THESIS

M.Phil (Sports Medicine)
UNIVERSITY OF CAPE TOWN

TITLE:

The Epidemiology of Injuries in South African High School Soccer Players

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DEDICATION

This work is a special dedication to my parents Simon & Gloria Ramathesele,

My beloved wife Thandi,

My partner Dr SM Legodi,

The apples of my eye - Atlehang and Reahile, my children.

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Medical Research Council of University of Cape Town.

DECLARATION

I, Jonas Ramorwesi Ramathesele, hereby declare that the work on which this thesis is based is my original work (except where acknowledgements indicate otherwise), and that neither the whole work, nor any part thereof has been, or is to be submitted for another degree in this or any other university.

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ABSTRACT

THE EPIDEMIOLOGY OF INJURIES IN SOUTH AFRICAN SENIOR SCHOOL SOCCER PLAYERS

The aim of the study was to document the epidemiology of injuries sustained by South African high school soccer players. Subjects for the study were selected from all the high schools (n = 10) in Tembisa (Gauteng, South Africa). A cohort of 227 high school soccer players, representing all the players in the Tembisa schools, was followed over one playing season. All practice and match hours were recorded and specific injury report forms were completed by all the coaches. All injured players were then referred to the principal investigator (JR) for detailed examination to document injuries. Factors such as pre-season training, warm-up, stretching, playing surface, environmental factors, and the use of protective equipment were also recorded. In this study, 63% of all the players sustained an injury during the season (seasonal incidence). The overall incidence of injuries was 9.04/1000 hours of play. The incidence in matches was 274 times higher than in practice. More than half (57%) of the injuries were classified as moderate. The highest incidence of injury per player position was in goalkeepers (13.7/1000 hours play). The lower extremity accounted for most injuries (88.8%), principally the ankle (42.4%) and the knee (27.1%). The most common type of injury was a ligamentous sprain (68%), followed by musculotendinous strains (15.8%). There were only two joint dislocations, and no fractures. All the participants in this study played on gravel pitches and on no occasion was a first-aid kit available. The majority of players were not aware of appropriate stretching, warm-up, and strapping techniques to prevent injuries. None of the players engaged in any form of pre-season training. In two of the schools (20%) the soccer coaches had formal training with coaching certification. Although the injury rate in high school soccer players in this study is only slightly higher than that reported by others, it is clear that scientifically based measures of injury prevention (pre-season training, warm-up, stretching, and strapping) need to be implemented in these schools. In addition, proper sports and first-aid facilities should be provided, and coaches should receive formal continuous training.

ABBREVIATIONS

ACL	Anterior cruciate ligament
CAF	Confederation of African Football
FIFA	International Federation of Football Associations
GK	Goalkeeper
HSRC	Human Science Research Council
LCL	Lateral collateral ligament
MCL	Medial collateral ligament
NCAA	National Collegiate Athletic Association
NSL	National Soccer League
PNF	Proprioceptive neuromuscular facilitation
SAFA	South African Football Association
SD	Standard deviation
TKM	Thuto-ke-Maatla (High School)
USSASA	United School Sport Association of South Africa
v/s	versus
%	percentage

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CHAPTER 1: INTRODUCTION AND SCOPE OF THE THESIS

1.1 GENERAL BACKGROUND

> "It is the purest form of sport known to mankind, and the oldest .....just kicking a ball for the fun of it" Mark Gleeson (1996)

The word "soccer" originated in 1863 when The Football Association was formed in England to define the rules and set a new game apart from various other football play at the time, such as rugby football. It became known as "Association football" which in players slang was shortened through "associa" to become a new word for the English dictionary, soccer.

In South Africa, precise recent data is not available regarding sports participation patterns. However, a study conducted in 1980 indicated that soccer is also the most popular sport in South Africa among all population groups (HSRC, 1982).

There is a significant risk for a soccer player to sustain an injury during a playing season (*Ekstrand et.al, 1993, Ekstrand et.al 1990 (a), Lewin et. al, 1989*) A study conducted at the University of Cape Town of club soccer players has shown that the risk of injury is substantial (*Surve et.al. 1987*) and that this differs between age groups (*Schmidt-Olsen et.al, 1991*).

However, despite it being the most popular sport among South African school children and the high injury risk, the incidence of soccer injuries in school children has not been investigated. School children comprise most of the playing population in the youth section of the sport. (< 18 years).

1.2 AIMS OF THE STUDY

The aim of this study was, therefore, to document the epidemiology of soccer injuries in schoolboys attending High Schools in the Gauteng Province, Tembisa, South Africa. The epidemiology was compared to those of senior soccer players in South Africa and elsewhere. Comparisons were also drawn with data on soccer injuries in this population in other countries.

1.3 GENERAL STRUCTURE OF THE STUDY

All 10 high schools in a specific geographical region of the Gauteng Province of South Africa, Tembisa, were sampled. Each has an average of 25 active and competitive soccer players. Permission was obtained from all headmasters concerned. The soccer coaches and captains of all schools were informed of the nature of the study and their permission was also obtained.

Over a period of one soccer season, February to September of 1993, all injuries were documented in this population of schoolboys. The investigator, with the help of coaches and captains, recorded the duration of all the matches and practice sessions for all the players to establish the total hours of playing time.

An injury was defined as any injury sustained during a match or practice that results in a loss of at least one practice or match. Specific injury forms were designed (Appendix B) and these were completed by soccer coaches in the event of an injury. These players were then referred to the investigators for a more detailed examination and diagnosis.

In addition, weekly visits were conducted by the investigator to the schools to obtain all information. Qualified medical practitioners confirmed the diagnoses of specific injuries. The site of the injuries was recorded and the severity was defined according to the number of matches and practices missed.

Information relating to the players' details including age and playing position was gathered by the school coaches and recorded. They also recorded specific potential aetiological factors such as pre-season training, warm-up, stretching, playing surface, environmental factors, match versus practice and the wearing of protective equipment.

The incidence of injury was therefore expressed as injuries per 1000 hours of exposure, at matches, practices and in total.

CHAPTER 2: THE EPIDEMIOLOGY OF SOCCER INJURIES

A LITERATURE REVIEW

2.1 INTRODUCTION

2.1.1 Popularity of soccer

Soccer or Association Football is a popular worldwide sport. It is played in at least 150 countries (*FIFA, 1984; Pardon, 1977*). There are more than 60 million players registered with the International Federation of Football Association, FIFA (*Ekstrand et.al 1990, FIFA 1984, Pardon 1977*) and it is estimated that there are 60 million other unregistered soccer players in the world (*Abramson et al, 1990*).

In Europe where the game historically originated, soccer is the most popular sport (*Nielsen et.al 1989*), as it is in Africa.

In the United States of America soccer is the fastest growing sport (*Keller et.al 1987; Mc Master et.al 1978*; *Pardon, 1977; Sullivan et.al 1980*), where it has become the third most popular team sport among children under 18 years of age with more than 1,4 million registered players.

In South Africa soccer is the most popular sport with close to 2 million players registered with SAFA, an affiliate of FIFA (*SAFA 1993*). There are also indications that the game is also played on a large scale on a recreational basis (*SAFA 1993*).

2.2 RISK OF INJURY

Soccer is a high intensity sport. Although not permitted by the rules of the game, physical contact is inevitable. As such, soccer carries a significant injury risk.

There is a significant risk for a soccer player to sustain an injury during a season (*Ekstrand et al, 1983, Ekstrand et al, 1990 a), Lewin et al, 1989*). In Europe soccer is responsible for 50 – 60% of all sports injuries (*Nielsen et al, 1989*).

2.3 SOCCER INJURY EPIDEMIOLOGY

2.3.1 Introduction

Despite its popularity, only a few well controlled prospective studies documenting soccer injuries have been conducted.

However, it is extremely difficult to compare soccer injury studies because of the vast differences in study methodology such as the criteria used to define injury. Recently, it has been suggested that an injury is one that leads to a missed match or practice (*Keller et.al 1987*). It has also been suggested that the number of matches and practices missed is useful in assessing the severity of injuries (*Keller et.al 1987*).

Injury definition

In Pappendal, Holland in 1986, a group of investigators under the aegis of the European Council coined a useful definition of injury. According to this definition, an injury was defined as an event which occurred during a game or in practice and caused one or more of the following:-

- reduction of activity
- the need for treatment or medical advise
- has social and economic consequences
  (*Schmidt Olsen et.al 1991*)

This definition is very broad and included minor injuries that would otherwise have been ignored.

A more recent approach is to define injury as an injury that is severe enough to miss the next match or practice session (*Keller et al, 1987*).

2.3.2 Comparison of soccer injury studies

It is always difficult to compare soccer injury studies over the years due to certain basic differences. The study populations are not the same - youth and senior soccer players differ in many respects as do gender (male or female) and the level of competition (amateur or professional).

Studies define injury rates differently, if at all. When investigating injury, some studies take into account the total period of exposure at matches and practices, and others do not. A more accurate assessment for the risk of soccer injuries is to express risk as injuries per 1 000 hours of matches or practices of total exposure.

Investigations undertaken throughout the year and those performed during tournaments are bound to yield different results.

2.3.3 Collection of soccer injury data

The varied sources of data point to a high level of bias in the retrospective studies. The accuracy of the diagnosis can also not be relied upon when this is made by non-medical personnel.

2.4 INTERNATIONAL SOCCER STUDIES

2.4.1 Introduction

2.4.1.1 Introduction

There are few studies of the epidemiology of soccer injuries. The growth of soccer in the USA (*Keller et al, 1987; Pardon et al, 1977*) has resulted in a renewed interest in the scientific, physiological and medical aspects of soccer injuries. A series of well controlled prospective studies on senior male Swedish soccer players between 1980-1988 made a substantial contribution to soccer injury epidemiology (*Ekstrand et al, 1983 (a), 1983 (b), 1990, 1993*). Further investigations extended into a review of 6 major studies of soccer injuries and the recommended standardization of soccer injuries investigations (*Keller et.al 1987.*) The international soccer epidemiology studies published in English consist of 28 studies. Nineteen of these studies are prospective and 9 are retrospective. In the following review, emphasis will be on the prospective investigations.

2.4.1.2 Duration of published studies on soccer injuries

Some of the first published prospective studies investigating soccer injuries analysed injuries sustained only during tournaments of a short duration (*Maehlum et al, 1986; Nilsson et al, 1978 Schmidt-Olsen et al, 1985*). However, there are problems regarding these events because :-

- the intensity of play is usually high during tournaments, and this may increase the risk of injury (*Ekstrand et al, 1983*);
- the onset of muscle fatigue is likely to occur quicker due to the closeness of the games with little rest, and muscle fatigue may increase susceptibility to injury;
- minor injuries that would otherwise not have met the requirements in terms of time lost in games and practice are recorded because there are more games and practices in a short space of time during tournaments;
- easy accessibility to medical facilities results in even more injuries being recorded further increasing reported rates.

Other studies have been done over one or more seasons (*Albert et al, 1983; Backous et al, 1988; Berger-Vachon et al, 1986; de Stefani et al, 1990; Ekstrand et al, 1983; Ekstrand et al, 1990; Engstrom et al, 1991; Hoff et al, 1986; Hoy et al, 1992; Lewin et al, 1989; McMaster et al, 1978; NCAA, 1991; Nielson et al, 1989; Rodriques et al, 1993; Rodriques et al, 1994; Schmidt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990).* One study was done on part of a season *(Surve et al, 1987)*. Comparisons between different studies are therefore extremely difficult because of varying duration of the studies.

2.4.1.3 Number of players per study

As Table 2.1 indicates, some studies investigated a large population of players. A study done in Norway in 1978 investigated 25 000 players (*Nilsson et al, 1978*) and one done by Maehlum in 1986 in the same country on 14 800 players. Interestingly the injury rate for both studies was identical at 8.9 injuries per 1000 hours (*Maehlum et al, 1986*). A study done from USA on 1 139 players documented an injury rate of 7.3 injuries per 1000 hours (*Backous et al, 1988*).

There might be more risk involved in larger studies and a possibility of missing out on some details due to the size of the study. However, if the injury rates are standardized, the results from different studies should be comparable.

2.4.1.4 Age group of players in different studies

FIFA defines a youth soccer player as one under the age of 18 years and a senior soccer player as one over the age of 18 years (*FIFA 1984*).

Table 2.1 shows that the majority of studies were done of populations combining youth and senior soccer players (*Berger-Vachon et al, 1986; Engstrom et al, 1990; Hoy et al, 1992; Lohnes et al, 1993; NCAA 1991; Schmidt-Olsen et al, 1985; Sullivan et al, 1980; Surve et al, 1987; Yde et al, 1980*). There were studies that were done exclusively on professional players (*Albert et al, 1983; Ekstrand et. al, 1983; Lewin et al, 1987; Mc Master et al, 1978).*

There were studies that investigated youth soccer players only (*Backous et al, 1988; Hoff et al, 1988; Maehlum et al, 1986; Nilsson et al, 1978; Rodriques et al, 1993, 1994; Schmidt-Olsen et al, 1991).*

There were also studies which we conducted on large youth tournaments held over a period of several days. The first study reported on a five day international youth soccer tournament in 1975 in Norway involving 25 000 players of ages 11 to 18 years (*Nilsson et al, 1978*).

The second study was conducted on 6 600 youth soccer players in Denmark with ages ranging between 9 and 19 years (*Schmidt-Olsen et al, 1985*).

In 1984 in the Norway Cup Tournament 14 800 youth soccer players we studied.

These two studies were done over tournaments. This is obviously the easiest way of studying youth groups because the subjects for these studies have to attend school. They also participated in other sports as well as other school and social activities:-

Therefore, the results of these studies have to be viewed against the background of these constraints and possible bias of the outcome.

One of the first prospective long term youth soccer studies was undertaken in Oklahoma USA in 1979 in the spring season. (*Sullivan et al, 1980*). They studied 1 272 players of ages 7 to 18 years. More recent studies were done in 1992 by Lohnes in North Carolina USA and Rodriques in Mexico in 1993 and 1994 (*Lohnes et al, 1993; Rodriques et al, 1993 and Rodriques et al, 1994*). It has become extremely important to consider the age of the players when comparing soccer studies because of:-

- basic anatomical and physiological differences in youth and senior soccer players (*FIFA, 1984*).
- differences in the rules of the game in the age groups (*FIFA, 1984*).

