THE EPIDEMIOLOGY OF INJURIES OF FEMALE HIGH SCHOOL SOCCER PLAYERS IN THE eTHEKWINI DISTRICT.

BY

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A dissertation submitted to the Faculty of Health Science in partial compliance with the requirements for the Master's Degree in Technology : Chiropractic, at the Durban University Of Technology.

I, Keamogetse Refilwe Sentsomedi, do declare that this dissertation represents my own work in both
conception and execution.

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DECLARATION

I, Keamogetse Refilwe Sentsomedi declare that this research is my own work. It is being submitted for the degree of Master of Technology in Chiropractic at the Durban University of Technology, Durban. It has not been submitted before for any degree or examination at this or any other university.

…… (Signature of the candidate)

…….day of…….. (Month), 2014

DEDICATION

This dissertation is dedicated to my mom, Morongwe Victoria Sentsomedi, and my aunt, Thabile Ingrid Metsing, for their guidance, words of wisdom and encouragement. Their love and support towards me has been incredibly beyond measure. Having you in my life has been a true blessing. Thank you.

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ABBREVIATIONS:

AC	**Acromio-clavicular**
ACL	**Anterior Cruciate Ligament**
DoE	**Department of Education**
DSR-SA	**Department of Sports and Recreation South Africa**
DUT	**Durban University of Technology**
FIFA	**Federation Internationale de football Association**
KZN	**KwaZulu-Natal**
LBP	**Low Back Pain**
LLE	**Little League Elbow**
OCD	**Osgood Schlatter Disease**
PSL	**Premier Soccer League**
SAFA	**South African Football Association**
USA	**United States of America**

ABSTRACT

Introduction: Participation of young females in soccer has started to increase in the past few years. Females participating in soccer are more vulnerable to injuries than males due to the nature of the sport especially because the sport is characterised as a vigorous, high intensity, intermittent ball and contact activity.

Objective: This study sought to determine the epidemiology of injuries in high school female soccer players in the eThekwini district.

Method: A quantitative approach using a cross sectional survey was used to determine the epidemiology of injuries in female high school soccer players in the eThekwini district. One-hundred-and-ninety-seven female high school soccer players, between the ages of 14 to 19 years who have played soccer for at least one season, from 27 female high schools in the eThekwini district were invited to participate. A self-administered questionnaire was used to determine the demographic profile of the players and the reported prevalence of injuries in the soccer players. The study also determined the profile of soccer related injuries, management of injuries, identified risk factors for injury, and compared injuries occurring during training and during matches.

Results: Out of a total of 85 respondents only 31 sustained injuries. The injury prevalence for the season was 36.5%. Only 61 injuries (71.8%) were reported by the injured players. The rate of injury was 90 per 1000 athlete exposure hours during the season. Only two female players reported the five injuries while all 29 female players sustained at least one injury. The defenders (31.7%) and midfielders (28.6%) sustained the most injuries. Most injuries reported were contact in nature (12.9%). More injuries occurred during training (12.9%) rather than during matches (8.2%). The lower extremity (77.8%) was injured more than the upper extremity (22.2%). The knee (22.2%) and ankle (15.9%) were the most frequently injured body parts. Muscle injury (23.5%) was the most commonly reported followed by bruising (10.6%).

Conclusion: Prevalence of injuries was high in the cohort studied. The lower limb, specifically the knee and ankle were most commonly injured. Muscle injury and bruising were the most common injury affecting the lower extremity. It is recommended that the study be extended to a larger cohort of school children.

Key Terms: epidemiology, soccer injuries, youth

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CHAPTER 1

Introduction

1.1 Introduction

Soccer is the most popular professional and recreational team sport in the world with more than 200 million players (Dvorak and Astrid 2000: S3; Giza *et al*. 2005: 212). More than 21 million females are registered with the Federation Internationale de Football Association (FIFA) (Giza *et al.* 2005b: 212). Soccer is a demanding sport which requires a combination of endurance, fitness, running and discontinuous sprinting (Hoff and Helgerug 2004: 166). The majority of the available literature has focused on the epidemiology of injuries in males who participate in sport (Messina, Farney and DeLee 1999: 294). However, the growth in the number of females participating in sports, including soccer, has made it necessary to understand the effect that sports activities have on female performance and injury patterns (Mandelbaum *et al.* 2005: 1004).

Soccer is a common contact sport played in high schools (Powell and Barber-Foss 2000: 385). Participation in soccer is an effective way for the youth to increase their level of physical activity and fitness. It involves intense physical effort over an extended period of time through training and matches (Bergeron 2007: 28). Talented youth often participate for school, club and national teams thus placing great stress on the growing body (Finch *et al*. 2002: 266).

Soccer's popularity has stimulated numerous epidemiologic studies which focused on paediatrics, university and adult players (Leininger, Knox and Comstock 2007: 292; Dick *et al*. 2007: 282; Giza *et al.* 2005b: 215), unlike high school soccer injury studies which were scarce (Yard *et al.* 2008: 1930). The increase in high school soccer participation, the continuously growing nature of the sport and the possibility of long-term effects of injury emphasises the need for new, broad studies of high school soccer injuries to

direct targeted intervention strategies (Jones *et al.* 2001: 270; Giza and Micheli 2005a: 141; Yard *et al*. 2008: 1931).

Lislevand (2010: 6) stated that soccer is considered a contact or collision sport with a high risk for injury. The epidemiology of sports injuries in young players is an important area of study that is receiving less attention in the medical and sport science literature (Caine, Maffulli and Caine 2008: 39; Messina, Farney and DeLee 1999: 294). Andrew *et al.* (2013: 758) stated that studies focusing on the cause of injury sport players were necessary to develop preventive measures for soccer injuries.

According to Scase *et al*. (2012: 209), the injury incidence reported junior male soccer players were 17.1 injuries per 1000 hours of exposure that occurred more in matches than training. In Europe the incidence of injuries in young female soccer players have been reported to range from 4.6 to 22.4 per 1000 match hours and 0.4 to 4.6 per 1000 training hours in the soccer season (Le Gall, Carling and Reilly 2008: 278). Owoeye, Mwachukwu and Akinbo (2012: 60) stated that there was a high incidence of injuries sustained by female soccer players during the Beijing Olympic Games in China.

In South Africa, the interest in soccer was stimulated after the constitution of the South African Women's team in 1993 which played against Swaziland, and when the team almost qualified to take part in the Women's World Cup for the first time in 1997 (Engh 2011: 14). The South African Football Association (SAFA) currently supports inter-regional tournaments for the women's U19 team. This has further stimulated the participation of young females in soccer (Absa Women's League National championships draw 2012).

1.2 Problem of the statement

The anatomical and physiological differences between young males and females, as well as the injury rate and type, may not be the same between the genders. The gap in

performance and injury patterns between males and females has become less marked as women have become more active in sports from a younger age (Holschen 2004: 852). In South Africa, there are few studies on young female soccer players but no study on the epidemiology of injuries in female soccer players in KwaZulu-Natal (KZN).

1.3 Aim of the study

The aim of the study was to determine the epidemiology of injuries in female high school soccer players in the eThekwini district of KwaZulu-Natal.

1.4 Objective of the study:

1. To determine:

1.1. The demographic profile of female high school soccer players in the eThekwini district.

1.2. The prevalence of injuries in female high school soccer players in the eThekwini district.

1.3. A profile of soccer-related injuries sustained by female soccer players over the last season.

1.4. The management of injuries.

1.5. The medical and nutritional status as reported by the players.

1.6. The risk factors for injury.

2. To compare injuries occurring in training and during matches.

1.5 Related hypotheses

Null hypothesis one

The demographic profile of high school female soccer players in eThekwini district is not similar to international literature profiling soccer players.

Null hypothesis two

The prevalence of injuries in female high school soccer players in the eThekwini district is not the same as other studies of the same population.

Null hypothesis three

A profile of soccer related injuries sustained by female soccer players over the last season is not the same with the literature with respect to number and mechanism of injury.

Null hypothesis four

The management of injuries is not similar to other studies of the same population.

Null hypothesis five

The medical and nutritional status as reported by the players is not congruent with other studies of the same population.

Null hypothesis six

To identify risk factors for injury shows correlation with the literature with respect to equipment, player position, age and gender.

Null hypothesis seven

To compare injuries occurring during training and during matches did not show the same location and severity of injuries.

1.6 Significance of the study

Injury affects the performance of an athlete. When injuries occur at an early age, without appropriate understanding and good prevention strategies, it can lead to the failure of sports careers. It is anticipated that the knowledge obtained will also assist in better management of players with a high risk of injury at an early age.

With increased knowledge of the epidemiology of soccer-related injuries for young female soccer players, prevention of injuries and training to improve performance can be improved. In addition, the common rate of injury can be decreased even as participation continues to increase. The results of this study will shed light on the extent of common soccer injuries and their risk factors when faced with soccer injury prevention at a later stage. Coaches and health team members can assist female high school soccer players with their injuries, thus promoting health and wellness through active participation, prevention, development and health promotion.

Definitions

Injury: Any physical complaint sustained by players that result from a soccer match or training, irrespective of the need for medical attention or time lost from soccer activities. Medical attention is defined as an assessment of a player's medical condition by a qualified medical specialist and called medical attention injury. Time loss is defined as a player is not able to take a full part in future soccer training or match. The term future is defined as any time after the onset of injury, including the day of injury (Fuller *et al*. 2006: 193).

Incidence/ Rate of injury: It is defined as a number of new sports injuries occurring during a period of time in a particular group of sportsmen. Incidence may be referred to as the number of injuries per 1000 hours of training, or the number of injuries per athlete exposure or player per season / tournament (Dvorak and Junge 2000: S4). Athlete-exposure is defined as one sport player participating in one match or one training session where the player is exposed to the possibility of being injured regardless of time (Wong and Hong 2005: 474).

Prevalence of injury: Is the measure of injuries in a population at a given point in time or period of time (Orchard and Seward 2002: 41).

Severity of injury: The number of days that have elapsed from the date of injury to the date of the player's return to full participation in team training and availability for match selection (Fuller *et al*. 2006: 194).

Recurrent of injury: An injury of the same type and at the same location which occurs after a player's return to full participation (Fuller *et al*. 2006: 194 and Woods *e al*. 2003: 234).

Acute injury: Is defined as an injury caused by a single event of trauma (Junge and Dvorak 2000: S41)**.**

Chronic injury: Is defined as an injury/ pain syndrome of the musculoskeletal system appearing during physical workout without any known trauma, disease, deformity or anomaly that might have given previous symptoms (Junge and Dvorak 2000: S41).

Q angle: is defined as the measurement of an angle, between the quadriceps muscle on the front of the thigh at the anterior superior iliac spine to the patella center and a line from the patella center to the tibial tuberosity/ patella tendon (Daneshmandi, Farzaneh Saki and Shahheidari 2011: 47).

Apophysis: Is the point of attachment of a tendon to bone. This is a type of ossification center or growth center that forms the attachment site for major muscle groups to the bone. This is caused by micro-avulsions at the bone-cartilage junction (Grady and Goodman 2010: 170).

Physis: Also known as the growth plate is the transition zone at the end of the long bones in the body between the metaphysis the diaphysis (Grady and Goodman 2010: 170).

Osgood Schlatter Disease: An apophysitis at the insertion of the patella tendon on the tibial tubercle (knee area) (Grady and Goodman 2010: 176).

Sever's Disease: An apophysitis at the insertion of the Achilles tendon and plantar fascia on the calcaneus (ankle area) (Grady and Goodman 2010: 176).

Healthy food: Any natural, organic or prepared food popularly believed to promote or sustain good health, as vital nutrients are included (Croll, Neumark-Sztainer and Story 2001: 196).

Sprain: is defined as a mild stretch to a complete disruption of the fibrous band of connective tissue that connects two bones at a joint. (Walden, Hagglund, Ekstrand 2001: 119).

Strain: is defined as a mild stretching or exerting of a fibrous band of connective tissue that connect bone and muscle beyond its limits. (Walden, Hagglund, Ekstrand 2001: 119).

1.7 Flow of the thesis

Chapter one: This chapter introduces the topic and provides a rationale for the study based on the literature. The aim, objectives and significance of the study are stated followed by the flow of the thesis.

Chapter two comprises a critical review of the literature designed to determine the prevalence and profile of injuries; risk factors of injury followed by comparison of injury in training and matches.

Chapter three describes the method of the study which includes the study design, identification of participants the instrument used, the method of data collection, ethical considerations and data analysis.

Chapter four describes results by displaying and presenting the main findings in this study.

Chapter five discusses the results of this study, comparing and contrasting them with the presented literature.

Chapter six provides the conclusion of this study. Recommendations and limitations are included.

CHAPTER 2

Literature Review

2.1 Introduction

This chapter presents a review of the literature focused on injuries sustained by young female soccer players. The literature includes a discussion of the profile of soccer-related injuries as well as medical and nutritional profiles of young female soccer players. Other aspects covered include risk factors contributing to soccer injuries and comparison of injuries sustained during soccer training and matches. Studies conducted on soccer injuries especially, in young females both internationally and nationally, were reviewed.

The databases that were searched included PubMed, E Medicine and Science Direct, Cochrane database, Medicine and Science of Sports, Journals of Athletics Training, American Academy of Pediatrics, Sage Publications, Springer, Google Scholar and Elsevier Saunders databases. The articles were sourced for a period of 15 years, from 1998 to 2013 categorised in the topics identified above.

Soccer is the most popular sport worldwide (Wong *et al.* 2007: 93). A soccer match is played by two teams of eleven players each (including one goalkeeper per team). A match comprises of two halves of 45 minutes each, separated by an interval of fifteen minutes. It is considered a contact sport, where players are allowed to rapidly tackle the ball with their feet, side stepping and cutting, landing and abruptly stopping. Sport-specific skills used in soccer include quick turns, pivots and jumps in the air. The complexity of soccer as a high-intensity contact sport may be associated with great injury risks (Junge *et al.* 2004: 169).

2.2 Participation in soccer by the youth in South Africa

Studies of soccer injuries in South Africa (SA) have increased but only a few studies on female soccer players have been conducted (Frantz, Amosun and Weitz 1999: 13; Goga and Gongal 2003: 498; Mtshali *et al.* 2009: 165; Mohammed, Useh and Mtshali 2012: 179). The Department of Sports and Recreation of South Africa (DSRSA) (2005: 4) conducted a study on participation patterns of sports and recreation activities in South Africa. The DSRSA (2005: 9) reported that participation in sports was a motivation in schools. Furthermore, 52% of youth between the ages of 16 to 20 years played school sports, of which 39% of young females were motivated to participate in school soccer while 31% of young males were motivated to participate in school sports (DSRSA 2005: 11).

In the Kwazulu-Natal (KZN) province all high school soccer matches are played in the third term, with trials beginning in the winter season. Female school soccer fixtures (matches) are scheduled for eight weeks in the third term of school. These fixtures are divided into the selection of female soccer players for the inter-district trials, followed by the district trials and finally in age group tournaments. The age groups include under 14, 16, 18 and 19 (open) years. Schools in seven districts compete against each other.

As this study aims to determine the profile of injuries in female high school soccer players, the next section will discuss the physiological development of a female and the risks of injury.

2.3 Physical development of a female

The onset of puberty corresponds to a skeletal or biological age of nine to eleven years in young females and thirteen years in young males (Rogol, Roemmich and Clark 2002: 196). On average young females complete each stage of puberty earlier than young

males (Rogol, Clark and Roemmich 2000: 523S). The typical female body has a wider pelvis (hip bone), femoral anteversion (internal hip), genu valgus (knock knees) and external tibial torsion (twist of lower leg) which lead to specific types of musculoskeletal injuries (Holschen 2004: 852). Injuries follow characteristic patterns of anatomical or skeletal immaturity (Emery, Meeuwise and McAllister 2006: 20). Skeletal immaturity or actively growing bone comprises of the growth plate complex, which is made of the bony epiphysis (outer new bone), cartilaginous physis and bony diaphysis (inner new bone) and the apophysis (Grady and Goodman 2010: 170).

Musculoskeletal development (skeletal immaturity) is influenced by physical activity or sports (Rogol, Clark and Roemmich 2000: 526S). Studies have suggested that moderate physical activity has a stimulating effect on growth, whereas intensive physical training impacts negatively on growth through chronic stress (Georgopoulos *et al*. 1999: 4529). During the period of peak growth, the changes in the biomechanical properties of bone cause an imbalance in strength and flexibility resulting in an increased susceptibility to injury (Sharma, Luscombe and Maffulli 2003: 246). Roach and Maffulli (2003: 59) reported that growth spurts affected flexibility due to bone growth without associated soft tissue development, which increased the risk of injuries. The study concluded that although injuries in young players were not sport specific, there may be an increased risk of overuse injury associated with high level participation at a young age (Roach and Maffulli 2003: 65).

2.4 Prevalence of injuries

Prevalence and incidence of soccer injuries are defined in different ways. When assessing injury incidence and prevalence, it also becomes important to define injury (Fuller *et al.* 2006: 197). Although the International Football Association (FIFA) has approximately 40 million registered female soccer players worldwide (Dvorak and Junge 2000: S3; Jacobson and Tegner 2007: 84), few studies have reported the incidence of

injuries in female soccer (Junge and Dvorak 2004: 936; Ostenberg and Roos 2000: 283). Three studies in female soccer players have shown an injury incidence during matches ranging from 12.6 to 23.3 injuries per 1000 hours and that during training ranging from one to three injuries per 1000 hours (Faude *et al*. 2005: 1696; Giza *et al.* 2005b: 213; Jacobson and Tegner 2007: 86).

A 13-week prospective study of young soccer players completed questionnaires and performed running and balance tests (Emery, Meeuwisse and Hartmann 2005: 1883). The overall injury incidence was almost six injuries per 1000 player hours with no gender variation. The injury rates were lowest in the oldest age group as compared to the younger age group (Emery, Meeuwisse and Hartmann 2005: 1889). Similarly, an eight season prospective female soccer study which described the incidences of injury reported by a sports physician was according to age level during matches (Le Gall, Carling and Reilly 2008: 281). These investigators found that the risk of injury was greater in the youngest (under age 15) group compared to the oldest (under 19) group. There was a great variation in the ages of the players competing together within the same group (15 to 19 years of age) and as a result there was a significantly higher overall injury incidence observed in the under 15 age group compared to the under 19 group (Le Gall, Carling and Reilly 2008: 281).

In a five-year retrospective study of female soccer players, the incidence and severity of injuries were determined (Lilley, Gass and Locke 2002: 4). The study showed that the incidence of upper extremity injuries was low and minor in nature as compared to the incidence and severity of lower extremity injuries, such as anterior cruciate ligament (ACL) tear. Simirlarly, Sweson *et al.* (2013; 464) reported knee injuries (4.53) per athlete exposure (AE) were high in female soccer players. Sweson *et al.* (2013:466) stated that United States high school sport players sustain many injuries yearly and described AE as a sport player participating in training or in a match. Yard *et al.* (2008:1931) reported that the injury rate per 1000 athletic exposure was high in matches (4.77) compared to training (1.37). Females reported higher match injury rate

(5.34 and 4.26) while males had higher training injury rate (1.51 and 1.21). Most match injuries were reported as likely to be due to increased exposure to high risk and full contact during play. Similarly, previous studies have indicated that the majority of match injuries resulted from player-to-player contact, while the majority of training injuries resulted from non-contact mechanisms (Agel *et al.* 2007: 271; Dick *et al.* 2007: 280). Ostenberg and Roos (2000: 281) followed 123 female soccer players from different levels during one season. They found 14.3 injuries per 1000 match hours and 3.7 injuries per 1000 training hours.

