The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality

By

Dale Cameron de Wit

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I, Dale Cameron de Wit, do declare that this dissertation is representative of my own work in both conception and execution (except where acknowledgements indicate to the contrary).

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Dale Cameron de Wit Date

Approved for final submission

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Supervisor: Professor Julian David Pillay, PhD Date

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Co-supervisor: Mrs Jennifer Frances Ducray, MMedSci Date

Dedication

I DEDICATE THIS DISSERTATION TO MY FAMILY AND FRIENDS.
THANK YOU FOR ALL YOUR LOVE AND SUPPORT.
WITHOUT YOU, THE COMPLETION OF THIS DISSERTATION WOULD NOT HAVE BEEN POSSIBLE.

Acknowledgements

To my parents: Thank you for always being my rock to stand on. Thank you for always believing in me and giving me the motivation to never give up. To my brother, Steven, thank you for being my first best friend. To my girlfriend, Anneri, thank you for all your love and support.

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Abstract

Background: Field hockey is a popular international sport which is played in 132 countries across the world. Due to the nature of hockey, players repeatedly perform a combination of forward flexion and rotational movements of the spine in order to strike the ball. These movements have been shown to increase the risk for pain and injury to the lumbar spine. Due to the popularity of the sport of field hockey more empirical randomised controlled studies and/or observational studies need to be conducted to determine the pathomechanics of the nature of lower back pain and injury among players.

Objectives: The objectives of this study were to determine the prevalence and incidence of low back pain in male adolescent field hockey players; to determine the characteristics of the low back pain in terms of location, chronicity, disability and treatment sought; and to determine the selected risk factors (demographics, equipment, health and lifestyle) of low back pain in male adolescent field hockey players.

Method: A descriptive study of cross-sectional design, using a survey data collection tool was used on 112 male adolescent field hockey players in the eThekwini Municipality. The questionnaire data were then statistically analysed using IBM SPSS version 25 with statistical significance set at p value <0.05. Descriptive statistics such as mean and standard deviation, or median and inter-quartile range were used to summarise responses to continuous variables as appropriate. Categorical variables were described using frequency tables. Associations between risk factors and low back pain were tested using Pearson's chi square test and t-tests as appropriate.

Results: A total of 68 participants completed and returned their questionnaires yielding a participation rate of 60.7%. The period prevalence of low back pain was 63.2% and the incidence was 38.2%. Point prevalence at the beginning of the season, mid-season, and end of season was 25%, 32.4% and 22.1% respectively. The most common location for low back pain was the middle low back region (39.5%), and the most common duration of pain was a few hours (32.6%). Most participants (79.1%) did not classify their pain as a disability, and only 44.2% of participants received

medical treatment for their low back pain. The results were found to be statistically significant between hydration and low back pain (p = 0.050) i.e. those individuals who did not hydrate frequently during matches and training were significantly more likely to experience low back pain.

Conclusion: Low back pain in male adolescent field hockey players is a common phenomenon. The results of this study, although limited to a select group of adolescents, showed a slightly higher prevalence of LBP to that of previous studies. More importantly, even though most participants did not experience low back pain classified as a disability, low back pain still had a large impact on participants, as nearly half of participants consulted with a medical professional for treatment. The study further indicates the need for frequent hydration during matches and training as inadequate hydration was found to be significantly related to low back pain. We highlight this as a novel finding and recommend special consideration to this by athletes and coaches. Moreover, the need for the development of strategies in the prevention and management of low back pain in field hockey is further recommended.

Key words: Adolescents, field hockey players, incidence, low back pain, prevalence, risk factors.

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Definitions

Adolescent: This refers to an individual between the ages of 10 and 19 years (WHO 2019).

Incidence: Incidence refers to the number of new cases within a given period. It is noted that when an epidemiological study includes incidence, it can identify causality as it follows a temporal order (Carlson and Morrison, 2009).

Low back pain: Any pain that is located between the 12th rib and the inferior gluteal folds, which may be associated with or without leg pain (Krismer and van Tulder, 2007: 77).

Male: Refers to men or boys, or the gender that fertilizes eggs and does not produce eggs or babies itself (Cambridge Dictionary, 2019).

Overuse Injury: Overuse injuries usually occur due to repetitive loading or activities of the musculoskeletal system with inadequate rest periods, which therefore do not allow for structural adaptation to take place (DiFiori *et al.,* 2014).

Prevalence: The percentage of a population that is affected with a particular disease at a given time (Merriam-Webster Dictionary, 2019). Point prevalence in this study refers to an episode of LBP at a given point in the season i.e. beginning, mid, or end of season. Period prevalence is a collective term which includes all cases of LBP throughout the season.

Abbreviations

The following abbreviations appear in this study:

BMI	Body Mass Index
cm	Centimetre
FIH	International Hockey Federation
Kgs	Kilograms
KZN	KwaZulu-Natal
LBP	Low back pain
N	Number
SD	Standard deviation

Chapter One

Introduction

This chapter provides a background of low back pain in the adult and adolescent population, as well as its impact on field hockey players. It outlines the aim and objectives of the study, and provides the studies rationale. Moreover, it outlines the flow of the dissertation, describing each chapter throughout the dissertation.

1.1 Background

Low back pain (LBP) is currently the most common type of musculoskeletal pain in the world (Storheim and Zwart, 2014) and is estimated to occur in 80% of the population (Smith *et al*., 2014: 1). Low back pain has been shown to have profound effects on an individual's well-being as well as having a negative effect on his/her physical activities, work and social responsibilities (Manchikanti *et al.,* 2014). The majority of LBP episodes usually last for a short duration of time (approximately four to six weeks). In a minority of cases, however, the episode will persist, resulting in increased treatment costs (Melloh *et al.,* 2011; Qaseem *et al.,* 2017). O'Sullivan, (2005) reported that up to 10% of individuals experience disability due to chronic back pain, therefore increasing the economic burden of health. This is especially relevant today, as Hartvigsen *et al.,* (2018) reported that LBP is now the leading cause of disability across the world.

Low back pain in both adolescents and children has typically been considered to be rare and serious. However, recent studies have shown a high prevalence of pain in the lumbar area, similar to those experienced by adults (Maher *et al.,* 2016). Swain *et al*., (2014) showed the prevalence of LBP in adolescents to be 37%, which contradicts the traditional thought of LBP being uncommon in adolescents. Low back pain during adolescence has also been shown to be a significant risk for developing LBP as an adult (Maher *et al*., 2016).

Using meta-analysis, Calvo-Muñoz *et al.,* (2013) compared 59 articles about the prevalence of LBP in adolescents and concluded that the prevalence is higher in the more recent studies than in earlier studies. This indicates that LBP in the adolescent population is becoming an increased health problem. They also described LBP in the adolescent population as becoming a public health concern. Their statistics showed that out of the articles that they studied, 42 were from Europe, six from North America and four from Asia. Only two out of the 59 articles were from Africa, which shows that there needs to be further research into low back pain in the adolescent population in Africa.

Injury and pain in the low back region are commonly due to repeated flexion and rotation of the lumbar spine as it causes tension of the erector spinae muscles (Shan *et al.,* 2013). These movements have also been shown to increase the risk of disc injury (Hadjipavlou *et al*., 2008). Due to the nature of hockey, players repeatedly perform a combination of flexion and rotational movements in order to make stick contact with the ball (Fenety and Kumar, 1992) thus increasing the risk for injury. Injury to the low back is not the only cause of pain as demonstrated by Murtaugh, (2001), who hypothesised that the semi-crouched position that field hockey players perform is a cause of low back pain. Murtaugh, (2001) also concluded that female university players had a low back pain prevalence of 59% during a season. Ellapen *et al*., (2011) supporting the hypothesis of the semi-crouched position as being a cause of LBP.

There is currently limited information about low back pain in male field hockey players in the adolescent population (12-19 years of age) in the eThekwini Municipality as well as in South Africa, as there have only been two South African field hockey studies which provided information on LBP. However, these two studies were conducted on female adolescent players (Ellapen *et al.* 2011; Ellapen *et al.,* 2014). Moreover, countries such as the UK, Canada, Australia and USA have completed multiple studies (two, two, five and nine respectively) however, these studies also did not include the male adolescent population (Barboza *et al.,* 2018). Therefore, providing insight into the epidemiology of the male adolescent population could help players, coaches and health professionals such as physical therapists and Chiropractors with the treatment, management and prevention of low back pain experienced by individuals who participate in field hockey.

1.2 Aim and objectives of the study

The aim of this study was to determine the epidemiology of low back pain in male adolescent field hockey players in the eThekwini Municipality.

Objectives:

To determine the prevalence and incidence of low back pain in male adolescent field hockey players.

To determine the characteristics of the low back pain in terms of location, chronicity, disability and treatment sought.

To determine the selected risk factors (demographics, equipment, health and lifestyle) of low back pain in male adolescent field hockey players.

1.3 Rationale

Previous studies completed have been cross sectional injury profiles of female field hockey players (Ellapen *et al.* 2011; Ellapen *et al.,* 2014; Murtaugh, 2001; Rishiraj *et al*., 2009; Dick *et al.,* 2007). These studies share little information into the epidemiology of LBP in male adolescent field hockey players in terms of the characteristics of LBP and the treatment sought. The above-mentioned studies do not determine at what particular point in time during the season that pain was experienced nor did they determine the incidence of LBP. This study aims to determine the period prevalence of LBP as well as the point prevalence at the beginning of the season, mid-season, and at the end of the season. Furthermore, this allows the incidence of LBP to be determined. When an epidemiological study includes incidence, it can identify causality as it follows a temporal order (Carlson and Morrison, 2009).

An epidemiological study of low back pain in male adolescent field hockey players which includes both incidence and prevalence as well as the characteristics, risk factors and treatment sought, can add valuable information to the literature. Furthermore, the epidemiology of low back pain in male adolescent field hockey

players in the eThekwini Municipality as well as South Africa is currently unknown. This would, therefore provide novel information in the South African context.

1.4 Flow of the dissertation

Chapter one introduces the background and the rationale for the study. This provides general insight to the study as well as premise for the study to take place. The aim and objectives have also been outlined in this chapter.

