group of professional Rugby Union players during the 1999 Super 12 competition**

INJURY	Mild	Intermed	Severe
Osteitis pubis	-	-	3
Tibial bone stress injury	-	-	1
Chronic stud pressure	-	-	1
Chronic cervical facet joint sprain	-	1	-
TOTAL:	0	1	5

Figure 1: Mechanism of injury to professional Rugby Union players during matches

* Injuries caused by getting tackled was significantly higher than by any other mechanism of injury ($p < 0,05$)

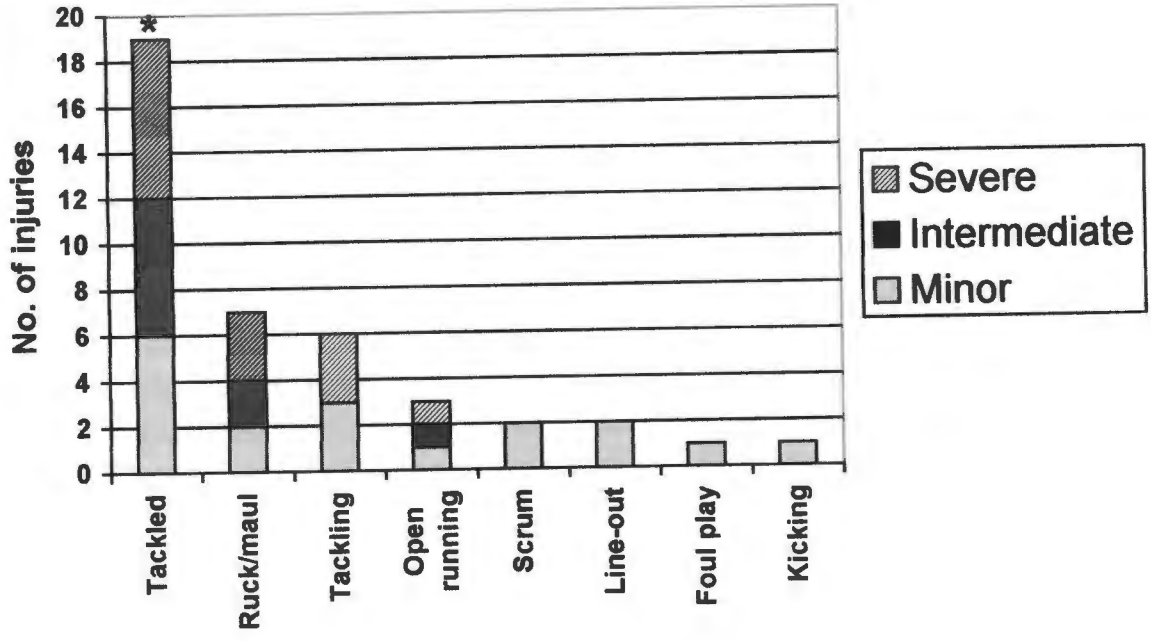


Figure 2: Incidence of injuries during different quarters of the game

* The incidence of injuries was significantly lower during the first quarter of games ($p < 0,05$).