Literature (Hägglund *et al*. 2005: 340; Fuller *et al*. 2006: 194; Caine, Maffulli and Caine 2008: 21) show findings related to injury prevalence and profiles due to the variations in the methods and definitions used. As a result the outcomes and conclusions vary. These differences prevent direct comparisons of results and conclusions reached. Therefore, significant comparisons of exposure and injury epidemiology can be made between studies with more similar study design, definitions and methods. Thus, the aim is to prevent injuries, implement and improve the safety of the sport and sport players. Preventive measures are based on epidemiological research.

2.5 Profile of soccer-related injuries sustained in female players

2.5.1 Types of Injury

Injuries can be defined as acute or chronic with clinically distinct presentations (Faude *et al*. 2006: 786; Junge and Dvorak 2000: S42). Giza *et al*. (2005b: 213) reported that 82% of injuries were acute and 16% were chronic. Strains (30.7%), sprains (19.1%), contusions (16.2%), and fractures (11.6%) were the most common injury types. Recently, many sport players began intense training at younger ages or participated in multiple sports in one season, thus creating more opportunities for acute injury and increased risk of overuse injuries (Adirim and Cheng 2003: 76).

Acute injuries include avulsions, bone bruises, fractures, joint dislocations and soft tissue sprains and strains. These may be caused by maximal forces, load or torsion and present with an instant onset of symptoms following a clearly identifiable traumatic event (Raissaki, Apostolaki and Karantanas 2007: 86). The incidence of acute injuries was 23.6 per 1000 match hours and 3.1 per 1000 training hours in female soccer players (Tegnander *et al.* 2008: 196).

A chronic or overuse injury is described as a repetitive, submaximal micro-trauma characterised by symptoms that progress from acute to sub-acute to chronic (Raissaki, Apostolaki and Karantanas 2007: 86). In skeletally immature soccer players chronic injuries include calcaneal apophysitis (Sever's disease), tendonitis, stress fractures, osteochondritis, Osgood Schlatter disease (OSD) and traction apophysitis (Adirim and Cheng 2003: 77). Overuse injuries account for a higher percentage of total injuries in females and the most commonly reported complaints included tendonitis, shin splints, and lower extremity stress fractures (Tegnander *et al.* 2008: 196). Overuse injuries accounted for almost one-third of injuries which typically affected the groin, knee and leg (Adirim and Cheng 2003: 77; Walden, Hägglund and Ekstrand 2005: 543).

Sprains and strains

Strains and sprains were reported to be common in soccer players (Hrysomallis 2013: 351). Studies (Lilley, Gass and Locke 2002: 4; Giza *et al.* 2005b: 213) have reported that strains and sprains were the most common diagnoses in female soccer players while Hawkins *et al*. (2001: 44) reported that the majority of sprains and strains occurred in the lower limb. Most thigh injuries were muscular strains (39%) while those to the knee and ankle were ligamentous sprains (67%). Price *et al*. (2004: 467) showed similar results reporting strains (31%) and sprains (20%) as the main injury types affecting the lower limb. Overall the above studies have similarities in that soft tissue injuries were the most common in soccer (Wong and Hong 2005: 477).

Contusion, concussion and laceration

Wong and Hong (2005: 477) found that bruises (contusions) and joint swelling or inflammation were among the common types of soccer injuries. According to Giza *et al.* (2005b: 213) contusions at 16.2% were found in women's professional soccer. Even though concussion is a common yet underreported injury on the sports field (Khurana and Kaye 2012: 1), studies have demonstrated that concussion rates in female soccer have increased (Colvin *et al.* 2009: 1699; Levy *et al.* 2012: 541) and are more likely to occur during matches, either from direct head-to-head contact or contact with the ball. This was supported by other studies (Fuller, Junge and Dvorak 2005: i7; Dick 2009: i49; Meehan and Bachur 2009: 119; Lincoln *et al.* 2011: 960) concluding that female soccer players exhibit higher rates of concussion in sport than their male counterparts.

Fractures

Giza *et al.* (2005b: 213) reported that fractures (11.6%) were among the most common diagnoses in women's professional soccer. Lilley, Gass and Locke (2002: 5) reported that the most common major injuries were stress fractures which accounted for 29%. Tibial stress fractures were the most common type of injury reported and considered to affect the growth stage of the young female player. The actively growing bone caused avulsion fractures and was common injuries in young soccer players (Sharma, Luscombe and Maffulli 2003: 251).

2.5.2 Location of Injury

Location of injury is an important variable in study surveys (Parkkari, Kujala and Kannus 2001: 988). Most studies reported injuries to the upper and lower extremity at two percent and 82% respectively (Jacobson and Tegner 2007: 87; Tegnander *et al*. 2008: 196). The upper-extremity injuries represented 33.9% of total injuries (Scase *et al.* 2012: 209). LaBella (2007: 40) reported that due to the nature of the sport, the lower extremity is the most likely body part to be injured when playing soccer. Soccer injuries affect

mostly the ankle and knee as well as the muscles of the thigh and calf (Junge *et al*. 2004: 169). When studying adolescent sport participation and injury in high schools, Emery and Meeuwisse (2010: 560) found the lower extremities to be injured in 78% of adolescent soccer players. Lower extremity musculoskeletal complaints were common in the skeletally immature sport player due to rapid bone growth and loss of flexibility, which predisposed the adolescent sport player to specific injuries (Grady and Goodman 2010: 182). The studies agreed that most of the injuries sustained playing soccer occur in the lower limb, regardless of gender (Powell and Barber-Foss 2000: 388; Junge *et al.* 2006: 567).

Foot, Ankle and Shin injuries

Studies (Le Gall, Carling and Reilly 2008: 281; Wong and Hong 2005: 476) investigating injury in female soccer players recorded a predominance of ankle and knee injuries, whereas Lilley, Gass and Locke (2002: 6) reported that ankle and shin injuries were common in high performance female soccer players with high recurrence. Lilley, Gass and Locke (2002: 6) were not clear on whether preventative measures were implemented other than strength and conditioning exercises focused on the upper leg, while for the lower leg no specific strength exercise was included.

Overall Emery, Meeuwisse and Hartmann (2005: 1887) agree with both the above studies in their results that the ankle was the most commonly injured body part, compared to others in the lower limb. When reviewing common sports injuries in young players the ankle was the most common area of injury in the lower limb (Emery, Meeuwise and McAllister 2006: 24).

Knee injuries

The knee is described as the most commonly injured lower extremity area in female professional adult soccer players (Giza *et al.* 2005b: 213; Faude *et al.* 2005: 1696). Similarly, Swenson *et al.* (2013: 464) reported knee injury rates were significantly higher

in young female players compared with males. Knee injuries represent 10% to 50% of all soccer injuries (Dick *et al*. 2007: 280; Schiff 2007: 370) with one of the most significant injuries being an anterior cruciate ligament (ACL) tear (Powell and Barber-Foss 2000: 389; Agel, Arendt and Bershadsky 2005: 527; Fernandez, Yard and Comstock 2007: 643). Hewett (2000: 315) described that anatomical structures, hormonal and neuromuscular factors were theories that increased knee injury occurrence in female players.

A study of South African under 23 years female soccer players reported that there was no clear relationship between the anatomical factors (Q-angle, pelvic width, and intercondylar notch width) and the high knee injury rate (Mohamed, Useh and Mtshali 2012: 178). Daneshmandi, Saki and Shahheidari (2011: 49) noted that three alignment tests of the lower extremity may, however, alter the position of the anatomical landmarks used to measure the Q angle. Another study (Holschen 2004: 852) found that the female body is anatomically more at risk for specific types of musculoskeletal injuries, mostly in the knee area. The growth and changes in young females had an effect on cutting, jumping and landing skills. As a result there was an increased risk of injuries in the lower extremity (Quatman *et al.* 2006: 811).

Studies above reported no similarities with different lower extremity alignment measurements. This could be due to the fact the first study (Mohamed, Useh and Mtshali 2012: 178) had a small sample and the number of injuries and participation time may not have been measured correctly, as players had to recall information from the past. The other study (Daneshmandi, Saki and Shahheidari 2011: 49) had a larger sample size and lower limb alignment characteristics may have changed the position of the anatomical landmarks used to measure the Q angle.

According to Hewett (2000: 315) the study related the effects of the female hormones (estrogen, progesterone and relaxin) on the female neuromuscular and musculoskeletal

systems. Studies reported increased joint laxity and decreased motor skills among females especially during menstrual cycle (Hewett 2000: 322).

Overall female sport players have reported high incidence of knee injury and will possibly remain a multifactorial concern. Thus, the differences in injury rates could be related to differences in sports activities and training levels but not physiological or structural differences (Hewett 2000: 316).

Thigh, hip and groin pain

Hassabi *et al*. (2010: 203) reported that the professional soccer team had more than 80% of injuries that occurred in the lower limbs mainly in the thigh and groin areas. According to Paajanen *et al*. (2011: 263) more groin injuries occur in soccer than in any other sport, however Eirale *et al*. (2013: 115) stated that the thigh was the most frequent injury location at 41.9%. Walden, Hagglund and Ekstrand (2005: 545) stated that the literature was unclear on whether the risk of thigh strain (81%) had increased during recent years, or if it was a relative increased risk due to a decrease in ankle sprains (67%).

Low back pain (LBP)

According to Houghton (2010: 7) the majority of LBP was found to be self-limiting and non-specific. In addition LBP is more common in young females with increasing age, levels of activity and during periods of rapid growth. A study by Walden, Hagglund and Ekstrand (2005: 543) reported that the most common overuse injuries produced low back pain. Low back pain is associated with sports involving repetitive extension, flexion and rotation, such as soccer, dance, cricket and gymnastics (Houghton 2010: 1). Lower back pain was reported to occur in 58% of soccer players (Iwai *et al*. 2004: 1298). A study by Purcell and Micheli (2009: 212) showed that 27% of back pain occurred in college soccer players, of which 47% of young female sport players sustained posterior

elements of the spine (pars inter-articularis) injuries. There were more common compared with disc-related pathology at eleven percent.

Contact sports such as soccer or rugby not only produced acute injuries but players presented with lower back pain which was found to be structural (Purcell and Micheli 2009: 220). Boden and Jarvis (2008: 76) reported an extremely low risk of severe spine injuries in sports. The study further stated that continued research into the epidemiology and mechanisms was vital to the future prevention of back injuries. According to Dvorak and Junge (2000: S7), male participants who suffered from muscle strains had a higher incidence of lumbar lordosis, sway back and abnormal knee interspace. Furthermore back injuries were associated with poor shoulder symmetry, scapular abduction, back asymmetry and abnormal back curvatures (kyphosis, lordosis, and scoliosis).

Shoulder and elbow injuries

According to Longo *et al.* (2012: 139) few studies focused on shoulder injuries in soccer players. Le Gall, Carling and Reilly (2008: 283) reported that shoulder injuries in female players represented two percent of total injuries and elbow as well as wrist/hand injuries were not common. Similarly, Tegnander *et al.* (2008: 197) reported shoulder, arm and elbow injuries at two percent in female soccer players.

Kaplan *et a*l. (2013: 43) reported that most of the shoulder injuries were due to player-to-player contact. Similarly, Chomiak *et al*. (2000: S62) found a high incidence of contact injuries compared with non-contact mechanisms in shoulder injuries. In addition, traumatic injuries (fractures and dislocations) were reported and goalkeepers did not suffer severe shoulder injury. Scase *et al*. (2012: 209) reported that shoulder injuries were significant and were associated with matches missed. The average number of matches missed due to shoulder injuries was 4.41.

Head and neck

Limited studies (Giannoti *et al*. 2010: 908; Koutures and Gregory 2010: 412; Braham, Finch and McCrory 2004: 452) have examined the epidemiology of head injuries amongst youth soccer players. Head injuries accounted for 15% of all reported injuries in youth soccer players reported at a hospital (Giannoti *et al*. 2010: 908). The incidence of head injury varied, with different studies reporting rates of 3% and 17% (Koutures and Gregory 2010: 412; Braham, Finch and McCrory 2004: 452). Contact of the player with the ball was responsible for more head injuries in females between 15–19 years of age compared to their male counterparts (Cusimano *et al*. 2013: 2).

Junge *et al*. (2006: 567) found that the head was most frequently injured (21%) during contact with another player, and the majority (91.9%) occurred during matches (Braham, Finch and McCrory 2004: 452). Picket *et al*. (2005: 231) found that head injury was also associated with contact with balls (26.4%) and only some players developed the skill of purposefully heading the ball to prevent injury. Pickett *et al*. (2005: 229) reported acute soccer-related injuries with a focus on head trauma. Most of the head injuries were superficial (18.7%) and had open wounds (24.7%) followed by minor head injuries (16.2%), concussion (14%) as well as eye injuries (15.3%).

2.5.3 Severity of Injury

The severity of an injury has been defined as minor, moderate or severe as determined by the length of time a player was absent from matches and training per month. Injury resulting in absence for four to seven days was considered a minor injury, eight to 28 days was considered a moderate injury, and 28 days or longer as severe injuries (Walden and Ekstrand 2013: 328).

Increased involvement of young players in sports from an early age through the years of growth raised concern about the risk and severity of injury (Caine, Maffulli and Caine

2008: 19). In professional soccer teams playing in the Premier league in Iran, it was found that nearly 80% of acute injuries resulted in an absence of one week and were classed as a minor injury, while 14% of injuries were moderate in severity and seven percent were major injuries. Chronic injuries, however, were mild to moderate in severity only (Hassabi *et al*. 2010: 204). Faude *et al*. (2005: 1696) found that more than half of the severe injuries involved the knee. According to Peterson *et al.* (2000: S56) the severity of an injury differs depending on the level of experience of the players. Similarly Sharma, Luscombe and Maffulli (2003: 247) reported that the severity of the injury was related to the players' level of skill. As a result male soccer players sustain more severe injuries, possibly due to their aggressive playing, while most young females have not mastered the skill or may be incompetent and under pressure from the coaches to perform (Mahlangu 2006: 3).

2.5.4 Mechanism of Injury

Agel *et al*. (2007: 271) classified injury mechanisms based on direct contact with a player, non-contact and other contact (for example balls, goals, and ground). Few injuries were sustained by contact and the majority occurred with no contact (Chomiak *et al*. 2000: S59). Similarly, Hawkins *et al*. (2001: 46) stated that 38% and 58% of injury mechanisms were classified as being contact and non-contact respectively. The study further specified that about half of the injuries provoked from player to player contact included tackling, being tackled, and collisions, whilst the remainder resulted from non-contact which was running, shooting, turning and heading.

Rahnama, Reilly and Lees (2002: 355) noted 16 injuries producing soccer-specific playing actions, which were dribbling the ball, goal catch, goal punch, goal throw, heading the ball, jumping to head, kicking the ball, making a tackle, making a charge, passing and receiving a ball, shot on goal as well as set kick and throwing the ball. Each action with its own definition in the study was associated with higher injury risk than others such as a tackle (Rahnama, Reilly and Lees 2002: 356).

Common injury mechanisms involved tackling, running, shooting, twisting, turning, as well as jumping and landing (Wong and Hong 2005: 480). Tackling is a skill in soccer where a player attempts to take possession of the ball. As a result injury can occur when the player cannot respond quickly enough to avoid rapid and unpredictable movement. Giza *et al.* (2003: 554) reported that the majority of foot and ankle injuries were caused by tackles, where lateral or medial forces created a corresponding eversion or inversion rotation of the foot or ankle, while running, twisting and turning was due to inferior playing surfaces and inappropriate footwear. In addition, jumping and landing were important components of activities such as heading and goalkeeping in which incorrect landing technique and collisions between players after take-off and before landing caused injuries.

2.5.5 Management of Injury

According to Hawkins *et al*. (2001: 43) the process of injury prevention can be considered in four stages: First, the extent of the injury must be identified and described. Second, the factors and mechanisms that play a part in the occurrence of injuries have to be identified. Third, preventive strategies must be implemented based on the first and second stage; and finally, strategies are evaluated to see effectiveness.

Chomiak *et al*. (2000: S64) reported that the most common treatment used in male adolescent soccer players was the application of a cold pack. Parkkari and Kujala (2001: 993) stated that the injury management strategies in soccer included pre-season medical screenings, proprioceptive training, rehabilitation and educational injury awareness intervention among teams. As a result, exercise-based plans were considered to be effective to prevent soccer injuries (van Beijsterveldt *et al*. 2013: 262).

The risk of sustaining injuries in sports depends on the sports medicine team to assess and manage a player's injury as soon as possible (Owoeye, Nwachukwu and Akinbo

2012: 60). Rapoo (2009: 49) stated that soccer injuries amongst Premier Soccer League (PSL) teams were managed by qualified professionals. Furthermore full range of movement and adequate strength were used as criteria for a return to sport. Thus concussion evaluation and the return-to-play in youth sports must be considered (Khurana and Kaye 2011: 9). Rehabilitation after an injury was inadequate for male soccer players and 41% of the injured players were treated by a physical therapist (Chomiak *et al.* 2000: S65). The preventative measures should be based on severity, mechanisms and risk factor for injuries to assess effective treatment (Faude *et al*. 2006: 789).

2.6 Risk factors for injury

Murphy, Connolly and Beynnon (2003: 13) noted that risk factors in soccer can be classified as intrinsic (person-related) and extrinsic (environmental–related). The risk factors were dependent on age, gender, adequate rehabilitation, lack of physical fitness, level of play or less skill and training, position played, and equipment and playing field surfaces.

2.6.1 Age and Gender

Age is an intrinsic factor that plays a role in contributing to lower limb injury (Murphy, Connolly and Beynnon 2003: 15). Increased injury incidence has been reported with increased age among soccer players (Chomiak *et al.* 2000: S63). A study by Osternberg and Roos (2000: 283) reported that players older than 25 years had a significantly increased risk of overall injury in comparison with younger players. Similarly, Chalmers, Samaranayaka and McNoe (2012: 71) found a higher incidence of injury in older soccer players when compared to young soccer players. This was because older female players were reported to be smokers, had a history of two or more injuries in the last year and played against medical advice, or while recovering from an injury. In addition, higher body mass index (BMI) and temperatures as well as

very hard ground conditions were associated with a higher risk of injury in older female players.

Some studies have found that younger soccer players, however, were more at risk of injury when compared to older soccer players (Peterson *et al.* 2000: S56; Le Gall, Carling and Reilly 2008: 281; Walden *et al.* 2011: 9). A similar result were obtained in a study of amateur female players in which injury rates were higher in the younger groups due to increased intensity of play in higher divisions, and was found possibly due to physiological immaturity or underreporting of minor injuries in the older age groups. Minor injuries occurred mostly in the under 14 year age group (Emery, Meeuwisse and Hartmann 2005: 1889). Injuries in the less skilled younger players were considered to be due to weaknesses in technical and tactical ability as well as in muscle strength, endurance, and co-ordination (Peterson *et al.* 2000: S56). Therefore, playing against older, mature and heavier opponents may have led to a higher incidence of injury in younger players (Söderman *et al.* 2001: 302).