Chapter two comprises the literature review. This chapter reviews the current literature available and provides in-depth analyses of the pertinent information associated with the topic of investigation. However, the literature available focused predominantly on low back pain in general, low back pain in adult field hockey players and injury profiles from a multitude of sports as few publications have investigated adolescent field hockey players.

Chapter three sets out the research methodology. This provides in-depth detail as to how the research aim and objectives of the study were achieved via the research methods, instruments and study design.

Chapter four presents the results of the study. These results are presented in tables, graphs and charts which are accompanied by a brief description of the data to better the understanding.

Chapter five comprises the discussion of the study. This chapter discusses the results of the previous chapter in relation to the current literature presented in the literature review as well discussing the results in relation to the aim and objectives of the study.

Chapter six outlines the conclusions and limitations of the study. Additionally, it provides recommendations for future studies.

Chapter Two

Literature review

2.1 Introduction

This chapter reviews the current literature available and embodies the following; an over-view of field hockey as a sport, common injuries associated with field hockey, low back pain (LBP), and its impact on field hockey players. This is followed by the anatomical structures of the low back and the possible mechanisms of injury leading to low back pain. Additionally, this chapter details the risk factors of low back pain in field hockey and the importance placed on the management and prevention of low back pain.

2.2 Field hockey

According to the International Hockey Federation (FIH), Field hockey is an Olympic sport played by both men and women (History of Hockey, 2018). The history of the sport dates back to crude forms of the game which occurred in Iran and Ethiopia between 2,000 - 1,000 BC as well as Egypt 4,000 years ago (History of Hockey, 2018). The modern game however, was first introduced in England in the 18th century and the first association was formed in 1876. By 1964 there were 50 countries affiliated with the FIH (History of Hockey, 2018). In recent years the sport has grown rapidly which is largely attributed to the participation in school sports. Today field hockey consists of five continental associations (African Hockey Federation, Asian Hockey Federation, European Hockey Federation, Pan American Hockey Federation, and Oceania Hockey Federation) and is played in 132 countries across the world, showing that field hockey is a highly popular sport worldwide (Hockey and the FIH, 2018). This popularity of field hockey therefore shows the potential for a high prevalence of LBP in players across the world.

The modern game consists of a maximum of 16 players per side, of which 11 players per team are allowed on the field at any given time and the remaining five players are substitutes (Collier *et al*., 2016). Each team is structured around four main positions

which include; a goalkeeper, defenders, midfielders/links and attackers/forwards, however, the exact structure may vary from team to team (Collier *et al.*, 2016). The goalkeeper is the only player on the field who wears full protective gear consisting of; a helmet, hand guards, kickers, leg guards, a chest protector, arm/elbow protectors, a throat protector, a groin/pelvic guard as well as a goalie stick. The goalkeeper is also the only player who is permitted to stop the ball by means of kicking or use of his/her body (Collier *et al*., 2016).

Field players are permitted to wear hand guards, shin guards and mouth guards. They are also permitted to wear supportive guarding such as ankle and knee guards (Collier *et al*., 2016). Field players may only use their stick in order to establish contact with the ball by means of stopping, hitting, pushing, flicking and scooping (Collier *et al*., 2016). In order to do so players must perform repeated flexion and rotational movements of the vertebral column (Fenety and Kumar, 1992). These movements have been shown to greatly increase the risk for paraspinal muscle strains and low back pain when performed in combination (Shan *et al.,* 2013).

2.3 Common injuries associated with field hockey

As with all competitive contact sports there is risk for injury to occur and certain injuries occur more commonly than others (DiFiori *et al.,* 2016). This is no different in field hockey. Ellapen *et al.,* (2009) indicated that the prevalence of ankle injuries amongst male adolescent field hockey players was 26.41%. Sharma *et al.,* (2012) found that injuries to the face and the ankle were the two most common injuries in Indian elite field hockey players. These injuries mostly consisted of contusions, bruising and sprains (Sharma *et al.,* 2012). Dick *et al*., (2007) concluded in a study of female university field hockey players that the ankle was the most common injury site, followed by the knee. However, one of the most common injuries shown to occur in field hockey players is low back pain. Murtaugh, (2001) reported that female university players had a low back pain prevalence of 59% during a season. Van Hilst *et al.,* (2015) concluded that young elite female players had a low back pain prevalence of 67% and young elite males had a prevalence of 33%. Additionally, Reilly and Seaton, (1990) reported a prevalence of 53%. Rishiraj *et al*., (2009), concluded in an injury profile of elite field hockey players that the low back along with the ankle/foot were the

most common injury sites in the body. Ellapen *et al*., (2014) reported that the low back was the second most common injury site after the knee among female adolescent field hockey players. These studies therefore show the commonality of low back pain in field hockey players.

However, these studies conducted by Murtaugh, (2001), Rishiraj *et al*., (2009), and Reilly and Seaton, (1990) were conducted on elite field hockey players or field hockey players who are over the age of 19 and the study conducted by Ellapen *et al*., (2014) was conducted on female adolescents. There is currently a lack of information about low back pain in field hockey players in the male adolescent population. Furthermore, few investigations have shown the specific risk factors for developing low back pain due to participating in field hockey.

2.4 Low back pain

Low back pain is defined as being pain located between the 12th rib and the inferior gluteal folds, which may be associated with or without leg pain (Krismer and van Tulder, 2007: 77). Low back pain (LBP) is currently the most common type of musculoskeletal pain in the world (Storheim and Zwart, 2014) and is estimated to occur in 80% of the population (Smith *et al*., 2014). Low back pain has been shown to have profound effects on an individual's well-being and may prevent them from performing activities of daily living (Ladeira, 2011) thereby having a negative effect on their physical activities, work and social responsibilities (Manchikanti *et al.,* 2014).

Low back pain can be specific or non-specific in nature however, most cases are non-specific (Maher *et al.,* 2017). Goertz *et al.,* (2012) reported that 15% of LBP cases are of a specific cause and 85% of LBP cases are of a non-specific cause. Krismer and van Tulder, (2007: 78) describe non-specific LBP as pain that does not have an underlying pathology, and specific LBP is described as having an underlying pathology such as; trauma, degenerative changes, infections, bone disease or neoplastic causes. Qaseem *et al.,* (2017) describe acute LBP as pain lasting less than four weeks, sub-acute LBP as pain lasting between four to 12 weeks and chronic LBP as pain lasting more than 12 weeks. The majority of LBP cases will resolve in less than six weeks, however up to 20% of LBP cases will become chronic (Chou, 2011).

Additionally, Hartvigsen *et al.,* (2018) reported that LBP is now the leading cause of disability across the world, therefore increasing the economic burden of health. These studies therefore show the large impact that LBP currently has on individuals.

2.5 Anatomical structures of the low back

This section discusses the various anatomical structures of the low back including; lumbar vertebrae and intervertebral discs. This includes descriptions, labelled diagrams and functions of these structures. Additionally, this section describes muscles of the low back region in terms of their origin, insertion, action and innervation.

2.5.1 Lumbar vertebrae

The vertebral column consists of five lumbar vertebrae (L1-L5) which are located between the 12th thoracic vertebra and the base of the sacrum. Each lumbar vertebra consists of a body, a vertebral foramen, transverse processes, articular processes and a spinous process. The lumbar vertebral bodies are larger than those of both the cervical and thoracic vertebrae and the fifth lumbar vertebra is the largest of all vertebrae. The large vertebral bodies along with the pelvis are weight-bearing structures and are therefore designed in order to support the weight of the entire upper body. The lumbar foramen are smaller than the cervical foramen however, are larger than the thoracic vertebral foramen. The transverse processes, articular processes and spinous processes are larger and broader than those of the cervical and thoracic vertebrae. These posterior structures provide valuable protection of the spinal cord. Furthermore, the spinous process and transverse processes of each vertebrae provide a site for muscle attachment (Moore *et al.,* 2010:).

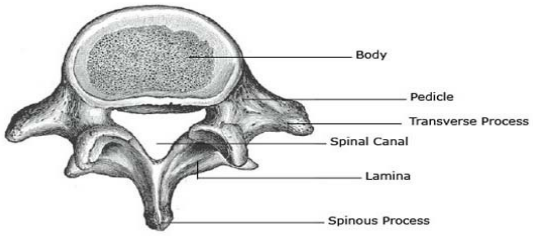

Figure 2.1 Above is a labelled diagram illustrating the anatomy of a lumbar vertebra. https://www.healthpages.org/anatomy-function/lumbar-spine-lower-back-structure-function/

2.5.2 Intervertebral discs

Intervertebral discs (IVD's) are soft pad-like structures found between adjacent surfaces of vertebral bodies and are the main shock absorbers in the vertebral column. Additionally, they provide spacing between the vertebrae in order to prevent the vertebral bodies from coming into contact with one another during movement such as flexion and extension (Frey, 2016). Each IVD consists of two parts: the nucleus pulposus and the annulus fibrosus. The annulus fibrosus forms an outer ring which encapsulates the nucleus pulposus and consists of collagen fibres which are arranged in multiple sheets called lamellae (Moore *et al.,* 2010: 464-465). The annulus fibrosus forms a layer of protection for the nucleus pulposus and amplifies stability of the spine during rotational movements (Frey, 2016). The nucleus pulposus forms the central portion of the intervertebral disc which consists of a semi-fluid elastic material and contains a greater concentration of water than the annulus fibrosus. The fluid nature of this part of the disc allows the disc to alter its shape and deform without being compressed when pressure is applied (Tortora and Derrickson, 2011: 234) thus providing the disc with its shock absorbing characteristics (Moore *et al*., 2010: 465).