These differences appear to influence the injury profiles of these age groups (*FIFA, 1984*).

2.4.1.5 Gender of the players in different soccer studies

Soccer is predominantly a male sport but there has been an increasing interest among women to participate in the game in recent years, especially in the USA. It is estimated that almost 6 million (women and youth) in the USA play soccer. Most of the studies on female soccer players were conducted among youth and during tournament play (*Maehlum et al, 1986; Nilsson et al, 1978; Schmidt-Olson et al, 1985*).

There appear to be only two long term studies on female soccer players but these were a subpopulation of a large population that included male players (*Backous et al, 1988; Sullivan et al, 1980*). Senior female soccer players were investigated in two studies so far (*Engstrom et al, 1991; NCAA, 1991*).

2.4.2 EPIDEMIOLOGY IN INTERNATIONAL SOCCER STUDIES

2.4.2.1 Injury rates of soccer studies

2.4.2.1.1 Overall rates of soccer injuries

There is obvious great difficulty in comparing the incidence of injury between different studies. It, however, appears that based on a number of studies:-

- the injury rate for youth soccer players (between 11 and 19 years of age) ranges between 0,5 to 14 injuries per 1 000 hours of exposure (*Backous et al, 1988; Maehlum et al, 1986; Nilsson et al, 1978; Nilsson et al, 1989; Schmidt-Olsen et al, 1991; Sullivan et al, 1980).*

- the injury rate for senior soccer players (over the age of 17 years) varies between 4 and 20 injuries per 1 000 hours of exposure (*Baas et al, 1967; Ekstrand et al, 1983 (a), 1983 (b), Ekstrand et al, 1990; Jorgessen et al, 1984; NCAA 1991; Nielsen et al, 1989; Surve et al, 1987; Weightman et al, 1974).*

Despite the differences in injury definition soccer players sustained 5 times fewer injuries as compared to other contact team sports such as American Football (*Pritchett et al,1981; Sullivan et al, 1980; Ward et al, 1987).*

2.4.2.1.2 Injury rates for studies expressing injury per unit exposure time

The incidence of soccer injury for the main studies expressing injury incidence per unit exposure time (per 1 000 hours of exposure) is shown in Table 2.1.

Five studies reported in injury rates for youth soccer players only. Three of these were tournaments based investigations while two were conducted over one season.

Injury rates during tournaments

The first study on 25 000 youth soccer players in these tournaments in Norway, documented an injury rate of 14 injuries for 1 000 hours of exposure (*Nilsson et al, 1978).* However, this rate only included the matches played during the five day tournaments and practices were not considered.

In the second study of 6 600 youth soccer players in Denmark participating in a tournament, the incidence of injury was reported as 19 injuries per 1 000 hours of exposure (*Schmidt-Olsen et al, 1985*). The other study assessing 14 800 youth players in the Norway Soccer Cup in 1984 reported an injury rate of 11,7 injuries per 1 000 hours of exposure: of these 8,9 injuries per 1 000 hours were for males and 7,6 for females.

Injury rates during seasons

In a study that followed youth players over two seasons in Mexico, overall injury rates were 7,28 (in 1991-1992) and 9,17 (in 1992-1993) per 1 000 hours of exposure. *(Rodriques et al, 1993; Rodrigues et al, 1994).*

The lower injury rates in this instance could be due to the fact that the study included exposure time during practice. The players were also followed up during the entire season and the time between matches allowed them to recover.

A study that investigated 1272 youth players in Oklahoma in 1979 season also showed a injury rate in male youth soccer players of 0,5 injuries per 1 000 hours of exposure (*Sullivan et al, 1980*). In the 1988 season in Denmark youth soccer players injury rate was 3,7 injuries per 1 000 of exposure per season *(Schmidt-Olsen 1991*).

In a study done in Denmark over one season, 123 male youth soccer players were investigated. The incidence of injury was 3,6 injury per 1000 hours practice and 14,3 injuries per 1 000 hours in matches in senior players (*Nielsen et al, 1989*). In the same study in youth players, the rates were 3,6 injuries per 1 000 hours during practice and 14,4 injuries per 1 000 hours during matches.

A prospective, one season duration American study showed an injury rate of 0,5 injuries per 1000 hours of exposure per season in youth players (*Sullivan et al, 1980*), whereas a similar Danish study showed a rate of 3,7 injuries per 1 000 hours. Part of the reason for the discrepancy is that the Danish study had a broader definition of injury.

In one of the few prospective, long-term soccer studies conducted in America, 1221 injuries were reported over a two year period. The injury incidence was 7,78 injuries per 1 000 hours of exposure (*NCAA, 1991*).

Despite the differences in study designs, it is apparent that the injury rate in experienced senior soccer players is similar (*Ekstrand et al, 1983 (a); Ekstrand et al, 1990; Nielsen et al, 1989*). In the youth players, the rates appear to be similar for the tournaments (*Maehlum et al, 1986; Nielsen et al, 1989; Nilsson et al, 1978; Schmidt-Olsen et al, 1985).* In the season - long studies of youth players the injury rate seemed lower (*Nielsen et al, 1989; Rodriques et al, 1993; Rodriques 1994*; *Schmidt-Olsen,1990; Sullivan et al, 1980).* In general, the injury rate in youth soccer players seems to be lower than in the senior counterparts.

2.4.2.1.3 Comparison of injury rate in relation to age

A number of studies have shown that the incidence of injury during soccer appears to increase with the age of the players (*Ekstrand et al, 1983; Ekstrand et al, 1990; Nielsen et al, 1989; Schmidt-Olsen et al, 1991; Sullivan et al, 1980*) provided tournament play is excluded (*Maehlum et al, 1986; Nilsson et al, 1978; Schmidt-Olsen et al, 1985*). Furthermore, a number of studies have also demonstrated that the increase in incidence of injuries also occurs at higher ages in the same youth group of players (*Nielsen et al, 1989; Nilsson et al, 1978; Schmidt-Olsen et al, 1991; Sullivan et al, 1990).*

Most soccer injury reports have shown a lower rate of injury for youth soccer players *(Backous et al, 1988; Schmidt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990)* compared to senior soccer players (*Ekstrand et al, 1983; Ekstrand et al, 1990*), if tournament play is excluded.

The injury rates reported on 1292 youths studied in the USA, 496 youths in Denmark and a further 152 youths in the same country, were 0,5 injuries per 1000 hours of exposure, 3,7 injuries per 1000 hours of exposure and 5,6 injuries per 1000 hours of exposure respectively (*Schmidt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990*).

Despite the differences in the study design, it is apparent that there is as much as a 30 fold higher rate of injury in senior soccer players as compared to youth players (*Ekstrand et al, 1983; Sullivan et al, 1980).*

2.4.2.1.4 Reasons for difference in injury rates for age

Several reasons have been proposed for the apparent fewer injuries in youth soccer players when compared to seniors, if tournaments are excluded (*Ekstrand et al, 1983; Keller et al, 1987; Nielsen et al, 1989; Schmidt-Olsen et al, 1991*). It has been suggested that the greater musculoskeletal flexibility in youth soccer players results in fewer injuries (*Keller et al, 1987*). Although an association between poor flexibility and injury has been recorded in senior soccer, no youth soccer studies have reported this association (*Ekstrand et al, 1983 (a); 1983 (b); 1983 (c)*). Youth soccer players also have a smaller body size, lower speed and momentum during collision produce smaller joint reaction forces and smaller impact forces (*Keller et al, 1987*).

It has also been suggested that senior soccer players play with more aggression and at higher intensity and competitive style with a resultant susceptibility to injury (*Keller et al, 1987*). This is supported by the high rate of injury among youth soccer players in a tournament setting where the intensity of play is greater than normal (*Nilsson et al, 1978; Keller et al, 1987*). In youths from Norway, the incidence of injury during tournaments was 30 times higher than it was in the course of one season in players in the USA *(Nielsen et al, 1978; Sullivan et al, 1980*). However, this discrepancy can be explained by the difference in definition of injury. In the Norway Cup tournament all injuries were recorded whereas in the study among Oklahoma youth players, injury was defined as one that forces a youth player to miss the next match or practice.

2.4.2.2 Differences in injury rates between match and practice

2.4.2.2.1 Introduction

Exposure to soccer takes into account the time a player spends at matches and practices in a season. The frequency of injury in senior players is observed to increase with exposure (Ekstrand et al, 1990). In general youth soccer players take part in fewer matches and practices than senior players.

2.4.2.2.2 Youth soccer studies

In youth soccer the incidence of injury is higher in matches than in practices (*Nielsen et al, 1989; Sullivan et al, 1980).*

Thirty youth soccer players were studied in Denmark and the injury rates were reported as 14,4 injuries per 1000 hours of exposure for matches and 3,6 injuries per 1000 hours of exposure for practices. This represents a four fold higher injury rate in matches compared with practices (*Nielsen et al, 1989*). In a group of youth soccer players studied in Oklahoma USA more injuries occurred during matches (62%) than during practices (38%) (*Sullivan et al, 1980*).

2.4.2.2.3 Senior Soccer Studies

The vast majority of studies reporting injury rates of male senior players have documented an increase in injuries during matches compared to practices (*Ekstrand et al, 1983; Lewin et al, 1989; McMaster et al, 1978; Nielsen et al, 1989).*

A review of six major soccer studies reported that injuries were equally distributed between practices and matches amongst senior soccer players. The situation however immediately changes if injury rates are expressed as injuries per exposure times. A Swedish study reported the incidence of injury in matches and practices was similar. However, the injury rate for practices was 7,6 injuries per 1000 hours and 66,9 injuries per 1000 hours for matches. Therefore, if exposure is taken into account the injury rate for matches is almost ten times that of practices (*Ekstrand et al, 1983*).

In a study of fifteen professional American soccer players, the frequency of injury was reported as the same for practices and matches (*Keller et al, 1987*). However, in this study exposure time was not considered.

It has also been shown that most overuse injuries, the majority of which are minor injuries, tend to manifest themselves mostly in practices as opposed to matches (where traumatic injuries are common) (*Ekstrand et al, 1983*). Therefore, the overuse injuries which otherwise would not fit the criteria for injury could increase the frequency of injury for practices. This could also account for the similarity of injury rates in match and practice in some studies (*McMaster et al, 1978*). A study reporting injuries in 45 professional players of an English Premier League Club showed that 65% of injuries occurred during matches and 34,% during practice (*Lewin et al, 1989*).

From all these studies, it is apparent that among senior soccer players, the incidence of injury is higher in matches than practices, if exposure time is considered.

2.4.2.2.4 Reason for Higher Injury Rates for Matches Compared to Practices

The intensity of play and aggression are higher at matches than practice. This is probably the reason for higher injury rates during play. This fact is confirmed by one study that has shown that more traumatic injuries occur during matches rather than during practice *(Ekstrand et al, 1983).*

Practice sessions are traditionally shorter in duration. They are also punctuated by numerous stoppages enforced by pep talks, fluid breaks and coaching sessions. Therefore, there is less muscle fatigue at training which might explain the low incidence of injury.

2.4.2.3 Severity of Soccer Injuries

2.4.2.3.1 Introduction

Comparison of severity of injuries in different studies is extremely difficult. This is due to the differences in the definitions of injury and the design of the studies. The best injury definition is one that includes time loss from practice and/or matches. This would give an indication of the injury rate as well as the severity thereof (*Keller et al, 1987*). Very few studies have expressed soccer injuries as time lost from practices and/or matches (*Ekstrand et al, 1983; Nielsen et al, 1989; Schmidt-Olsen et al, 1991*). Only a few studies have reported the relationship between site and type of injury to the severity thereof *(Ekstrand et al, 1983; Nielsen et al, 1989; Rodrigues et al, 1993; Rodrigues et al, 1994).*

2.4.2.3.2 Comparison of severity of injuries

The severity of soccer injuries can best be defined in terms of period of inactivity as a result of the injury:-

Less than one week	-	minor injury
One to four weeks	-	moderate injury
More than four weeks	-	severe injury

This is the most commonly used classification. The current trend however is classification according to the number of matches and/or practices missed:-

One to three matches/practices	-	minor
Four to eight matches/practices	-	moderate
More than eight matches/practices	-	severe

In general, soccer injuries are pre-dominantly minor in nature (*Albert et al, 1978; Ekstrand et al, 1983; Lewin et al, 1989; Rodrigues et al, 1993; Rodrigues et al, 1994; Sullivan et al, 1980).* Few studies have shown a high rate of severe soccer injuries (*Nielsen et al, 1989*).

In a study of 180 soccer players in Sweden, 62% of injuries were minor and only 11% were severe (*Ekstrand et al, 1983*). When 1272 players were studied only 3% were absent from the sport for 4 weeks i.e. severe injury, whereas 50% were minor injuries (*Sullivan et al, 1980*). In one of the few soccer studies showing a high incidence of severe injury, 35% of the players were away from the sport for more than 4 weeks (*Nielsen et al, 1989*). A follow-up study of an English Premier League club revealed that 21% of injuries were severe (*Lewin et al, 1989*).

It can thus be concluded that the majority of soccer injuries are of mild severity.

2.4.2.3.3 Youth studies and severity of injuries

In a study reporting injuries in youth soccer players in tournaments, 90% of the injuries resulted in no time lost to play and/or practice (*Nielsen et al, 1978*). In a study on similar American senior soccer players, 77% of the injuries resulted in no time lost in match or practice (*McMaster et al, 1979*).

In a 1992 study done in Mexico, in which the definition of injury took into account the time lost as a result of the injury, 227 injuries occurred. Of these injuries, 63% were minor, 30% moderate and 7% severe (*Rodrigues et al, 1993*). In a similar study done in 1993, 44% of the injuries were minor, 46,3% moderate and 9,6% severe (*Rodrigues et al, 1994).*

Of the studies that define injury as one that leads to a match and/or practice time loss, two have shown that 11,1% of senior soccer players and 3% of youth soccer players were absent from the sport as a result of injury for more than four weeks *(Ekstrand et al, 1983; Sullivan et al, 1980).*

2.4.2.3.4 Severity of injury per anatomical site

There are few soccer studies reporting on the type, site and severity of injuries and of these almost all show that the knee injuries account for the severest injuries in terms of enforced absence from the sport. In the study of 123 Danish soccer players, 55% of all players who were absent from soccer for more than one month had knee injuries (*Nielsen et al, 1989*). In a similar study of 180 players in Sweden 36% of severe injuries (absent from soccer for more than four weeks) had occurred to the knee (*Ekstrand et al, 1983*).