Being female was identified as a risk factor for soccer injuries (Chalmers, Samaranayaka and McNoe 2012: 71). According to Murphy, Connolly and Beynnon (2003: 17) female soccer players suffered more serious knee injuries compared to male soccer players due to the difference in anatomical structures, hormonal and neuromuscular factors. As a result, female players had two to three times more risk of injury of ACL during match play as compared to male players, while the risk of ACL injury in training was the same for both genders (Walden *et al.* 2011: 8). Ankle injuries, however, were common amongst both youth female and male soccer players (Le Gall, Carling and Reilly 2008: 1887; Junge *et al.* 2006: 567) with the higher prevalence in male soccer players (Twizere 2004: 61).

Lincoln *et al*. (2011: 960) found soccer to be the leading cause of concussion in both males and females, with females being twice at risk. A study by Picket *et al*. (2005: 229) stated that most head injuries occurred in males and youth aged 15 to 19 years as

compared to females (ratio was 2.2:1). Cross *et al.* (2013: 3) found females to have significantly lower rates of recurring hamstring strains than males due to differences in the flexibility of the rectus femoris and hamstring muscles. Paajanen *et al*. (2011: 263) reported that more groin injuries occur in soccer than any other sport. As a result male players had acute groin injuries nearly three times more often than females, while chronic persistent groin pain was found in only one male and two female players.

In studies involving both female and male soccer players the incidence of injury is higher per 1000 hours of matches than training (Junge and Dvorak 2004: 930). Wong and Hong (2005: 474) reported that the injury rate was higher in female than male players that and may be due to less skill with experience and not controlling the ball. The players avoided injury-provoking activities such as tackling and sliding. Thus, Yard *et al*. (2008: 1935) stated that high school soccer injury patterns varied by gender.

2.6.2 Level of skill

Soccer is a complex sport where performance is determined by a wide range of technical, tactical and physiological skill qualities (Reilly 2007: 1). Dynamic movement and potential change in different skill qualities of the players occurred during the season. Therefore, players skilled in ball receiving, passing and shooting, and decision-making when in ball possession, experienced a threefold risk of contact injury. Soligard *et al.* (2010: 1121) suggested measuring the skills before the injuries occur and that following-up with prospective repeated assessments throughout the season is important.

2.6.3 Player position

Faude *et al*. (2006: 789) noted that player position has an implication for injury in elite female soccer players. The potential for injury was higher in defenders and strikers compared with goalkeepers and midfielders. Goalkeepers had more upper extremity

injuries. Similarly, Dvorak and Junge (2000: S7) stated that upper extremity injuries seem to involve the goalkeeper position more often than any other player position. Kaplan *et al*. (2013: 41) found that there was no significant correlation between the injured body part or injury type versus player position. A low correlation was, however, observed between injury mechanisms versus field position. Player position injuries were reported higher in defenders (31%) then midfielders (24%) followed by strikers (21%) and goalkeepers (15%).

In contrast, Giza *et al.* (2005b: 213) reported that 34.1% of midfielders sustained a large number of injuries, followed by 28.1% of defenders, in the study of female professional soccer players. Le Gall, Carling and Reilly (2008: 283) stated that comparing young female soccer players in different positions of play may be difficult, as the players may not yet be ready to occupy definitive positional roles. In this study they reached an agreement that the defenders sustain more injuries compared with other positions.

2.6.4 Equipment

One of the contributing factors to sports injuries has been found to be the equipment used. The equipment in soccer consists of the soccer ball, soccer boots, soccer kit as well as protection guards (shin, ankle and knee). Protective equipment is designed to shield different body parts against injury with no restriction of any sports activity (Brukner and Khan 2006a: 87). Above all, Wong *et al*. (2007: 93) stated that 77 % of the equipment that caused injuries was attributed to soccer boots.

Wong *et al*. (2007: 93) reported that a soccer boot was an important item of equipment and when fitted comfortably the foot was protected from external forces. Soccer boots offering poor support to the lower limb caused higher injury rates. Meyers (2013: 2413) found that there was a significant effect between surfaces by soccer shoe (cleat design). A significantly lower incidence of injuries was reported while wearing soccer shoes (a combination of molded cleat design) on astro-turf as compared to a grass field. There was, however, no significant differences among the cleat designs (studded,

combination of molded conical or blade). O' Connor and James (2013: 377) reported that professional soccer players should be educated to select and wear the most suitable boot for their foot profile, according to surface type and surface condition.

Shin guards are designed to minimise the risk of contusions and fractures of the lower leg (Agel *et al.* 2007: 275). Failure to wear shin guards has been reported to cause leg injuries in soccer players (Dvorak and Junge 2000: S6). In contrast, Agel *et al.* (2007: 275) stated that the wearing of shin guards was not significant or recognizable in decreasing the ankle and lower leg injury rate as shin guards became compulsory equipment during match play in 1991. Boden *et al.* (1999: 264) suggested, however, that 90% of lower leg fractures occurred while shin guards were worn.

2.6.5 Field surface

According to Kordi *et al*. (2011: 3), there were differences in the incidence and type of soccer match injuries sustained on grass fields and astro-turf (artificial grass). The overall incidence of match injuries for men was 36.9 injuries/1000 player hours on grass field and 19.5 on astro-turf. More ankle injuries occurred when playing on the grass while more knee injuries were sustained on the astro-turf. Similarly, 693 injuries were reported with 272 (39.2%) injuries occurring on astro-turf and 421 (60.8%) on grass field. As a result there were fewer traumatic injuries on the astro-turf field (Meyers 2013: 2412). Sousa, Rebelo and Brito (2013: 148) however, reported a higher injury incidence on astro-turf field. Although in this study the soccer players only trained and played matches on astro-turf, there were injuries sustained more during matches than in training sessions as well as during the pre-season.

Williams, Hume and Kara (2011: 921) found strong evidence overall for a slight difference in injury incidence rates between astro-turf compared with grass field. There was a severe injury in young female soccer players and increased risk of ankle injury on astro-turf field. Although no clear differences between surfaces were evident in relation to training and match injuries, there was however potential mechanisms for differing

injury patterns on astro-turf compared with grass field. As a result, changing between surfaces may be a basis for injury in soccer.

Ekstrand, Hagglund and Walden (2011a: 828) stated that the majority of injuries affected the lower limb on the grass field at 81% and astro-turf at 87%. The findings in this study were found to be in contrast with the studies mentioned above and concluded that the injury risk did not change significantly when playing soccer on astro-turf surfaces compared to playing on grass field. The overall injury incidences were similar on the two surfaces.

2.6.6 Warm-up and pre-season conditioning

According to McNoe and Chalmers (2011: 485) warm-up, cool-down and stretching were utilised exercises of soccer activities. The warm-up was inclusive of aerobic activity, dynamic stretching and soccer-specific skills while the cool-down included aerobic activity, dynamic and static stretching. McNoe and Chalmers (2011: 485) reported that almost all the soccer players warmed-up for matches and training. Warming-up for training was shorter than for matches and most commonly included aerobic activity, static stretching, exercise and cooling down. In addition, female players were more likely than male players to cool-down after matches. In a study by Walden *et al.* (2012: 4) neuromuscular warm-up programmes significantly reduced the rate of ACL injury in young female soccer players.

Agel and Schisel (2013: 35) reported that pre-season training was responsible for an overall higher number of injuries as compared with in-season and post-season training injury rates across all sports. A combination of balance and control exercises, eccentric hamstring, plyometrics and strength exercises emphasised useful prevention of all lower limb injuries (Andrew *et al*. 2013: 758). Drawer and Fuller (2002: 451) reported that playing soccer when not fully fit exposes players to a high risk of re-injury. Fatigued sport players have decreased skill performances, which can lead to injury (McGrath and Ozanne-Smith 1997: 35). Accordingly, promoting and encouraging proper warm-up

exercises, strengthening, endurance and stretches prior to matches or training sessions is necessary. Regular training exercises may result in a reduction of training and overuse injuries (Junge *et al.* 2002: 657).

2.7 Comparison of injuries sustained during training and matches

According to Agel *et al*. (2007: 275) the rates and patterns of high school sport injuries differed between training and matches. Matches were consistently recognised to have a higher injury risk than training due to full contact between players as a consequence of aggressiveness and the competitive nature of the sport (Yard *et al.* 2008:1931; Emery, Meeuwisse and Hartmann 2005: 1889). Wong and Hong (2005: 474) however reported that injury rates were higher during matches for male players, possibly due to higher match levels with greater speed of movement and more body contact, while injury rates for female players were higher during training.

During matches, injuries occurred mostly during the second half of the remaining fifteen minutes of the match, while the majority of training injuries resulted from non-contact mechanisms (Agel *et al.* 2007: 271; Dick *et al.* 2007: 280; Sousa, Rebelo and Brito 2013: 147). As a result higher rates of injury during matches may be due to increased play intensity (Giza *et al.* 2005b: 213). On average, the incidence of injuries during soccer matches was four to six times higher than during training (Junge and Dvorak 2004: 930).

2.8 Medical and nutritional profile

Physicians treating the youth are aware of the physiological and developmental differences between the youth and adults (Adirim and Cheng 2003: 80). Mullinix *et al.* (2003: 590) reported that the common health condition impacting negatively on breathing and performance in females' soccer players was asthma, due to inappropriate treatment.

A nutritional plan is a vital component for sports players' training programmes. Female diets have lacked key components that could affect both health and performance on the sports field (Gibson *et al*. 2011: 513). Kirkendall (2004: 5) reported that there was no evidence that supplements such as creatinine was beneficial to soccer. Gravina *et al*. (2012: 8) reported a link between nutritional intake and muscle damage when 28 female soccer players completed an 8-day dietary record and played a match the same week. It was suggested that preventing the adverse physiological effects provoked by soccer matches would benefit the players.

There is limited information on the nutritional and hydration strategies in female soccer players (Maughan and Shirreffs 2007: i60). Maughan and Shirreffs (2007: i62) found that dehydration adversely affects skill and stamina in both males and females. Ali (2007: 31) found that in women soccer team, hydration had an impact on performances and recommended fluid intake. Similarly, Adirim and Cheng (2003: 80) stated that it was important to remind soccer players to frequently hydrate during training and matches. Mullinix *et al.* (2003: 589) found that all women responded correctly to questions relating to the importance of hydration. Therefore proper hydration before exercise, and losing small amounts of fluid as sweat during exercise, could be the reason why the female players in the study by Ali (2007: 29) did not suffer from a loss of soccer skill performance. The study reported that small fluid losses could be easily replaced, whereas other studies suggested that dehydration of over one percent should be avoided as it can impact on performance and health (Coyle 2004: 42).

2.9 Conclusion

This literature review focused on all the aspects that pertained to the current study. Although many studies on epidemiology of injuries in high school female soccer players have been evaluated, only a few studies have been reported in South Africa. This research therefore aimed at investigating the epidemiology of injuries in high school soccer players in the eThekwini district.

CHAPTER 3

Methods

3.1 Study design

A quantitative approach using a retrospective descriptive survey was used to allow an investigation of the epidemiology of injuries in female high school soccer players in the eThekwini district.

3.2 Study setting

There are 60 high schools in the eThekwini district, KwaZulu-Natal (KZN). Only the 27 schools which offered soccer to female learners were invited to participate in this study.

3.3 Population and Sampling

Multi-stage sampling was used in order to optimise the response rate and minimise resources and time needed. Multi-stage sampling is a sampling method where the sampling units at each stage are sub-sampled from the larger units chosen at the previous stage (Levy and Lemeshow 2008: 20). The multi-stage sampling used in this study is described below:

First stage: The eThekwini district was identified as a study setting by convenience to allow access with minimal budget. The eThekwini district consists of two sub-districts, namely Pinetown and Umlazi. Both sub-districts were included in the study.

Second stage: Each sub-district serves four circuits. One circuit was conveniently chosen from each sub-district, namely the Umhlathuze circuit from the Pinetown sub-district, and the Central Durban circuit from the Umlazi sub-district, for participation in the study to allow convenient accessibility for the researcher to the schools in the two circuits.

Third stage: The Umhlathuze (City of Durban) circuit has 29 public high schools with ten offering soccer to female learners. The Central Durban circuit has 31 public high schools with 17 offering soccer to female learners. The high schools selected were public with the exception of one independent high school according to the sub-district listing by the Department of Education KZN.

Fourth stage: The population of participants included all female soccer players between the ages of 14 and 19, who were not pregnant and played soccer for at least one or more seasons, in the selected schools. The calculated sample size was met from selected schools. The population size was 400 and the sample size required was a minimum of 197 participants at a confidence level of 95%, as suggested by the statistician (determined using Raosoft Statistical Software). Two hundred players were invited to participate and if the total number of players who were willing to participate was low or dropped out due to the consent form not being signed, and then additional players from the lists of players in each school were invited to participate to account for attrition. All invited learners agreed to participate and signed a letter of informed assent (Appendix B1) and were in possession of signed letter of consent if applicable (Appendix B2).

3.4 Instrumentation and outcome measurements

Data was collected using a self-administered questionnaire.

3.4.1 Questionnaire

The questionnaire was developed and categorised to gather relevant information to achieve the aims and objectives of the study, based on studies by Archary (2008: 78); Mahlangu (2007: 76); Twizere (2004: 120); Gabbe *et al.* (2005: 107) as well as Hawkins and Fuller (1998: 141). The questionnaire for this research was limited to English only. The content of this validated questionnaire sought to obtain similar data as that reported by the researchers mentioned above. The questionnaire was developed to meet the objectives of the study and suit the study design. The questionnaire elicited information regarding the subjects' demography, injury data, equipment and treatment, as well as medical and nutritional profiles. The profile of high school female soccer-related injuries that players sustained over the previous season was also sought. Questions were closed-ended.

3.4.2 Validity (Face and construct)

The purpose of the expert group was to develop the face and construct validity of the developed questionnaire. Face validity is based on a consensus among the researchers and those who participated in an expert group. Content validity is achieved when an instrument has appropriate content for measuring a complex concept. Construct validity determines how accurately the answers to questions in a questionnaire reflect theoretical predictions of a particular construct (Black 1999: 299).

To validate the questionnaire, at least eight participants were required for the expert group to show the best result, according to Salant and Dillman (1994: 29). The expert group used in this study consisted of eight experts, including a Chiropractor who had completed a research survey; one Homoepath (co-supervisor); two Chiropractic students with experience in the treatment of soccer injuries; a Chiropractor who manages sports injuries; Durban University of Technology (DUT) female soccer coach; the DUT sports administrator (Biokineticist); and one DUT female football player who received treatment for soccer injuries. Each expert read a Letter of Information

(Appendix F1), signed an Informed Consent Form (Appendix F2), as well as a statement of confidentiality (Appendix F3) and Code of Conduct (Appendix F4). The participants were allowed to comment on how the questionnaire could be modified in order for it to be used to achieve the aims and objectives of the study. The changes required are described in Appendix C1. A physiotherapist and statistician were also consulted for assistance in structuring the questions in order to make data analysis possible. Injuries were interpreted by the expert group then recorded their injury data on pre-established questionnaire designed for this study. The researcher had pre-established questions and pre-set response categories in the form of tick-box option on which quantitative data had to be recorded. The pre-established questionnaire was adapted from validated ones in those used in various literatures (Finch, Valuri and Ozanne-Smith (1999: 51); Junge and Dvorak (2000: S42) and Fuller *et al.* 2006: 195).

Content validity

The questionnaire was administered to an independent sample of 20 school soccer players in order to improve the structure, layout, language and understanding of the tool. In addition it also determined whether the questionnaire would yield the correct and necessary information, as well as if there was a reasonable amount of time allocated for the task (Beatty *et al.* 2004: 377). The changes made to Appendix G are reflected in Appendix E. The aim of this research study was to present standards for injury surveillance of high school matches and tournaments for soccer seasons. The National High School Sports-Related Injury Surveillance System in this study was implemented (Yard, Collins and Comstock 2009: 647).

3.4.3 Reliability

The reliability of data collected was ensured by one researcher administering all the questionnaires.

3.5 Procedure

After Institutional ethical approval, permission to conduct the study was obtained from the Department of Education KZN (Appendix A1). Once approval from the Department of Education (DoE) was obtained, the researcher visited the high schools to request permission from the principals (Appendix A2) to conduct the research. On day one of the study, the researcher explained briefly what the research was about to the learners; and information letters (Appendix A4) were handed out to the learners who were 18 and 19 years old. Learners who were younger than 18 years of age were given parental or guardian information letters (Appendix A3) and parent consent forms (Appendix B2) to be signed in order to participate in the study. On day two of the study, learners 18 years and older were given assent forms (Appendix B1) which was signed and returned to the investigator. Learners who had consent forms signed by their parents or guardians were given their information letters and the research process explained to all. Thereafter, respective assent forms were signed. All the consent and assent forms were collected prior to the questionnaires being handed out to the learners. The researcher explained to the learners how to complete the questionnaires, which took approximately ten minutes of their time. All participants were informed that they were at liberty to withdraw from the study at any time, without reason and without repercussion.

The researcher was present to answer any questions posed by the participants, and the researcher collected the completed questionnaires. Participants were informed that their identity will be kept confidential (will be coded), in the recording, analysis and reporting of the data. The data was collected during breaks or after training and/or after school without interfering with school activities.

Once all the questionnaires were completed and handed in, the researcher placed them in an envelope. Only the researcher and the research supervisor had access to collected data (to ensure participant confidentiality). All participants were thanked and

informed that should they wish to know the outcome of the study; a presentation could be arranged through the principal or coach**.**

3.6 Data analysis

Data was collected and analysed using SPSS version 20.0. The statistical analysis included the following:

- Descriptive statistics using frequency and cross-tabulation tables and various types of graphs, and means and standard deviations.

- Inferential statistics using Pearson's correlations to correlate protective equipment, number of injuries and injury severity.
- Testing of hypotheses using chi-square tests for nominal data. The relationship between type and mechanism of injuries was analysed using chi-square tests. The relationship between location of injury and player position was analysed using chi-square.
- Testing hypotheses using ANOVA (factorial).

Inferential analysis was performed at a 0.05 level of significance.

CHAPTER 4

Results

4.1 Introduction

This chapter presents the results using tables and figures. Demographic data will be presented first, followed by the prevalence of soccer injuries in female high school soccer players in the eThekwini district. Subsequently, the results related to the profile of soccer injuries sustained by female players and injury risk factors will be reported. This chapter also compares soccer injuries during training and matches.

4.2 Response rate

A total of 173 questionnaires from eight high schools in the eThekwini district were returned, making up a return rate of 88%. This was from schools that had active female soccer schedules. Only eight schools participated in the study because the other 19 schools that offered soccer were either not currently active in soccer during the study or did not want to participate in the study. Only 85 questionnaires making up 49% were usable since the others were incomplete and therefore eliminated from the data analysis.

4.3 Demographic profile of the participants

Objective One: ***To determine the demographic profile of female high school soccer players in the eThekwini district***

4.3.1 Age

The age distribution of the 85 participants who submitted usable questionnaires is illustrated in Figure 4.1. The majority of the participants were 15 years of age (29.4%) followed by 16 years of age (24.7%). The mean and standard deviation of the age were 15.85 ± 1.32 years respectively.