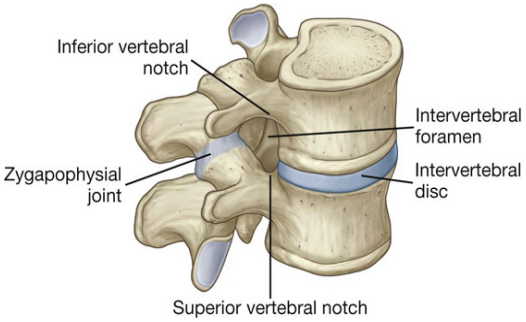

Figure 2.2

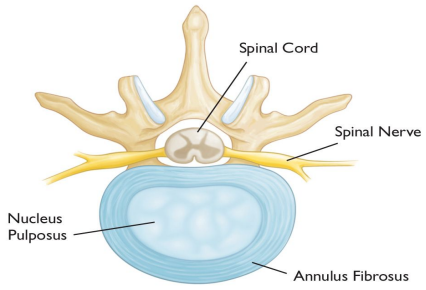

Figure 2.3

Figure 2.2 and figure 2.3 above are labelled diagrams illustrating the anatomy of an intervertebral disc.

http://physiologicnyc.com/treatment-for-herniated-disc/

https://orthoinfo.aaos.org/en/diseases--conditions/herniated-disk-in-the-lower-back/

2.5.3 Erector spinae

Erector spinae consists of three muscles which include: Iliocostalis group, Longissimus group and Spinalis group.

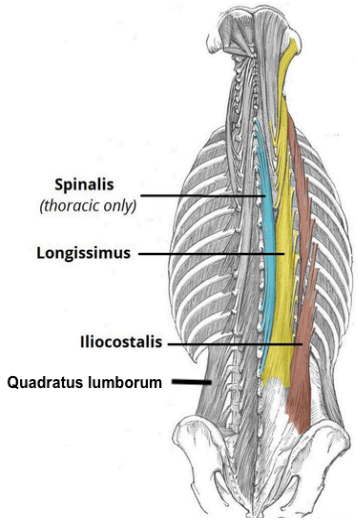

Figure 2.4 Above is a labelled diagram illustrating the erector spinae muscle group as well as the Quadratus lumborum muscle.
http://teachmeanatomy.info/back/muscles/intrinsic/

Table 2.1 Erector spinae muscles.

Muscle	Description	
Iliocostalis thoracis. (Tortora and Derrickson, 2011: 418)	Origin	Ribs 7-12.
	Insertion	Ribs 1-6.
	Action	- Lateral flexion of the lumbar spine at the level of attachment. - Extension of the vertebral column when acting with Iliocostalis cervicis in order to maintain upright posture.
	Innervation	Thoracic spinal nerves.
Longissimus thoracis.	Origin	Originates from the lumbar transverse processes.
	Insertion	Inserts to the transverse processes of the upper lumbar vertebrae, all the thoracic vertebrae as well as ribs 9 and 10.
	Action	- Lateral flexion of the lumbar spine at the level of attachment.

(Tortora and Derrickson, 2011: 418)		- Extension of the vertebral column when acting with Longissimus cervicis and Longissimus thoracis in order to maintain upright posture.
	Innervation	Thoracic and lumbar spinal nerves.
Spinalis thoracis. (Tortora and Derrickson, 2011: 418)	Origin	T10-L2 Spinous processes.
	Insertion	Superior thoracic vertebrae spinous processes.
	Action	Extension of the vertebral column.
	Innervation	Thoracic spinal nerves.

Table 2.2 Additional muscles which may contribute to low back pain.

Muscle		Description
Quadratus lumborum. (Muscles - Organized by Region, 2009)	Origin	Posterior aspect of the iliac crest.
	Insertion	L1-L4 lumbar vertebrae transverse processes as well as the 12th rib.
	Action	Lateral flexion of the vertebral column.
	Innervation	Spinal nerves L1-L4 (ventral primary rami and the subcostal nerve)
Psoas major. (Muscles - Organized by Region, 2009)	Origin	Lumbar vertebrae bodies and transverse processes.
	Insertion	Lesser trochanter of the femur via the iliopsoas tendon.
	Action	Forward and lateral flexion of the lumbar vertebral column as well as flexion of the thigh.
	Innervation	Spinal nerves L2-L4 (branches of the ventral primary rami).
Multifidus. (Tortora and Derrickson, 2011: 418)	Origin	Inferior-lateral aspects of the spinous processes.
	Insertion	L1-L5 lumbar mamillary processes.
	Action	Bilaterally- extension of the lumbar spine. Unilaterally- provides stabilization during rotation.
	Innervation	Medial branch of the dorsal ramus.

Gluteus maximus. (Moore *et al.,* 2010: 564).	Origin	Iliac crest, posterior surface of the sacrum, coccyx and sacrotuberous ligament.
	Insertion	Iliotibial tract and the gluteal tuberosity.
	Action	Extension of the thigh and assistance of lateral rotation of the thigh.
	Innervation	Inferior gluteal nerve L5-S2.
Gluteus medius. (Moore *et al.,* 2010: 564).	Origin	Outer surface of the Ilium.
	Insertion	Lateral aspect of the greater trochanter of the femur.
	Action	Abduction and medial rotation of the thigh.
	Innervation	Superior gluteal nerve L5, S1.
Gluteus minimus. (Moore *et al.,* 2010: 564).	Origin	Outer surface of the Ilium.
	Insertion	Anterior aspect of the greater trochanter of the femur.
	Action	Abduction and medial rotation of the thigh.
	Innervation	Superior gluteal nerve L5, S1.

2.6 Possible mechanisms leading to low back pain in field hockey

There are numerous factors which may be potential causes of low back pain and lumbar overuse injuries associated with field hockey. Some of these causes include: type of movement, repetition and fatigue, posture and asymmetric activity.

2.6.1 Type of movement

During matches and practices field hockey players may only use their stick in order to make contact with the ball by means of stopping, hitting, pushing, flicking and scooping (Collier *et al*., 2016). In order to do so players must perform repeated flexion and rotational movements of the vertebral column (Fenety and Kumar, 1992). Shan *et al.,* (2013) reported that lumbar flexion on its own is usually well tolerated, however, when

lumbar flexion is combined with rotational movements it greatly increases the risk for muscle strains and low back pain. Muscle strains and ligament sprains are not the only area of concern. According to Hadjipavlou *et al*., (2008) rotation of the vertebral column places annular fibres of the lumbar intervertebral disc under a mechanical disadvantage and therefore a combination of forward flexion, compression and rotational movements increases the risk for disc degeneration and injury. These changes due to torsional injury are well observed in clinical imaging studies (Hadjipavlou *et al*., 2008).

2.6.2 Repetition and Fatigue

Repetitive motion injuries are highly common amongst athetes and make up more than 50% of all sporting related injuries seen by medical doctors (Haraldson and Blasko, 2017). These injuries occur as a result of microtears which occur in tissue such as muscle and tendons (Haraldson and Blasko, 2017). Due to the repetition of movement the microtearing occurs at a faster rate than what the body is able to repair the tissue, resulting in inflammation and pain (Haraldson and Blasko, 2017).

Repetition of movements may also lead to possible fatigue of muscles. During dynamic activity the sequence between muscle contraction and relaxation occurs rhythmically, thus allowing muscles to receive adequate blood supply (van Tulder *et al*., 2007). However, when there is continuous contraction of muscle with insufficient break periods blood circulation may decrease to the muscles being used, resulting in muscular fatigue which is a precursor to strain and injury (van Tulder *et al*., 2007). In addition to this, it is possible that pain receptors may become hypersensitive, leading to an increased pain response even with minimal stimulation (van Tulder *et al*., 2007).

2.6.3 Asymmetric activity

Due to the nature of hockey, asymmetrical activity is another factor which needs to be taken into consideration when looking at fatigue, pain and injury. It has already been stated that in order to make contact with the ball, players must perform repeated flexion and rotational movements of the lumbar spine. In addition to these movements, field hockey is only played right-handed. This meaning that the ball may only come

into contact with the flat surface of the stick which is on the left side of the hockey stick, and faces towards the left side of the player (Collier *et al*., 2016: 6). Under no circumstance may the ball come into contact with the back of the hockey stick (Collier *et al*., 2016: 61). This creates an asymmetrical movement when striking the ball as one side is favoured.

Asymmetrical activity has been shown to have a negative impact on the risk factors for low back pain (Motmans *et al.,* 2006). According to Ning *et al.,* (2011) asymmetric activity causes implications in spinal loading. This is due to muscles and structures being stressed unevenly on the contralateral versus the ipsilateral side with regard to the direction of movement, which therefore increases the chance for mechanical imbalances (Ning *et al.,* 2011). In movements such as rotation and lateral flexion, high levels of activity occur contralateral to the direction of movement, whereas the level of activity on the ipsilateral side are minimal (Pope *et al*., 2002). This asymmetry in muscular activity can result in unequal stress on various other structures of the spine (Pope *et al*., 2002:).

2.6.4 Posture

Posture is defined as being the position or bearing of the body whether that be characteristic or assumed for a specific purpose (Definition of Posture, 2018). According to Pope *et al.,* (2002) any prolonged posture will lead to static loading of the soft tissues and cause discomfort and fatigue. In order to support an upright posture muscular activity is necessary, however, this activity is minimal when vertebral segments are aligned to the centre of gravity as the vertebral bodies and intervertebral discs will support a large majority of the load (Pope *et al*., 2002). However, any position which changes the centre of gravity requires increased muscular activity to counterbalance forces and provide equilibrium (Spyropoulos *et al.,* 2016). Activities that maintain awkward postures, bending, turning, crouching, or positions of prolonged sitting or standing as well as repetitive movements may result in the development of low back pain disorders (Spyropoulos *et al.,* 2016). This supports Murtaugh, (2007) who demonstrated that injury is not the only cause of low back pain and hypothesised that the semi-crouched position that field hockey players perform is a cause of low back pain. Murtaugh's hypothesis was supported by Ellapen *et al*., (2011).

Furthermore Sharma *et al.,* (2012) noted that the semi-crouch position while performing fast movements such as running and dribbling is an ergonomically unsuitable posture which will likely lead to back pain in field hockey players.