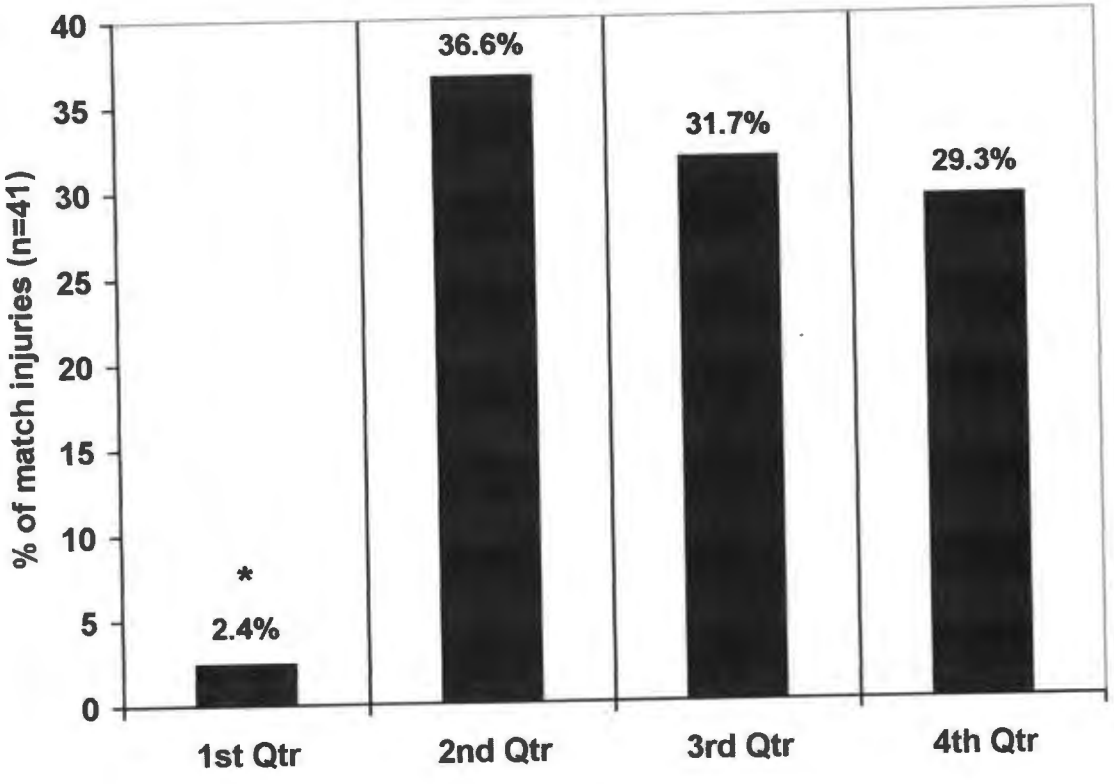


Figure 3: Incidence of injuries during matches in different phases of the season

* The incidence of injuries were significantly higher during pre-competition preparatory matches ($p < 0,05$)