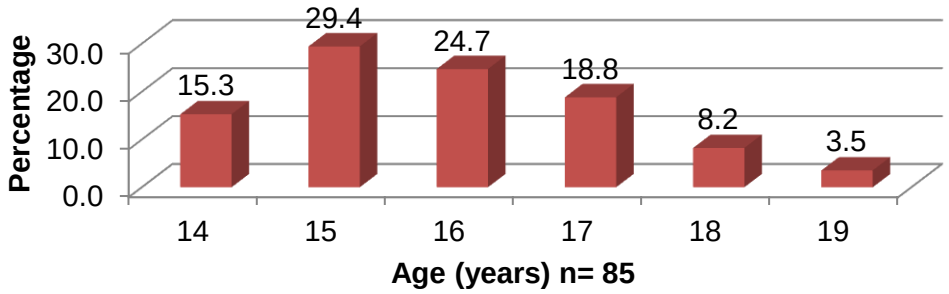

Figure 4.1 Percentage of participants by age category

4.3.2 Demographic data and history of other sports

Of the 85 female soccer players who participated in the study the majority of 70 players were from the Umlazi sub-district and 15 players from the Pinetown sub-district. The participants of each district according to race, age, team, player position and other sports are shown in Table 4.1. Sixty-eight percent of players were African, 15.3% were White players followed by Coloured players at 14.1%.

The majority of the participants were in the U15 age group (37.6%) and most participants played in the first team (82.9%) in the last season and tournaments in both sub-districts. The distribution of participants by playing position shows that the largest number of players in both sub-districts were defenders (38.8%), followed by midfielders (29.4%) and strikers (23.5%). Most of the participants also played other sport (63.5%).

Table 4.1 Number and percentage of participants from each sub-district according to race, age, team, player position and other sport played.

eThekwini District							
		Umlazi		**Pinetown**		**Total**	
		n	**%**	**n**	**%**	**n**	**%**
		70	82.4	**15**	17.6	85	100
Race	African	52	74.3	6	40	58	68.2
	Coloured	10	14.3	2	13.3	12	14.1
	Indian	1	1.4	1	6.7	2	2.4
	White	7	10	6	40	13	15.3
Age group played last season	U15	26	37.1	6	40	32	37.6
	U16	20	28.6	7	46.7	27	31.8
	U17	7	10	1	6.7	8	9.4
	U18	14	20	0	0	14	16.5
	U19	3	4.3	1	6.7	4	4.7
Team	A	58	82.9	9	60	67	78.8
	B	10	14.3	5	33.3	15	17.6
	C	2	2.9	1	6.7	3	3.5
Player position	Goal Keeper	3	4.3	4	26.7	7	8.2
	Defender	29	41.4	4	26.7	33	38.8
	Midfielder	19	27.1	6	40	25	29.4
	Striker	19	27.1	1	6.7	20	23.5
Other sport	Yes	45	64.3	9	60	54	63.5

n = number of participants

4.3.3 Years of participation in school soccer

The experience of the female soccer players ranged from one year to nine years (mean= 2.92 years; and SD= 1.88 years). Figure 4.2 illustrates that more players had one and two years of experience playing school soccer at 30.6% and 22.4% respectively. The percentage of players with four to nine years of experience playing soccer was low.

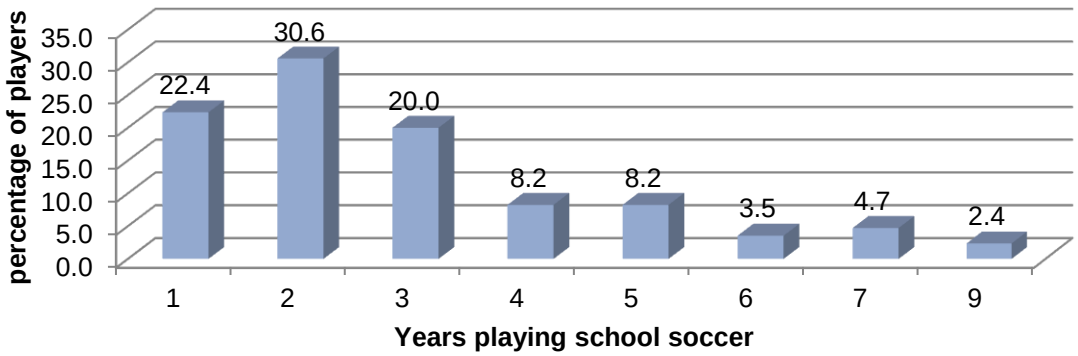

Figure 4.2 Percentage of players by number of years playing school soccer

4.4 The prevalence of soccer injuries

Objective Two: ***To determine the prevalence of injuries in female high school soccer players in the eThekwini district.***

4.4.1 Prevalence of injury

The prevalence was calculated from the total players in both the sub-districts who at least sustained one or more injuries at any time (of training or matches) from soccer activity. Overall 71.8% of the participants sustained injuries. The majority of injured

participants had at least one injury. Of all the reported injuries only two participants had five injuries. A significant proportion of players reported no injuries. This is illustrated in Table 4.2.

Table 4.2 Prevalence of injury in participants

Number of injuries	n = 85	%
0	**54**	**63.5**
1	19	22.4
2	3	3.5
3	2	2.4
4	5	5.9
5	2	2.4
	31	**36.5**

n = number of participants

4.5 Profile of soccer-related injuries

Objective *Three: to determine a profile of soccer-related injuries sustained by female soccer players over the last season.*

4.5.1 Type of injury

Figure 4.3 shows the proportions of the types of injury sustained. Muscle injury accounted for the highest proportion of injuries (23.5% $p < 0.001$). Bruising was less common at almost eleven percent of all injuries.

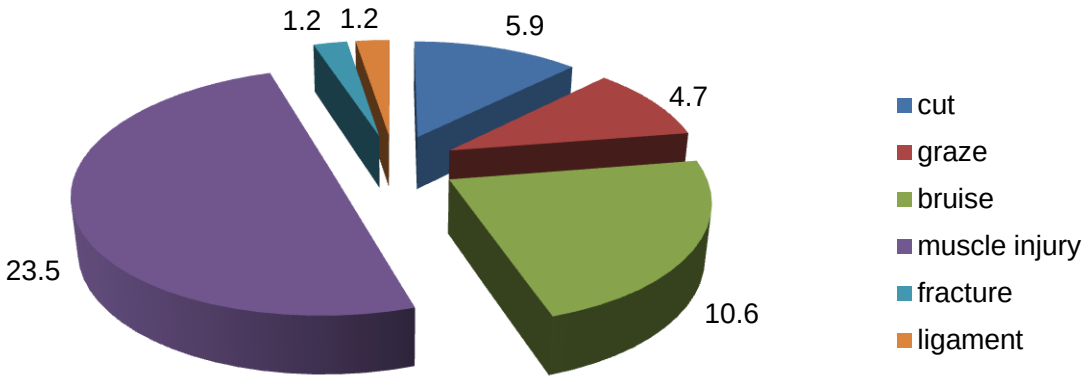

Figure 4.3 Percentage of type of injuries reported by participants

4.5.2 Location of injury

Figure 4.4 shows the body parts injured by the 31 participants who sustained injuries. The most affected body part was the knee at 16.5% ($p < 0.001$) followed by the ankle almost twelve percent. Lower limb injuries were the most common (56.5%) compared to upper limb injuries (17.8%).

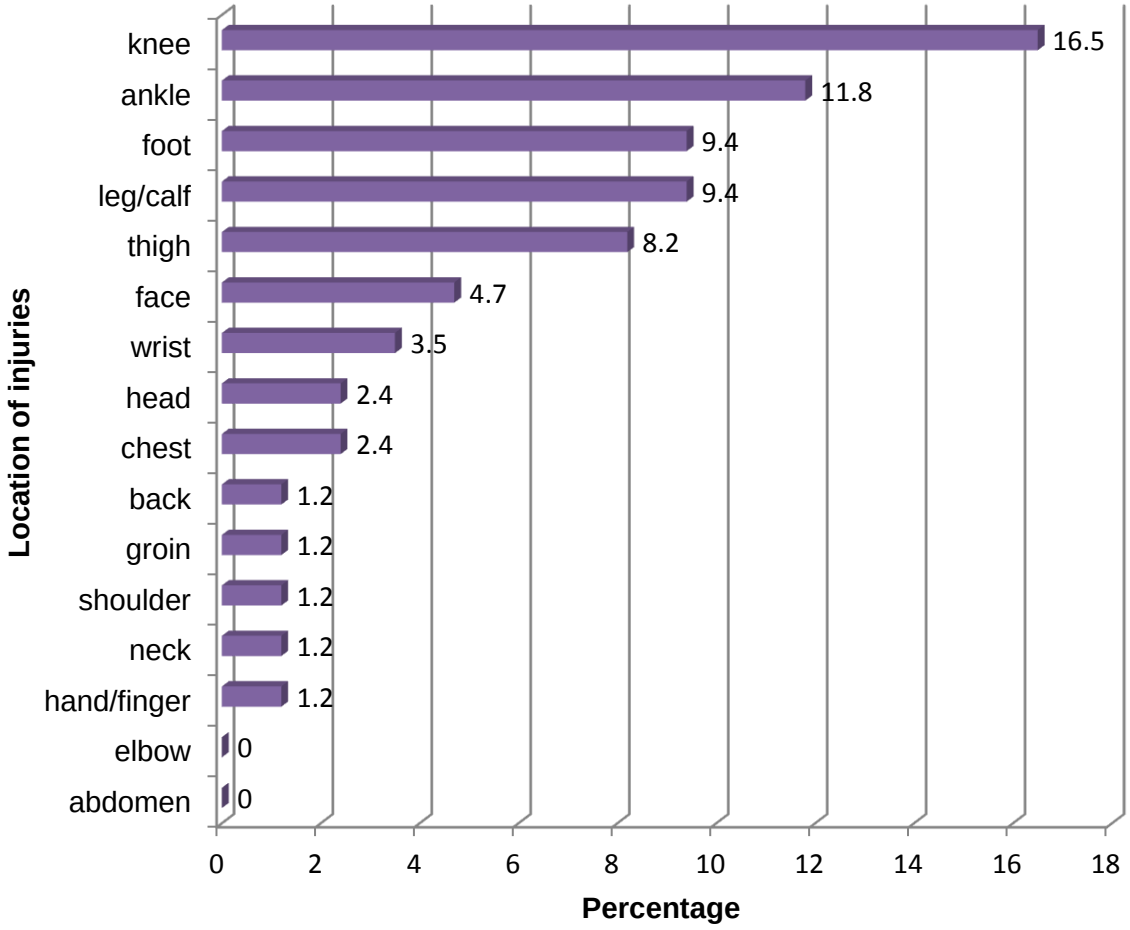

Figure 4.4 Percentage of specific injured body parts reported by participants

4.5.3 Severity of injury

Table 4.3 shows the distribution of “severity of injury”. Injury severity was defined as the number of days that elapsed between the dates of injury to the date the players returned to full participation in soccer as defined by Fuller *et al.* (2006: 197). Only four respondents stopped participating in soccer as a result of injury or injuries. Of the four, three participants had severe injuries and one had moderate injuries.

Table 4.3 Number and percentage of severity of injury

		n	%
Did you stop playing soccer as a result of injury or injuries?	Yes	4	4.7
	No	27	31.8
How long have you been unable to participate in soccer for?	2 weeks	1	3.2
	2 months	2	6.5
	6 months	1	3.2

n= number of participants

4.5.4 Mechanisms of injury

The mechanisms by which players were commonly injured during soccer are shown in Figure 4.5. The majority of the injuries were sustained due to collision with another player at 12.9% ($p < 0.001$) followed by running at almost twelve percent, tackling and landing at nine percent and seven percent respectively.

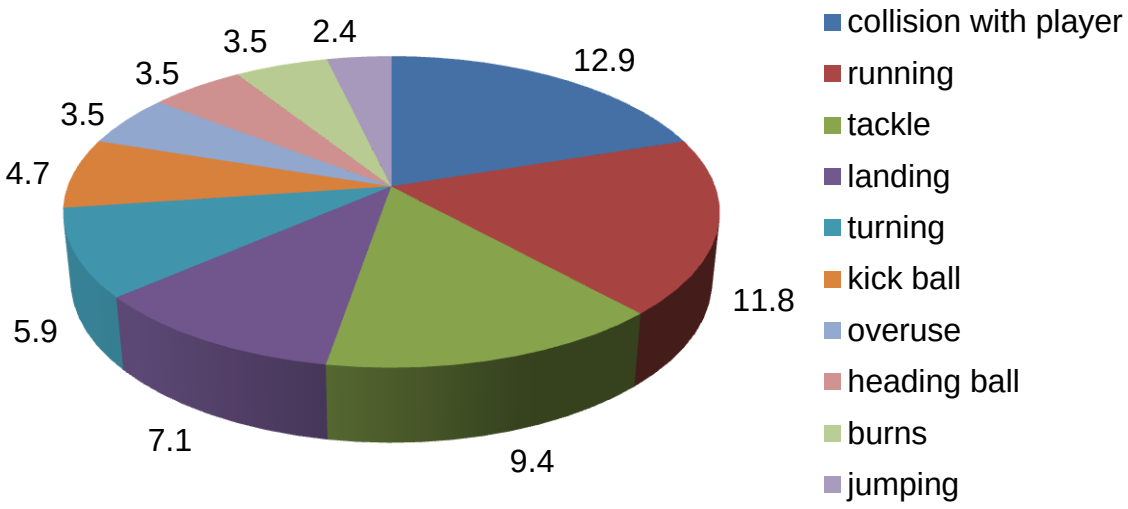

Figure 4.5 Percentage of participants reporting specific mechanisms of injury

4.5.5 Relationship between types of injury and mechanisms of injury

Types of injuries relating to mechanisms of injury sustained are presented in Table 4.4. Since one or more mechanisms of injury could be reported, the total percentages did not equal 100%. It is shown that running (p< 0.001) at 18.5% followed by collision with another player (p< 0.001) at 17.3% as well as tackle (p< 0.002) and landing (p< 0.139) at 13.6% resulted in the most muscle injuries (52%). Bruises (21%) were mostly sustained during landing (p< 0.012).

Table 4.4 Mechanism and type of injury reported by participants

Type of injury	Mechanisms of injury										
	Ta	**Tu**	**L**	**R**	**HB**	**J**	**O**	**C**	**KB**	**B**	**Total (%)**
Cut	1 (16.7)	0 (0)	1 (16.7)	1 (16.7)	**2 (33.3)**	0 (0)	0 (0)	1 (16.7)	0 (0)	0 (0)	6 (7.4)
Graze	2 (20)	0 (0)	2 (20)	2 (20)	1 (10)	0 (0)	1 (10)	1 (10)	0 (0)	1 (10)	10(12.4)
Bruise	2 (11.8)	2 (11.8)	**3 (17.6)**	2 (11.8)	**2 (11.8)**	**2 (11.8)**	1 (5.9)	2 (11.8)	0 (0)	1 (5.9)	**17 (21)**
Muscle injury	**6 (14.3)**	**3 (7.1)**	**4 (9.5)**	**8 (19.1)**	1 (2.4)	1 (2.4)	**3 (7.1)**	**9 (21.4)**	**4 (9.5)**	**2 (4.8)**	**42 (52)**
Fracture	0 (0)	0 (0)	1 (33.3)	1 (33.3)	0 (0)	0 (0)	0 (0)	1 (33.3)	0 (0)	0 (0)	3 (3.7)
Ligament injury	0 (0)	0 (0)	0 (0)	1 (33.3)	0 (0)	0 (0)	1 (33.3	0 (0)	1 (33.3)	0 (0)	3 (3.7)
Total (%)	11 (13.6)	5 (6.2)	11 (13.6)	**15 (18.5)**	6 (7.4)	3 (3.7)	6 (7.4)	**14 (17.3)**	5 (6.2)	4 (4.9)	**81**

Number of injuries (n),tackle(Ta),turning (Tu),landing (L) run(R),head ball(H), jump(J), overuse(O),collision(C),kick ball(K), burns(B)

4.5.6 Relationship between location of injury and player position

The defenders (31.7 %) and midfielders (28.6 %) accounted for the highest number of injuries reported in Table 4.5. Since two locations (elbow and abdomen) reported no injuries, the total percentages did not equal 100%. The results show that defenders had the highest number of injuries at the leg/calf and ankle (40%) followed by the feet (62.5%). The midfielders had the most knee injuries (35.7%) and ankle injuries were reported at 30.0%. The goalkeepers were the only players who reported three wrist injuries ($p<0.000$) while sustained the knee injuries at 21.4%. The strikers had more thigh injuries (42.9%).

Table 4.5 Location of injury and player position as reported by participants

Location of injury(%)		Goal keeper (%)	Defender(%)	Midfielder(%)	Striker(%)
Head	2(3.2)	0(0)	0(0)	2(100)	0(0)
Face	4(6.4)	0(0)	1(25)	1(25)	2(50)
Neck	1(1.6)	0(0)	0(0)	1(100)	0(0)
Shoulder	1(1.6)	0(0)	0(0)	1(1000	0(0)
Elbow	0(0)	0(0)	0(0)	0(0)	0(0)
Wrist	3(4.8)	3(100)	0(0)	0(0)	0(0)
Hand/finger	1(1.6)	0(0)	1(100)	0(0)	0(0)
Chest	2(3.2)	0(0)	0(0)	1(50)	1(50)
Abdomen	0(0)	0(0)	0(0)	0(0)	0(0)
Back	1(1.6)	0(0)	1(100)	0(0)	0(0)
Groin	1(1.6)	0(0)	0(0)	0(0)	1(100)
Thigh	7(11.1)	2(28.6)	1(14.3)	1(14.3)	3(42.9)
Knee	**14(22.2)**	3(21.4)	3(21.4)	**5(35.7)**	3(21.4)
Leg/Calf	8(12.7)	1(12.5)	4(50)	2(25)	1(12.5)
Ankle	**10 (15.9)**	2(25)	**4(40.0)**	3(30.0)	1(12.5)
Foot	8(12.7)	1(12.5)	**5(62.5)**	1(12.5)	1(12.5)
Total (%)	63	12(19.1)	**20(31.7)**	**18(28.6)**	13(20.6)

Number of injuries (n)

4.6 Management of injury

Objective Four: ***To determine the management of injury***

Treatment received for the injuries is shown in Table 4.6. In terms of self-treatment, ice (29.4%) and rest (nine percent) were the main treatment modalities used. Of the 31 injured players, 27.1% players had been advised to rest, 17.6% of players had been advised to engage in limited sport activity and almost six percent were allowed to continue to participate fully in sport activity after sustaining an injury. Almost 31% of respondents reported having access to healthcare during training or play. The medical or paramedical services (23.5%) followed by coach (nine percent) were most commonly sought to manage the injury. The sport massage therapy (eight percent) was the third most commonly consulted for advice.

Table 4.6 Responses regarding the management of injuries

		n	%
Self-treat	Ice	25	29.4
	Rest	9	9.4
	Stretch	6	7.1
	Elevation	4	4.7
	Compression	3	3.5
	Deep heat	3	3.5
	Plaster	2	2.4
	Antibiotics	1	1.2
Advice for injury?	Rest	23	27.1
	Limit sport activity	15	17.6
	Full sport activity	5	5.9
Healthcare services	Medical/Paramedic	20	23.5
	Coach	8	9.4
	Sports massage therapy	7	8.2
	Physiotherapy	5	5.9
	Biokinetics	2	2.4
	Chiropractic	1	1.2
Access to healthcare during training/match	Yes	26	30.6
	No	35	41.2
	Sometimes	24	28.2

n= number of injuries

4.6.1 Exercises or activities performed during training

The participants reported activities performed during training (Figure 4.6). The majority of the participants did warm-ups (85.9%), jogging (76.5%) followed by stretching (71.8%) during training.