2.7 Risk factors for low back pain related to field hockey

Risk factors in sport are considered to be any factors that may increase the likelihood for injury (Meeuwisse, 1991). According to Emery (2005) adolescent injury risk factors are divided into two basic categories. These two categories include extrinsic or intrinsic risk factors which can further be broken down into either non-modifiable risk factors or potentially modifiable risk factors (Emery, 2005). According to Caine *et al.,* (2008) intrinsic risk factors are the individual's characteristics which may predispose the athlete to injury and the manner in which that athlete may react to an injury. Extrinsic risk factors may facilitate or contribute to injury once the athlete has already been predisposed to injury via the intrinsic risk factors, and may impact the athlete while they are playing the sport (Caine *et al.,* 2008). Extrinsic risk factors include; level of competition, playing position, playing time, rules of the game, equipment (footwear and protective equipment) as well as playing surface (Emery, 2005). Intrinsic risk factors include; age, gender, body mass index (BMI), previous injury, fitness level, strength, flexibility, biomechanics and joint stability (Emery, 2005).

2.7.1 Adolescence and growth spurts

The benefits of adolescents participating in physical activity for fitness, self-esteem and socialisation are well understood and documented (DiFiori *et al.,* 2014). As a result, the participation of adolescents in school and organised sports is becoming increasingly popular and more competitive across the world (DiFiori *et al.,* 2016). However, the importance placed on competitive success in order to achieve Provincial/National selection, as well as obtaining university bursaries or professional contracts has become common place (DiFiori *et al.,* 2014). Due to these circumstances many children begin specialising in their respective sports from an early age and many of these individuals train year-round (DiFiori *et al.,* 2016). This increase in participation from a young age raises questions regarding the risks for developing

acute and overuse injuries and how these injuries may be prevented (Caine *et al.,* 2008).

It is also important to note that growth spurts during adolescence increases the risk for overuse injuries (DiFiori *et al.,* 2016). The rapid growth in skeletally immature individuals places the apophysis and articular surfaces of bone under a disadvantage as they are less resistant to compressive, tensile and shear forces (DiFiori, 2010). DiFiori, (2010) reported that bone is more porous during adolescence because linear growth occurs more rapidly than bone mineralization and therefore the likelihood of injury and stress fractures is heightened. In addition to this, during rapid skeletal growth the synchronization between bone, muscle and tendon is not equivalent which may result in decreased flexibility (Grady and Goodman, 2010) and increased muscle-tendon tightness (DiFiori *et al.,* 2014). DiFiori, (2010) reported that there are also biomechanical factors to take into consideration that occur with rapid growth. These factors include changes in the mass and length of an individual as well as the moment of inertia placed on joints. This results in increased stress placed upon ligaments, musculotendinous junctions, tendon-bone junctions and cartilage (DiFiori, 2010). The increase in stress placed upon these structures coupled with an imbalance between growth and strength as well as an increased training routine creates a situation where the development of overuse injuries and resultant pain in adolescents is highly likely (DiFiori, 2010).

2.7.2 Body mass index

The World Health Organization describes body mass index (BMI) as a nutritional status measurement which is calculated by an individual's body mass in kilograms divided by their height in meters squared (Body mass index – BMI, 2018). Shiri *et al.,* (2010) concluded in a meta-analysis of 33 studies that increased body mass amongst individuals increases the risk for low back pain. According to Caine *et al.,* (2008) a higher body mass will create greater forces on joints and surrounding soft tissue, thus increasing the risk for injury of that individual. This supports Stuart *et al.,* (2003) who reported an increased injury rate among individuals who have a higher body mass or players who have an increased BMI. Furthermore, in a study conducted by Ellapen *et al.,* (2014) which examined female adolescent field hockey players, found that there

were higher injury rates amongst players who had a higher mean body mass (kg), taller mean stature (m) and overall higher mean BMI.

2.7.3 Playing position

There is limited information amongst studies conducted on field hockey to determine which playing position has the greatest prevalence of low back pain, and the literature available is conflicting. A study conducted by Sharma *et al.,* (2012) concluded that goalkeepers had the highest rate of low back pain amongst field hockey players. Defenders and midfielders were tied as the second most common position to experience low back pain and forwards had the least number of low back pain cases (Sharma *et al.,* 2012). However, Ellapen *et al.,* (2014) found that defenders had the highest rate of low back pain cases. Additionally, strikers had the second highest number of low back pain cases, followed by midfielders and lastly goalkeepers.

2.7.4 Level of competition and frequency of play

Literature shows that there is a greater risk for injury amongst athletes in competition than in practice. According to Murphy *et al.,* (2003) athletes may be more susceptible to risk taking behaviour in matches as well as being more aggressive at a higher competition level than during practices, thus increasing the risk for injuries to occur during matches. This may be especially true with players who are at the elite level of play. Fett *et al.,* (2017) conducted a cross-sectional study which included 1114 athletes in order to determine the prevalence of back pain in elite athletes compared to a control group consisting of physically active individuals. The elite athletes' group consisted of various sports disciplines including field hockey (Fett *et al.,* 2017). Their results concluded that the elite athletes had a higher prevalence of low back pain in all disciplines of sport compared to that of the control group with physically active individuals (Fett *et al.,* 2017). They determined that the highly competitive level of the elite athletes as well as the significantly higher training volume may contribute to the high back pain prevalence (Fett *et al.,* 2017). Additionally, Hoskins, (2012) stated that young athletes who transition from their respective teams to a higher level of specialisation or to the professional level, may be at greater risk for injury as they may still have poor technique. Furthermore, they may continue to practice and compete

with their low back pain in fear that non-participation may affect their selection to a higher or more professional level of competition (Hoskins, 2012).

2.7.5 Aerobic fitness

It would seem logical that poor aerobic fitness would constitute a risk factor for injury as it would lead to muscle fatigue at a faster rate, thus altering biomechanics and the forces placed on supportive structures such as ligaments and tendons (Murphy *et al.,* 2003). However, the relationship between aerobic fitness levels and injury is currently unclear as studies provide conflicting results. A prospective study of female football players conducted by Östenberg and Roos, (2000) revealed that there was no relationship between fitness levels and risk for injury. Andersen *et al.,* (2006) found no association between physical fitness and back pain in adolescents, however, they did conclude that adolescents with high isometric muscle endurance experienced less back pain. In contrast, Smeets *et al.,* (2006) concluded that people, particularly males ,who have poor aerobic fitness levels are more likely to experience low back pain, compared to those of individuals who have normal fitness levels. Furthermore, Heneweer *et al.,* (2012) conducted a cross-sectional study of 1,723 police officers and found that participants with high physical fitness levels experienced less low back pain than participants with low fitness levels. A possible explanation for the conflicting results between these studies may be due to the studies using different methods in order to determine physical fitness.

2.7.6 Hydration

Water is the largest component of the human body which makes up 45-70% of an individual's body weight (Jones *et al.,* 2008). Furthermore, muscle tissue consists of approximately 75% water (Jones *et al.,* 2008). Therefore, adequate hydration is essential when exercising, especially under the circumstances of hot and humid weather. Exercising vigorously under these conditions may result in increased sweat production which in turn may lead to dehydration (Dehydration, 2018). Dehydration has been shown to cause fatigue, dizziness, muscle cramps and heat injury (Dehydration, 2018). Additionally, Cleary *et al.,* (2005) found that participants experiencing dehydration due to exercise in a hot environment presented with

microdamage of muscle as well exacerbation of delayed onset muscle soreness (DOMS). They further cautioned that individuals exercising in hot and humid weather should take frequent rehydration breaks.

According to Jones *et al.,* (2008) consuming sufficient amounts of fluid in hot weather is essential for athletes in thermal regulation, as well as for producing anaerobic power. Jones *et al.,* (2008) found a direct relationship between water deficits and an athlete's ability to produce power. They reported that athletes who became dehydrated by 3.3% of their body mass had a reduced ability to generate both upper and lower body anaerobic power. Furthermore, they determined that fatigue severity was significantly higher (70%) in the dehydrated group compared to that of the euhydrated group with a *p* value of 0.009. An increase in fatigue has already been shown in 2.6.2 to be a precursor to strain and injury (van Tulder *et al*., 2007). These studies conducted by Cleary *et al.,* (2005) and Jones *et al.,* (2008) therefore indicate the importance of staying sufficiently hydrated in hot and humid weather.

2.7.7 Nutrition

Proper nutrition is a fundamental aspect for growth and development (Smith *et al.,* (2015). Adequate nutrition and calorie intake is crucial in order to provide athletes with enough energy to meet energy demands placed upon them when performing activities in training and competitions, as well as helping with the recovery process (Smith *et al.,* 2015). However, during adolescence individuals experience an increased appetite. They also spend more time eating away from home and often make their own food decisions at school which can greatly be influenced by their friends (Healthy eating during adolescence, 2018). This creates a situation where many adolescents consume unhealthy processed foods and foods high in sugar (Healthy eating during adolescence, 2018). Foods which contain refined carbohydrates such as sugar have been shown to contribute to pain and inflammation (Juanola-Falgarona *et al.,* 2014). These foods high in refined carbohydrates combined with over training may lead to a situation of chronic inflammation (Maffetone and Laursen, 2016).

2.7.8 Equipment

According to DiFiori *et al.,* (2014) incorrect sizing, maintenance or the use of improper equipment for a sport may lead to possible injury. Grip size, weight and length of equipment held by hand, type of shoe and the fit of shoe are all common concerns of equipment, especially when these are not adjusted to the changes in growth of adolescents (DiFiori *et al.,* 2014). It would also seem logical to think that preventive equipment such as bracing would help prevent injury. However, in a systematic review of sports injuries in adolescents, Abernethy and Bleakley, (2007) found that protective bracing was actually associated with an increased injury rate. Protective bracing may contribute to muscle fatigue and reduced athletic performance, which are associated with increasing the risk for injury (Abernethy and Bleakley, 2007). Furthermore, the evidence is contradictory that bracing may enhance sensorimotor control as some studies suggest (Abernethy and Bleakley, 2007). It is important to note that any injury in the lower extremity may alter the kinematic chain of the body and increase the risk for low back pain (Brantingham *et al.,* 2006).