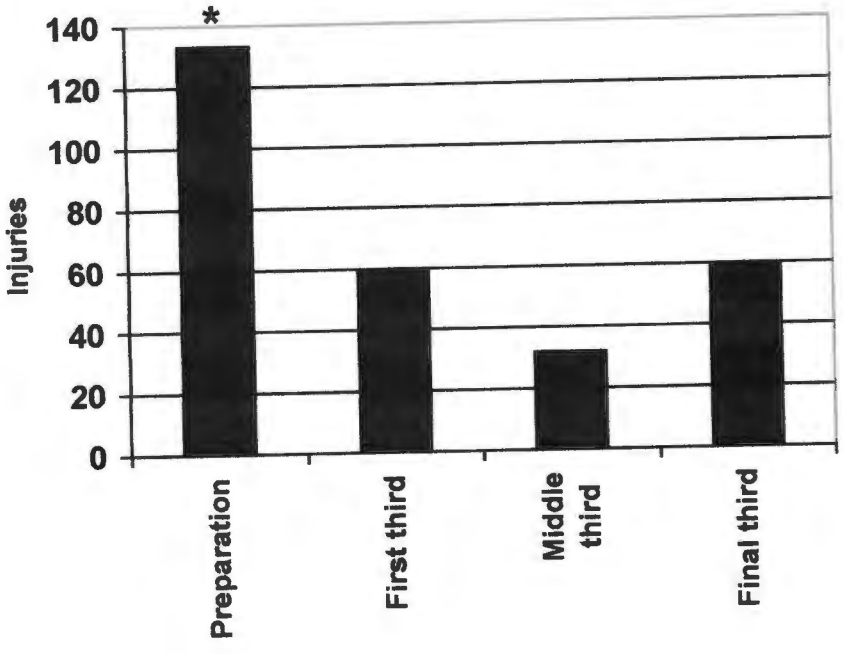
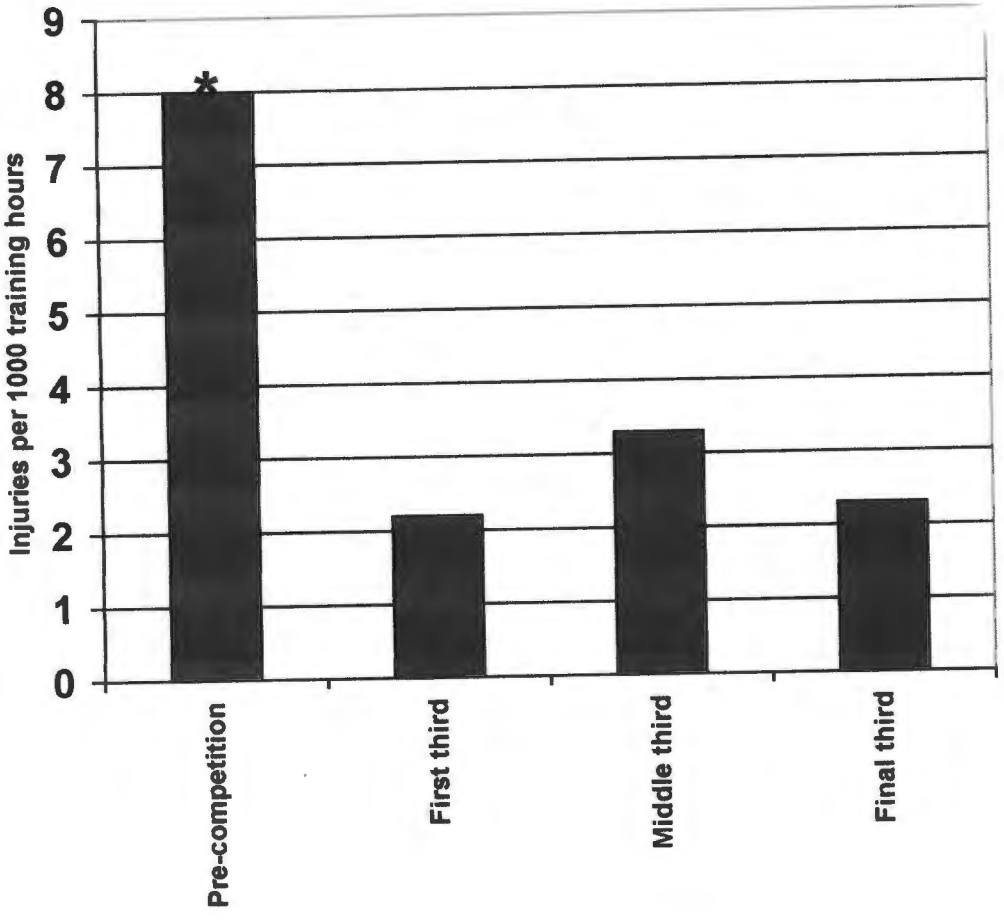


Figure 4: Incidence of injuries during training sessions in different phases of the season

* The incidence of injuries during training in the pre-competition phase were higher than during the first, second and third thirds of the competition, but was not statistically significant (p =0,125).



CHAPTER 5

SUMMARY AND CONCLUSION

In the review of epidemiological studies on injuries in professional rugby union, the following main conclusions were reached:

- A very small amount of literature exists on the epidemiology of injuries in professional rugby union. Comparison of data in available studies on injuries in both professional and amateur rugby has been complicated by the lack of uniformity in study design. The value of collective data that is not directly comparable is of limited scientific value. Epidemiological research in rugby should be conducted according to a uniform study design. It is suggested that governing bodies of rugby union such as the International Rugby Board (IRB) co-ordinate such research and standardise research methods.