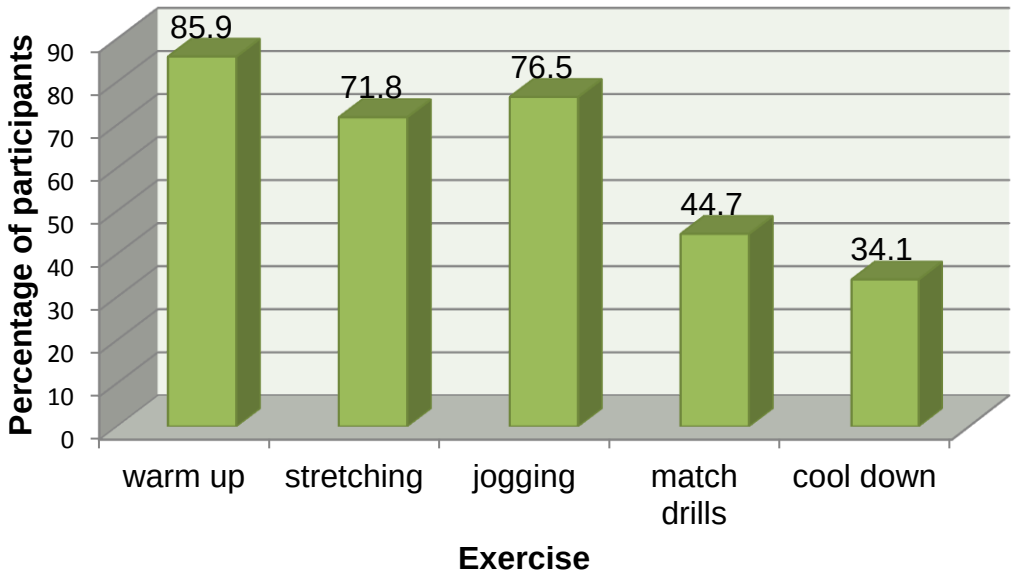

Figure 4.6 Percentage respondents reporting on exercises performed during training

4.7 Medical and nutritional profile

Objective Five: ***To determine the medical and nutritional status as reported by the players***

The participants were requested to report on their medical and nutritional history, which is shown in Table 4.7. Out of the 85 participants, 18 had medical conditions and only 13 participants took medication. The most common medical condition reported was asthma at 16.5%. Only eleven participants reported eating healthy food (12.9%). Healthy food is considered any natural, organic or prepared food popularly believed to promote or sustain good health, as vital nutrients are included. Almost 64% of the participants had sufficient fluid intake of water. Few participants reported taking supplements (18.8%) as part of their diet.

Table 4.7 Number and percentage of responses for each medical and nutritional variable

Medical and nutritional profile		N	%
Medical condition	Asthma	14	16.5
	Anaemia	1	1.2
	Epilepsy	1	1.2
	Type 2 DM	1	1.2
	Low BP	1	1.2
	Total	**18**	**21.3**
Medication	Yes	13	15.3
Diet	Healthy food	8	9.4
	No spices	1	1.2
	No starches	1	1.2
	Vitamins	1	1.2
Fluid intake	Water	54	63.5
	Energy drink	20	23.5
	Herbalife/USN shake	2	2.2
	Black tea	1	1.2
Supplements	Yes	16	18.8

n= number of participants

4.8 Risk factor for injury

Objective Six: ***To identify risk factors for injury***

4.8.1 Equipment

The players were requested to indicate the equipment they used during matches. Table 4.8 shows the frequency with which each type of equipment was used, which included the use of shoes and protective guards when playing soccer. The results show that 63.5% played with soccer boots while 34.1% played using trainers. Out of the 31 injured participants, only 14.1% wore footwear and protective guards when injury occurred.

Table 4.8 Number and percentage responses of equipment used by participants

		n	%
Footwear	Takkies/ Trainers	29	34.1
	Soccer boots	54	63.5
	School shoes	1	1.2
	None	1	1.2
Protective equipment wear when injury occurred	Yes	12	14.1

n= number of participants

4.8.2 Field surface

The participants had to indicate which surface11 is played on during matches and training sessions. Figure 4.7 shows the most field surface played on was grass at 76.5% followed by ground at 22.4% and the least used was astro-turf at one percent.

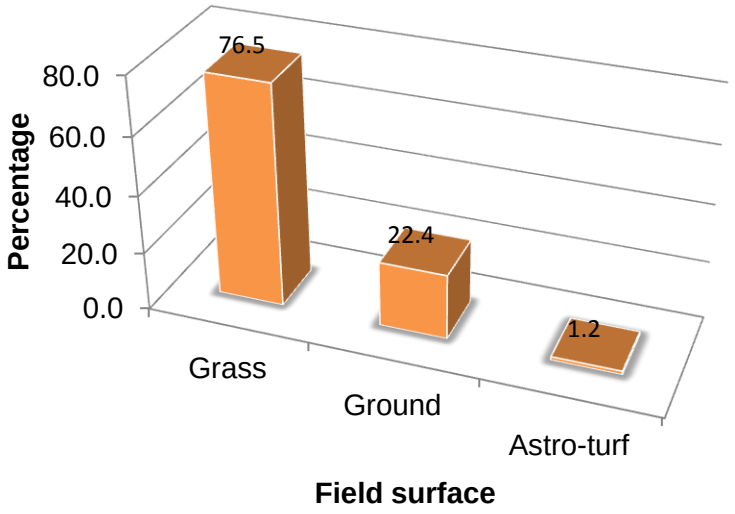

Figure 4.7 Percentage of field surface as reported by participants

4.9. Comparison of injuries during training and matches

Objective Seven: ***To compare injuries occurring during training and matches***

4.9.1 Participation in soccer training and matches

Table 4.9 shows that there were more matches than training sessions. Almost 52% of the respondents participated in one to five matches over the reporting period in the last season, while 40% of female high school soccer players participated in one to five training sessions.

Table 4.9 Number and percentage of participation in matches and training sessions in the previous soccer season

Number of participation in soccer	Match		Training	
	n=85	%	n=85	%
1-5	44	**51.8**	34	**40.0**
6-10	23	27.1	12	14.1
11-15	10	11.8	8	9.4
16-20	3	3.5	11	12.9
>20	5	5.9	20	23.5
	Tournament			
	n=85		**%**	
1-4	**45**		**52.9**	
5-7	16		18.8	
8-12	14		16.5	
>12	10		11.8	

n= number of participants

4.9.2 Injuries during training and matches

Table 4.10 reports the number of injuries sustained during matches and training. Of the 31 participants who reported injuries, more participants (12.9%) were injured during training than during the matches (eight percent). The rate of injuries during training and matches were significant ($p< 0.000$). There were more injuries sustained during training than during matches ($p< 0.001$).

Table 4.10 Number and percentage of injuries occurring during training and matches

Injury occurred during	n	%
Match (M) only	7	8.2
Training (T) only	11	12.9
Both T and M	13	15.3
No injury	**54**	**63.5**

n= number of injuries

Table 4.11 shows the relationship (p-values) between the type of injuries that occurred during soccer training, matches and tournaments. During training, muscle injury was significantly related to training ($p< 0.001$). During matches, grazes ($p< 0.000$) and bruises ($p< 0.002$) were significant.

Table 4.11 Relationship between Injury type during training and matches

p-values			
Type of injury	**Training**	**Match**	**Tournament**
Cut	0.699	0.098	0.569
Graze	0.081	**0.000**	0.012
Bruise	0.033	**0.002**	0.048
Muscle injury	**0.001**	0.119	0.536
Fracture	0.600	0.482	1.000
Ligament injury	0.224	0.212	1.000

4.9.3 Protective guards worn during training and matches

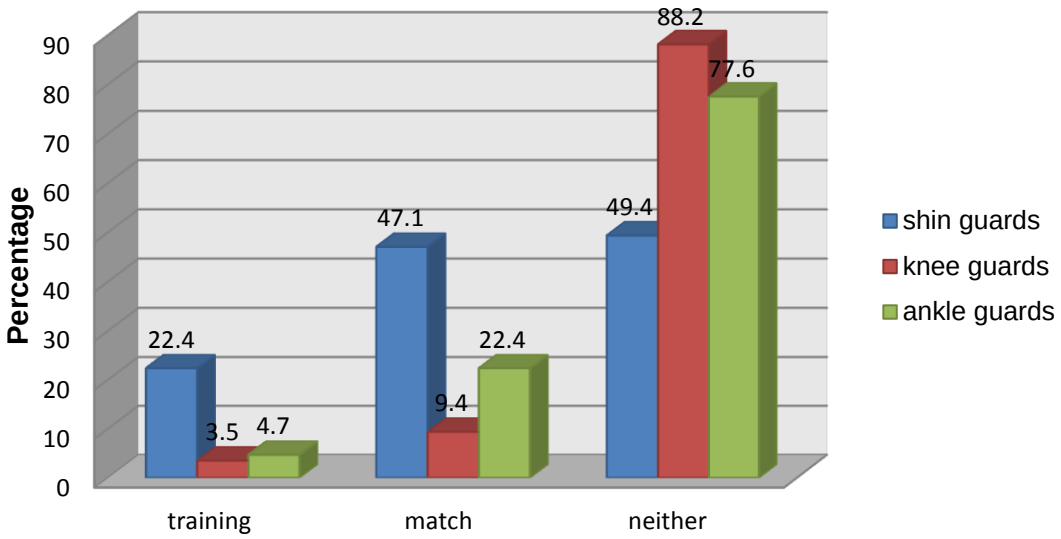

Figure 4.8 Use of protective guards during matches and training

Figure 4.8 shows the frequency of use of sport (guards) equipment during training and matches. The participants had to indicate how often they used shin, knee and ankle guards in both training and match sessions. Few players always or very often used the described equipment in both training and match sessions, while most players never used the equipment in either training or match sessions.

The most commonly used protective guards by players were shin guards during matches (47.1%) and in training (22.4%). The ankle guards were reported as the second most used protective equipment during matches at 22.4% and training at almost five percent. Knee guards were worn the least during matches at 9.4% and in training at almost four percent. It is noted that shin (49.4%), ankle (77.6%) and knee (88.2%) guards were not commonly worn during matches and training.

CHAPTER 5

Discussion

5.1 Response rate

The usable response rate in this study was 49% and was higher than that reported in previous studies (Woods *et al*. 2002: 437; Mtshali *et al*. 2009: 165). A possible reason for the high response rate is that the soccer players had to complete the questionnaire during break-time and at the soccer fields at a given time, as they were not allowed to take the questionnaire home. Only participants who provided complete data were included in the analyses.

5.2 The demographic profile of female high school soccer players in eThekwini district.

The Umlazi sub-district showed a higher response rate (82.4%) compared to the Pinetown sub-district (17.6%) possibly, due to the fact that the first sub-district had more female players than the second sub-district. A considerable number of second sub-district players had other sport commitments and had to travelling far, or parents did not allow their children to participate during the data collection period. The higher proportion of African players can be attributed to their population density in the eThekwini district accounting for 73.8% as compared to the White population at 6.6%, Indian at 16.6% and Coloured at 2.5% (Mid-year population estimates, South Africa 2007: 9).

The mean age of the female high school soccer players was 15.85 years with a standard deviation of ± 1.32 years. This low standard deviation signified a low deviation in the age of players, which meant the majority of players were aged between 15 and 16 years old.

There was no statistically significant ($p < 0.825$) difference between the injured players and uninjured players with respect to age, race, district, player position and other sports played. Additionally, the results indicated that players from both districts had similar characteristics.

5.3 The prevalence of injuries in female high school soccer players in the eThekwini district.

Overall 71.8% of the respondent sustained injuries during training and matches. This is congruent with previous studies stating that the sustained injuries were high in female soccer players, which ranged from 55-87 % (Giza *et al*. 2005b: 213; Faude *et al*. 2005: 1696 and Hawkins *et al.* 2001: 44).

The participants in this study had adequate soccer experience as revealed in the results. Most of the players had two years of experience playing high school soccer. This is due to the fact that more players when entering high school choose soccer as their first choice of sport and hence the higher participation when beginning high school. The difference between reports on young and adult female soccer players' may be as a result of the level of exposure, since the professional players have increased number of training per 1000 hours (Giza *et al.* 2005b: 213; Faude *et al.* 2005: 1696).

The number of injuries was lowest in the participants aged between 17-19 years old in this study. This finding may suggest that there were 26 players in this age group or less reporting of injuries. More injuries were reported by the 15 and 16 year age group. This study is supported by findings reported by Emery, Meeuwisse and Hartmann (2005: 1889) that physiologic differences or underreporting of minor injuries (older group) while increased intensity of play in higher divisions (young group).; and Le Gall, Carling and Reilly (2008: 278) study covered up the whole playing season.

5.4 Types of injury

Muscle (strain) injury was the most common injury type reported in this study. This finding is in agreement with other studies (Hawkins *et al.* 2001: 44; Walden, Hagglund and Ekstrand 2005: 544; Hrysomallis 2013: 351). Although injuries sustained during running (non-contact), collision with player (contact) and tackle (contact) was significantly (p= 0.000) associated with muscle injury in this study, those sustained during running (non-contact) was congruent with that reported by Ekstrand, Hagglund and Walden (2011b: 10) which stated that almost all muscle injuries occurred during non-contact mechanisms.

Bruising (contusion) was the second most common type of injury sustained and the findings were in line with a study by Wong and Hong (2005: 477), who found that in male soccer players contusion was the most common injury. Similarly, Mahlangu (2007: 40) reported bruises as the second most common injury type in female soccer players. This may probably be explained by the fact that the level of participation (training and matches) was higher in the above studies which was congruent with this study. This study contradicted the findings by Meyers (2013: 2415), which reported bruising as the least common injury that was sustained. The study was conducted playing on astro-turf as compared to grass field.

5.5 Location of injury

An increased number of lower extremities injuries were reported compared with those in the upper extremities. The findings of this study agreed with studies that have found lower extremity injuries representing 60-87% of the total injuries suffered by soccer players (Hawkins *et al*. 2001: 44; Emery, Meeuwisse and Hartmann 2005: 1887; Emery and Meeuwisse 2010: 560). The findings by other investigators (Hagglund, Walden and Ekstrand 2009: 821; Osternberg and Roos 2000: 282; Dick *et al*. 2007: 28) reported that female players are more likely to sustain injuries to their knees than to ankles, were

congruent with findings in this study. The findings of this study, however disagree with studies conducted by Le Gall, Carling and Reilly (2008: 279) and Lilley, Gass and Locke (2002: 6) reporting that the ankle was the most affected followed by the knee joint. The most frequent type of injuries were sprains due to overuse by players (Le Gall, Carling and Reilly (2008: 279). The findings of this study reported muscle injuries (strains) as the most frequent type of injuries. A study by Lilley, Gass and Locke (2002: 4) reported ankle injuries followed by shin injuries as the highest percentage of injuries in young female soccer players. The higher number of knee and ankle injuries may be attributed to the task of cutting, jumping and landing, which is different in young females.

5.6 Severity of injury

The definition of the severity of injury adopted in this study was similar to the one used in other studies (Fuller *et al*. 2006: 194; Junge *et al*. 2002:654). The severity of injury was categorised as minor, moderate or severe depending on the length of time needed for recovery. Minor injuries in this study group can be related to the time lost for not playing soccer. The time for recovery was two to three days for minor, four to seven days for moderate, one to four weeks for major, and more than four weeks for severe or serious injuries. This study revealed four players who sustained soccer injuries reported moderate to severe injury, contrary to what had been found in other studies (Hawkins *et al*. 2001: 44). The study reported that severity of injuries was classified as minor to moderate. Similarly, Wong and Hong (2005: 478) stated that most studies of soccer injuries reported minor injury as compared to moderate injury and no difference was noted between adolescent, professional and senior players. Injuries to players can have a significant effect on the performance and confidence of the team (Woods *et al*. 2002: 440).

5.7 Mechanism of injury

Collisions with another player and tackle (contact) as well as running (non-contact) were the common mechanisms of injury. This is similar to the findings of Chomiak *et al*. (2000: S59) who reported that 53.6% involved no body contact and 46.4% of injuries were caused by contact. Rahnama, Reilly and Lees (2002: 356) suggested that selected playing actions, such as making a tackle, were associated with higher injury risk. A study by Agel *et al*. (2007: 271) showed that most injuries that occurred during matches resulted from contact with another player whereas injuries sustained during training resulted from non-contact activation. Both in matches and training, players sustained injury mechanisms through contact with the playing surface. Most of the injuries which resulted from contact (collision with player and tackle) were muscle injuries (strain). This finding could have been influenced by the fact that most players had only two years' experience of playing soccer and their level of skill has not yet developed. Accordingly the lack of strength, flexibility and skill to time the tackles and avoid collision with other players needs attention. Given the fact that the non-contact mechanisms also represent a considerable frequency in injury occurrence, more emphasis must be placed on the condition of the field surface, equipment, as well as some soccer sporting programmes such as warm-up, cooling down, stretching, muscle strength balance, speed, endurance, risk of injury, nutrition and prevention of injury implementation by coach/trainer (Kakavelakis et al. 2003: 177).

5.8 Management of injuries

Ice followed by rest was the most commonly used self-treatment modalities in this study. This is congruent with Chomiak *et al.* (2000: S64) who reported that the most common treatment used among young male soccer players was ice. The most advised treatment for injury was rest followed by limit sport activity in this study. This is not congruent with Rapoo (2009: 49). The study reported that soccer injuries were

managed by qualified professionals therefore full range of motion and adequate strength were used for return to play sport.

Hodson (1999: 90) stated that doctors, therapists and physical educators have a clinical responsibility to advise and examine young sports players. Medical or paramedic healthcare professions were seen as the most used for treatment of injuries in this study. All the healthcare professionals were often not often present during training, however, and consequently some injuries may have occurred in their absence. Arnason *et al*. (2004: 15S) agreed that the limited attendance of healthcare professionals during training may lead to underestimation of minor injuries, causing players to miss one or two training sessions.

Brukner and Khan (2006b: 954) recommended that the medical sports team should ideally comprise of a team doctor or physician, physiotherapist, massage therapist or trainer. Every medical professional in the team has a specific role in relation to the injured player and the entire team, therefore dominance of a particular profession leaves a loop hole in the team. The main goal of the injured player was to receive treatment and be healed. The studies above are in contrast with this study due to the fact that the coach was seen as the most used. The increase in the use of coaches as compared to other health professionals suggested there may be a higher availability of coaches and that players usually approach them first. Good training of coaching with safety in mind was recommended to decrease injuries (Kakavelakis et al. 2003:177).

5.9 Medical and nutritional profile

A limited number of participants reported the presence of medical conditions and the majority of the participants reported a healthy nutritional lifestyle. This study is congruent with Kirkendall (2004: 5) stating that soccer is a glycogen-dependent sport and a as result carbohydrates are of critical importance. Furthermore sustaining running speed, goal-scoring and avoiding injuries are dependent on glycogen levels. The intake

of healthy food before strenuous training and matches is critical to maintain adequate glycogen levels in the muscles. Slight dehydration can be harmful and decrease performance in soccer, and sports drinks containing moderate amounts of carbohydrate and electrolytes, especially sodium, are better than plain water in maintaining hydration during soccer play and in rehydrating during recovery. As a result, this is congruent with this study because the majority of the participants had a higher water intake, even though few participants had other sports-fluid intake.

5.10 Injury risk factors

This study reported that there were few participants who wore protective equipment and possibly as a result many of them reported lower extremity injuries. The use of protective equipment was shown to decrease injury rates. This was not congruent with a study by Yang *et al*. (2005: 517). In this study there were limited leg or shin injuries, which were congruent with a study by Mtshali *et al*. (2009: 165). Contact, rather than overuse, has been linked to acute shin injuries. The ankle injuries were associated with wearing shoes with studs. Although the study was not clear on whether the participants were wearing shin guards or not, however not wearing shin guards has been shown to have a direct correlation to leg injuries (Dvorak and Junge 2000: S8).