2.8 Management and prevention of low back pain

According to DiFiori *et al.,* (2014) low back pain caused by sport in adolescents can possibly be prevented by limiting participation time, scheduling regular rest periods, monitoring the workload of training during growth spurts, pre-season conditioning, correct equipment and fitting, and early skill development to learn the correct techniques. However, in the case that LBP is not prevented, management is required. Due to the high prevalence of low back pain and the increased growing awareness and concern, there have been a large number of management and prevention methods developed. However, the management of LBP still remains one of the biggest challenges in musculoskeletal conditions (Hill *et al*., 2011). Therefore, improving the management of LBP could potentially minimise the long-term effects, disabling symptoms and decreased work capacity (Hill *et al*., 2011). Ladeira, (2011) completed a systematic review of thirteen multidisciplinary guidelines and three mono-disciplinary guidelines to determine a consensus for the management of LBP. Additionally, Foster *et al.,* (2018) reviewed guidelines from Denmark, the US and the UK. Both studies state that LBP should be managed with the most effective practices available. This is

achieved through evidence-based practice (EBP), which is considered the gold standard method for practitioners to treat patients effectively at the lowest possible cost (Albright *et al*., 2001).

Ladeira, (2011) found that the majority of EBP guidelines for acute LBP included patient education, spinal manipulative therapy and exercises. Most guidelines exercise recommendations included core stability, aquatic therapy and individualised programs (Ladeira, 2011). Foster *et al.,* (2018) also recommends patient education, exercises and other non-pharmacological therapies such as spinal manipulation and acupuncture. Evidence-based practice guidelines for subacute and chronic LBP included the same management as acute LBP, however, with additional cognitive behavioural therapy or a multidisciplinary rehabilitation approach (Ladeira, 2011; Foster *et al.,* 2018). However, Ladeira, (2011) concluded that there is a necessity for mono-disciplinary guidelines to be developed as this will reduce the costs of multidisciplinary care and improve the management of LBP by healthcare practitioners.

2.9 Financial implications of low back pain

Low back pain has a major economic impact internationally (Hartvigsen *et al.,* 2018). Low back pain usually lasts for a short duration of time and therefore does not require extensive treatment, however, in a minority cases it will persist and become chronic, thus resulting in increased treatment costs (Melloh *et al.,* 2011; Qaseem *et al.,* 2017). In addition, Hartvigsen *et al.,* (2018) reported that LBP is now the leading cause of disability across the world, therefore increasing the economic burden of health. The economic burden of health caused by LBP is so high that Ladeira, (2011: 191) reported that up to 50 billion US Dollars a year is spent on LBP in the United States alone. Crow and Willis, (2009) reported that total costs of low back pain in the United states including decreased productivity and lost wages exceeds 100 billion US Dollars a year. The reasoning for such high costs is due to direct and indirect costs. Direct costs include treatment bills from practitioners (such as GP's, Chiropractors and Physiotherapists), hospital bills, and workers' compensation. Indirect costs include lost productivity, over-pay to work colleagues for picking up extra shifts and training/hiring

of new employees when the injured employee is unable to return to work (Indirect Costs of Back Pain and MSDs, 2014).

2.10 Conclusion

Field hockey is an immensely competitive sport across the world that entails a combination of aerobic fitness, skill and coordination. Due to the nature of the game and the anatomical positions that players need to repetitively undertake in order to make stick contact with the ball, such as a combination of forward flexion with rotation and the semi crouched position, field hockey players are often predisposed to factors which lead to low back pain. Low back pain has been discussed in depth according to the current literature in terms of what it is, the commonality in field hockey, the possible mechanisms leading to low back pain, the risk factors, the importance of management and the financial implications if left untreated. Although the prevalence of low back pain in field hockey varies between studies, no study has shown a complete lack of low back pain amongst a group of players, in fact most studies have shown low back pain to be one of the most commonly affected sites of injury. Furthermore, there is a paucity of literature amongst the male adolescent population. An understanding into the information gained about the prevalence, incidence, risk factors and treatment sought for low back pain as a result of field hockey will help healthcare practitioners, coaches and players with the best possible understanding and management approaches to take in order to minimise and prevent low back pain in the sport. This is especially true in the male adolescent population where there is currently a lack of literature.

Chapter Three

Methodology

3.1 Background

This chapter describes the methodology used in terms of the; study design, setting, population, permissions granted, inclusion and exclusion criteria, participant recruitment, measuring tools, the study procedure, along with the data collection and its analysis.

3.2 Study design

This research study was a descriptive study of cross-sectional design, using a survey data collection tool. Survey research is defined as “the collection of information from a sample of individuals through their responses to questions” (Check and Schutt, 2012: 160). The questionnaire (Appendix I) contained the following sections; demographics, general, health and lifestyle, low back pain, treatment and disability.

3.3 Setting

The setting of this research was held at selected high schools within the eThekwini Municipality.

3.4 Population

The study population included male adolescent field hockey players in the eThekwini Municipality. The population age range was set between 12-19 years of age.

3.5 Permission to conduct research

Full ethical approval was granted to conduct research by the Institutional Research Ethics Committee (IREC) (Appendix M) at the Durban University of Technology,

following the review of the results from the focus group and the pilot study. In order to grant full ethical approval IREC also required gate keeper permissions. These permissions were obtained as permission was granted from the Kwazulu-Natal Department of Education (Appendix G and H) and permission from the Principals of the respective schools (Appendix E and F). Full ethical approval indicated that the research study obeyed the principles of the Declarations of Helsinki of 1964, and Nuremburg and Belmont of 1947.

3.6 Inclusion and exclusion criteria

The following criteria were used to determine those eligible for inclusion in the study:

- Male adolescents (12-19 years of age) who participate in field hockey in the eThekwini Municipality.
- Field hockey players who participate on an Astroturf surface.
- Participants having completed the learner assent form (Appendix D) along with their parent/legal guardian providing consent (Appendix B).

The following criteria were used to determine those not eligible for inclusion into the study:

- Participants who participated in the pilot study.
- Participants whose parent/legal guardian did not provide informed consent (Appendix B)
- Participants who did not sign the learner assent form (Appendix D).
- Participants residing outside the eThekwini municipality.

3.7 Sampling

Sampling included participant recruitment and sample size.

3.7.1 Participant recruitment

Once permission was granted from IREC (Appendix M), the KZN Department of Education (Appendix G and H) and the Principals of the selected high schools (Appendix E and F), the researcher contacted each high school and set up a suitable

time and date to meet at the end of the playing season (month of July). This was discussed with the Directors of hockey at each school in order to arrange a suitable time and date. The procedures were then explained to the participants who met the inclusion criteria.

3.7.2 Sample size

Four Government high schools in the eThekwini municipality met the requirements in playing hockey on Astroturf. Each school met the same requirements of the 1st team, 2nd team, u16 A and B sides, and u14 A and B sides.

A target population of 157 participants was estimated by the Raosoft® software package as a minimum response rate (70%) to provide generalizability (Singh, 2016). However, two of the high schools did not provide permission to conduct research. As such, the new target population became 112 participants. All 112 participants in the target population were invited to participate in the study. This resulted in a sample size of 112 participants.

3.8 Measurement tool

A self-administered questionnaire was developed by the researcher. Questionnaires from Westbrook (2005) and Goertz et al. (2012) were used to inform the development of the questionnaire. The questionnaire was modified by the expert focus group discussion and pilot study, respectively. The Quebec Pain Disability Scale was used from Kopec *et al.,* (1995), and Davidson and Keating (2002) in order to determine the characteristics of low back pain in terms of disability.

3.8.1 Focus group

In order for IREC to grant full ethical approval of the study, a focus group was used in order to validate the pre-focus group questionnaire. The focus group assessed factors such as length and layout of the questionnaire, as well as appropriateness of the questions. Additionally, it allowed for corrections to be made with regard to any mistakes identified in questions as well as the option to remove existing questions and/or add new questions.

The focus group consisted of the following members to validate the questionnaire:

- The researcher
- The research supervisor/s
- Two potential participants
- A Master's student who was currently conducting questionnaire research
- One lecturer who has experience in quantitative research

These individuals read and signed the Letter of Information and Consent (Appendix J and K) and a focus group code of conduct form (Appendix L). Once all members of the focus group agreed to the procedure, they received a copy of the questionnaire. Thereafter, all questions in the questionnaire were discussed and all necessary changes or suggestions were made. This formed the pilot questionnaire.

3.8.2 Pilot study

A pilot study is a pre-run testing trial that allows the researcher to identify if there are any discrepancies in the questionnaire and if the participants understand the instructions and questions being asked. This allows the researcher to determine if there are any weak points in the questionnaire (Kelley *et al.* 2003). Two male adolescent field hockey players were chosen to participate in the pilot study. These participants did not take part in the focus group. The researcher explained the procedure to the pilot study participants and ensured that the process was confidential and the participants were able to withdraw from the pilot study at freewill. Participants read and signed the Learner Letter of Information (Appendix C) and the Learner Assent (Appendix D). Their parents read and signed the Parent Letter of Information (Appendix A) and signed the Parent Consent (Appendix B). Once this was completed, the researcher measured the height of the participants with a measuring tape and measured the participants body mass with an electronic scale. The participants then began answering and completed the questionnaire. The height, body mass, and answering of the questionnaire were performed in the exact same manner and with the use of the same measuring instruments as the main research study to provide reliability. These participants were given the opportunity to provide feedback and to make necessary changes. The pilot study helped determine if the questionnaire was

easy to understand, and to address any areas that the participants found problematic. Additionally, the pilot study determined the average time taken by the participants to complete the study. The participants opted not to make any changes to the questionnaire.

3.9 Study procedure

Once permission was received by IREC (Appendix M), the KZN Department of Education (Appendix G and H) and the Principals of each school (Appendix E and F), a suitable time and date were arranged at the end of the playing season (month of July) for the researcher to visit the selected schools. Questionnaires along with the Parents' Letter of Information and Consent (Appendix A and B) and the Learner Letter of Information and Learner Assent (Appendix C and D) were handed out at the schools of the participants. These were taken home with the participants so that their parent/legal guardian could read and sign the Letter of Information and Consent. They were then collected by the researcher at the participant's school at an arranged later date. The participants also read and signed the Learner Letter of Information and Learner Assent. The researcher was present to address any concerns or questions. A member of staff from the school was present at all times in order to maintain freedom from bias and ensure that there was no coercion. In addition, the pupils were carefully informed about voluntary participation and freedom to withdraw prior to embarking on the data collection.