- The suspected high incidence of injuries in professional rugby was confirmed. An average of 86,4 injuries per 1000 player hours of exposure was found in the studies reviewed. No clear difference between injury rates in professional and amateur rugby could be shown, possibly because of the lack of sufficient data. The tackle has consistently been documented as the most dangerous phase of play, whereas the scrums and lineouts where stringent rules have been introduced, have the lowest injury rates in professional rugby.

- Data describing re-injury rates and chronic overuse injuries are vague in the literature and need to be researched in greater detail.

The following main findings and recommendations were made from pre-season assessments of a cohort of South African players in the 1999 Rugby Super 12 competition:

- Medication and nutritional supplements are often not used systematically and for the wrong indications. Better guidance and control from medical staff is recommended.

- Further research is recommended to establish the effectiveness of protective head gear and shoulder padding. It should be established whether use of these have an effect on the reduction of injuries, or, conversely, put players at higher risk of injury through altered player behaviour. Further research into acceptable and effective ankle protection is also recommended.

- Even though the use of mouth guards have been established to protect players against injuries to a number of structures, many players are still not using it. Compulsory use of custom-made mouth guards during matches and contact training sessions is recommended.

- Concussion was the most common previous injury recorded, of which 72% were repeated insults. The sensible compulsory rest period after a bout of concussion is hampered by lack of practical diagnostic criteria, lack of assessment time during matches and underreporting of subtle symptoms. Management of concussion in rugby should be reviewed in order to protect players from serious complications and long-term sequelae of this potentially serious condition.

The following main findings and recommendations were made from the prospective cohort study documenting the incidence and nature of injuries in South African players during the 1999 Rugby Super 12 competition:

- The suspected high incidence of injuries in professional rugby players in South Africa has been confirmed by recording 55,4 injuries per 1000 player game hours. Fifty per cent of injuries recorded were musculo-tendinous strains and ligament sprains, confirming the high incidence of these injuries in the literature.

- The tackle was confirmed as the most dangerous phase of play. Stricter application of current tackle laws, implementing of new laws to prevent front-on tackling, and conditioning of players in techniques of going to ground in the tackle should be considered to reduce the risk of injury.

- Higher injury rates were recorded early in the season and later in games. Proper pre-season physical conditioning and gradual introduction to contact phases in pre-season training is suggested to reduce risk of injury in the early parts of a season. Higher injury rates later in games suggest fatigue as a cause of injury. The importance of proper physical fitness, proper nutrition and hydration, and the benefit of substituting fatigued players in the reduction of injuries is postulated.

APPENDICES

APPENDIX 1

RUGBY SUPER 12 1999

PRE-SEASON PLAYER MEDICAL PROFILE

Date:

A. PLAYER DETAILS

NAME:		
POSTAL ADDRESS:		
PHONE: **CELL:** **WORK:** **HOME:** **FAX:**		
AGE:	**DATE OF BIRTH:**	
PLAYING POSITION:		
YEARS OF PROVINCIAL "A" EXPERIENCE:		
NUMBER OF FIRST CLASS GAMES:		
NEXT OF KIN: **PHONE (NEXT OF KIN):**		

B: MEDICAL SCREENING:

1. CURRENT AND PREVIOUS INJURIES

Do you have, or have you ever had, any of the following conditions?

Nr.	INJURY	CURRENT(tick)	BEFORE(tick)	
1.	Concussion(s) Number:			
2.	Skull fracture(s) Number:			
3.	Neck injuries			
4.	Shoulder injuries			
5.	Arm/wrist/hand injuries			
6.	Ribcage/sternum injuries			
7.	Back injuries			
8.	Hip/groin injuries			
9.	Thigh injuries			
10.	Knee injuries			
11.	Lower leg injuries/shinsplints			
12.	Ankle injuries			
13.	Foot injuries			
14.	Muscle strains ("pulls")			
15.	Abdominal injuries			
16.	Any other injury?			
17.	False teeth/bridge/crown?			

Details of injuries ticked off:

Nr.	**Injury no. 1:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Injury no. 2:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Injury no. 3:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Injury no. 4:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Injury no. 5:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	

2. PAST ILLNESS OR MEDICAL PROBLEMS

Do you now have, or have you ever had, any of the following conditions?