Hawkins and Fuller (1998: 140) reported that despite the importance of shin guards in injury prevention and their compulsory wearing in both training and matches, 28 players used shin and ankle guards only in competitive matches and 51 did not wear protection equipment in training. Thirty of these players, however, agreed that wearing shin pads reduced the risk of lower leg injury. Fifty three players, however, reported that they were not encouraged by the coaching staff to wear shin guards during training. This study indicated that ankle guards were worn most often compared to the knee guards in matches, rather than in training. Therefore, given the fact that the knee joint was reported as the most affected body part in this study, it can be believed that the lack of usage of the knee guards could influence the occurrence of knee injuries in female

soccer players without ruling out the role other factors such as playing surfaces and shoes could have played.

The most played on surface reported was grass and ground field, whereas the least reported at one percent was the astro-turf field. The finding in this study was similar to Ekstrand, Hagglund and Fuller (2011a: 828), who stated that the injury risk for both male and female elite players did not change significantly when playing soccer on astro-turf surfaces compared to playing on the grass field.

The defenders and midfielders were reported to be the most injured in the knee and ankle area in this study. This finding was congruent with Kaplan *et al.* (2013: 43) who stated that defenders and midfielders were the most injured, which may be due to the fact that these positions involve a higher level of physical contact than others. Soccer is more vigorous in midfield and strength is required to win the ball. The goalkeeper showed significance ($p< 0.000$) at the wrist area in this study and the finding was not congruent with Kaplan *et al*. (2013: 41), who found no significant correlation between injured body parts in all player positions. However, Le Gall, Carling and Reilly (2008: 283) reported hand injuries were common in goalkeepers reflecting the differences in the physical demands of the playing amongst goalkeepers.

5.11 Comparisons of injuries in training and matches.

There were an increased number of injuries in training as compared with matches. These findings were not congruent with previous studies (Agel *et al*. 2007: 270; Faude *et al*. 2005: 1696) which stated that injury incidence rate in elite female soccer players was high during soccer matches. Wong and Hong (2005: 474), however, stated that the injury rates were higher during matches for male players, while for female players they were higher during training.

The Chi-Square test in this study showed that there was a higher significance ($p < 0.001$) that more injuries occurred during training than during matches. Similar findings have been reported in a study by Twizere (2004: 83). The study showed that the number of injuries sustained during training and matches were related ($p=0.0017$). However, more injuries ($p<0.005$) occurred during training than during matches. The health professionals reported increased soccer injuries during matches than training sessions, but their absence during training may have led to the occurrence of some injuries. Arnason *et al.* (2004: 13S) stated that limited attendance of health professionals during training led to underestimation of minor injuries in players resulting in them to missing one or two training sessions. This is congruent with this study which showed that there was more participation of players in matches than training sessions. The players reported higher availability of coaches as compared to other health professionals and not all coaches are qualified in healthcare or first-aid.

5.12 Objectives and the related hypotheses

Null hypothesis one

The demographic profile of high school female soccer players in eThekwini district is not similar to international literature profiling soccer players.

This is not rejected, based on the findings with respect to the local demographic groups that participated in this study.

Null hypothesis two

The prevalence of injuries in female high school soccer players in the eThekwini district is not the same as other studies of the same population.

This was rejected as a number of studies supported the injury prevalence findings in this study.

Null hypothesis three

A profile of soccer-related injuries sustained by female soccer players over the last season is not the same with the literature with respect to location, number and mechanism of injury.

This hypothesis is rejected, based on the presence of significant findings which are congruent with the literature.

Null hypothesis four

The management of injuries is not similar to other studies of the same population.

This was rejected as a number of studies supported the management of injuries of the same population.

Null hypothesis five

The medical and nutritional status as reported by the players is not congruent with other studies of the same population.

This is rejected as the number of studies supported the medical and nutritional status findings in this study.

Null hypothesis six

To identify risk factors for injury shows correlation with the literature with respect to equipment, player position, age and gender.

This was accepted as other studies supported the injury risk factor findings in this study.

Null hypothesis seven

To compare injuries occurring during training and during matches did not show the same number of injuries.

This was accepted as a number of studies supported match injury as compared to training injury findings in this study.

CHAPTER 6

Conclusion and Recommendations

6.1 Conclusion

Overall, the findings of this study revealed that injury prevalence was high (72%) in the last season of soccer played. The lower limb was affected more than any other part of the body, with more knee and ankle injuries.

The common types of soccer injuries in female players were muscle strains and bruises. Muscle (strain) injury accounted as the highest type of injury found. The defenders and midfielders were most injured compared with goalkeepers and strikers. Injury mechanisms that seemed to be accountable for most injuries in this study were collisions with another player and running. The findings of types of injuries in this study have highlighted the seriousness of the injuries in female high school soccer players. In terms of severity, minor injuries were mainly reported. The injuries occurred more during training than in matches.

6.2 Limitations

Any incomplete questionnaires with missing data were reflected as such. The sample size could have been larger to produce a larger effect size. The injuries were self-reported and this could have resulted in inaccuracies in the data. The questionnaire was not the FIFA injury questionnaire.

6.3 Recommendations

6.3.1 Recommendations with respect to the study

A clear definition of the word ligament, which may vary depending on the individual, needs to be used because most of the female soccer players were injured in the knee and ankle joints but mechanisms did not show accordingly. There was no question addressing the reasons for the non-usage of shin guards in the questionnaire. The exposure in duration of training is suggested in order to determine appropriate skills developed. In terms of diet intake, it is suggested that nutritional advice be clearly included regarding carbohydrates, fats and proteins, all before and after training and matches. It is recommended that the FIFA questionnaire is used in future studies.

6.3.2 Recommendations for further studies

It is suggested that further studies should be planned to examine and diagnose the injuries in order to get true injury results. Further studies should aim to ascertain whether the low emphasis on wearing shin guards during training sessions were related to the current results. It is suggested that an adequate sample size be used to determine the effectiveness of protective equipment affecting injury rates.

This study involved a once-off assessment of participants and it is recommended that future studies include a continuous assessment of participants throughout the season, at the beginning of the season and at the end of the season or the end of the previous season and the end of the current season, for accurate comparison.

The participants had difficulty recalling the past events of their sports injuries, as observed by the researcher during the period of the data collection. As a result, a number of participants did not complete the questionnaire. It is suggested that future researchers allow a greater amount of time for the participants to fill in the questionnaire even if it involves two or more sessions.

It is recommended that further studies regarding adolescents' musculoskeletal birth abnormalities need to be investigated. High schools in the eThekwini district need to be made aware of the role of other healthcare services such as Chiropractic and Biokinetics in the management of soccer injuries.

Injuries among female soccer players have not been thoroughly investigated. More specifically, prospective studies of the injury incidence over an entire soccer season in a large group of female high school players in eThekwini district can be conducted. It is important to carry out such studies in order to avoid different biases such as recall bias in a retrospective study, and bias owing to variation of injuries over the season.

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APPENDIX A1 LETTER OF PERMISSION AND INFORMATION:

Dear Department of Education Representative

Welcome to my Research Study

Title of the Research Study: The epidemiology of injuries in female high schools soccer players in the eThekwini district

Principal Researcher: Keamogetse Sentsomedi, Student - Mtech: Chiropractic.
Co-Investigator/s/supervisor/s: Professor T. Puckree, Ph.D: Physiotherapist; Doctor C. Kell, Mtech: Homeopathy

Brief Introduction and Purpose of the Study: Participation of young soccer females has started to grow in the past few years in South Africa. No studies have been done to find out about the profile of injuries in female high school soccer players in KwaZulu-Natal, eThekwini district. With the increased interest by females in playing soccer, it is important to determine the occurrence of these injuries so that proper interventions can be planned to reduce injuries in the high school population of female soccer players.
There is limited information on injuries in female soccer players and most of the reported information is about male soccer players. In general, sports are started at school at a young age and thus most learners are vulnerable to injuries at an early stage in their life. Injuries occurring at an early age without appropriate understanding and good prevention strategies can lead to failure of sports careers in the future.
The aim of the study is to determine the demographic profile and prevalence of injuries in female high school soccer players in the eThekwini district. The research will also establish the profile of related injuries that female soccer players sustained during the previous season, and to identify frequently injured parts of the body and risk factors to injuries.

Outline of the Procedures: Learners that are under 18 years of age will bring their parents' signed letter of informed consent before participating in the study (day one of research). On arrival the researcher will give learners' letters of information to read, and an Informed Consent form to read and sign as their agreement to participate in the research study. The research will be conducted using a pre-validated questionnaire that will be administered to the female soccer players which will take 20 minutes to complete (day two of the research) and all questions will be answered honestly and to the best of their ability. This is not a test and there will be no wrong answers. All the information gathered will be strictly confidential.
The entire process of the research during data collection including the evaluation questionnaire assessment should not take more than 30 minutes. This survey will be

conducted after regular school hours and will not interfere with any regular school activities.

Risks or Discomforts to the Participant (Learner): They are no risks or discomfort involved in this research.

Benefits: This study will benefit learners to understand the types of injuries sustained during and after particular games, and also to have programs planned to improve methods of injury prevention. Coaches and medical experts will have the understanding and causes of sports injuries at an early age.

Reason/s why the Participant May Be Withdrawn from the Study: The involvement in this study is voluntary and those who do not sign / participate will not result in any adverse consequences. Participants are free to withdraw from the study at any time.

Remuneration: Participants will not be awarded any money for taking part in this study.

Costs of the Study: Involvement in this research is free of charge.

Confidentiality: The identity of the participants will remain secret (confidential) by the use of a coding system

Research-related Injury: The D.U.T clinic protocol will be followed.

I will be grateful if you would grant permission for me to access the schools listed below, in order to conduct a survey on female soccer players. I will obtain permission from the principal of each school prior to accessing the learner.

Your assistance would be highly appreciated and vital to this research.

Persons to Contact in the Event of Any Problems or Queries: Researcher: Keamogetse Sentsomedi Cell: 0834767827, Supervisor: Professor T. Puckree 031-3732704, Co-Supervisor: Doctor C. Kell 031-3732393. Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

APPENDIX A2 LETTER OF PERMISSION AND INFORMATION PRICIPAL/SCHOOL:

Dear Principal/ Board of Governors

Welcome to my Research Study

Title of the Research Study: The epidemiology of injuries in female high schools soccer players in the eThekwini district

Principal Researcher: Keamogetse Sentsomedi, Student - Mtech: Chiropractic.
Co-Investigator/s/supervisor/s: Professor T. Puckree, Ph.D: Physiotherapist; Doctor C. Kell, Mtech: Homeopathy

Brief Introduction and Purpose of the Study: Participation of young soccer females has started to grow in the past few years in South Africa. No studies have been done to find out about the profile of injuries in female high school soccer players in KwaZulu-Natal, eThekwini district. With the increased interest by females in playing soccer, it is important to determine the occurrence of these injuries so that proper interventions can be planned to reduce injuries in the high school population of female soccer players.
There is limited information on injuries in female soccer players and most of the reported information is about male soccer players. In general, sports are started at school at a young age and thus most learners are vulnerable to injuries at an early stage in their life. Injuries occurring at an early age without appropriate understanding and good prevention strategies can lead to failure of sports careers in the future.
The aim of the study is to determine the demographic profile and prevalence of injuries in female high school soccer players in the eThekwini district. The research will also establish the profile of related injuries that female soccer players sustained during the previous season, and to identify frequently injured parts of the body and risk factors to injuries.

Outline of the Procedures: Learners that are under 18 years of age will bring their parents' signed letter of informed consent before participating in the study (day one of research). On arrival the researcher will give learners' letters of information to read, and an Informed Consent form to read and sign as their agreement to participate in the research study. The research will be conducted using a pre-validated questionnaire that will be administered to the female soccer players which will take 20 minutes to complete (day two of the research) and all questions will be answered honestly and to the best of their ability. This is not a test and there will be no wrong answers. All the information gathered will be strictly confidential.
The entire process of the research during data collection including the evaluation questionnaire assessment should not take more than 30 minutes. This survey will be

conducted after regular school hours and will not interfere with any regular school activities.

Risks or Discomforts to the Participant (Learner): They are no risks or discomfort involved in this research.

Benefits: This study will benefit learners to understand the types of injuries sustained during and after particular games, and also to have programs planned to improve methods of injury prevention. Coaches and medical experts will have the understanding and causes of sports injuries at an early age.

Reason/s why the Participant May Be Withdrawn from the Study: The involvement in this study is voluntary and those who do not sign / participate will not result in any adverse consequences. Participants are free to withdraw from the study at any time.

Remuneration: Participants will not be awarded any money for taking part in this study.

Costs of the Study: Involvement in this research is free of charge.

Confidentiality: The identity of the participants will remain secret (confidential) by the use of a coding system

Research-related Injury: The D.U.T clinic protocol will be followed.

Permission from the Department of Education prior to accessing the learners will firstly have to be obtained and then for the approval from you to grant permission for me to access the high school female learners, in order to conduct a survey on female soccer players.

Your assistance would be highly appreciated and vital to this research.

Persons to Contact in the Event of Any Problems or Queries: Researcher: Keamogetse Sentsomedi Cell: 0834767827, Supervisor: Professor T. Puckree 031-3732704, Co-Supervisor: Doctor C. Kell 031-3732393. Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

APPENDIX A3 LETTER OF PERMISSION AND INFORMATION PARENT/ GUARDIAN:

Dear Parents/Guardians

Welcome to my Research Study

Title of the Research Study: The epidemiology of injuries in female high schools soccer players in the eThekwini district

Principal Researcher: Keamogetse Sentsomedi, Student - Mtech: Chiropractic.
Co-Investigator/s/supervisor/s: Professor T. Puckree, Ph.D: Physiotherapist; Doctor C. Kell, Mtech: Homeopathy

Brief Introduction and Purpose of the Study: Participation of young soccer females has started to grow in the past few years in South Africa. No studies have been done to find out about the profile of injuries in female high school soccer players in KwaZulu-Natal, eThekwini district. With the increased interest by females in playing soccer, it is important to determine the occurrence of these injuries so that proper interventions can be planned to reduce injuries in the high school population of female soccer players.
There is limited information on injuries in female soccer players and most of the reported information is about male soccer players. In general, sports are started at school at a young age and thus most learners are vulnerable to injuries at an early stage in their life. Injuries occurring at an early age without appropriate understanding and good prevention strategies can lead to failure of sports careers in the future.
The aim of the study is to determine the demographic profile and prevalence of injuries in female high school soccer players in the eThekwini district. The research will also establish the profile of related injuries that female soccer players sustained during the previous season, and to identify frequently injured parts of the body and risk factors to injuries.

Outline of the Procedures: Learners that are under 18 years of age will bring their parents' signed letter of informed consent before participating in the study (day one of research). On arrival the researcher will give learners' letters of information to read, and an Informed Consent form to read and sign as their agreement to participate in the research study. The research will be conducted using a pre-validated questionnaire that will be administered to the female soccer players which will take 20 minutes to complete (day two of the research) and all questions will be answered honestly and to the best of their ability. This is not a test and there will be no wrong answers. All the information gathered will be strictly confidential.
The entire process of the research during data collection including the evaluation questionnaire assessment should not take more than 30 minutes. This survey will be

conducted after regular school hours and will not interfere with any regular school activities.

Risks or Discomforts to the Participant (Learner): They are no risks or discomfort involved in this research.

Benefits: This study will benefit learners to understand the types of injuries sustained during and after particular games, and also to have programs planned to improve methods of injury prevention. Coaches and medical experts will have the understanding and causes of sports injuries at an early age.

Reason/s why the Participant May Be Withdrawn from the Study: The involvement in this study is voluntary and those who do not sign / participate will not result in any adverse consequences. Participants are free to withdraw from the study at any time.

Remuneration: Participants will not be awarded any money for taking part in this study.

Costs of the Study: Involvement in this research is free of charge.

Confidentiality: The identity of the participants will remain secret (confidential) by the use of a coding system

Research-related Injury: The D.U.T clinic protocol will be followed.

Permission from both the Department of Education and school principal will have to be obtained first prior to accessing your child. Then for both permission approvals will have to be granted for me to allow your child to participate in the study.

Your assistance would be highly appreciated and vital to this research.

Persons to Contact in the Event of Any Problems or Queries: Researcher: Keamogetse Sentsomedi Cell: 0834767827, Supervisor: Professor T. Puckree 031-3732704, Co-Supervisor: Doctor C. Kell 031-3732393. Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

APPENDIX A4 LETTER OF PERMISSION AND INFORMATION LEARNER:

Dear Learners

Welcome to my Research Study

Topic of my research study is: The epidemiology of injuries in female high schools soccer players in the eThekwini district

Researcher: Keamogetse Sentsomedi, Student - Mtech: Chiropractic.
Supervisors: Professor T. Puckree, Ph.D.: Physiotherapist; Doctor C.Kell, Mtech: Homeopathy

Introduction and why am I doing the Study: Girls soccer team has started to grow in the past few years in South Africa. This project has been informed by the fact that many girls play soccer. We are aware that playing soccer exposes you to injuries, and we wish to find out as much as we can about these injuries so that we can plan programmes to prevent these injuries. No studies have been done to find out about the injuries in girls' high school soccer players in KwaZulu-Natal, eThekwini district.
There is no enough information regarding injuries in young girls' soccer players and most of the reported information is about boys' soccer players. In general, sports are started at school at a young age and therefore most learners get injuries at an early age in their life. When injuries occur at an early age with no great understanding and good prevention plan then this can lead to poor performance in sports and no sports careers in the future. Coaches and Medical teams should also have the understanding and causes of sports injuries at an early age. This study will focus on number of injuries and finding out related injuries that players get over the previous season.

What to do for the study: Day 1- On arrival I will briefly explain my research and then giving you letters of information to read, informed consent for parents to sign if you are under 18 years of age and an assent form, if applicable, to read and sign as your agreement to participate in the research study (part one of the research). Day 2- All learners will hand in their signed letters to the researcher before continuing to be part of the research. You will then be handed the questionnaire which will take about 20 minutes to complete (part two of the research). Please answer all questions honestly and to the best of your ability. This is not a test and there are no wrong answers. All the information gathered will be strictly confidential. The entire process of the research during data collection including the evaluation questionnaire assessment should not

take more than 30 minutes. Your help and time with this project are invaluable and greatly appreciated.

They are no risks involved in this research. The results from the research will help us to develop programmes to prevent injuries in young girls' soccer players.

You can leave from the Study: Your involvement in this study is voluntary and those who do not sign/ participate will not cause any harm on my study. You are free to leave from the study at any time.

You will not be awarded any money for taking part in this study. Your involvement in this research is free of charge.

Your personal information will remain secret by the use of a coding system

I humbly ask you to participate in my study.

Your help would be highly appreciated and important to this research.

Research-related Injury: The D.U.T clinic rules will be followed.

Persons to Contact in the Event of Any Problems or Queries: Researcher: Keamogetse Sentsomedi Cell: 0834767827, Supervisor: Professor T. Puckree 031-3732704, Co-Supervisor: Doctor C. Kell 031-3732393. Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC: TIP, Prof F. Otieno on 031 373 2382 or dvctip@dut.ac.za.

APPENDIX B1 ASSENT CONSENT FORM:

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)
ASSENT FORM

Dear Learner.