The name of the school and name of the participants remained anonymous and were not placed on the questionnaires. The height and weight of the participants was measured by the researcher at the respective schools. Weight was measured with an electronic scale and height was measured with a tape measure. This was not performed in front of other students in order to maintain confidentiality and comfort. A member of staff, however was present for this. There was no physical examination performed. It should also be noted that not all participants needed to complete the entire questionnaire (Appendix I), as participants who have not experienced low back pain did not need to complete the questionnaire from section D onwards, as these questions were not applicable to them.

3.10 Ethical considerations

- Full ethical approval was granted from the Institutional Research and Ethics Committee (IREC) at the Durban University of Technology (Ethics number: REC 102/17).
- The KZN Department of Education and Principals of each school provided written permission (Appendix H and F respectfully).
- The participants' parents read and signed the Letter of Information and Informed Consent (Appendix A and B), respectively as the participants are considered a vulnerable group in still being minors.
- The participants read and signed the Learners' Letter of Information and Learner Assent (Appendix C and D) to ensure autonomy.
- The names of schools and participants were not given on the questionnaires in order to provide confidentiality.
- Nonmaleficence was ensured as participants did not suffer any harm from the research.
- Justice was ensured throughout as the study was fair and impartial. There was no direct benefit for participation and each participant was treated the same.
- Participants were able to withdraw from the study at any time as the process was voluntary.
- The research data will be utilised by the researcher, the research supervisor and the statistician only, and confidentiality will be maintained at all times.
- Data collected will be safely stored and will be kept for 5 years in the DUT Chiropractic department, thereafter will be destroyed by shredding.

3.11 Data analysis

The data was captured on a Microsoft excel spreadsheet and then statistically analysed using IBM SPSS version 25. Descriptive statistics such as mean and standard deviation, or median and inter-quartile range were used to summarise responses to continuous variables as appropriate. Categorical variables were described using frequency tables. Associations between risk factors and low back pain were tested using Pearson's chi square test and t-tests as appropriate. A p value <0.05 was considered as statistically significant.

Chapter Four

Results

4.1 Introduction

This chapter presents the statistical data and results of the study. It embodies the following; the participation rate, the prevalence and incidence of low back pain, the characteristics of low back pain in terms of the location, chronicity, disability and treatment sought. Lastly, it presents the selected risk factors identified, which include; demographics, equipment, health and lifestyle.

4.2 Participation rate

The target population consisted of all the male adolescent field hockey players currently attending government high schools within the eThekwini Municipality. Using this target population, an initial study population size of 157 participants was calculated according to Singh (2016). However, two schools within the eThekwini Municipality subsequently declined to participate in the study, reducing the study population to 112. All of the 112 male adolescent field hockey players were invited to participate in the study, and a total of 112 questionnaires were administered. Of the 112 questionnaires administered, 68 participants completed and returned their questionnaires. This resulted in a participation rate of 60.7% of the study population.

4.3 Demographics

Demographics consisted of the age and ethnicity of the participants. The mean age of participants was 15.37 years (SD 1.5 years) with an age range from 13 to 18 years. With regard to ethnicity, the majority of participants were White (72.1%; n = 49), followed by African (11.8%; n = 8), Indian (10.3%; n = 7), Coloured (4.4%; n = 3), and lastly participants identifying as Other (1.5%; n = 1).

4.4 Prevalence and incidence of low back pain

The overall period prevalence of low back pain during the three month playing season was 63.2% (Table 4.1). Incidence included all participants who developed low back pain over the season and did not experience it in the beginning of the season (i.e. the number of new cases). Incidence was 38.2% (Table 4.1). Point prevalence was measured at the beginning of the season, mid-season and at the end of the season. Point prevalence at the beginning of the season was 25%, mid-season point prevalence was 32.4%, and end of season point prevalence was 22.1% (Table 4.1). It is noted that some players experienced more than one point prevalence.

Table 4.1 Prevalence and incidence

	No Low back pain		**Low back pain**	
	Frequency (n)	**Percent (%)**	**Frequency (n)**	**Percent (%)**
Period prevalence	25	36.8%	43	63.2%
Incidence	42	61.8%	26	38.2%
Point prevalence beginning of season	51	75%	17	25%
Point prevalence mid-season	46	67.6%	22	32.4%
Point prevalence end of season	53	77.9%	15	22.1%

4.5 Location of low back pain (LBP)

Most participants experienced middle low back pain (39.5%) or bilateral low back pain (34.9%) with very few participants (2.3%) experiencing LBP with Gluteal pain (Figure 4.1).

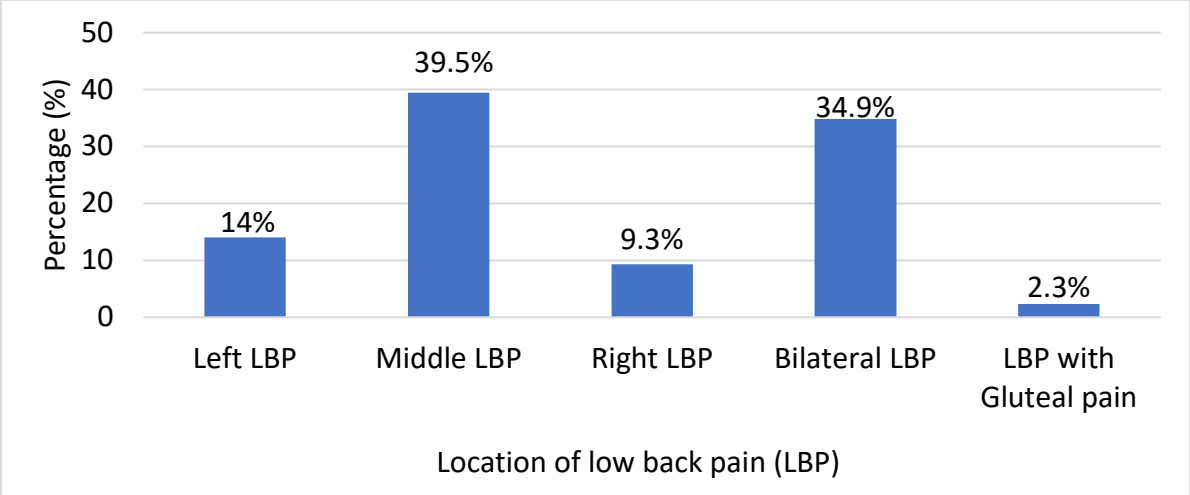

Figure 4.1 Location of low back pain

4.6 Chronicity of low back pain

Most participants experienced low back pain for a few hours (32.6%) or days (27.9%) (Figure 4.2).

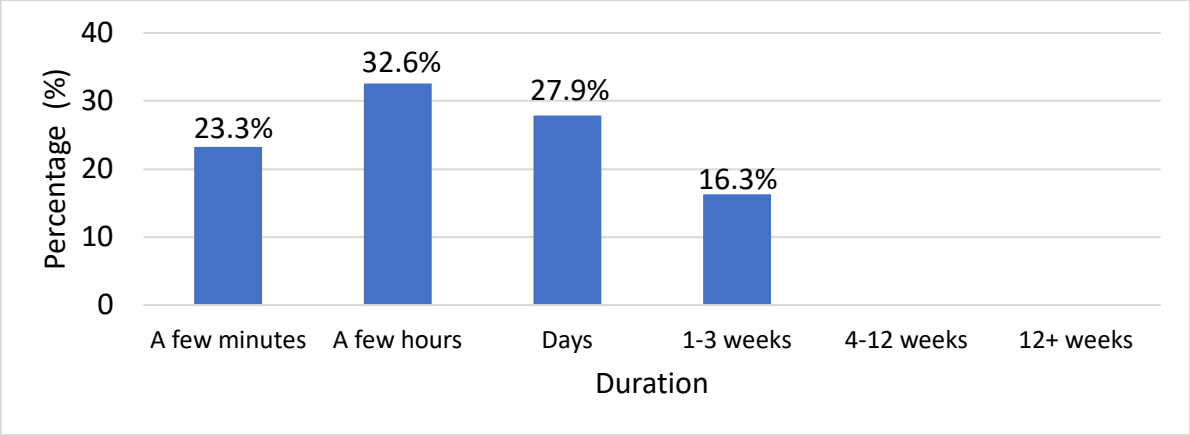

Figure 4.2 Duration of low back pain

It is noted that 62.8% of participants experienced low back pain during a previous hockey season, and 37.2% of participants did not experience low back pain during a previous season.

Furthermore, low back pain was experienced most commonly during training sessions (20.9%) or post-match (18.6%) (Table 4.2), indicating that low back pain only lasted for a short duration of time.

Table 4.2 Type of play when low back pain was experienced

Type of play		Frequency (n)	Valid Percent (%)
Valid	First training session of season	6	14.0
	First training session, During training and post-match	1	2.3
	First training session and during other training sessions	3	7.0
	First training session and post-match	1	2.3
	During training sessions	9	20.9
	During training, post-training, during a match and post-match	2	4.7
	Post-training, during a match and post-match	5	11.6
	During training sessions and post-match	1	2.3
	Post-training	4	9.3
	Post-training and post-match	3	7.0
	Post-match	8	18.6
Total		43	100.0

4.7 Disability due to low back pain

The Quebec Back Pain Disability Scale was used to determine if any participants experienced self-reported disability due to low back pain. A score of greater than 15 indicates disability with regard to this scale. The median score of participants was 6 (Table 4.3). Most players did not experience low back pain that was classified as a disability (79.1%) (Figure 4.3). Furthermore, missing practices or matches due to low back pain were not common and most participants did not have to adjust the way they play due to their low back pain.

Table 4.3 Quebec Back Pain Disability Scale

Quebec Back Pain Disability Scale (over 15 indicates disability)		
N	Valid	43
	Missing	25
Median		6.00
Minimum		0
Maximum		45
Percentiles	25	1.00
	50	6.00
	75	13.00

20.9% of participants experienced low back pain classified as a disability. This is shown in Figure 4.3.