Nr.	ILLNESS/CONDITION	CURRENT(tick)	BEFORE(tick)	
1.	Frequent headaches			
2.	Fainting spells/dizziness			
3.	Epilepsy or convulsions			
4.	Nosebleeds			
5.	Difficulty hearing			
6.	Frequent colds			
7.	Rheumatic fever			
8.	Heart murmur			
9.	High blood pressure			
10.	Diabetes			
11.	Skin disorders			
12.	Allergies: Food that should not be taken Skin allergies Medicines			
13.	Asthma			
14.	Hepatitis/jaundice			
15.	Indigestion/heartburn			
16.	Any other? Please state:			

Have you ever been hospitalised? **Yes/No**.

Reason:.....

.....

Do you have a family member that suffers from chronic disease (heart disease, blood pressure, seizures, asthma, diabetes, etc)? **Yes/No.**

Please state details:	

Details of conditions ticked off:

Nr.	**Condition no. 1:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Condition no. 2:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Condition no. 3:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Condition no. 4:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	
Nr.	**Condition no. 5:** **Diagnosis:** **Date:** **Treatment:** **Doctor/physio:** **Complete recovery Yes/No**	

3. IMMUNISATION

Have you ever been immunised against the following conditions?

IMMUNISATION	YES	NO	DATE	
Tetanus	Y	N		
Hepatitis A	Y	N		
Hepatitis B	Y	N		
Other in last year	Y	N		

4. MEDICATION/FOOD SUPPLEMENTS

Are you currently taking any medication (over the counter or prescription)?

Please state details:	

Are you currently taking any food supplements (vitamins, minerals, creatine, amino acids, etc)?

Please state details:	

5. PROTECTIVE EQUIPMENT

5.1. Do you use any of the following protective devices?

DEVICE	DURING MATCH		DURING PRACTICE		
Head shield	Y	N	Y	N	
Mouthguard	Y	N	Y	N	
Shoulder pads Left/right	Y	N	Y	N	
Thigh sleeve left/right	Y	N	Y	N	
Thermal pants	Y	N	Y	N	
Knee brace left/right	Y	N	Y	N	
Shin pads	Y	N	Y	N	
Ankle brace left/right	Y	N	Y	N	
Orthotics/inner soles	Y	N	Y	N	
Any other? Please state:	Y	N	Y	N	

5.2. Do you strap/tape any of the following?

ANATOMICAL PART	DURING MATCH		DURING PRACTICE		
Ears	Y	N	Y	N	
Shoulder: left/right	Y	N	Y	N	
Elbow: left/right	Y	N	Y	N	
Wrist: left/right	Y	N	Y	N	
Fingers	Y	N	Y	N	
Thigh	Y	N	Y	N	
Knee	Y	N	Y	N	
Ankle	Y	N	Y	N	
Any other? Please state:	Y	N	Y	N	

APPENDIX 2

RUGBY SUPER 12 1999

PRE-SEASON MEDICAL EXAMINATION

Date:

NAME:		
MASS:	**HEIGHT:**	

SYSTEM	ABNORMALITY		NOTES
	YES	NO	
GENERAL			
Temperature:			
Jaundice:	Y	N	
Anaemia:	Y	N	
Clubbing:	Y	N	
Oedema:	Y	N	
Lymphadenopathy:	Y	N	
CARDIOVASCULAR			
Rhythm:	Y	N	
Murmurs:	Y	N	
Other:	Y	N	
RESPIRATORY	Y	N	
NEUROLOGICAL	Y	N	
Migraine:	Y	N	
Concussion:	Y	N	
EYES			
Vision:	Y	N	
Contact lenses:	Y	N	
Glasses:	Y	N	
EAR, NOSE, THROAT			
Tympanic membranes:	Y	N	
Throat:	Y	N	
Nose:septum,symmetry	Y	N	
ABDOMEN			
Liver:	Y	N	
Spleen:	Y	N	
Hernia sites:	Y	N	
Other:	Y	N	