In contrast, the minor injuries, had occurred to the groin, thigh and ankle areas (*Ekstrand et al, 1983 (a), 1983 (b); Nielsen et al, 1989*). It can, therefore, be concluded that soccer has a low percentage of severe injuries if injury is defined as time lost in match and/or practice. Senior soccer players appear to suffer from severe injuries than the youth. Knee injuries account for the majority of severe soccer injuries.

2.4.2.4 Injuries per player position

2.4.2.4.1 Introduction

Only a few studies have reported on the relationship between player position and injury rates for soccer players *(de Stefani et al, 1990; Ekstrand et al, 1983; McMaster et al, 1978; Sullivan et al, 1980*). Even fewer studies have been designed specifically to assess the effect of player position on soccer injuries as indicated in Table 2.2.

Many factors have to be considered when comparing the injury rates for different player positions in soccer.

i) Player positions are not equally distributed in a soccer team: each soccer team has only one goalkeeper, whereas there may be 3 or 4 defenders, and midfielders or forwards. The rate of injury by player position must therefore be expressed per unit exposure time per player. This would accommodate the unequal distribution of exposure due to the number of players in different positions.

ii) The number of players at different positions depends on the playing formation which in turn is dependent upon the coaching tactics of the managers. Some coaches prefer an attacking to a defending formation and others employ different formations during the same game.

iii) Soccer players are exposed to different amounts of activity during a game. Customarily, midfielders have a higher work-rate than the forwards and defenders. Goalkeepers traditionally have the lowest rate of activity and exposure than the rest of the team.

2.4.2.4.2 Injury rates for player position in soccer players

The majority of the studies reporting rates for different playing positions in soccer assume the player formation of 4-3-3; 1 goalkeeper, 4 defenders, 3 midfielders and 3 forwards. Four studies reporting injury rates for different playing positions are shown in Table 2.2 : *(de Stefani et al, 1990; Ekstrand et al, 1983; McMaster et al, 1978; Sullivan et al, 1990).*

In a study on 15 professional American soccer players, forwards had the highest frequency of injuries (38%) and the goalkeepers had the lowest frequency of 10% (*McMaster et al, 1978*). A similar trend was reported in a study of 1272 Oklahoma youth soccer players with the forwards showing the highest frequency of injury (33%) and the goalkeepers had the lowest frequency (18%) (*Sullivan et al, 1980*). In a study of 180 senior Swedish soccer players, forwards sustained the highest frequency of injury (36%) and the goalkeepers, lowest (9%) (*Ekstrand et al, 1983 (a)*. A study of 179 Italian Professional players showed goalkeepers to have the lowest frequency of injuries at 6% with the midfielders showing the highest frequency at 47% (*de Stefani et al, 1990*).

The goalkeepers tend to have fewer injuries per player due to less exposure time, but when distribution of time per playing position is corrected for, the results change. However, in all the above studies there was no significant difference found in the injury frequency of forwards, defenders and midfielders. Therefore, in the main, there does not seem to be any specific playing position that has a higher frequency of injury if the distribution of time per player position is corrected for.

2.4.2.4.3 Injury rate for player position difference in youth and senior soccer players

The study of American youth players compared favourably with the senior players studies with the forwards showing the highest frequency of injury (33%) and the goalkeeper the lowest (*Sullivan et al, 1980*).

2.4.2.5 Anatomical sites of soccer injury

2.4.2.5.1 Introduction

Many soccer studies have reported on the frequency of injury for different anatomical sites (*Albert et al, 1983; de Stefani et al, 1990; Ekstrand et al, 1983 (a), 1983 (b), 1983 (c); Lewin et al, 1989; Nielsen et al, 1989; Schmidt-Olsen et al, 1991*). It is important to differentiate soccer injury rate for upper and lower extremities as well as for specific anatomical sites.

2.4.2.5.2 The frequency of injury of lower and upper extremities in soccer players

The lower extremity is the commonest site of injury in soccer. The frequency of lower extremity injuries is between 58% and 81% as shown in Table 2.3 (a) for youth players and Table 2.4 (a) for senior soccer players.

The frequency of lower extremity injuries in the youth is lower than in senior soccer players (*Nielsen et al, 1989*). Upper extremity injuries account for 5% to 26% of all injuries and they are common among goalkeepers, and youth soccer players.

It is, however, noteworthy that upper extremity injuries will not be recorded as such. This is because in the out field players, upper extremity injuries, unless severe, will not result in the player missing a match or practice. With the goalkeepers, however, the situation is different because they rely heavily on their upper extremities to perform their playing tasks.

Between 58% and 87% of all youth soccer injuries are in the lower extremity while the upper extremity injuries vary between 5% and 26% (*Backous et al, 1983; Hoff et al, 1986; Maehlum et al, 1986; Nielsen et al, 1989; Nilsson et al, 1978; Pritchett et al, 1981; Sadat Ali et al, 1987; Schmidt-Olsen et al, 1985; Sullivan et al, 1980; Yde et al, 1990).*

In senior soccer players, the frequency of lower extremity injuries is between 61% and 80% of all injuries, while that of upper extremity injuries is 7% to 15% of all injuries *(Backous et al, 1982; Hoff et al, 1986; Maehlum et al, 1986; Nielsen et al, 1989; Nilsson et al, 1978; Pritchett et al, 1981; Sadat Ali et al, 1987; Schmidt-Olsen et al, 1985, 1981; Sullivan et al, 1980; Yde et al, 1990*). There is thus a higher proportion of upper extremity injuries in youth when compared to senior soccer players.

2.4.2.5.3 Injury rates for specific anatomical sites in soccer

No standardized definition exists for anatomical sites in injury studies. Most studies differentiate between head and face, back and trunk, ankle, foot, knee, leg, groin, hip, thigh and upper extremity injuries. Some studies have grouped together some of these anatomical sites.

2.4.2.5.3.1 Youth Soccer Players

A number of studies have reported on the distribution of soccer injuries by specific anatomical site for youth soccer players (*Backous et al, 1982; Hoff, 1986; Maehlum et al, 1986; Nielsen et al, 1989; Nilsson et al, 1978; Pritchett et al, 1981; Sadat Ali et al, 1987; Schmidt-Olsen et al, 1985, 1981; Sullivan et al, 1980; Yde et al, 1990*). The distribution of soccer injuries as a percentage of total injuries for youth soccer players is shown in Table 2.3 (a).

The ankle is the commonest site of injury in youth soccer players and the frequency varies between 16% and 44% of all injuries (*Nielsen et al, 1989; Nilsson et al, 1978; Sullivan et al, 1980; Schmidt-Olsen et al, 1991*). Knee injuries are the second commonest soccer injury reported for youth soccer players and the frequency varies between 12% and 26% of all injuries (*Nielsen et al, 1989; Nilsson et al, 1978; Schmidt-Olsen et al, 1991; Sullivan et al, 1980*). Hip, groin and thigh injuries account for between 8% and 24% of soccer injuries and leg injuries are between 7% and 16% of total youth soccer injuries *(Backous et al, 1982; Nilsson et al, 1978; Schmidt-Olsen et al, 1989; Sullivan et al, 1980; Yde et al, 1990*). Head, neck and face injuries account for between 4% and 22% of all youth soccer injuries (*Hoff et al, 1986, Maehlum et al, 1986; Nielsen et al, 1989; Sullivan et al, 1980).*

Foot injuries account for 10% to 19% of all youth soccer injuries (*Backous et al, 1987; Schmidt-Olsen et al, 1991*). Back injuries are not reported in most of the studies on youth soccer players. The frequency is between 3% and 14%. A study of 496 Danish youth soccer players, however, showed a high percentage of back injuries (14%). (*Schmidt-Olsen et al, 1991*). No convincing reason was given for this high frequency although reference was made of a possible association between posture, growth and injury in this study (*Schmidt-Olsen et al, 1991).*

2.4.2.5.3.2 Senior soccer players

Table 2.4 (a) shows the distribution of injuries per specific anatomical site among senior soccer players.

Ankle injuries, as is the case among youth soccer players, are the most common injuries in senior and youth soccer players, 17 % to 40 % of total injuries (*Ekstrand et al, 1983 (a); Nielsen et al, 1989*). Knee injuries account for between 7 % and 22 % of all injuries reported (*Nielsen et al, 1989*). However some studies have shown a higher incidence of knee injuries than ankle injuries (*Ekstrand et al, 1983*). Groin, hip and thigh injuries are extremely common amongst senior soccer players, ranging between 17 % and 32 % of all injuries (*Nielsen et al, 1989*). The high frequency of groin, hip and thigh injuries among senior soccer players as compared to youths at 8 % to 24 % and is postulated to be due to poor muscle flexibility of senior soccer players.

Lower leg injuries in senior soccer players account for 4 % to 16 % of all injuries, while head, neck and facial injuries made up 3 % to 7 % of all injuries (*Albert et al, 1983; Lewin et al, 1989*). Back and trunk injuries account for 5 % to 6 % of total injuries (*Lewin et al, 1989; NCAA 1978).*

2.4.2.5.4 Reasons for differences in Injury rate by anatomical site between youth and senior soccer players

In a review of 6 major anatomical studies on soccer injures a number of reasons were proposed for the high incidence of upper extremity injuries in youth soccer players (*Keller et al, 1987*). The suggestion is that youths fall more on outstretched hands. Poor technique in heading as well as the high ball-weight were postulated as reasons why head and facial injury were also high among youth soccer players *(Keller et al, 1987*).

The high frequency of groin, hip and thigh injuries amongst senior soccer players is thought to be related to poor flexibility in these players due to age (*Ekstrand et al, 1983*). The validity of the association between poor flexibility and these injuries needs to be investigated further – although eccentric muscle weakness seems a more likely risk factor.

The lower incidence of lower leg injuries in senior soccer as compared to the youth, was thought to be due to the stricter application of the rules of the game at senior level. These rules enforce the compulsory wearing of shin guards which protect the leg from injury during collision.

2.4.2.6 Soccer injury type

2.4.2.6.1 Introduction

Soccer injuries can be differentiated according to the time of onset (traumatic or overuse), contact between players (contact or non-contact) and the type of tissue injured. The reliability of the examiner is very important when interpreting reports of soccer injury type. It is obvious that studies in which the physical examination was done by doctors and physiotherapists will be more reliable.

2.4.2.6.2 Specific types of injury

In soccer studies specific injury types are usually recorded as ligamentous sprains, musculotendinous strains, contusions and fractures and dislocations which are often combined. A number of studies have reported on the distribution of soccer injury type and these are shown in Table 2.5.

The most common types of injuries are liagmentous sprains and musculotendinous strains. These occur mainly in the extremities especially the ankles and knees. (*Albert et al, 1983; Backous et al, 1982; Berger-Vachem et al, 1986; Ekstrand et al, 1991; Ekstrand et al, 1983; Hoff, 1986; Hoy et al, 1982; Jorgenson et al, 1984; Maehlum et al, 1986; McMaster et al, 1978; NCAA, 1978; Nielsen et al, 1989; Nilsson et al, 1978; Schmidt-Olsen et al, 1985; Sullivan et at, 1980; Yde et al, 1990).*

Combined ligamentous sprains and musculotendinous strains account for between 40 % and 70 % of all injury types, especially for senior soccer players.

Ligamentous sprains are the most common injury type that occur varying between 16 % and 49% for youth (*Hoff, 1986; Yde et al, 1990*) and between 26 % and 42 % for senior soccer players (*Sadat Ali et al, 1987*).

The ankle is the most common joint sprained and accounts for between 40 % and 70 % of all ligamentous sprains in soccer players (*Ekstrand et al, 1983; Sullivan et al, 1980*).

Musculotendinous strains account for 11 % of youth soccer injury types and 47 % of the senior players (*Sullivan et al, 1980*). By far the most common musculotendinous strains among senior soccer players are those of hamstrings, groins and quadriceps muscles (*Ekstrand et al, 1983; Nilsson et al, 1989).*

Contusions account for 8 % to 47 % of all injury types *(McMaster et al, 1978; Sullivan et al, 1980*). However a high incidence of contusion is reported amongst youth soccer players *(Maehlum et al, 1986; Nilsson et al, 1978; Sullivan et al, 1980).*

Irrespective of age or level of competition there is a consistent low frequency of fractures and dislocations, varying between 1 % and 20 % of all injuries. In senior soccer players the majority of fracture/dislocations occurred in the lower extremities as opposed to the upper extremities. In the youth soccer players this trend is reversed. (*Lewin et al, 1989; Schmidt-Olsen et al, 1991*). Cervical spine and skull fractures are uncommon amongst soccer players.