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my gender, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage and without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and of my own free will declare myself prepared to participate in the study.
- I understand that any significant new findings developed during the course of this research, which may relate to my participation, will be made available to me.

_____ _____ _____ _____

Full Name of Participant **Date** **Time** **Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness (If applicable) **Date** **Signature**

_____ _____ _____

Full Name of Legal Guardian (If applicable) **Date** **Signature**

APPENDIX B2 PARENT CONSENT FORM:

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)
CONSENT FORM

Dear Parent/Guardian.

Statement of Agreement for your child to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Parent/Guardian Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my child's gender, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage and without prejudice, withdraw my consent and child's participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to allow my child to participate in the study.
- I understand that significant new findings developed during the course of this research, which may relate to my child's participation, will be made available to me.

_____ _____ _____ _____

Full Name of Parent/Guardian **Date** **Time** **Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

APPENDIX C QUESTIONNAIRE POST-PILOT GROUP:

QUESTIONNAIRE FOR FEMALE HIGH SCHOOL SOCCER PLAYERS IN THE ETHEKWINI DISTRICT

Dear Learner.
Please answer all questions to the best of your ability. Tick the relevant box for each question. All responses are strictly confidential.

PART A: DEMOGRAPHIC PROFILE

1. **How old are you?** : 14yrs☐ 15yrs☐ 16yrs☐ 17yrs☐ 18yrs☐ 19yrs☐
2. **What is the name of the sub-district that your school falls under?**
   Pinetown☐ Umlazi☐
3. **Race:** African☐ Coloured☐ Indian☐ White☐ (for statistical purpose only)
   Other (please specify) _____
4. **In which team did you play in the previous season?** A☐ B☐ C☐
5. **What age group did you play in?** U/15☐ U/16☐ U/17☐ U/18☐ U/19☐
6. **How many years have you participated in school soccer?** _____
7. **What position did you play?**
   Goalkeeper (GK) ☐ Defender (DF) ☐ Midfielder (MF) ☐ Striker(S) ☐
8. **How many soccer matches did you play in during the past season?**
   1-5☐ 6-10☐ 11-15☐ 16-20☐ More than 20 matches☐
9. **How many training sessions did you participate in during the past season?**
   1-5☐ 6-10☐ 11-15☐ 16-20☐ More than 20 training sessions☐
10. **How many matches did you participate in during the last soccer tournament?** 1-4☐ 5-7☐ 9-12☐ More than 12 matches☐
11. **Do you play any other sport?** Yes ☐ No ☐
    If yes, please specify_____ and at what level?
    Professional☐ League☐ Club☐ Other☐(please specify)_____
12. **Do you participate in any sport or non-sport extra-mural activity/activities?**
    Yes☐ No☐

If yes, please specify_____ (for example: ballet, acrobatics, gymnastics, surfing, trail running etc.)

PART B: INJURY PROFILE

1. **How many injury/injuries do you currently have due to playing soccer?** _____ (if none, please proceed to question 9.)

2. **Which part/s of your body is injured? (You may choose more than 1)**

   Head☐ Face☐ Neck☐ Shoulder☐ Elbow☐ Wrist☐ Hand/Finger☐ Chest☐

   Abdomen☐ Back☐ Groin☐ Thigh☐ Knee☐ Leg/Calf☐

   Ankle☐ Foot☐ Other☐(please specify) _____

3. **When did your injury/injuries occur?** A week ago☐ 2 weeks ago☐

   3 weeks ago☐ 4 weeks ago☐ More than 4weeks☐

4. **Did the injury/injuries occur during:** Match play ☐ Training☐ Both ☐

5. **How would you describe the injury/injuries?(You may choose more than 1)**

   Cut ☐ Graze ☐ Bruise ☐ Muscle injury ☐

   Fracture (Broken bone) ☐ Other ☐(please specify) _____

6. **How did you hurt yourself? (Please tick more than 1 if applicable)**

   Tackle ☐Turning☐ Landing☐ Running☐

   Heading the ball ☐ Jumping☐ Overuse☐ Collision with player☐

   Kicking ball☐ Burns (from grass) ☐ Other☐(please specify)_____

7. **Did you stop playing soccer as a result of the injury/injuries?**

   Yes☐ No☐

8. **If yes, how long have you been unable to participate in soccer for?** _____

9. **How many injury/injuries did you have due to playing soccer last season?**_____ (if none, please proceed to Part C.)

10. **Which part/s of your body was injured? (You may choose more than 1)**

    Head☐ Face☐ Neck☐ Shoulder☐ Elbow☐ Wrist☐ Hand/Finger☐ Chest☐

    Abdomen☐ Back☐ Groin☐ Thigh☐ Knee☐ Leg/Calf☐

    Ankle☐ Foot☐ Other☐(please specify) _____

11. **When did your injury/injuries occur?** Please specify_____

12. **Did the injury occur during:** Match play ☐ Training ☐ Both ☐

13. **How would you describe the injury/injuries?(You may choose more than 1)**

Cut ☐ Graze ☐ Bruise ☐ Muscle injury ☐

Fracture (Broken bone) ☐ Other ☐(please specify) _____

14. **How did you hurt yourself? (Please tick more than 1 if applicable)**

Tackle ☐Turning☐ Landing☐ Running☐

Heading the ball ☐ Jumping☐ Overuse☐ Collision with player☐

Kicking ball☐ Burns (from grass) ☐ Other☐(please specify)_____

15. **Did you stop playing soccer as a result of the injury/injuries?**

Yes☐ No☐

16. **If yes, how long have you been unable to participate in soccer for?** _____

PART C: EQUIPMENT

1. **What footwear do you wear when playing soccer?**

Takkies/Trainers☐ Soccer boots☐ Other☐(please specify) _____

2. **Do you wear shin guards during:** Matches☐ Training☐ Neither☐
3. **Do you wear ankle protection during:** Matches☐ Training☐ Neither☐
4. **Do you wear knee protection during:** Matches☐ Training☐ Neither☐
5. **What surface do you play soccer on?**

Grass☐ Astroturf☐ Ground☐ Tar road surface☐

6. **Were you wearing protective equipment when your injury/injuries occurred?**

Yes☐ No☐

PART D: TREATMENT

1. **Did you self-treat your injury/injuries?** Yes☐ No☐

If yes please specify_____(E.g. Rest, Ice, Compression,Elevation, Stretch)

2. **Did you receive any advice for the injury?** Yes☐ No☐

If yes, please choose one or more options below:

Rest☐ Limit sport activity☐ Full sport activity☐

3. **Do you have any access to healthcare during training/matches?**

Yes☐ No☐

4. **Which healthcare service is available to you during training/matches?**

Medical/Paramedical☐ Chiropractic☐ Physiotherapy☐ Biokineticist☐

Sports Massage Therapy☐ Other☐(please specify) _____

5. What exercises or activities do you perform during training?

Warming-up☐ Stretching☐ Jogging☐ Match drills☐ Cool down☐

Other☐(please specify)_____

6. Do you have any access to healthcare at school?

Yes☐ No☐ Sometimes☐

PART E: MEDICAL AND NUTRITIONAL PROFILE

1. Do you suffer from any medical condition/s?

Yes☐ No☐ (if no, then proceed to question 3)

If yes, please name the condition/s_____
(E.g. Anaemia, Diabetes Mellitus, High Blood Pressure, Asthma)

2. Do you take medication for the condition/s? Yes☐ No☐

3. Do you have any abnormality/abnormalities that you were born with?

Yes☐ No☐ (if no, then proceed to question 5)

If yes, please specify _____

4. What treatment are you having for your condition/s? _____

5. Have you been advised/prescribed any specific diet? Yes☐ No☐

If yes, please specify _____

6. Do you drink water or any other form of fluids (such as energy drinks) during soccer training or matches? Yes☐ No☐

If yes, please specify _____

7. Do you take any supplements (such as medical, nutritional or vitamin supplements)? Yes☐ No☐

Please include anything you want to say in the space below

_____

_____

_____

Thank you for participating in this study.
Ms. K. R. Sentsomedi

APPENDIX C1 QUESTIONNIARE CHANGES FROM APPENDIX G:

Part A: Demographic profile

2. The phrase ‘ Name of the sub-district:’ was changed to a question ‘What is the name of the sub-district that your school falls under?’.
3. The word ‘Ethnicity’ was changed to ‘Race’.
4. The question ‘At what level did you play in the previous season? 1st □ 2nd □ 3rd, was changed to ‘In which team did you play in the previous season? A□ B□ C□’.
5. The question and the options to the question ‘What age group did you play in? U/15□ U/16□ U/17□ U/18□ U/19□’ was added.
6. The question ‘How many years have you played soccer in a team?’ was changed to ‘How many years have you participated in school soccer?’. The number to this question changed from 5 to 6.
7. The word ‘do’ was changed to ‘did’ in the question. .the number to this question was changed from 6 to 7.
8. The question ‘How many soccer matches have you played in the past season? 0-2 □ 3-4 □ 5-6 □ 7-8□ 9-10□ More than 11matches□’ was changed to ‘How many soccer matches did you play in during the past season? 1-5□ 6-10□ 11-15□ 16-20□ More than 20 matches□’. The number to this question was changed from 7 to 8.
9. The question ‘How many training sessions have you participated in the past season? 0-2 □ 3-4 □ 5-6 □ 7-8□ 9-10□ More than 11matches□‘was changed to ‘How many training sessions did you participate in during the past season? 1-5□ 6-10□ 11-15□ 16-20□ More than 20 training sessions□’. The number to this question was changed from 8 to 9.
10. The question ‘How many matches did you participate in during the last soccer tournament? 1-4□ 5-7□ 9-12□ More than 12 matches□’ was added.
11. The word ‘sports’ was changed to ’sport’. The number to this question was changed from 10 to 11.
12. The question ‘Do you participate in any sport or non-sport extra-mural activity/activities?’ was added.

Part B: Injury profile

1. The question ‘How many soccer injuries do you currently have? None □ 1-5□ 6-10 □ More than 10□ none□ , then proceed to PART C.’ was changed to ‘How many injury/injuries do you currently have due to playing soccer?

_____ (if none, please proceed to question 9.)'.

2. The question 'Which part/s of your body was injured?' was changed to 'Which part/s of your body is injured? (You may choose more than 1)'. The word 'hand/finger' was added.
3. The question 'How long ago did the injury occur? A week ago□ 2-4weeks□ More than 4weeks□' was changed to 'When did your injury/injuries occur? A week ago□ 2 weeks ago□ 3 weeks ago□ 4 weeks ago□ More than 4weeks□'.
4. The question 'Did the injury occur during a: Match□ Training□' was changed to 'Did the injury/injuries occur during: Match play □ Training□ Both □'.
5. The question 'What type/s of injury/ies did you have/get? Broken bone□ Wound□ Cut□ Dislocation□ Muscle tear/strain□ Tendon injury□ Nerve injury□ Head injury□ Bruise□ Back pain□ Ligament sprain□ other, please specify_____' was changed to 'How would you describe the injury/injuries?(You may choose more than 1) Cut □ Graze □ Bruise □ Muscle injury □ Fracture (Broken bone) □ Other □(please specify) __'.
6. The phrase 'Choose more than 2' was changed to 'Please tick more than 1 if applicable'. The word 'heading' was changed to 'heading the ball'.
7. The question 'Did you stop training/playing soccer because of the injury?' was changed to 'Did you stop playing soccer as a result of the injury/injuries?'.
8. The question 'If yes, for how long have you not been training/ playing because of the injury/ies?' was changed to 'If yes, for how long have you been unable to participate in soccer?'.
9. The question 'How many injury/injuries did you have due to playing soccer last season? _____ (if none, please proceed to Part C.)' was added.
10. The question 'Which part/s of your body was injured? (You may choose more than 1) Head□ Face□ Neck□ Shoulder□ Elbow□ Wrist□ Hand/Finger□ Chest□ Abdomen□ Back□ Groin□ Thigh□ Knee□ Leg/Calf□ Ankle□ Foot□ Other□(please specify) _____' was added.
11. The question 'When did your injury/injuries occur? Please specify_____' was added.
12. The question 'Did the injury occur during: Match play □ Training □ Both □' was added.
13. The question 'How would you describe the injury/injuries?(You may choose more than 1) Cut □ Graze □ Bruise □ Muscle injury □ Fracture (Broken bone) □ Other □(please specify) _____' was added.
14. The question 'How did you hurt yourself? (Please tick more than 1 if applicable)' Tackle□ Turning□ Landing□ Running□ Heading the ball □ Jumping□ Overuse□ Collision with player□ Kicking ball□ Burns (from grass) □ Other□(please specify)_____' was added.

15. The question ‘Did you stop playing soccer as a result of the injury/injuries? Yes□ No□’ was added.
16. If yes, how long have you been unable to participate in soccer for? ____’ was added.

Part C: Equipment profile

2. The question ‘Do you wear shin guards during soccer training sessions? Yes□ No□ Sometimes□’ was removed.
3. The question ‘Do you wear shin guards during matches? Yes□ No□ Sometimes□’ was changed to ‘Do you wear shin guards during: Matches□ Training□ Neither□’. The number to this question was changed from 2 to 3.
4. The question ‘Do you wear ankle protection? Yes□ No□ Sometimes□’ was changed to ‘Do you wear ankle protection during: Matches□ Training□ Neither□’. The number to this question was changed from 3 to 4.
5. The question ‘Do you wear knee protection? Yes□ No□ Sometimes□’ was changed to ‘Do you wear knee protection during: Matches□ Training’. The number to this question was changed from 4 to 5.
6. The question ‘What surface do you play on? Dry grass□ Wet grass□ Ground□ Tar road surface□’ was changed to ‘What surface do you play soccer on? Grass□ Astroturf□ Ground□ Tar road surface□’ the number to this question was changed from 5 to 6.
7. The question ‘What other physical shape/fitness training do you do outside soccer training?’ was removed.
8. The question ‘Did you wear protective equipment when the injury occurred?’ was changed to ‘Were you wearing protective equipment when your injury/injuries occurred?’.

Part D: Treatment profile

1. The question ‘Did you do anything for your injury/ies?’ was changed to ‘Did you self-treat your injury/injuries?’.
2. The phrase ‘Please choose the options below’ was changed to ‘Please choose one or more options below’.
3. The question ‘Do you have any access to healthcare during training/matches at school/site on the field?’ was changed to ‘Do you have any access to healthcare during training/matches?’.
4. The question ‘Which healthcare service is available to you during/after soccer match?’ was changed to ‘Which healthcare service is available to you during training/matches?’ and the word ‘GP’ was changed to ‘ medical/ paramedical’.
5. The question ‘Do you perform the following exercises during training?’ was changed to ‘What exercises or activities do you perform during training?’ and the word ‘match drills ‘and ‘ cool down’ were added.

6. The word ‘site’ was removed from the question.

Part E: Medical and Nutritional profile

1. The word ‘Hypertension’ was changed to ‘High Blood Pressure’ and the word ‘Asthma’ was added as one of the conditions.
2. The word condition was slightly amended as ‘condition/s’.
3. The question ‘Do you have any of the following congenital abnormalities?’ was changed to ‘Do you have any abnormality/abnormalities that you were born with?’ and all the name of the conditions were removed.
4. The question ‘Do you take medication for the condition?’ was changed to ‘What treatment are you having for your condition/s?’.
5. The question ‘Have you been prescribed any diet?’ was changed to ‘Have you been advised/prescribed any specific diet? If yes, please specify’.
6. The question ‘Do you have energy drink/water when training/playing soccer?’ was changed to ‘Do you drink water or any other form of fluids (such as energy drinks) during soccer training or matches?’.
7. The question ‘Do you take any other supplements/ medication?’ was changed to ‘Do you take any supplements (such as medical, nutritional or vitamin supplements)?’.

APPENDIX C2 QUESTIONNARE CHANGES FROM APPENDIX E:

- The statement 'All questions are strictly confidential. Please answer the utmost best and tick one box per question.' was changed to read 'All questions are strictly confidential. Please answer to the best of your ability and tick the boxes below.'

Part A: Demographic profile

- With the Age and blank space next to it the question was vague so it was changed by adding a block next to specific age to tick.
- The name of the school was removed.
- The word race was changed to ethnicity and specified with brackets that the question is for statistical purpose only.
- The question, 'In which team did you play' was changed to 'At what level did you play' and the third block was added.
- The question, 'For how many years have you been playing soccer' was changed to 'For how many years have you played soccer in a team'.
- The question, 'In what position do you play' was added including specific name positions with blocks next to it.
- The question, 'How many soccer matches have you played in the past season' was changed to 'How many soccer matches did you play in during the past season' and more blocks were added with numbers to select accordingly.
- The question, 'How many training sessions have you participated in the past' was changed to 'How many training sessions did you participate in during the past season' and more blocks were added with numbers to select accordingly.
- The question, 'Do you play any other sport, if yes please specify' was added with at what level and the specific categories with their blocks respectively.

Part B: Injury profile

- The question, 'How many injuries do you currently have, state number' was changed to 'How many soccer injuries do you currently have' and a tick 'none' block was added with 'then proceed to PART C'.
- The question, 'Which parts of the body were injured' was changed to 'Which part/s of your body was/were injured' and the answer blocks for 'head/neck/face' were separated, the 'knee/thigh' was separated, the 'foot/ankle' was also separated then 'shoulder, groin and leg/calf' blocks were added.

- The option answer for the question ‘How long did the injury occur’ the word ‘specify’ was removed.
- The option answer for the question ‘Did the injury occur during a’ the words ‘other(specify)’ was removed.
- The question, ‘What type/s of injury/ies did you have/get’ was changed to ‘what type/s of injury/ies did you have’ and the word ‘ligament sprain’ with the block next to it was added.
- The option answer for the question, ‘How did you hurt yourself’ the word ‘collision’ was added as ‘collision with player’ and the other word ‘shooting’ was changed to ‘kicking with ball’.
- The question, ‘Did you see a doctor/ physiotherapist/other for the injury/ies’ was removed from this category of part B.
- The question, ‘If yes, how long have you been out of training/ not playing because of the injury/ies’ was added as the last question in part B.

The words, ‘Part C: Equipment and treatment’ was changed as ‘Part C: Equipment’ and ‘Part D: Treatment was added.

Part C: Equipment

- The answer option for the question ‘What footwear do you wear when playing soccer’ the word ‘sneakers’ was changed to ‘takkies’ and the words ‘soccer cleats’ were changed to ‘soccer boots’.
- The question, ‘Do you wear shin guards’ was changed to ‘Do you wear shin guards during soccer training sessions’.
- The question, ‘Do you wear ankle protection’ was changed to ‘Do you wear ankle protection during training/matches’.
- The question, ‘Do you wear knee protection during training/matches’ was added.
- The question, ‘What surface do you play on’ was added, with option blocks to choose from.
- The question, ‘What other physical shape/fitness training do you do other than soccer training’ was changed to ‘What other physical fitness training do you do other than soccer training’.
- The question, ‘Did you wear protective equipment when the injury occurred’ was changed to ‘Were you wearing protective equipment when the injury occurred’.
- The question, ‘What treatment did you have/obtain for the injury/ies’ was removed from this category of part C.
- The question, ‘Did you receive any advice’ was removed from this category of part C.
- The question, ‘For how long have you not been training /playing because of the injury/ies’ was removed.

- The question, ‘Do you perform the following exercises during training’ was removed.
- The question, ‘Do you have any access to healthcare at school/site’ was removed from this category of part C.
- The question, ‘Which healthcare service is available to you during/after soccer game’ was removed.
- The question, ‘Do you want to play for the club league/national professional level in the future’ was removed.