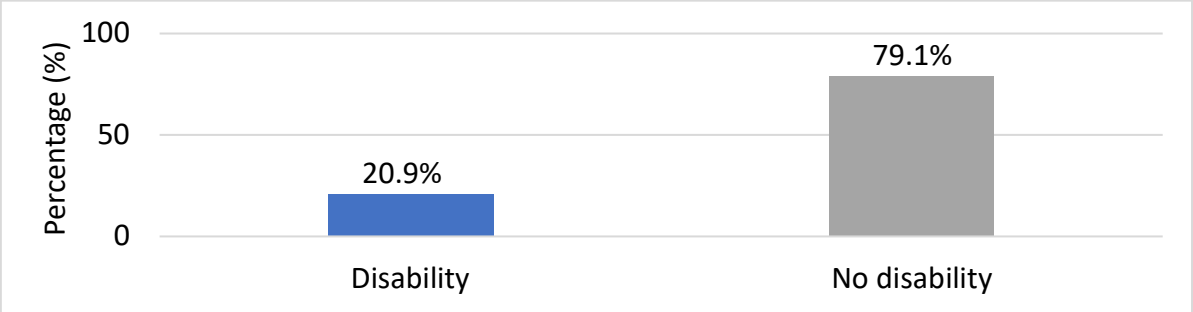

Figure 4.3 Percentage of participants with self-reported disability

Disability will further be discussed in terms of; practices/matches missed due to low back pain, adjustments made to play and other injuries experienced during the season.

4.7.1 Practices or matches missed due to low back pain

Missing practises or matches due to low back pain were not common. 93.0% of participants did not miss practices or matches, while only 7.0% of participants did. In the case where practices or matches were missed, the maximum number missed was only 2, as seen in Table 4.4.

Table 4.4 Number of practices/matches missed

Number of practices/matches missed		Frequency (n)	Valid Percent (%)
Valid	1	1	33.3
	2	2	66.7
Total		3	100.0

4.7.2 Adjustments made to play due to low back pain

Low back pain did not cause most participants to adjust the way they play, as 86.0% of participants reported no changes to play. Only 14.0% of participants reported that low back pain resulted in adjustments to play.

In the case where adjustments to play were made, there was a common thread of difficulty with bending forward (forward flexion) (Table 4.5).

Table 4.5 Adjustments made to play

Adjustments made to play		Frequency (n)	Valid Percent (%)
Valid	Difficulty bending forwards	1	16.7
	Difficulty running, making fast movements and bending	1	16.7
	Had to play without bending	1	16.7
	More upright and not bending	1	16.7
	No explanation	1	16.7
	Ran slower	1	16.7
Total		6	100.0

4.7.3 Other injuries experienced during the season

Of those with low back pain, 72.1% of participants did not experience other injuries. However, of the 27.9% of participants who did experience other injuries during the season, the most common area injured was the knee (25.0%) (Table 4.6).

Table 4.6 Anatomical area of injury

Anatomical area of injury		Frequency (n)	Valid Percent (%)
Valid	Head/concussion	1	8.3
	Foot	2	16.7
	Ankle	2	16.7
	Knee	3	25.0
	Hamstring	2	16.7
	Groin	2	16.7
Total		12	100.0

4.8 Treatment of low back pain

Treatment of low back pain encompasses the following: treatment by medical professionals, self-treatment of low back pain, medical professionals available to participants and management/treatment advice received for low back pain.

4.8.1 Treatment by medical professionals

Only 44.2% of participants received treatment from medical professionals for their low back pain, while 55.8% of participants did not.

The participants who received treatment, were mostly treated by a Chiropractor (42.1%) or a Physiotherapist (26.3%) (Figure 4.4).

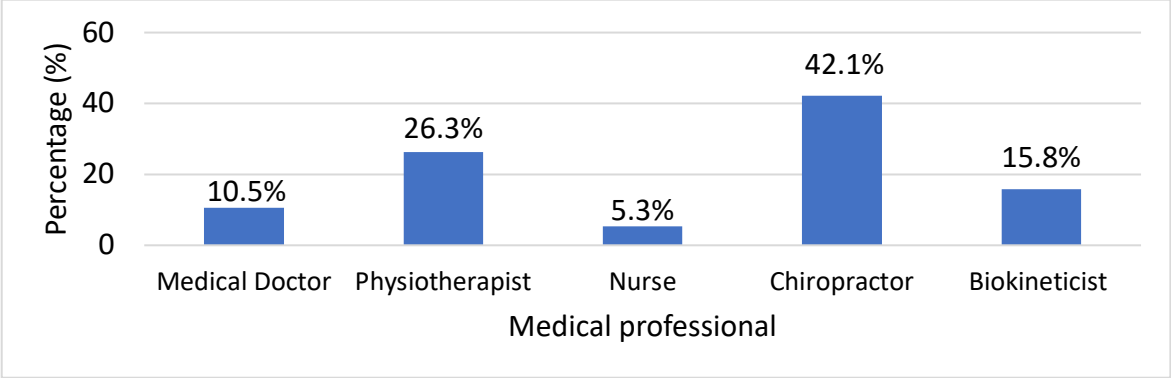

Figure 4.4 Medical professional who treated participants

4.8.2 Self-treatment of low back pain

58.1% of participants treated their low back pain by themselves. It is noted that some participants treated their low back pain by themselves as well as receiving treatment from a medical professional. In the case where participants used self-treatment, most participants self-treated their low back pain by stretching (28%), as seen in table 4.7.

Table 4.7 Type of self-treatment used

Type of self-treatment used		Frequency (n)	Valid Percent (%)
Valid	Arnica ice	1	4.0
	Deep heat	1	4.0
	Ice, stretch and made school bag lighter in weight	1	4.0
	Ischaemic compression	1	4.0
	Massage	2	8.0
	Neurofen	1	4.0
	Rest	1	4.0
	Rest, Ice	1	4.0
	Rest, stretch	2	8.0
	Rest, stretch, Arnica ice	1	4.0
	Stretch	7	28.0
	Stretch and ice	2	8.0
	Stretch, foam roller	1	4.0
	Stretch, ice and strapping	1	4.0
	Stretch, rest, massage	1	4.0
	Transact pad	1	4.0
Total		25	100.0

4.8.3 Medical professionals available to participants

Most participants (88.4%) had access to medical professionals at school, matches or training, while 11.6% of participants reported to not having access to medical professionals.

Of the participants that had access to medical professionals at school, matches or training, 39.5% had access to a combination of a Physiotherapist, Chiropractor and a Biokineticist (Figure 4.5).

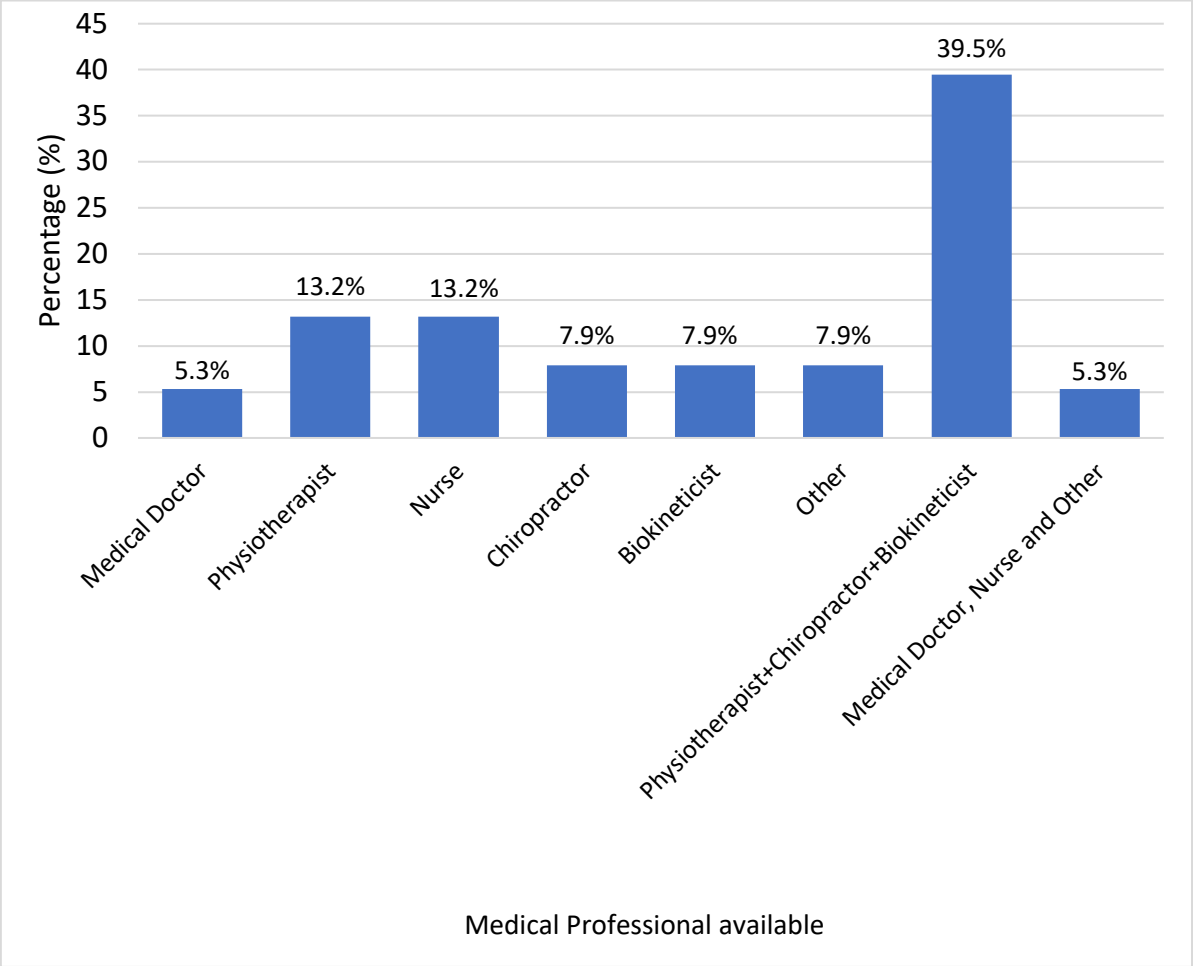

Figure 4.5 Type of medical professionals available at school, matches or training

4.8.4 Management or treatment advice received for low back pain

53.5% of participants did not receive advice on how to manage or treat their low back pain.