Table 2.1 (a)

Prospective studies of soccer injury epidemiology

First Author Year Country	Study Period	Number of Players	Age Group	Injury Rate per 1000 hours
McMaster 1978 U.S.A.	1976 – 1977	15	Professional	-
Nilsson 1978 Norway	1977 – 1978	250 000	11 – 18	8.9
Sullivan 1980 U.S.A.	1979	1272	7 – 8	0.51
Albert 1983 U.S.A.	1979 – 1981	56	Professional	-
Ekstrand 1983 Sweden	1980	180	Average 25	16.9
Schmidt-Olsen 1985 Denmark	1985 – Tournament	6600	9 –19	19
Hoff 1988 U.S.A.	-	1042	8 – 16	-
Maehlum 1986 Norway	1984 – Tournament	14800	12 – 18	8.9
Berger-Vachon 1986 France	1985	123 175	10 – 25	1.7

Continued to next page

CONTINUED FROM TABLE 2.1

First Author Year Country	Study Period	Number of Players	Age Group	Injury Rate per 1000 hours
Surve 1987 South Africa	1987	704	11 – 29	12.5
Backous 1988 USA	-	1139	6 – 17	7.3
Nielsen 1989 Denmark	1986 – 1987	123	-	14.3
Lewin 1987 United Kingdom	1987 – 1988	45	Professional	-
Yde 1980 Denmark	-	152	10 – 18	5.6
Schmidt-Olsen 1991 Denmark	1988	496	Youth	3.1
Ekstrand 1990 Sweden	1988	639	Senior	-
Engstrom 1991 Sweden	-	41	16 – 28	-
NCAA 1991 USA	1987 – 1989	-	17 – 22	Time Loss

Continued to next page

CONTINUED FROM TABLE 2.1

First Author Year Country	Study Period	Number of Players	Age Group	Injury Rate per 1000 hours
Hoy 1992 Denmark	-	-	5 – 54	-
Lohnes 1993 USA	1992	227	720	20
Rodrigues A 1993 Mexico	1991 – 1992	218	Youth	7.28
Rodrigues B 1994 Mexico	1992 – 1993		Youth	9.17

Table 2.2

Distribution of percentage injury per player position

Author/Year	Goalkeepers	Defenders	Midfielders	Forwards
Ekstrand 1983	9%	27%	27%	37%
McMaster 1978	11%	19%	31%	39%
Sullivan 1980	18%	32%	17%	33%
de Stefani 1990	6%	33%	47%	14%

Table 2.3 (a)

Soccer injury distribution by anatomical site as a percentage of total injuries for youth soccer players

Year	First Author	Anatomical Site						
		Lower Extremi-ties (%)	Ankle (%)	Foot (%)	Leg (%)	Groin Hip Thigh (%)	Other (%)	Upper Extremities (%)
1987	Nilsson	68	16	13	14	13	12	15
1980	Sullivan	65	14	-	12	-	-	17
1981	Pritchett	58	-	-	12	-	-	26
1985	Schmidt-Olsen	81	44	-	-	-	-	-
1986	Maehlum	61	-	-	-	-	-	14
1986	Hoff	63	-	-	-	-	-	6
1987	Sadat Ali	59	-	-	-	-	-	-
1988	Backous	71	19	10	13	16	8	5
1989	Nielsen	-	37	-	22	7	15	-
1990	Yde	-	27	19	19	-	24	-
1991	Schmidt-Olsen	-	23	-	26	11	11	10

Table 2.3 (b)

Soccer injury distribution by anatomical site as a percentage of total injuries for youth soccer players

Year	First Author	Anatomical Site				
		Head Face (%)	Back Trunk (%)	Pelvis (%)	Other (%)	Total Injuries
1978	Nilsson	10	7	-	-	858
1980	Sullivan	15	-	-	-	34
1981	Pritchett	9	-	4	-	436
1985	Schmidt-Olsen	5	-	4	-	343
1986	Maehlum	17	-	7.5	-	411
1986	Hoff	22	-	8	-	120
1987	Sadat Ali	-	-	-	-	542
1988	Backous	7	3	3	-	216
1989	Nielsen	-	-	-	18	27
1990	Yde	4	-	-	-	62
1991	Schmidt-Olsen	4	14	-	-	312

Table 2.4 (a)

Soccer injuries distribution by anatomical sites as a percentage of total injuries for senior soccer players

Year	First Author	Anatomical Site						
		Lower Extremities (%)	Ankle (%)	Foot (%)	Leg (%)	Groin Hip Thigh (%)	Other (%)	Upper Extremities (%)
1978	NCAA	-	21	9.5	18	7	17	7
1983	Albert	-	25	-	18	4	-	8
1983	Ekstrand	-	17	12	20	29	14	-
1989	Nielsen	-	30	-	10	8	32	-
	Division	-	40	-	22	8	17	-
	Series							
1989	Lewin	-	23	-	12	-	-	-
1990	de Stefani	70	13	3.1	10	-	-	-

Table 2.4 (b)

Soccer injuries distribution by anatomical sites as a percentage of total injuries for youth and senior soccer players

Year	**First Author**	**Anatomical Site**						
		Lower Extremities (%)	**Ankle (%)**	**Foot (%)**	**Leg (%)**	**Groin Hip Thigh (%)**	**Other (%)**	**Upper Extremities (%)**
1985	Sandelin	64	-	-	-	-	-	12
1986	Berger-Vachon	61	-	-	-	-	-	13
1991	Engstrom	-	-	9	23	9	15	-

Table 2.4 (c)

Soccer injury distribution by anatomical sites as a percentage of total injuries for senior soccer players

Year	First Author					
		Head Face (%)	Back Trunk (%)	Pelvis (%)	Other (%)	Total Injuries (%)
1978	NCAA	7	5	6	-	1221
1983	Albert	7	-	20	-	142
1983	Ekstrand	-	5	13	7	256
1989	Nielsen Division Series	- -	- -	- -	19 11	37 45
1989	Lewin	3	6	-	3	69
1990	de Stefani	70	13	3.1	10	-

Table 2.4 (d)

Soccer injury distribution by anatomical sites as a percentage of total injuries for youth and senior soccer players

Year	First Author					
		Head Face (%)	Back Trunk (%)	Pelvis (%)	Other (%)	Total Injuries (%)
1985	Sandelin	14	9	-	-	1989
1986	Berger-Vachon	12	-	7	-	6153
1991	Engstrom	-	-	6	-	78

Table 2.5

The distribution of soccer injury type as a percentage of total injuries

Year	First Author	Soccer Injury Type						
		Ligamen-tous sprains (%)	Musculo-tendinous strains (%)	Contusion (%)	Tendonitis (%)	Fracture and/or Dis-location (%)	Other (%)	Total (%)
1978	McMaster (professional)	35	47	8	-	7	3	60
1978	Nilsson (youth)	20	-	36	-	3.5	39	1534
1980	Sullivan (youth)	35	9	38	-	9	-	34
1983	Albert (youth)	28	34	16	3	8	-	142
1983	Ekstrand (seniors)	29	18	20	23	6	-	256
1985	Schmidt-Olsen (youth)	-	-	33	-	4	-	343
1986	Berger-Vachon (youth & senior)	40.5	4	21	-	17	8	6153
1986	Hoff (youth)	16	11	8	-	1	-	120
1986	Maehlum (youth)	22	-	47	-	6	18	411
1987	Sadat Ali (youth)	26	-	23	34	20	-	542
1988	Backous (youth)	19	28	35	-	-	-	216
1989	Nielsen (youth & senior)	49	21	9	16	5	-	109
1990	Yde (youth)	49	21	-	16	6	-	62
1991	NCCA (seniors)	27	24	21	3	8	6	1221
1991	Engstrom (youth & senior)	33	10	15	24	-	-	78
1992	Hoy (youth & senior)	46	-	25	-	20	5	715

2.5 SOUTH AFRICAN SOCCER STUDIES

2.5.1 Introduction

In Europe and Africa soccer is the most popular team sport (*HSRC, 1985; Nielsen et al, 1990*). It is the most popular sport in South Africa *(HSRC, 1985)* being played by more than 1 million registered players. Many soccer players are not included in these statistics since they play the sport on recreational basis.

Despite the popularity of soccer in South Africa, only one published study has investigated injuries in South African soccer players (*Surve et al, 1987*). This study was undertaken as a student Community Health Project at the University of Cape Town.

2.5.2 Injury definition

Injury was defined as one that required first aid treatment. Included in these injuries were also those that allowed a player to continue play after treatment *(Surve et al, 1987)*. This differed from the preferred definition of an injury as one that leads to a soccer player missing the next match and/or practice session (*Ekstrand et al, 1983; Keller et al, 1987*).

2.5.3 Collection of soccer injury data

The investigators designed questionnaires which were completed by the first-aiders after giving treatment to the injured soccer players. There has been great concern about the accuracy of diagnosis made by the first-aiders. The perception is that trained medical personnel make more accurate diagnoses.

2.5.4 Duration of investigation

This study was done over 9 weeks of the soccer playing season of 1985 in the Western Province. The players were senior members of Cape District Football Association.

2.5.5 Number of players in the study

A total of 704 soccer players were studied. All of these were amateur players of mixed ages. These players made up 64 teams.

2.5.6 Age of players in the study

The age group of the players in this study are shown in Table 2.6. There were 14 teams of the under 18 years category, 10 teams of under 21 years and the rest were made up by teams of the first and second divisions.

2.5.7 Gender of soccer players in the study

In this study only male soccer players were investigated.

2.5.8 Results

2.5.8.1 Injury rates

These are shown in Table 2.6. 704 soccer players played 227 games. The total number of injuries recorded was 73. A total injury rate of 12.53 was recorded. The exposure of the players to injuries was only calculated from matches. Practice hours were excluded which therefore casts doubts over the accuracy of the results. This therefore makes it difficult to compare these results with others.

2.5.8.2 Injury rate in match vs. practice

This study was done exclusively on injuries sustained during competitive matches. Comparisons between injuries at matches and practices is therefore impossible.

2.5.8.3 Severity of injuries

The definition of severity in this study was any injury that was severe enough to force a player to leave the field. There were no varying degrees of severity. In this unique situation 23 of the 73 injuries recorded in 227 matches were severe. It is therefore extremely difficult to compare the severity of injuries in this study with other similar investigations.

2.5.8.4 Soccer injuries per player position

Incidence of injury per player position is shown in Table 2.7 Midfielders had the highest injury rate of 32 % followed by forwards at 27 %, defenders at 26 % and goalkeepers at 15%. However, with the unequal distribution of players per position, the figures were corrected. This correction revealed that goalkeepers sustained most injuries at 37 %, forwards 23 %, defenders 21 % and midfielders accounting for 19 % of total injuries.

2.5.8.5 Soccer Injuries Per anatomical site

Injuries per anatomical site are shown in Table 2.8. The ankle was the most common site of injury among soccer players (25 %). Surprisingly, the knee accounted for only 7 % of total injuries which is less that the thigh at 16 % and shin at 12 %. Hand injuries account for 11% of total injuries. This is not surprising because hand injuries are not recorded in many studies as they do not lead to a player missing a match or practice - except in goalkeepers.

2.5.8.6 Soccer Injury Type

The type of soccer injury in this study is shown in Table 2.9. While ligamentous sprains account for the majority of injuries at 42 %, the percentage of lacerations at 32 % is surprising. A low incidence of fractures at 1 % is however not surprising.

2.5.9 Summary

The only published study investigating soccer in South Africa is difficult to compare to others for the following reasons:

1) The definition of injury was rather liberal, allowing all injuries necessitating first-aid to be recorded. This increased the number of injuries that were recorded.

2) Only injuries sustained during matches were recorded. Those sustained at practice were excluded. Total exposure of the player to injury was therefore not determined.

3) The definition of severity was not determined in terms of number of matches and/or practices missed. There were no varying degrees of severity.

4) The 9 week duration of the study constituted a rather low exposure time when compared to other studies done elsewhere (*Ekstrand et al, 1983*).

This study was nevertheless important in determining injury trends in South African soccer of senior players. It shows that:

1) There are no significant differences in injury rate per player position.

2) The ankle joint is the most common anatomical site of injury.

3) Ligamentous sprains are the most common injury type, with a low incidence of fractures.

Table 2.6

Injury distribution per division per time in South African club soccer players (Surve et al, 1987)

Division	Number of Teams	Number of Matches	Number of Injuries	Number of Injuries per Match	Total Match Hours	Incidence per 1000 Match Hours
Under 18	14	38	14	0.37	836	16.67
Under 21	10	40	19	0.48	880	21.74
Second	22	95	5	0.05	2438	2.23
First	9	24	11	0.46	792	13.89
Premier	9	30	24	0.80	880	27.0
Total	**64**	**227**	**73**	**0.32**	**5826**	**12.53**

Table 2.7

The incidence of injury in different playing positions in South African club soccer players. (Surve et al, 1987)

Position	Number of Injuries	Corrected Percentage of Injuries
Goalkeeper	11 (15%)	37.0%
Back	19 (26%)	21.3%
Midfielder	23 (32%)	19.3%
Forwards	20 (27%)	22.4%
Total	**73 (100%)**	**100%**

Table 2.8

Distribution of injuries over anatomical sites in South African club soccer players (Surve et al, 1987)

Site	Number of Injuries (% of all injuries)
Ankle	18 (25%)
Thigh	12 (16%)
Shin	9 (12%)
Hand	8 (11%)
Knee	5 (7%)
Groin	7 (6%)
Back	4 (6%)
Foot	3 (4%)
Calves	3 (4%)
Elbow	2 (3%)
Face	2 (3%)
Neck	1 (1%)
Shoulder	1 (1%)
Ribs	1 (1%)
Total	**73 (100%)**

Table 2.9

Distribution of type of injury in South African club soccer players (Surve et al, 1987)

Type of Injury	Number of Injuries
Sprains	31 (42%)
Lacerations	23 (32%)
Strains	13 (18%)
Contusions	5 (7%)
Fracture	1 (1%)
Total	**73 (100%)**

2.6 RISK FACTORS IN SOCCER INJURIES

2.6.1 Warm-up

It is common practice amongst athletes to perform low intensity physical activity before participating in a strenuous athletic event. This activity usually takes the form of a "warm-up" and/or a stretching routine. Scientific literature appears to support the idea that this form of activity enhances athletic performance and perhaps even more importantly, reduces the risk of injury during the athletic event (*Van Mechellen et al, 1993*).

The association between muscular exercise and a rise in body temperature has been reported in the scientific literature since 1873 (Asmussen, 1945) and athletes generally believe that a preliminary period of "warm-up" will improve their performance and that it will decrease the risk of injury.

Traditionally a warm-up has been considered adequate if a core temperature elevation of 1-2 degrees centigrade has been achieved. The observance of light to mild sweating in normal ambient conditions has been suggested as a realistic indicator of this level of temperature elevation (*Saltin et al, 1966*). The precise intensity and duration of the warm-up will vary with the state of training of the athlete, the ambient conditions and the event. This is therefore individualised for each athlete.

Experimental evidence suggests that alterations in tissue temperature may decrease the risk of injury. This evidence is based of findings relating to altered biophysical properties of tissue at higher temperatures. Examples of changes that occur in tissues at higher temperatures are:

- increased muscle elasticity in warm muscles because of increased blood supply (*Shellock et al, 1985*).
- increased joint range of motion at higher temperature due to increased extensibility of connective tissue (*Sapega et al, 1981*).