MUSCULOSKELETAL	ABNORMALITY		NOTES	
	YES	NO		
Neck:	Y	N		
Thoracic spine:	Y	N		
Lumbar spine:	Y	N		
Shoulder:	Y	N		
Elbow:	Y	N		
Hip:	Y	N		
Knee:	Y	N		
Ankle:	Y	N		
Foot:	Y	N		
Lower leg:	Y	N		
Muscular:	Y	N		
URINALYSIS:	Y	N		

PROBLEM LIST		
Active:		
Passive:		

Further investigations recommended?.....

.....
...

MEDICAL EXAMINER:
(PRINT):.....SIGNATURE:.....

APPENDIX 3

RUGBY SUPER 12 1999

INJURY REPORT

DATE: _____

1. PLAYER INFORMATION

NAME:	
PLAYING POSITION:	
TEAM:	

PRE-SEASON MEDICAL PROFILE AND EXAMINATION DONE?	YES	NO	

2. ACTIVITY

MATCH OR PRACTICE	Match (tick)	Practice (tick)	

Injury during match:

	vs.		

Injury during practice: (tick off)

Contact session		
Strength training		
Speed training		
Endurance training		
Skills training		

3. CONDITIONS (please tick off)

WEATHER	HOT	COLD	MILD	RAINING	
	DRY	DAY	NIGHT		
SURFACE	WET	DRY	SOFT	FIRM	
STUDS	SHORT	MEDIUM	LONG		
TIME	1ST 20 MIN	2ND 20 MIN	3RD 20 MIN	4TH 20 MIN	

4. SITE OF INJURY

Head and neck: (tick off)

Face	Nose	Eye	Ear	
Neck	Head	Mouth	Jaw	

Upper limbs:

Shoulder	Elbow	Wrist	Fingers	
Upper arm	Forearm	Hand	Collarbone	

Lower limbs:

Pelvis	Hip	Knee	Foot	
Thigh (front)	Thigh (back)	Calf	Ankle	

Trunk:

Ribs	Sternum	Internal injury	Upper back	
Lower back	Groin	Buttock	Abdomen	

5. TYPE OF INJURY:

Concussion	Muscle strain	Ligament sprain	Fractures	
Contusions	Internal organ	Chronic overuse	Lacerations	
If any other, please state:				

6. MECHANISM OF INJURY:

Tackled	**Tackling**	**Scrum**	**Line-out**	
Open running	**Ruck/maul**	**Foul play**	**Other**	

If other, please describe:.....

7. INJURY DETAILS:

SPECIFIC DIAGNOSIS:			
FIRST INJ/RECURRENT	First	Recurrent	
PROPHYLACTIC BRACE/TAPING USED?	Please specify:		

8. MANAGEMENT:

Medical	Surgical	Physiotherapy	Rehabilitation	
Other. Please specify:				

9. RETURN TO MATCH FITNESS: Date:.....

Number of sessions missed: (1session = 1match or 1 practice session. One week = 2 practice sessions and one game: 3 sessions)

3 or less	**4 to 9**	**10 or more**	**Whole season**	

APPENDIX 4

SUPER 12 RUGBY 1999

INFORMED CONSENT FOR PHYSICAL TESTING

I, ..., do hereby declare that, to the best of my knowledge I am currently free from any existing medical condition or other complaint that would preclude me from undertaking any of the physical tests that have been described to me.

I waive all claims of whatever nature and howsoever arising and hold the organisers of the Super 12 competition, team management, coaching and medical staff, the Sports Science Institute of South Africa, and the University of Cape Town free of any liability for any harm, injury or damages which I may suffer in consequence of or in the process of being tested.

I hereby consent to medical examinations during the course of the Super 12 tournament and for the findings to be used for research purposes.

Signed at (place).....on (date).....1999.

Signature:.....

Witness:.....