Part D: Treatment profile

- The question, ‘Did you do anything for your injury/ies’ and a statement ‘If yes please specify’ was added.
- The question, ‘Did you receive any advice for the injury’ and the statement ‘If yes, please choose from the options below’ was added.
- The question, ‘Do you have any access to healthcare during training/matches at school/on the field’ was added.
- The question, ‘Which healthcare service is available to you during/after soccer match’ was added.
- The question, ‘Do you perform the following exercises during training’ was added, with the answer options and their blocks on the side.
- The question, ‘Do you have any access to healthcare at school/site’ was added.

Part E: Medical and Nutrition profile

- The word ‘Nutrition’ from the heading was changed to ‘Nutritional’.
- The question, ‘Do you suffer from any medical condition’ was changed to ‘Do you suffer from any medical condition/s, if no, then proceed to question 3’.
- The question, ‘Do you take medication for the condition/s’ was added.
- The question, ‘Did you receive any professional advice regarding your injuries’ was removed.
- The question, ‘Do you have any of the following congenital abnormalities, if no, then proceed to question 5 and if yes, please choose options below’ was added.
- The question, ‘What treatment are you taking for the condition’ was added.
- The question, ‘Do you follow any special eating plan’ was changed to ‘Have you been prescribed any diet’.
- The question, ‘Do you drink 8 glasses of water a day’ was changed to ‘Do you have energy drink/water when training/playing soccer’.
- For the answer option for the question, ‘Do you take any other supplements/ medication’, the word ‘sometimes’ with the block next to it was removed.

APPENDIX D1 LETTER OF INFORMATION PRE-PILOT GROUP:

Dear Participant,

I would like to welcome you into the pilot group of my study, the title of my research project is:
The epidemiology of injuries in female high school soccer players in the eThekwini district

Background to the study:
Soccer is regarded as the number one sport globally in terms of participation as well as support. Due to the physical nature of the sport and the high number of injuries, there is a need to establish a profile of soccer injuries. This is needed in order to determine appropriate preventative measures and treatment strategies. My research sets out to achieve this by means of a questionnaire.

Objective of the study:
The data obtained by means of this questionnaire will allow for the establishment of an injury profile for female soccer players and provide valuable information to assist healthcare professionals.

The questionnaire will only take a few minutes to complete, as most of the questions require you to tick the appropriate answer. There are only a few short written responses that are required.
Your participation in this study is much appreciated and you are assured that your comments and contributions to the discussion will be kept confidential. The results of the discussion will only be used for research purposes.

If you have any further questions please feel free to contact either me or my supervisor.

Kind regards,
Keamogetse Sentsomedi (083 476 7827)

Prof. T. Puckree
Research Supervisor (031 373 2704)

Dr C. Kell
Research Co-supervisor (031 373 2393)

APPENDIX D2 INFORMED CONSENT FORM PRE-PILOT:

(TO BE COMPLETED BY THE PARTICIPANTS OF THE PILOT GROUP)

Dear Participant

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my gender, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage and without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and of my own free will declare myself prepared to participate in the study.
- I understand that any significant new findings developed during the course of this research, which may relate to my participation, will be made available to me.

_____ _____ _____ _____

Full Name of Participant **Date** **Time** **Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness (If applicable) **Date** **Signature**

_____ _____ _____

Full Name of Supervisor (If applicable) **Date** **Signature**

APPENDIX E PRE-PILOT STUDY (POST EXPERT GROUP):

QUESTIONNAIRE FOR FEMALE HIGH SCHOOL SOCCER PLAYERS IN THE ETHEKWINI DISTRICT

All questions are strictly confidential. Please answer to the best of your ability and tick the boxes below.

PART A: DEMOGRAPHIC PROFILE

1. **How old are you?** : 14yrs☐ 15yrs☐ 16yrs☐ 17yrs☐ 18yrs☐ 19yrs☐
2. **Name of the sub-district:** Pinetown☐ Umlazi☐
3. **Ethnicity :** African☐ Coloured☐ Indian☐ White☐ (for statistics purpose only)
   Other (please specify) _____
4. **At what level did you play in the previous season?** 1st ☐ 2nd ☐ 3rd
5. **For how many years have you played soccer in a team?** _____
6. **In what position do you play?**

   Goalkeeper (GK) ☐ Defender (DF) ☐ Midfielder (MF) ☐ Strikers(S) ☐
7. **How many soccer matches did you play in during the past season?**

   0-2 ☐ 3-4 ☐ 5-6 ☐ 7-8☐ 9-10☐ More than 11matches☐
8. **How many training sessions did you participate in during the past season?**

   0-2 ☐ 3-4 ☐ 5-6 ☐ 7-8☐ 9-10☐ More than 11matches☐
9. **Do you play any other sports?** Yes ☐ No ☐
   If yes, please specify_____ and at what level?

   Professional☐ League☐ Club☐ Other☐(please specify)_____

PART B: INJURY PROFILE

1. **How many soccer injuries do you currently have?**

   1-5☐ 6-10 ☐ More than 10☐ None☐(then proceed to PART C.)
2. **Which part/s of your body was/were injured**?

   Head☐ Face☐ Neck☐ Shoulder☐ Elbow☐ Wrist☐ Chest☐

   Abdomen☐ Back☐ Groin☐ Thigh☐ Knee☐ Leg/Calf☐

   Ankle☐ Foot☐ Other☐(please specify) _____
3. **How long ago did the injury occur?**

   A week ago☐ 2-4weeks☐ More than 4weeks☐

4. **Did the injury occur during a:** Match☐ Training☐
5. **What type/s of injury/ies did you have?**

   Cut ☐ Back pain ☐ Broken bone ☐ Ligament sprain☐

   Wound☐ Head injury☐ Tendon injury☐ Nerve injury ☐ Muscle tear/strain☐ Bruise☐ Dislocation☐ Other☐(specify)_____
6. **How did you hurt yourself? (Choose more than 2)**

   Tackle ☐ Turning☐ Landing☐ Running☐

   Heading ☐ Jumping☐ Overuse☐ Collision with player☐

   Kicking ball☐ Burns (from grass) ☐ Other☐(please specify) _____
7. **Did you stop training/playing soccer because of the injury?** Yes☐ No☐
8. **If yes, how long have you been out of training/ not playing because of the injury/ies? _____**

PART C: EQUIPMENT

1. **What footwear do you wear when playing soccer?**

   Takkies☐ Soccer boots☐ Other☐(please specify) _____
2. **Do you wear shin guards during soccer training sessions?**

   Yes☐ No☐ Sometimes☐
3. **Do you wear shin guards during training/matches?**

   Yes☐ No☐ Sometimes☐
4. **Do you wear ankle protection during training/matches?**

   Yes☐ No☐ Sometimes☐
5. **Do you wear knee protection during training/matches?**

   Yes☐ No☐ Sometimes☐
6. **What surface do you play on?**

   Dry grass☐ Wet grass☐ Ground☐ Tar road surface☐
7. **What other physical fitness training do you do other than soccer training?**

   _____
8. **Were you wearing protective equipment when the injury occurred?**

   Yes☐ No☐

PART D: TREATMENT

1. **Did you do anything for your injury/ies?** Yes☐ No☐

   If yes please specify_____

(e.g. Rest, Ice, Compression, Elevation, Stretch)

2. Did you receive any advice for the injury? Yes☐ No☐

If yes, please choose from the options below:

Rest☐ Limit sport activity☐ Full sport activity☐

3. Do you have any access to healthcare during training/matches at school/on the field? Yes☐ No☐

4. Which healthcare service is available to you during/after soccer match?

GP☐ Physiotherapy☐ Chiropractic☐ Biokineticist☐ Sports Massage☐

Self- treatment☐ Other (please specify) _____

5. Do you perform the following exercises during training?

Warming-up☐ Stretching☐ Jogging☐
Other, please specify_____

6. Do you have any access to healthcare at school/site?

Yes☐ No☐ Sometimes☐

PART E: MEDICAL AND NUTRITIONAL PROFILE

1. Do you suffer from any medical condition/s?

Yes☐ No☐ (if no,then proceed to question 3)

If yes, please name the condition/s_____
(E.g. Anaemia, Diabetes Mellitus, Hypertension)

2. Do you take medication for the condition/s? Yes☐ No☐

3. Do you have any of the following congenital abnormalities?

Yes☐ No☐ (if no, then proceed to question 5)

If yes, please choose options below:

Genu varum☐ Scoliosis☐ Hip dysplasia☐ Marfan syndrome☐

Genu valgus☐ Spina-bifida☐ Cystic fibrosis☐ Neurofibromatosis☐

Club-foot☐ Turner's syndrome☐ Other☐(specify)_____

4. What treatment are you taking for the condition? _____

5. Have you been prescribed any diet? Yes☐ No☐

6. Do you have energy drink/water when training/playing soccer?

Yes☐ No☐

7. Do you take any other supplements/ medication? Yes☐ No☐

APPENDIX F1 LETTER OF INFORMATION PRE-EXPERT GROUP:

Dear Participant,

I would like to welcome you into the expert group of my study, the title of my research project is:
The epidemiology of injuries in female high school soccer players in the eThekwini district

Background to the study:
Soccer is regarded as the number one sport globally in terms of participation as well as support. Due to the physical nature of the sport and the high number of injuries, there is a need to establish a profile of soccer injuries. This is needed in order to determine appropriate preventative measures and treatment strategies. My research sets out to achieve this by means of a questionnaire.

Objective of the study:
The data obtained by means of this questionnaire will allow for the establishment of an injury profile for female soccer players and provide valuable information to assist healthcare professionals.

The questionnaire will only take a few minutes to complete, as most of the questions require you to tick the appropriate answer. There are only a few short written responses that are required.
Your participation in this study is much appreciated and you are assured that your comments and contributions to the discussion will be kept confidential. The results of the discussion will only be used for research purposes.

If you have any further questions please feel free to contact either me or my supervisor.

Kind regards,
Keamogetse Sentsomedi (083 476 7827)

Prof. T. Puckree
Research Supervisor (031 373 2704)

Dr C. Kell
Research Co-supervisor (031 373 2393)

APPENDIX F2 INFORMED CONSENT PRE-EXPERT GROUP:

INSTITUTIONAL RESEARCH ETHICS COMMITTEE (IREC)
CONSENT

Dear Learner.

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my gender, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage and without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and of my own free will declare myself prepared to participate in the study.
- I understand that any significant new findings developed during the course of this research, which may relate to my participation, will be made available to me.

_____ _____ _____ _____

Full Name of Participant **Date** **Time** **Signature / Right Thumbprint**

I, _____ (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

_____ _____ _____

Full Name of Researcher **Date** **Signature**

_____ _____ _____

Full Name of Witness (If applicable) **Date** **Signature**

_____ _____ _____

Full Name of Legal Guardian (If applicable) **Date** **Signature**

APPENDIX F3 CONFIDENTIALLY STATEMENT EXPERT GROUP DECLARATION:

IMPORTANT NOTICE:
THIS FORM IS TO BE READ AND FILLED IN BY EVERY MEMBER PARTICIPATING IN THE EXPERT GROUP, BEFORE THE EXPERT GROUP MEETING CONVENES.

1. All information contained in the research documents and any information discussed during the expert group meeting will be kept private and confidential. This is especially binding on any information that may identify any of the participants in the research process.

2. The returned questionnaires will be coded and kept anonymous in the research process.

3. None of the information shall be communicated to any other individual or organisation outside of this specific focus group as to the decisions of this expert group.

4. The information from this expert group will be made public in terms of a journal publication, which will in no way identify any participants of this research.

Once this form has been read and agreed to, please fill in the appropriate information below and sign to acknowledge agreement.

Please print in block letters:

Expert Group Member: _____Signature:_____

Witness Name: _____ Signature: _____

Researcher's Name: _____Signature: _____

Supervisor's name: _____Signature: _____

APPENDIX F4 CODE OF CONDUCT:

This form needs to be completed by every member of the Expert Group prior to the commencement of the expert group meeting.

As a member of this committee I agree to abide by the following conditions:

1. All information contained in the research documents and any information discussed during the expert group meeting will be kept private and confidential. This is especially binding to any information that may identify any of the participants in the research process.

2. Due respect to be given to every suggestion and comment by any member of the focus group and be debated with reference to the outcomes of the research.

3. The information gathered from this expert group by the researcher will be made public in terms of a mini-dissertation and journal publication. The researcher will ensure that any participants in the expert group and research remain anonymous and confidential.

MEMBER REPRESENTS	MEMBER'S NAME	SIGNATURE	CONTACT DETAILS

APPENDIX G QUESTIONNARE PRE-EXPERT GROUP:

QUESTIONNAIRE FOR FEMALE HIGH SCHOOL SOCCER PLAYERS

All questions are strictly confidential. Please answer the utmost best and tick one box per question.

PART A: DEMOGRAPHIC PROFILE

13. **Age**:_____
14. **Name of School:** _____

15. **Race:** Black ☐ Coloured ☐ Indian ☐ White ☐
    Other (specify) _____

16. **In which team did you play in the previous season?** 1st ☐ 2nd ☐
17. **For how many years have you been playing soccer?** State number0-2 ☐
    3-5 ☐
18. **How many soccer matches have you played in the past season? State number**0-2 ☐ 3-4 ☐
    More than 4 ☐
19. **How many training sessions have you participated in in the past season? State number**
    0-2 ☐ 3-4 ☐ More than 4 ☐
20. **Do you play any other sports?** Yes ☐ No ☐
    If yes, please specify_____

PART B: INJURY PROFILE

17. **How many injuries do you currently have? State number**
    None ☐ 1-5☐ 6-10 ☐ More than 10☐
18. **Which parts of your body were injured**?
    Wrist ☐ Elbow ☐ Head/Neck/Face ☐ Knee/Thigh ☐ Chest ☐
    Abdomen ☐ Foot/Ankle ☐ Back ☐ other (specify) _____

19. **How long ago did the injury occur?** A week ago ☐ 2-4weeks ☐ More than 4weeks ☐ specify

20. **Did the injury occur during a:** Match ☐ Training ☐
Other (specify) _____

21. **Did you stop training/playing soccer because of the injury?** Yes ☐ No ☐

22. **What type/s of injury/ies did you have/get?**

Broken bone☐ Wound ☐ Cut ☐ Dislocation ☐ Muscle tear ☐ Tendon injury ☐ Nerve injury ☐ head injury☐ Bruise ☐ back pain☐ don't know ☐

23. **How did you hurt yourself? (Choose more than 2)**

Tackle ☐ Burns (from grass) ☐ Running ☐ Shooting ☐ Jumping ☐ Landing ☐ Heading ☐ Turning ☐ Collision☐ Overuse☐ Other (specify) _____

24. **Did you see a doctor/physiotherapist/other for the injury/ies?** Yes☐ No☐

25. **If yes, who?**) _____

PART C: EQUIPMENT AND TREATMENT

7. **What footwear do you wear when playing soccer?**

Sneakers ☐ Soccer cleats ☐ Other (specify) _____

8. **Do you wear shin guards?** Yes ☐ No ☐ Sometimes ☐

9. **Do you wear ankle protection?** Yes ☐ No☐ Sometimes ☐

10. **What other physical shape/fitness training do you do outside soccer training?** _____

11. **Did you wear protective equipment when the injury occurred?** Yes ☐ No☐

12. **What treatment did you have/obtain for the injury/ies?**

GP ☐ Physiotherapy ☐ Chiropractic ☐ Biokineticist ☐ Sport Massage ☐ Self- treatment ☐ Other (specify) _____

13. **Did you receive any advice** Rest ☐ Limit sport activity ☐ Full sport activity ☐

14. **For how long have you not been training/ playing because of the injury/ies?** _____

15. **Do you perform the following exercises during training? (Warming-up, stretching, jogging etc.)** Yes ☐ No☐

16. **Do you have any access to healthcare at school/site?** Yes ☐ No ☐ Sometimes ☐

17. **Which healthcare service is available to you during/ after soccer game?**
GP ☐ Physiotherapy ☐ Chiropractic ☐ Biokineticist ☐ Self- treatment ☐ Sports massage ☐ Other (specify) _____

18. **Do you want to play for the club league/ national professional level in the future?**
Yes ☐ No ☐ Maybe ☐

PART D: MEDICAL AND NUTRITION PROFILE

1. **Do you suffer from any medical condition?** _____
(E.g. Anaemia, Diabetes Mellitus, Hypertension)

2. **Did you receive any professional advice regarding your injuries?**
Yes ☐ No ☐

3. **Do you follow any special eating plan?** Yes ☐ No ☐

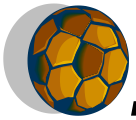
4. **Do you drink 8 glasses of water a day?** Yes ☐ No ☐

5. **Do you take any other supplements/ medication?** Yes ☐ No ☐ Sometimes ☐

APPENDIX H EXPERT GROUP DVD RECORDING:

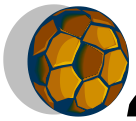
APPENDIX I1 ADVERT A:

DUT DURBAN UNIVERSITY OF TECHNOLOGY

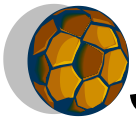
• STEP  1

HAND IN CONSENT FORM FROM PARENTS/GUARDIAN IF UNDER 18 YEARS OLD

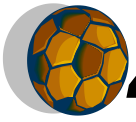
(NOTE: IF YOU DO NOT HAVE THE FORM YOU CANNOT PARTICIPATE IN THIS RESEARCH)

• STEP  2

READ INFO SHEET

• STEP  3

SIGN CONSENT FORM

• STEP  4

COMPLETE QUESTIONNAIRE

(YOU WILL TAKE ABOUT 15-20 MUNITES TO FILL IN THE QUESTIONS)

APPENDIX I2 ADVERT B:

RESEARCH IN PROGRESS

QUESTIONNIARES OF FEMALE HIGH SCHOOL SOCCER PLAYERS

DATE: ……

NAME OF SCHOOL:

……

(QUIET RESEARCH IN PROGRESS)

APPENDIX J- ETHICS CLEARANCE CERTIFICATE:

APPENDIX K- RISK ESTIMATE:

Risk Estimate			
	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio	11.250	2.035	62.195
For cohort (1 injury)	2.708	1.168	6.281
For cohort (2 or more injuries)	0.241	0.081	0.719
Number of valid cases	31		

B13_GRAZE_13 * A8_Match_Played

Crosstab

			A8_Match_Played				
			1 - 5	6 - 10	11 - 15	16 - 20	> 20
B13_GRAZE_13	No	Count	44	23	9	3	2
		% of Total	51.8%	27.1%	10.6%	3.5%	2.4%
	Yes	Count	0	0	1	0	3
		% of Total	0.0%	0.0%	1.2%	0.0%	3.5%
Total		Count	44	23	10	3	5
		% of Total	51.8%	27.1%	11.8%	3.5%	5.9%

Crosstab

			Total
B13_GRAZE_13	No	Count	81
		% of Total	95.3%
	Yes	Count	4
		% of Total	4.7%
Total		Count	85
		% of Total	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	38.171[a]	4	.000	.000	
Likelihood Ratio	19.028	4	.001	.000	
Fisher's Exact Test	17.411			.000	
Linear-by-Linear Association	22.764[b]	1	.000	.000	.000
N of Valid Cases	85				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.000[b]
N of Valid Cases	

a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is .14.

b. The standardized statistic is 4.771.

Risk Estimate

	Value
Odds Ratio for B13_GRAZE_13 (No / Yes)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.