In two studies the effects of warm-up on the stress-strain curve of a muscle-tendon unit have been investigated. *(Safran et al. 1988; Strickler et al, 1980)*. It appears that after passive warm-up, the ability to increase the muscle length is greater, but that no protection is offered to greater force application (*Strickler et al, 1990*). The other study showed that active muscle warm-up leads to a significant increase in force to failure and length to failure (*Safran et al, 1988*). It therefore appears that active warm-up is a method of choice because it enables the athlete to protect the muscle-tendon unit from greater force application and increasing length. These experimental data provide valuable evidence for the use of active warm-up in prevention of musculo-tendinous injury.

2.6.2 Stretching

The primary aim of instituting a stretching programme for athletes would be to decrease the risk of injuries. However, if this advice is to be given with confidence, there has to be good scientific evidence to support the belief that stretching improves flexibility and an improved flexibility will lead to a reduction in injuries.

In general most clinical studies indicate that a stretching programme can improve flexibility *(De Vries, 1962; Shellock et al, 1985; Van Mechellen et al, 1993).*

However, all the reports are not of equal scientific value because of a variety of flaws in study designs such as inadequate control, lack of baseline measurement, varied training programmes, the use of different instruments and measurement in different muscle groups (*Sady et al, 1982*). A further variable is the type of stretching technique that was used between ballistic, static and proprioceptive neuromuscular facilitation (PNF). The general consensus is that flexibility appears to be improved by stretching particularly if the PNF techniques are employed *(Sady et al, 1982; Shellock et al, 1985; Tanigawa, 1972*).

Gurton (1941) suggested that flexibility exercises, if increased to a sufficient level, would strengthen muscle, tendons and ligaments. It was postulated that this would decrease the risk of injury. However, there appears to be very little good evidence to substantiate that statement. Only a few clinical studies have been conducted to examine the relationship between flexibility and risk of injury, probably because this is a very difficult area to study.

In a study conducted on football players in the United States, a pre-season conditioning programme which included stretching significantly reduced both the incidence and severity of knee injuries (*Cahill et al, 1978*). The authors felt that pre-season conditioning improved flexibility thereby reducing the risk of knee injuries. This postulation remains questionable because pre-season conditioning was not restricted to stretching alone, but involved weight training, endurance training and other exercises.

In summary, although there appears to be little evidence to support the hypothesis that increased flexibility decreases the risk of injury, this may be largely because there are very few studies that have been conducted well enough to prove the contrary. Because stretching can be conducted safely, it is still correct to advise athletes to continue with their practice until evidence becomes available to suggest the contrary.

2.6.3 Pre-season training

Pre-season training or conditioning is a very significant factor in injury prevention (*Cahill et al, 1978*). It is usually preceded by a pre-competition medical assessment wherein latent medical problems, injuries and abnormalities are defected and attended to. Optimal training using scientifically researched principles are instinctively important in effectively preventing injury. These include:-

- aerobic exercise training
- high-intensity interval training
- skeletal muscle strength and endurance training (*Baumhauer et al, 1995*)
- flexibility training
- agility training
- visual-skills training
- sports-specific training
- cross-training
- principles of periodization of training

2.6.4 Bracing/Taping

Taping and bracing are used to restrict undesired or harmful motion, but should allow desired motion to occur. Taping and bracing can be used as a preventative measure in high risk activities such as in soccer players ankles. They can also be used as a rehabilitative mechanism during healing and rehabilitation. (*Firer, 1990; Garrick et al, 1973; Robbins, 1995; Rovere et al 1988).*

2.6.4.1 Taping

Taping is appropriate where the sliding of the skin can be limited in one direction. It works well in injury prevention of acromio-clavicular joints, wrist, ankle, finger and the first metacarpophalangeal joint. The best variety to use is the rigid tape. It promotes good mechanical support and may enhance proprioception (*Firer, 1990; Garrick et al, 1973; Robbins, 1995; Rovere et al, 1988).*

2.6.4.2 Bracing

Bracing for the athlete may be standard produced or custom-made. Ideal body areas to apply braces include knee, ankle, lower body, wrist and elbow. It has proven effective in preventing sprains in previously sprained ankles (*Surve et al, 1994*). It promotes good mechanical support, enhances proproception and is effective in reducing injuries (*Alves et al, 1992; Surve et al, 1994).*

2.6.5 Protective equipment

Protective equipment in soccer is aimed at preventing injury not only imposed by the sport itself, but also by the playing surface.

Thermal pants are a case in point. Apart from protecting the thigh from "grass-burns" — i.e. abrasion it has been shown that they might reduce the risk of hamstring injuries in rugby players. *(Upton et al, 1995*). The compulsory wearing of shinguards introduced by FIFA is an important preventative measure to reduce the incidence of leg injuries in soccer, and in particular leg fractures (*FIFA, 1984*). In a study done on 180 Swedish soccer players, only 30% were found to wear shinguards (*Ekstrand et al, 1983 (b)*). Of note is that 100% of all the players with leg injuries were found not to have worn any shinguards. (*Ekstrand et al, 1983 (b)).*

2.6.6 Playing surface

Inadequate surfaces on which sports are played may be a causative factor in injury. The torque generated by the athlete may be significantly altered by the foot-floor interface. The ground reaction force imparted on the athlete and the torque generated are different on grass, turf, astro-turf gravel, modern floors, rubber floors, asphalt, snow, ice, sand and water. (*Ekstrand et al, 1983 (c)).* Appropriate equipment specific to these surfaces may protect the athlete from injury. An example of this is the use of six-stud instead of multi-stud soccer boots on a wet or slippery playing surfaces.

2.6.7 Weather conditions

Weather conditions, especially rain, can affect the quality of the playing surface and this may affect the risk of injury. *(Ekstrand et al, 1983 (a), 1983 (b), 1983 (c)).*

Extreme cold and rainy conditions might also hamper the stretching and warm up programmes, which in turn may influence the risk of injury.

2.6.8 Availability of First-Aid Treatment

First aid is the first and most important step in assessment and treatment of sports injuries. A proper clinical assessment needs to occur in order to avoid further injuries and to institute treatment or refer where appropriate. Inadequate rehabilitation has been reported to be indirectly responsible for a high frequency of recurrent soccer injuries. In a study of 180 male Swedish soccer players, 20% of all players with a minor injury were followed two months later by a more severe injury to the same player. *(Ekstrand et al, 1983 (b)).* While trained and qualified medical personnel best do this, these professionals are not always available.

It is, therefore, important to train coaches and team-managers to provide them with proper first-aid education and facilities to prevent injuries.

2.6.9 Match officials

Soccer's governing body, FIFA, defines the role of referees as two-fold. *(FIFA, 1984).* Firstly, the referees has to adhere strictly to the rules of the sports to promote fair play and keep the sport entertaining. Secondly, the referee must also apply the rules to protect the players from injuries — such as severe penalties for rough play. It is thought that rule violation is associated with an increased risk of soccer injury. In a study of 180 Swedish soccer players, 12% of injuries were associated with rule violation (*Ekstrand et al, 1983 (b)).* Importantly, 30% of the traumatic injuries were sustained due to foul play (*Ekstrand et al, 1983 (b)).* Proper training of match officials is, therefore, an important factor in an attempt to reduce the risk of soccer injuries.

2.6.9.1 Coaching

Proper education of coaches must emphasise not only the tactics and technique of the sports, but also the principles of injury prevention: stretching, warm-up, bracing and taping, use of protective equipment, and, effects of weather conditions should form an integral part of any coaching programme. The first step in prevention of soccer injuries is to identify and address mechanisms of injury and risk factors for injuries in soccer players (*Ekstrand et al, 1983 (a); 1983 (b); 1983 (c)).*

Administration

Administration of soccer must be directed towards the significance of its role in reducing the risk of injury among players. The administration of first aid treatment and the development of proper soccer facilities must be a goal that is addressed at school, social and government level, as well as by the private sector.

Soccer development must include proper and continuous training of match officials at all levels if injuries in the sport are to be adequately prevented.

2.7 SUMMARY AND CONCLUSION

The epidemiology of soccer injuries in South Africa and internationally has been reviewed in this chapter. A summary of the major findings follows:

1) Association Football or Soccer is the most common sport in the world, being played in more that 150 countries by more than 60 million registered players. It is also the most popular sport in South Africa.

2) There have been very few prospective studies undertaken on the epidemiology of soccer injuries. In South Africa there has been only one published study.

3) Lack of standardisation of study design, data collection and injury definition makes comparison of soccer injury studies extremely difficult.

4) Recommended injury definition for soccer injury studies should include time loss from practice or play because this will help determine severity of soccer injury.

5) Most soccer injury studies lack sophisticated statistical evaluation.

6) The incidence of soccer injury for youth soccer players, (11 to 17 years), ranges between 0.5 and 14 injuries per 1000 hours of exposure.

7) The incidence of soccer injury for senior soccer players varies between 2 and 20 injuries per 1000 hours of exposure.

8) Tournaments played over a short period tend to show higher incidence of injury when compared to long-term prospective studies.

9) Soccer injury rates increase with age, with senior players sustaining as much as 30 fold increase in injuries in comparison to youth soccer players. The proposed reasons for this discrepancy are that young players have increased muscle flexibility, and decreased mass and collision force, and seniors play the game at increased intensity.

10) Senior soccer players have more severe injuries than youth players.

11) The incidence of soccer injuries is greater for matches than practices which is likely to be due to the higher intensity of play.

12) Soccer injuries tend to occur more frequently at matches than at practices in youth and senior players.

13) Most studies suggest that the majority of soccer injuries are minor, with more than 50 % of injured soccer players being able to resume play or training within one week.of injury.

14) The incidence of soccer injury does not seem to be influenced by player position. South African and international studies show goalkeepers to have a higher incidence of upper extremity injuries.

15) The lower extremity accounts for between 58 % and 81 % of all soccer injuries.

16) Ankle injuries account for between 16 % and 44 % of all soccer injuries.

17) Knee injuries account for between 7 % and 20 % of all soccer injuries. In senior and youth players ankle and knee sprains account for a third of all injuries. Hip/thigh/groin injuries are more common in senior than in youth players, accounting for between 17 % and 32 % of all injuries.

18) Ligamentous sprains account for 30 % to 50 % of all soccer injury types. Ankle and knee ligament sprains make up 50 % to 80 % of all ligamentous sprains in soccer players.

19) Ligamentous sprains, musculotendinous strains and contusions account for 75 % of all injuries in youth and senior players while the incidence of fracture/dislocations is extremely low in soccer players.

20) Warm-up and stretching should form a significant part of soccer players training and preparation as it may reduce the risk of injury.

21) Pre-season training does not only afford the players good tactical and technical preparation of the game, but may also reduce the risk of injury.

22) Taping and bracing as well as proper use of protective equipment may reduce the risk of injury in soccer players.

23) Adequate time and resources should be devoted to proper development of soccer at coaching and administrative levels of all strata of these sports to lend safety to the sport.

24) The only South African Soccer Injury study published to date indicates that the injury trend compares well to these documented elsewhere.

25) Future research into South African soccer is very important and it has to be done according to recommended methods, designs and definitions.

26) Youth soccer has to be studied as a matter of urgency in South Africa.

CHAPTER 3: THE EPIDEMIOLOGY OF INJURIES IN SOUTH AFRICAN HIGH SCHOOL SOCCER PLAYERS

3.1 INTRODUCTION

Soccer, or Association Football, is played in more than 150 countries, making it the most commonly played sport in the world (*FIFA 1984, Pardon 1977; Surve et al, 1987).* The world governing body, the International Federation of Football Associations (FIFA) has more than 60 million individual players as members. (*Ekstrand et al, 1990; FIFA, 1984; Pardon, 1977*). Soccer is the most popular team sport in Europe (Nielsen et al, 1989) and is the fastest growing team sport in the United States of America (USA). (*Keller et al, 1987; McMaster et al, 1978; Pardon, 1977; Sullivan et al, 1989).* It is also the most popular sport in South Africa (SA), being played by more than 1 million registered players (*HSRC, 1982*). In the last soccer FIFA World Cup finals held in the USA 1994, a record number of 3,567,415 persons watched the tournament, with 94 194 of them at the final game (*FIFA, 1994*).

As a contact sport, soccer has an inherent risk of injury. There is a significant risk for a soccer player to sustain an injury during a season (*Ekstrand et al 1983, Ekstrand et al 1990 a) Lewin et al, 1989*). The recent rapid growth of the sport, especially in the USA (*Keller et al, 1987; Pardon, 1977*) has resulted in renewed interest in the science, physiology and medical aspects of soccer injury epidemiology.

Until recently there have been very few well-controlled prospective studies reporting on injuries among young soccer players. In SA only one study has been published that investigates the epidemiology of soccer injuries in senior players (*Surve et al, 1987*) and no studies have investigated soccer injury epidemiology in school-boys and youth.

Risk factors associated with soccer injuries have been identified in prospective randomised studies *(Ekstrand et al, 1983)*. These include intrinsic factors such as inadequate training and injury rehabilitation as well as extrinsic factors such as playing surface, equipment, weather conditions and playing position. Further prospective randomised studies need to be undertaken to verify the validity of these findings.

Few epidemiological studies have taken into account total exposure of the player at matches and practices. Fewer studies have defined injury as one that leads to time loss from matches and practice and express injury incidence per unit time of exposure (*Ekstrand et al, 1983; Nielsen et al, 1989; Schmidt-Olsen et al, 1991*). There is therefore a great need for soccer injury studies to use standardised definitions of injury, severity and exposure (*Keller et al, 1987).*

Youth soccer injuries have been studied in Norway, USA, Denmark and Mexico (*Backous et al, 1988; Hoff et al 1986; Maehlum et al, 1986; Nielsen et al, 1978; Rodrigues et al, 1993; Rodrigues et al, 1994; Schmidt-Olsen et al, 1985; Schmidt-Olsen, 1991; Sullivan et al, 1980; Yde et al, 1980*), but none have been done in South Africa and Africa. These studies, as discussed in Chapter 2, indicate a difference in the injury profiles between youth and senior players.

3.2 AIMS OF THIS INVESTIGATION

The main aim of this study is to investigate the epidemiology of injuries in youth soccer players in South Africa during one season. The secondary aim is to compare these injuries with those of senior soccer players in SA and in turn compare these differences to those found between youth and senior soccer players elsewhere. The final aim is to identify risk factors to the incidence of injury in youth soccer players.

3.3 MATERIALS AND METHODS

3.3.1 Subjects

Two hundred and twenty seven (n = 227) schoolboy soccer players were identified as subjects for this study. The players represented 10 school soccer teams from each of all 10 high schools in Tembisa in the Gauteng Province of South Africa. The post-primary school population of Tembisa consists of 10 high schools and one technical college. Each school has an average of 700 students who participate in soccer, netball, softball and athletics under the auspices of United School Sports Association of South Africa. A panel comprising two teachers and a student representative selects members of the soccer teams. These teachers act as managers and coaches and are usually active or ex-soccer players themselves. The team members are registered at the beginning of the school soccer season and no new members are added during the course of the season.

These schools were chosen because of the following reasons:

1) Strict registration of players ensured that a cohort of players for a prospective study could be selected.

2) School soccer is the most organised among the youth and can therefore be investigated with accuracy.

3) The investigator, because of working in the area, had a fair knowledge of the schools and their personnel which increased the level of co-operation.

4) The investigator's provision of medical care to the injured school soccer players further enhanced co-operation from the schoolboys and teachers alike.

Permission was obtained from all headmasters of the schools in the study. A specific injury report form was designed (see Appendix B). The coaches, in the event of injury at matches and practices, completed these forms. The players were subsequently referred to the investigators for a full medical examination and rehabilitation. In addition, regular weekly visits by the investigators were conducted to the schools to obtain all vital information.

3.3.2 Injuries

For the purposes of this study, **an injury was defined as any injury that occurred during a scheduled match or practice and caused a player to miss the next match or practice session.** This definition was chosen since the recent recommendation that soccer epidemiological studies should use a standardised definition of injury that includes time loss from practice or play *(Keller et al, 1987)*. All injuries were reported to the coaches who in turn completed the administrative part of the injury report (see Appendix B) and then referred the injured soccer player to the investigators for further assessment and treatment. The recognised risk factors as applicable to the injured soccer player were also detailed in the injury report (see Appendix B).

3.3.3 Recording of Matches and Practices

A special questionnaire was designed in which the teacher/coaches provided details of the duration (hours) of matches and practices. The number of matches and practices for each school were also recorded (see Appendix A). From this information the total number of playing hours during the season was calculated for the group. The coaches for all players (see Appendix B) also recorded time loss from practice and play due to injury.

3.3.4 Incidence of Injuries

This study was done on a cohort of players and no new players were added during the course of the season. This was possible because each school registered a certain number of players. The incidence of injury was expressed as the number of injuries per unit exposure time. This expression of injury incidence per 1000 hours of exposure was used because it is consistent with recent recommendations for the expression of the incidence of injury (*Keller et al, 1987*). The injury incidence is also expressed as injury per 1000 playing hours for matches and practices separately.

3.4 STATISTICAL ANALYSIS

The Statistical Analysis of the data was performed in conjunction with the Institute of Biostatistics at the Medical Research Council.

The student T test was used to test for the significance of the differences in injury rate for matches and practices, per player position and severity of injury. The level of significance was set at $p<0,05$.

3.5 RESULTS

3.5.1 Age of the players

The age (mean ± SD) of the players was 17,4 ± 1,3 years (range 15 – 22).

3.5.2 Exposure hours of the study population

3.5.2.1 Overall Exposure to Soccer

Table 3.1 shows that during the season, 227 soccer players participated in 199 matches and 478 practice sessions. While the matches are played in equal regulation time of 90 minutes each - the training session durations were not necessarily of equal duration for all schools.

The 227 soccer players in this study were exposed to 15 938 hours of soccer participation. The time practising was 12 651 hours (79,4 %) and the time participating in matches was 3 287 hours (20,6 %) as shown in Table 3.2.

3.5.2.2 The distribution by exposure (hours) for player position

The players were not equally distributed for the different playing positions (Figure 3.1). Of the total players, 42,3 % were midfielders, 28,6 % were defenders, 19,3 % were forwards, and 9,3 % were goalkeepers. The percentage distribution by exposure in hours for player position in this study population (N = 227) is shown in Table 3.3. The average exposure per player per season was similar for the different playing positions. It ranged from an average exposure of 70,2 hours per player per season for goalkeepers, 70,2 hours for defenders, 70,1 hours for midfielders and 69,9 for forwards. The average exposure per player per season for all players was 70,2 hours.

3.5.3 The injury incidence

The incidence of injury per 1000 hours of exposure for all injuries for all the schools (N = 227) is shown in Table 3.4.

3.5.3.1 All injuries

Of the 227 players of the study population, 144 (63,4 %) sustained an injury. The overall incidence of injury was 9,04 injuries per 1000 hours of exposure per season.

3.5.3.2 The incidence of injury for matches and practices

Table 3.4 shows the distribution of injury rates in matches and practice sessions per 1000 hours of exposure. Of the 144 injuries in the study population, 142 (98,6 %) occurred during matches, while only 2 (1,4 %) occurred during practice. The incidence of injury for matches was 43,9 injuries per 1000 hours of exposure, and for practices, 0,16 injuries per 1000 hours of exposure. There is therefore a 274 fold increase in the incidence of injury for matches when compared to practices in this study population.

3.5.4 Severity of injury

The definition and distribution of injury severity in the study population group is shown in Table 3.5 a) and Table 3.5 b). Eighty-two (57 %) of the injuries were of moderate severity with the soccer players returning to activity after missing four to eight matches or practices. Thirty-one (21,5 %) of the injuries were minor and a further thirty one (21,5 %) were severe with the players missing more than eight matches and practices. However, the statistical analysis of these results shows that these differences in severity of injury are not significant ($p > 0.05$).

3.5.5 Player position

Figure 3.2 shows the distribution of injury by player position. Fifty-three (36 %) defenders, 48 (33,3 %) midfielders, 24 (16,6 %) forwards, while 19 (13,2%) goalkeepers were injured.

However, as there is only one goalkeeper in a team and three or four of the other positions, this difference is corrected for the incidence injury rate per 1000 hours per season per playing position and is shown in Table 3.6. The goalkeepers show a high injury rate of 13,7 compared to forwards with 7,98 injuries per 1000 hours of exposure per season per player.

Statistical analysis however, shows no significant difference in injury rates in different player positions ($p > 0.05$).

3.5.6 Anatomical site of injury

The percentage distribution of injury by anatomical location for this study group (N = 227) is shown in Table 3.7. Ankle injuries accounted for just less than half (42,4 %) of all injuries, with the knee injuries accounting for 27,1 % and groin, hip and thigh together account for 15,9 %.

The lower extremity accounted for more than 80 % of all injuries. The lateral ligament complex of the ankle joint was the most common anatomical site of injury in this study at 37,5 %. The medial collateral ligament of the knee followed at 9,7 % and the groin muscles at 9,7 %. Upper extremity injuries were only 8,3 % of the total number of injuries. There was only 1 anterior cruciate ligament injury in this study. Lower leg injuries were 1,4%.

3.5.7 Injury type

The distribution of injury type for the study population (N = 144) is shown in Table 3.8. Ligamentous sprains accounted for more than two thirds (68 %) of the injury types. The other injury types were musculotendinous strains (15,3 %), contusions (13,2 %), and dislocations (1,4 %). There were no fractures recorded in this study. Nosebleeds were grouped with the contusions. The remainder of the injuries was lacerations and abrasions.

3.5.8 Anatomical location and the type of injury

The percentage distribution of injury type in relation to anatomical site for the study population (N = 144) is shown in Table 3.9.

Ankle and knee ligamentous sprains accounted for 86,7 % of all ligamentous sprains, of which ankle ligamentous sprains constituted 62,2 %. All ankle injuries were ligamentous sprains and they accounted for 42,4 % of all injuries in the study population. All musculotendinous strains were confined to the groin, hamstrings and thigh. Sixty-four percent of the musculotendinous strains were to the groin, 13,6 % to the hamstrings and a further 13,6 % to the thigh. Contusions occurred to the head, neck and knee with 79 % of all contusions occurring to the knee joint and most of the contusions were mixed with abrasions. There were only 2 dislocations recorded in the study and both occurred to the shoulder.

3.5.9 Risk factors in soccer injuries

3.5.9.1 Warm-up

Warm-up was practised by only 22 % of the 227 subjects who participated in the study. It is interesting to note that all the players who practised warm-up came from the only two schools (Ikusasa and Masiqhakaze) who were managed by qualified soccer coaches. As shown in Table 4 the injury rates among these players from Ikusasa (8,49 injuries per 1000 playing hours) and Masiqhakaze (3,45 injuries per 1000 playing hours) are below the total incidence of all schools (9,04 per 1000 playing hours).

3.5.9.2 Stretching

Stretching was practised by only 22 % of the 227 subjects who participated in the study. These also came from the schools coached by qualified and certified soccer coaches. The injury rates among these players are shown in Table 3.4, from Ikusasa (8,49 injuries per 1000 playing hours) and Masiqhakaze (3,45 injuries per 1000 playing hours) were below the total injury rates of all the schools, (9,04 per 1000 playing hours).

3.5.9.3 Pre-season training

None of the total 227 subjects engaged in any form of pre-season training.

3.5.9.4 Bracing and taping

None of the total 227 subjects used taping or bracing.

3.5.9.5 Protective equipment

All the subjects, (100 %) of the total 227 playing population used shinguards.
None used thermal pants.

3.5.9.6 Playing surface

One hundred and ninety six (98 %) matches were played at gravel school pitches
3 (2 %) matches were played in a grassed pitch at the local stadium.

3.5.9.7 Weather conditions

One hundred and eighty six (94 %) of the matches were played under dry conditions, and thirteen (6%) under wet conditions.

The tendency was to cancel matches if it rained as gravel pitches are unplayable when wet.

3.5.9.8 Availability of first-aid

There were no medical personnel or emergency facilities available at matches and practices.

3.5.9.9 Match officials

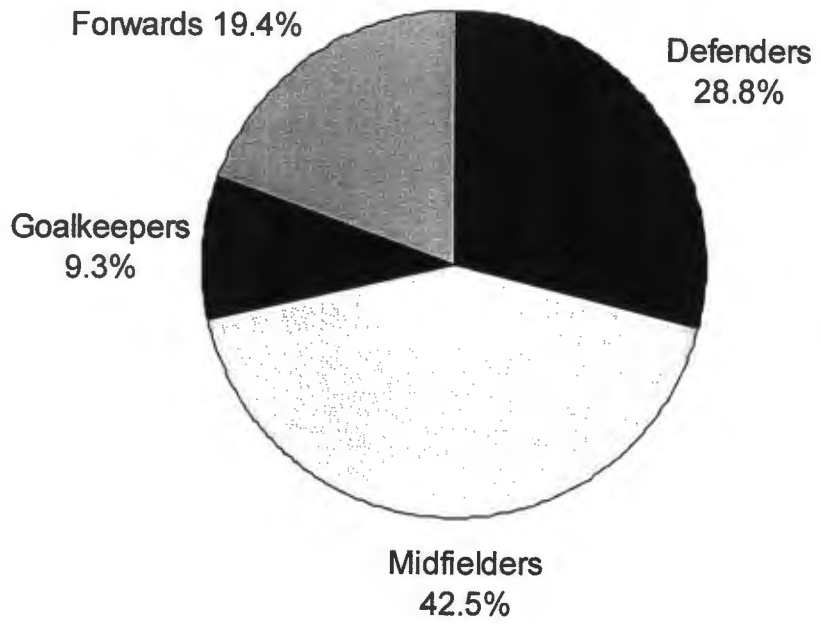
Only twelve (6%) of the matches were officiated by SAFA-trained referees. One hundred and eighty seven (94%) of the matches were officiated by referees with no formal training.

Table 3.1

Exposure hours of matches and practices per school

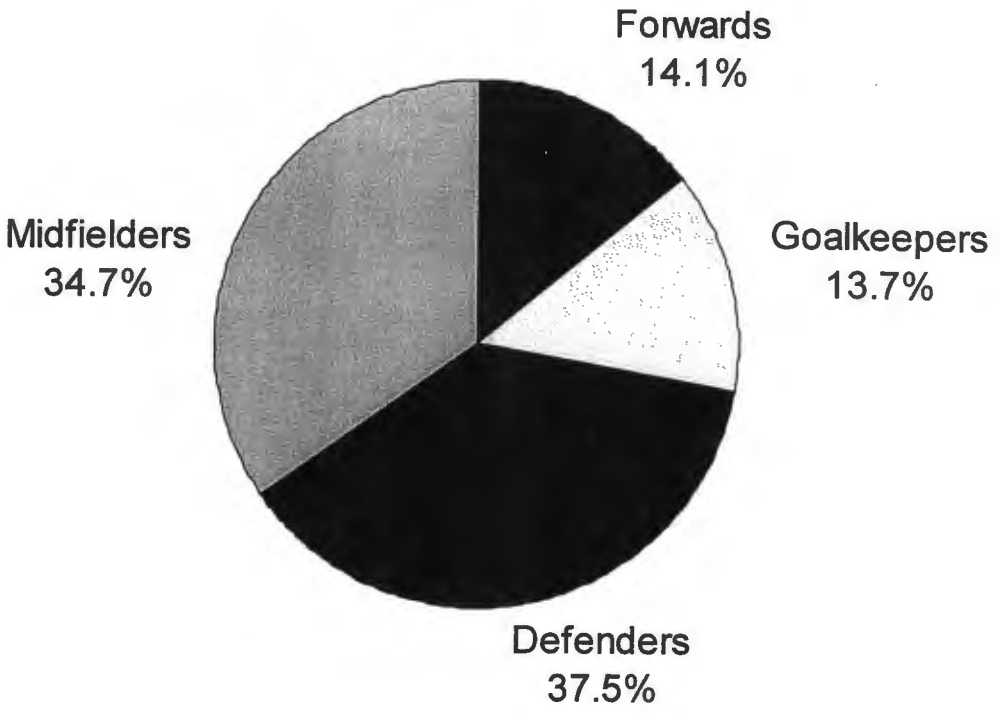
School	Number of Players	Number of Matches	Number of Practices
Tembisa	20	22	44
Umqhele	22	19	57
Ikusasa	25	21	63
TKM	19	19	76
Bokamoso	20	20	40
Boitumelong	24	19	38
Jiyana	22	21	44
Ingqayizivele	28	20	40
Masiqhakaze	25	19	38
Masisebenze	22	19	38
Total	**227**	**199**	**478**

Figure 3.1



The distribution of players per playing position for the study population (N = 227)

Figure 3.2



The distribution of percentage injury per player position for the study population (N = 144)

Table 3.2

Exposure hours of matches and practices per school

School	Number of match hours	Number of practice hours	Total hours of exposure
Tembisa	363	1320	1683
Umqhele	314	1254	1568
Ikusasa	347	2363	2710
TKM	314	1444	1758
Bokamoso	330	800	1130
Boitumelong	314	912	1226
Jiyana	347	1386	1733
Ingqayizivele	330	1120	1450
Masiqhakaze	314	1425	1739
Masisebenze	314	627	941
Total	**3287 (20,6%)**	**12651 (79,4%)**	**15938**

Table 3.3

Distribution of player position per exposure hours per season

Position	N	Exposure Hours - Matches	Exposure Hours – Practice	Total Exposure Hours	Exposure Hours/Player/ Season
Goalkeepers	21	304	1170	1474	70.2
Defenders	65	940	3622	4562	70.2
Midfielders	97	1402	5402	6804	70.1
Forwards	44	634	2441	3075	69.9
Total	**227**	**3280**	**12650**	**15934**	**70.2**

Table 3.4

The distribution of match vs practice injury rate per 1000 hours

School	Number of Injuries	Match Injury Rate	Practice Injury Rate	Total Injury Rate
Tembisa	11	30.3	0	6.54
Umqhele	10	31.89	0	6.38
Ikusasa	21	66.37	0	8.49
TKM	19	60.60	0	10.81
Bokamoso	10	30.30	0	8.85
Boitumelong	11	35.08	1.09	8.98
Jiyana	13	37.52	0.72	7.5
Ingqayizivele	32	96.97	0	22.06
Masiqhakaze	6	19.14	0	3.45
Masisebenze	9	28.71	0	9.57
Total	**144**	**43.85**	**0.16**	**9.04**

Table 3.5 (a)

The distribution of injuries according to severity of injury

Matches and/or Practice missed	Severity of Injury	Total Injuries
1 – 3	Mild	31 (21.5%)
4 – 8	Moderate	82 (57%)
more than 8	Severe	31 (21.5%)

Table 3.5 (b)

The distribution of severity of injury per anatomical site

Anatomical Site of Injury	Mild	Moderate	Severe
Head and Neck	-	2	2
Upper Extremity	2	10	-
Groin Muscle	-	7	7
Quadriceps	-	-	3
Hamstrings	2	1	-
Medial Collateral Ligament – Knee	4	9	2
Lateral Collateral Ligament – Knee	7	3	2
Anterior Cruciate Ligament - Knee	-	-	1
Patella	2	8	2
Meniscus	-	1	1
Medial Ankle Ligament Complex	-	6	1
Lateral Ankle Ligament Complex	11	33	10
Trunk and Back	2	1	-
Calf	1	1	-
Totals	**31**	**82**	**31**

Table 3.6

Injury rate per player position - corrected for time distribution

Position	N	Number of Injuries	Injury Rate per Player per Season
Goalkeeper	21	19	13.7
Defenders	65	53	11.1
Midfielders	97	48	10.3
Forwards	44	24	7.98
Total	**227**	**144**	

Table 3.7 a)

The distribution of injuries per anatomical site and percentage

Anatomical Site of Injury	Number of Injuries	Percentage
Head and Neck	4	2.78%
Upper Extremity	12	8.33%
Groin Muscle	14	9.7%
Quadriceps	3	2.08%
Hamstrings	3	2.08%
Medial Collateral Ligament - Knee	14	9.72%
Lateral Collateral Ligament - Knee	10	6.94%
Meniscus	2	1.39%
Patella	12	8.33%
Anterior Cruciate Ligament - Knee	1	0.69%
Calf	2	1.39%
Medial Ankle Ligament Complex	7	4.86%
Lateral Ankle Ligament Complex	54	37.5%
Trunk and Back	3	2.08%

Table 3.7 b)

The distribution of injuries per anatomical site and percentage (with anatomical groupings)

Trunk and Back	Head, Face	Upper Extremities	Groin, Hip Thigh	Knee	Lower Leg	Ankle
2.08%	2.7%	8.3%	15.9%	27.1%	1.4%	42.4%

Table 3.8

The percentage distribution of injury type for the study population (n = 144)

Injury Type	N	%
Ligamentous sprains	98	68%
Musculotendinous strains	22	15.3%
Contusions	19	13.2%
Dislocation	2	1.4%
Fracture	0	0
Other	3	2.1%
Total	**144**	**100%**

Table 3.9

The percentage distribution of injury type in relation to anatomical site for the study population (n = 144)

Type	N	Site	N	%
Ligamentous sprains	98	Ankle	61	62.2%
		Knee	24	24.5%
		Back/Trunk	3	3.1%
		Upper limb	10	10.2%
Musculotendinous strains	22	Hamstring	3	13.6%
		Groin	14	63.6%
		Thigh	3	13.6%
		Calf	2	9.1%
Contusion/Abrasion	19	Head, Neck	4	21.1%
		Knee	15	79%
Dislocation	2	Shoulder	2	100%
Fracture	0	Nil	0	
Other	3	Other	3	100%
Total	**144**		**144**	

3.6 DISCUSSION

3.6.1 Introduction

This is the first study documenting the epidemiology of soccer injuries in South African schoolboys over a period of one season. The only other published study described injury patterns in an older age group of amateur players and was over a short period (9 weeks) (*Surve et al, 1987*). However, many other studies done elsewhere have focused on senior soccer players (*Albert et al, 1983; Ekstrand et al, 1983; Lewin et al, 1987; McMaster et al, 1978*). Some studies have documented injury profiles in groups combining youth and senior soccer players (*Berger-Vochen et al 1986; Engstrom et al, 1990; Lohnes et al, 1993; NCAA 1991; Schmidt-Olsen et al, 1985; Sullivan et al, 1980; Yde et al, 1992;*). Fewer studies have documented injuries in youth soccer players (*Backous et al, 1988; Hoff et al, 1986; Maehlum et al, 1986; Nielsen et al, 1978; Rodrigues et al, a) 1993; Rodrigues et al, (b)1994; Schmidt-Olsen et al, 1991).*

It is not possible to compare the results from these different studies for several reasons. Firstly, the definition of injury varies and can be (i) any event that disrupts play, (ii) an event that necessitates first-aid treatment, or (iii) an event that leads to a player missing the next match or practice session (*Keller et al, 1987*). Secondly, very few studies have taken into consideration the exposure of the players to both matches and practices. Therefore few studies express the incidence of injury per unit exposure time. Thirdly, there are factors that can affect the incidence of injury and therefore need to be considered when comparing studies. These are the gender of the players, the level of play (social, amateur or professional), level of fitness, preparation, use of protective equipment, footwear, application of the rules of the game and adequate rehabilitation. It is, therefore, only meaningful to compare the results of this study with those of the few studies that (i) define injury with respect to time loss from practice and matches, and (ii) take into account the exposure of players and therefore express the incidence of injury per unit exposure time (*Albert et al, 1983; Ekstrand et al, 1983; Ekstrand et al, 1990; Engstrom et al, 1991; Lewin et al, 1989; Nielsen et al, 1989; Schimdt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990*). Only a few studies have used similar methods of design, data collection, injury definition and exposure calculation.

3.6.2 The overall incidence of soccer injury

The overall incidence of soccer injury in this study was 9,04 injuries per 1000 hours of exposure. This compares well with the findings of other studies in youth soccer players where the reported incidence of injury ranges between 0,5 and 14 injuries per 1000 hours of exposure, excluding tournament play (*Maehlum et al, 1986; Nielsen et al, 1989; Schmidt-Olsen et al, 1991; Sullivan et al 1980*). Despite the differences in the design of soccer studies there is a consensus that soccer injuries for senior soccer players have an incidence of between 4 and 20 injuries per 1000 hours of exposure (*Bass, 1967; Ekstrand et al, 1982; Ekstrand et al, 1983; Ekstrand et al, 1990; Jorgesen 1984; Nielsen et, 1989; Weightman and Brown, 1974*). Therefore, a comparison among international studies shows that youth soccer players have a lower overall incidence of injury compared to senior soccer players. South African youth soccer players, therefore, also have a lower incidence of injury (9,04/1000 hours) when compared to senior soccer players (12,53/1000 hours).

3.6.3 The injury incidence for matches and practices

In this study the incidence of injury during matches was 43,9 injuries per 1000 playing hours - while the incidence during practices was 0,16 injuries per 1000 playing hours. This translates into a 274 fold increase in incidence of injury during matches than at practice. In a similar study among 30 youth soccer players in Denmark, the match injury incidence was 14,4 injuries per 1000 playing hours compared to 3,6 injuries per 1000 hours practice (*Nielsen et al, 1989*), which is a four fold increase.

There is thus a trend in youth soccer players for injury incidence to be higher during matches than for practice - but the high disparity in this study needs further explanation. The reasons for this are not clear. However, a possibility exists that the strict definition of injury could have excluded a number of practice injuries that were otherwise recorded in other studies. Secondly, matches are traditionally more competitive than practices in youth soccer (*Sullivan et al, 1980*) and the competitiveness, could have increased the level of aggression with a resultant higher incidence of match injuries. Thirdly, practice sessions are often punctuated by frequent stoppages for fluid breaks and coaching sessions. This decreases the level of skeletal muscle fatigue that might explain the low incidence of injury at practices.

In senior soccer studies, injuries appeared to be equally distributed between matches and practices, but when exposure was taken into account, it revealed a higher incidence of injury at matches than at practices (*Ekstrand et al, 1983; Ekstrand et al, 1990; Nielsen et al, 1989).*

It is however, unfortunate that the South African study done on adults did not include injuries occurring at practice (*Surve et al, 1987).* It can therefore not be established whether South Africa has any unique trends in this regard.

3.6.4 The severity of soccer injuries

The severity of injuries is extremely difficult to compare among different studies. This is due to the different definitions of injury and severity. The most useful definition of injury is one that includes time lost from matches and/or practice, which makes it possible to accurately determine injury incidence and the severity thereof *(Keller et al, 1987*).

Most studies define severity in terms of the period of inactivity due to the injury - where minor injuries lead to inactivity for less than one week and severe injury as four weeks or more of inactivity. In our study, severity was defined as the number of matches and/or practices missed as a result of the injury. A minor injury was defined as an injury where less than 4 matches/practices were missed; a moderate injury was defined as an injury where 4-8 matches/practices were missed; and a severe injury was defined as an injury where more than 8 matches/practices were missed. Soccer studies are compared despite the differences in definitions of injury and severity. In this study more than half (57 %) of the injuries were moderate, 21,5 % were minor and a further 21,5 % were severe.

In a similar study among youth soccer players from Mexico, 63 % of the injuries were minor, 30 % were moderate and 7 % were severe injuries (*Rodrigues et al, 1993*). The following year the same group was studied and the result showed 44% minor, 46,3 % moderate and 9,6 % severe injuries (*Rodrigues et al, 1994*). While both studies show little difference between the percentage of injury in the minor and moderate severity, the percentage of severe injuries was consistently low. In the USA, a similar study has also shown a low percentage of severe injury of 3 % (*Sullivan et al, 1980*). The percentage of severe injuries in our study therefore appears unusually high. In a South African study investigating senior soccer players, the percentage of severe injury of 10 % was reported despite its poor definition of injury (*Surve et al, 1987*). However, the difference in severity of injury in our study appeared not to be of clinical significance. It appears that this is mainly as a result of a high percentage (44,6 %) of injuries occurring to the ankle, the majority of which (79,6%) were moderate and severe.

It is generally accepted that senior soccer players have a higher percentage of severe injuries ranging between 21 % and 35 % (*Lewin et al, 1989; Nielsen et al, 1989*). The reason for this is thought to be the high intensity and competitiveness of the game at senior level. The introduction of prize money and other incentives into school soccer could have increased the level of intensity and competitiveness to the point of increasing the percentage of severe injuries as appears to be the case in our study.

These pressures could also lead to players who are not fully rehabilitated to return to soccer prematurely, further predisposing them to severe injuries. This argument is supported by examining the findings of a study of an English Premier Division team in which severe injuries were 35 % of the total number of injuries (*Lewin et al, 1989*). This league is known to be highly competitive with a congested programme of an average of one match in four days (*Lewin et al, 1989).*

It needs to be stressed however that in our study the statistical analysis shows the differences in severity of injury not to be significant. ($p > 0,05$).

3.6.5 Severity of soccer injury per anatomical site

In this study, ankle injuries accounted for 36 % of severe injuries with knee injuries accounting for 26 %. Other studies done elsewhere have shown knee injuries accounting for between 36 % and 55 % of severe injuries (*Ekstrand et al, 1983; Nielsen et al, 1989*).

In this study the majority of ankle injuries (61 %) were of moderate severity when other studies have shown them to be of the minor category (*Ekstrand et al, 1983 (a), 1983 (b); Nielsen et al, 1989).*

The percentage of ankle injuries in the moderate and severe category in our study is cause for concern. The relationships between these injuries and the risk factors aforementioned need to be carefully investigated.

3.6.6 The injury incidence per player position

Very few studies have reported on the influence of player position on the injury rates for soccer players. Even fewer studies have been specifically designed to assess the effect of player position on the incidence of soccer injury. Soccer players are not equally distributed in the field of play and playing formations are never uniform among different teams. In the same team, formations may change during the course of the game. In this study, most teams employed the European formation of 4-4-2 (one goalkeeper, four defenders, four midfielders and two forwards). In some of the previous studies a 4-3-3 formation was generally employed (*Ekstrand et al, 1983; McMaster et al, 1978; Sullivan et al, 1980*). Because of the unequal distribution of the players, injury rates per player position have to be expressed per unit time exposure per player. This correction eliminates the inequalities in the number of different positions in a team.

In our study goalkeepers had the highest incidence of injury of 13,7 per 1000 hours per player. The forwards had the lowest incidence of 7,98 injuries per 1000 hours per player. The defenders had 11,1 injuries per 1000 hours per player and midfielders had 10,3 injuries per 1000 hours per player. This is despite the goalkeeper percentage of injury being the lowest at 13,2 %.

Another youth study recorded forwards with the highest percentage of injury and the goalkeepers the lowest (Sullivan et al, 1980). Senior soccer studies done elsewhere have also shown forwards to have the highest percentage of injury and the goalkeepers the lowest (*Ekstrand et al, 1983 (a); McMaster et al, 1978*). A study among senior soccer players in the Italian Premier Division revealed midfielders with the highest percentage of injury and the goalkeepers the lowest (*de Stefani et al, 1990*). It is difficult to predict what the outcome of these studies would have been if they had corrected the unequal distribution of players on the field.

In a South African study among senior soccer players - the exposure correction was made and this study recorded incidence similar to our study - with the goalkeepers showing the highest incidence of injury (*Surve et al, 1987*). The other playing positions were not much different in incidence of injury for playing position. Despite a fairly similar injury incidence for the different playing positions, the South Africa goalkeepers seem to have a high incidence of injury.

It must however be considered that the upper limb injuries which might not lead to infield players missing matches and practices often have that effect on goalkeepers, and that could affect the overall incidence of reported injury in that playing position.

The significance and interpretation of these results can only be validated by undertaking studies that are specifically designed to investigate the effect of playing position on the incidence of injury.

3.6.7 Anatomical site of injury

The lower extremity accounted for 86,8 % of all injuries in this study, and the upper extremity accounted for only 8,38 %. This compares favourably with other youth soccer studies which have recorded lower extremity injury frequencies of 58 % to 87 % and upper extremity injury frequencies of 5 % to 26 % (*Backous et al, 1982; Hoff et al 1986; Maehlum et al, 1986; Nielsen et al, 1989; Nilsson et al, 1978; Pritchett et al, 1981; Sadat-Ali et al, 1987; Schmidt-Olsen et al, 1985, 1991; Sullivan et al, 1980; Yde et al, 1990).*

In a South African study among senior soccer players lower extremity injuries accounted for 74 % of injuries, and the upper extremity accounted for 15 % of all injuries (*Surve et al, 1987*). Therefore, comparison of South African studies failed to confirm that youth soccer players sustain more upper extremity injuries when compared to senior players (*Backous et al, 1989; Hoff et al 1986; Maehlum et al, 1986; Nilsson et al, 1978; Nielsen et al, 1989; Pritchett et al, 1981; Sadat Ali et al, 1987; Schmidt-Olsen et al, 1985, 1991; Sullivan et al, 1980; Yde et al, 1990).*

Youth soccer injury studies have reported the ankle as the most common site of injury (16 % to 44 % of all injuries), followed by the knee joint (12 % to 26 % of all injuries). *(Nielsen et al, 1989; Nilsson et al, 1978; Sullivan et al, 1980; Schmidt-Olsen et al, 1991).*

In our study, results are comparable with these findings - with ankle injuries and knee injuries accounting for 42,4 % and 27 % of all injuries respectively.

Groin, hip and thigh injuries account for 27,1 % at all injuries in our study. This is higher than that recorded by other youth studies (*Backous et al, 1982; Nilsson et al, 1978; Schmidt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990*). This may be explained by a definition of youth, in other words, less than 17 years of age. The age range in our study was 15 - 22 years. It has been observed that older soccer players have a higher tendency to sustain injuries to the groin, hip and thigh (17 % to 32 %) (*Nielsen et al, 1989*). It is postulated that older soccer players have poor muscle flexibility and eccentric muscle weakness that may predispose them to muscle strains (*Ekstrand et al, 1983*).

Lower leg injuries in our study were 1,4 % of all injuries. This is lower than recorded in other youth studies which range between 7 % and 16 % (*Backous et al, 1982; Nilsson et al, 1978; Schmidt-Olsen et al, 1991; Sullivan et al, 1980; Yde et al, 1990*). The reason could be the compulsory wearing of shinguards, as stipulated by FIFA, by the players in this study.

3.6.8 Type of injury

Soccer injuries can be differentiated according to the time of onset (traumatic or overuse) or the type of tissue injured. The reliability of the examiner is an important factor when interpreting these results. In our study all injured players were examined by the principal investigator.

In our study ligamentous sprains accounted for more than two thirds (68 %) of all injuries. This is higher than recorded elsewhere for youth soccer, (16 % to 49 %) (*Hoff, et al 1986; Yde et al, 1990*), and for senior soccer players (26 % to 42 %) (*Sadat Ali et al, 1987*). A South African study in senior soccer players recorded ligamentous sprains as 42 % of all injuries (*Surve et al, 1987*).

Of all ligamentous sprains in our study 62,2 % were at the ankle joint. Other studies have recorded ankle ligamentous sprains accounting for 40 % to 70 % of all ligamentous sprains in soccer players (*Ekstrand et al, 1983; Sullivan et al, 1980*). The lateral ligament complex of the ankle joint was the most common anatomical site of injury in our study (37,5 % of all injuries).

Musculotendinous strains accounted for 15,3 % of all injury types in our study. This is high in comparison to other studies on youth soccer, (11 %). Forty seven percent of total injuries in senior soccer players were reported to be musculotendinous strains (*Sullivan et al, 1980*). In our study, musculotendinous strains occurred in the groin, hamstring and thigh muscles, and this is similar to that recorded in other youth soccer studies done elsewhere (*Ekstrand et al, 1983; Nielsen et al, 1989*). A South African study on senior soccer players recorded musculotendinous strains of 18 % of all injury types and these were also confined to groin, hamstring and quadriceps muscles.

Irrespective of the age of the player or level of competition, there is a consistentently low frequency of fractures and dislocations in soccer players, ranging between 1 % and 20 % of all injuries. In our study, there were two shoulder dislocations and both were sustained by goalkeepers. There were no fractures recorded in any of the subjects in this study.

3.6.9 Risk factors

3.6.9.1 Warm-up

Twenty two percent of all the youth soccer players in our study participated in warm-up prior to matches and practices. This is a low percentage when taking into account the scientific evidence available which indicates that warm-up may improve performance and prevent injuries. (*Safran et al, 1988; Sapega et al, 1981; Shellock et al, 1985; Strickler et al, 1990; Van Mechellen et al, 1993*). It is also interesting to note that all the players who participated in warm-up are managed by certified coaches, and their injury rates were (3,45 and 8,49 injuries per 1000 hours of exposure) which is below the total average (9,02 injuries per 1000 hours of exposure). This seems to suggest a positive effect of this exercise – although other interventions associated with good coaching practices such as tactics could also play a part.

3.6.9.2 Stretching

Only 22 % of all the youth soccer players in our study participated in stretching prior to matches and practices. This is despite the fact that this exercise is generally considered beneficial to performance and possibly to prevent injury (*Cahill et al, 1978;*). Scientific evidence to the injury prevention afforded by stretching is unconvincing, but because it poses no danger to the athlete it is highly recommended. The players who participated in a stretching programme in our study were all trained by certified coaches. Their injury rates (3,45 and 8,49 injuries per 1000 hours of exposure) were below the overall injury rate (9,02 injuries per 1000 hours of exposure). This may suggest a positive benefit of this procedure – as might other interventions associated with good coaching practices such as tactics.

3.6.9.3 Pre-season training

None of the subjects in our study engaged in any form of pre-season training. Pre-season training is still considered a significant factor in injury prevention (*Cahill et al, 1978).*

3.6.9.4 Bracing and taping

Taping, when applied to appropriate joints such as the ankle and finger, provides good mechanical support and it may also enhance proproception, thereby preventing injury *(Firer, 1990; Garick et al, 1973; Robbins, 1995; Rovere et al, 1988).*

Bracing has been shown to provide good mechanical support and proproception. In particular it has been shown to prevent harmful ankle sprains in soccer players (*Surve et al, 1994).*

No subject in our study applied these methods.

3.6.9.5 Protective equipment

One hundred percent of players in our study wore shinguards. This is probably due to the players strict adherence to the FIFA rule that enforces wearing of shinguards *(FIFA, 1984).*

3.6.9.6 Playing surface

Ninety eight percent of matches/practices in our study were played on gravel pitches. These were all school pitches which are poorly maintained. Two percent of matches were played at grassed pitches at the local stadium. This was because these were high profile knockout matches.

3.6.9.7 Weather conditions

Ninety four percent of the matches were played under dry conditions. The soccer season in these schools is in the winter months where there is little rainfall. There is also a tendency to postpone matches/practices when it rains because the pitches become unplayable.

3.6.9.8 Availability of first-aid

There was no form of first-aid or emergency services available at any matches/practices in our study. There are no finances available for this type of activity in these schools.

3.6.9.9 Match officials

Only 6 % of matches in this study were officiated by trained match officials. Ninety four percent were overseen by students and teachers with knowledge of the rules of the sport.

The schools that are managed by certified coaches had a below average incidence of injury. Although this is not statistically significant, it may reflect positive effects that proper coaching development has on prevention of injury in school soccer.

3.6.10 Recommendations and future research

Our study has confirmed that the incidence of injury in youth soccer players is lower than in senior players (*Surve et al, 1987*). However, in South African schoolboys, the match injury rate was 274 times higher than during practice. Furthermore, South African youth soccer injury profile recorded different trends when compared to those reported in European and American counterparts. South African youth soccer players had a higher percentage of severe injuries, ligamentous sprains, musculotendinous strains and goalkeeper injuries, but there were no significant differences in the incidence of injury severity and injuries per player position. ($p > 0,05$).

Scientifically based measures of injury prevention such as warm-up, stretching, pre-season training and bracing/taping, need to be further investigated in this population group. It is further recommended that more studies in youth soccer be done in South Africa and other African countries to validate our findings. It is also essential that studies in South African and African soccer players should use standardised design data collection methods, injury definition, severity and exposure calculation (*Keller et al, 1987*). This will make possible accurate comparisons with other studies done elsewhere.

3.7 SUMMARY

This study has documented the epidemiology of soccer injuries in South African youth soccer players in high schools.

Association Football or Soccer is the most popular sport in the world, and indeed in South Africa as well (*HSRC, 1982; Keller et al, 1987*). However, soccer injury studies are difficult to compare due to lack of standardisation in the design, data collection and the definition of injury and expression of injury incidence.

The incidence of soccer injuries in our study was 9,04 injuries per 1000 hours of exposure. This compares favourably with those previously reported in other countries. There was however a 274 fold higher rate in injuries during matches when compared to practices. This disparity is significantly higher than shown in youth soccer studies done elsewhere.

More than half (57 %) of injuries in our studies were of moderate severity, which resulted in players missing between 4 and 8 matches and practices. Severe injuries accounted for 21,5 % of total injuries. This is higher than shown in other youth studies. The majority of the moderate and severe injuries (79,6 %) occurred to the ankle joint and perhaps this explains why the difference in the severity of injury in our study was shown to be non-significant as they occurred on the same anatomical site.

Only 19 (13 %) of total injuries occurred to goalkeepers. However, when the exposure per player position per season was taken into account, the goalkeepers showed an incidence of 13,7 injuries per 1000 hours per player per season. This was higher than other playing positions, but the statistical analysis showed that the difference in incidence by player position was not significant. Therefore, our study showed that player position does not influence the incidence of injury.

This study recorded a large majority (86,8 %) of all injuries occurring in the lower extremity. The ankle joint accounted for 42,4 % of all injuries and all these were ligamentous sprains, the majority of which (88,5 %) occurred to the lateral ligament complex. The knee joint was the second commonest anatomical site of injury (27 %). The groin, hamstring and quadricep muscle injuries (27,1 %) were higher for youth soccer players than recorded in other studies.

In our study, ligamentous sprains accounted for 68 % of all injury types, and musculo-tendinous strains accounted for 15,3 %, both of which are higher than those recorded elsewhere. Furthermore, there were only two dislocations in this study population and no fractures at all.

There is an obvious lack of proper sports facilities in South African high school soccer in South Africa. This is accompanied by poor coaching development at this level. Future research must be devoted to a careful evaluation of how these factors affect the safety of soccer at schools. There is also a need for further research of the epidemiology of youth and female soccer players in South Africa and other African countries, especially at high schools.

Improvement of sport facilities, coaching and match official education in youth soccer should be a matter of priority in South Africa, especially at high schools.

APPENDIX A

AN INVESTIGATION OF THE EPIDEMIOLOGY OF SOCCER INJURIES IN SOUTH AFRICAN SCHOOL BOYS DURING ONE PLAYING SEASON

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INFORMATION ON SOCCER COACHES

SCHOOL COACHES:

NAME:

NUMBER OF ACTIVE PLAYERS:

NAME OF SCHOOL:

QUALIFICATIONS:

PRE-SEASON TRAINING:

STRETCHING:

WARM-UP:

WARM-DOWN:

PRE-MATCH MEALS:

Time Before Match -

Contents -

FIRST AID KIT:

PRACTICE SESSIONS:

DURATION:

Duration

Number per week

APPENDIX B

AN INVESTIGATION OF THE EPIDEMIOLOGY OF SOCCER INJURIES IN SOUTH AFRICAN SCHOOL BOYS DURING ONE PLAYING SEASON

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INJURY REPORT FORM

DATE:
SURNAME:
AGE:
SCHOOL:
PLAYING SURFACE:

MATCH:
FIRST NAMES:
ADDRESS & TELEPHONE:
PLAYER POSITION:
FOOTWEAR:
NAME
NEW - YES/NO
STRETCHING:

PROTECTIVE EQUIPMENT:
- SHINPADS
- STRAPPING

WARM-UP:
- DURATION
- WARM-DOWN

PREVIOUS INJURY:

CLUB FOOTBALL:
- DIVISION
- SOCIAL

PRE-SEASON TRAINING:

WEATHER:

PRE-MATCH MEAL-TIME
CONTENT:

INJURY REPORT

SITE:
MATCHES/PRACTICE MISSED:

NATURE/DIAGNOSIS:
TREATMENT:

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