Of the 46.5% of participants who did receive management/treatment advice for their low back pain, 55% were advised to stretch (Table 4.8).

Table 4.8 Management/treatment advice given

Management/treatment advice given		Frequency (n)	Valid Percent (%)
Valid	Exercises	1	5.0
	Ice	1	5.0
	Ischaemic compression	1	5.0
	Low back strength exercises	1	5.0
	Physiotherapy	1	5.0
	Rest, stretch	2	10.0
	Stretch	11	55.0
	Stretch and core exercises	1	5.0
	Stretch, rest, foam roller	1	5.0
Total		20	100.0

4.9 Selected risk factors

It is noted that non-case represents participants who did not experience low back pain and period prevalence represents participants who did experience low back pain. T-tests were done to compare means between the groups with and without prevalent back pain and where necessary, Pearson's chi square tests were done to compare categorical variables between the groups with and without back pain. A p-value of 0.05 was considered to be statistically significant for both tests.

4.9.1 Demographics

Demographics investigated: height, body mass, age, ethnicity, level of competition, frequency of play, playing position, and participation in other sports during the season.

4.9.1.1 Height and body mass

Non-case prevalence participants had a mean height of 170.84cm (SD 10.495) and period prevalence participants had a mean height of 174.67cm (Std. Deviation 9.778). Additionally non-case mean body mass was 62.40kgs and period prevalence mean body mass was 66.00kgs. This is provided in Table 4.9.

Table 4.9 Height and body mass

Risk factor	prevalence	N	Mean	Std. Deviation	Std. Error Mean	P value
Height (cm)	non case	25	170.84	10.495	2.099	0.134
	period prevalence	43	174.67	9.778	1.491	
Body mass (kg)	non case	25	62.40	9.811	1.962	0.120
	period prevalence	43	66.00	8.644	1.318	

4.9.1.2 Age

Non-case prevalence participants had a mean age of 15.28 years and the period prevalence group had a mean age of 15.42 years (Table 4.10).

Table 4.10 Participants age (non-case vs period prevalence)

Risk factor	prevalence	N	Mean	Std. Deviation	Std. Error Mean	P value
Age (years)	non case	25	15.28	1.621	.324	0.715
	period prevalence	43	15.42	1.435	.219	

4.9.1.3 Ethnicity

The most common ethnic group was White (n = 49; 72.1%). However, based on percentage, the Coloured ethnic group and the participant identifying as Other had the highest period prevalence of low back pain (100%). It is also noted that the Indian population had the lowest period prevalence of low back pain (28.6%) (Table 4.11).

Table 4.11 Ethnicity

Risk factor		Prevalence				P value
		non case		period prevalence		
		Count	Row N (%)	Count	Row N (%)	
Ethnicity	African	5	62.5%	3	37.5%	Not able to calculate due to too many small cell counts
	Coloured	0	0.0%	3	100.0%	
	Indian	5	71.4%	2	28.6%	
	White	15	30.6%	34	69.4%	
	Other	0	0.0%	1	100.0%	

4.9.1.4 Level of competition

The u14A team and the 2nd XI team experienced the highest period prevalence (75%) followed by the 1st XI team with a period prevalence of 69.2% (Table 4.12). Furthermore, the individuals who represent KZN Schools Hockey had the highest period prevalence (68%) compared to those who represent other teams (Table 4.13). It should be noted that most of the individuals who play for the A teams or 1st XI team are the individuals that compete for the representative teams.

Table 4.12 School team

Risk factor		Prevalence				P value
		non case		period prevalence		
		Count	Row N (%)	Count	Row N (%)	
School team	u14A	3	25%	9	75%	0.680
	u14B	5	55.6%	4	44.4%	
	u16A	7	41.2%	10	58.8%	
	u16B	4	44.4%	5	55.6%	
	1st XI	4	30.8%	9	69.2%	
	2nd XI	2	25%	6	75%	

Table 4.13 Representative team

Risk factor		Prevalence				P value
		non case		period prevalence		
		Count	Row N (%)	Count	Row N (%)	
Representative team	District team	5	50%	5	50%	0.760
	KZN Schools Hockey	8	32%	17	68%	
	South African Schools Hockey	1	50%	1	50%	
	None	11	35.5%	20	64.5%	

4.9.1.5 Frequency of play

A trend was observed with the number of years playing field hockey and pain (p = 0.079) where those who had played for slightly longer were more likely to have experienced low back pain (Table 4.14).

Table 4.14 Frequency of play

Risk factor	Prevalence	N	Mean	Std. Deviation	Std. Error Mean	P value
Number of matches played during the season	non case	25	21.72	7.475	1.495	0.579
	period prevalence	43	22.98	9.721	1.482	
Number of times played per week (during the season)	non case	25	4.68	1.145	.229	0.497
	period prevalence	43	4.93	1.609	.245	
Number of years played	non case	25	5.84	2.075	.415	0.079
	period prevalence	43	6.79	2.144	.327	

4.9.1.6 Playing position

The most common playing position was Defender with a non-case count of 9 participants and a period prevalence count of 18 participants (Total count of 27). Participants who played both the Defender or Midfield position had the highest period prevalence of low back pain (100%) followed by individuals who only play in the Defender position (66.7%) (Table 4.15).

Table 4.15 Playing position

Risk factor		Prevalence				P value
		non case		period prevalence		
		Count	Row N (%)	Count	Row N (%)	
Playing position	Goalkeeper	3	37.5%	5	62.5%	Not able to calculate due to too many small cell counts
	Defender	9	33.3%	18	66.7%	
	Midfield	7	43.8%	9	56.3%	
	Forward	5	38.5%	8	61.5%	
	Defender or midfield	0	0.0%	3	100.0%	
	midfield or forward	1	100.0%	0	0.0%	

4.9.1.7 Participation in other sports during the season

Most participants did not participate in other sports during the field hockey season. Participants who did participate in other sports had a 66.7% period prevalence of low back pain compared to those who do not participate in other sports, who had a 62.5% period prevalence (Table 4.16).

Table 4.16 Participation in other sports

Risk factor		Prevalence				P value
		non case		period prevalence		
		Count	Row N (%)	Count	Row N (%)	
Participation in other sports during the hockey season	No	15	37.5%	25	62.5%	0.727
	Yes	9	33.3%	18	66.7%	

4.9.2 Equipment

Equipment investigated: footwear used, protective attire and comfortability of attire. Most participants use hockey boots with a total count of 57 participants (83.8%). The most commonly used protective attire is shin pads with a total count of 60 participants (88.2%). Furthermore most participants find their attire to be comfortable while playing with a total count of 65 participants (95.6%) answering 'yes' (Table 4.17).

Table 4.17 Equipment

Risk factor		**Prevalence**				**P value**
		non case		**period prevalence**		
		Count	**Row N (%)**	**Count**	**Row N (%)**	
Footwear used	Running shoes	1	100.0%	0	0.0%	0.383
	Trail shoes/Cross trainer	3	30.0%	7	70.0%	
	Hockey boots	21	36.8%	36	63.2%	
	Other	0	0.0%	0	0.0%	
Protective attire	Shin pads	23	38.3%	37	61.7%	#
	None	1	20.0%	4	80.0%	
	Shin pads and Ankle-guard	0	0.0%	1	100.0%	
	Shin pads and Knee-guard	1	50.0%	1	50.0%	
Does your attire feel comfortable when playing?	No	1	33.3%	2	66.7%	0.900
	Yes	24	36.9%	41	63.1%	

not able to compute statistics due to too many small cell counts.

4.9.3 Health and Lifestyle

Health and Lifestyle investigated: warming up before play, diet/nutrition, frequent hydration during training and matches, and aerobic fitness levels. The only association found to be significant was hydration (p = 0.050). Those who did not hydrate before matches and training were more likely to have experienced low back pain (Table 4.18).

Table 4.18 Health and Lifestyle

Risk factor		**Prevalence**				**P value**
		non case		**period prevalence**		
		Count	**Row N (%)**	**Count**	**Row N (%)**	
Warm up before play	No	1	100.0%	0	0.0%	0.186
	Yes	24	35.8%	43	64.2%	
Diet/Nutrition	Very healthy	0	0.0%	2	100.0%	0.597
	Healthy	12	40.0%	18	60.0%	
	Moderately healthy	13	37.1%	22	62.9%	
	Unhealthy	0	0.0%	1	100.0%	
Frequent hydration during training and matches	No	0	0.0%	6	100.0%	0.050
	Yes	25	40.3%	37	59.7%	
Aerobic fitness levels	Excellent	6	50.0%	6	50.0%	0.520
	Good	11	36.7%	19	63.3%	
	Acceptable	8	30.8%	18	69.2%	

Chapter Five

Discussion

5.1 Introduction

This chapter discusses the results found in chapter four and compares these results to similar studies conducted on field hockey players, which have been gathered from both local and international literature in order to gain a better understanding of how low back pain affects male adolescent field hockey players in the eThekwini Municipality.

5.2 Prevalence and incidence of low back pain

The period prevalence found in this study was 63.2% (Table 4.1), which is slightly higher than previous studies conducted. Murtaugh, (2001) reported that female university players had a low back pain prevalence of 59.0% during a season, and Reilly and Seaton, (1990) found the prevalence to be 53.0% in international female hockey players. Additionally, Van Hilst *et al.,* (2015) concluded that young elite male players had a low back pain prevalence of 33.0%. The period prevalence of this study was however lower than the findings from Van Hilst *et al.,* (2015) of young elite females, who had a low back pain prevalence of 67.0%. It is also noted that the incidence found in this study was 38.2% (Table 4.1), which is lower than a previous study conducted by Haydt *et al.,* (2012) who reported the incidence of low back pain in NCAA division III female field hockey players to be 56.0%.

A possible explanation for the varying results may be due to the different demographics of the above studies, as these studies primarily looked at female participants who were over the age of 18. Thus, they do not represent the adolescent population, which is a more vulnerable population to overuse injuries and pain due to the imbalances between growth and strength during skeletal development (DiFiori, 2010). The study of Van Hilst *et al.,* (2015) was the only one that included both the

male and female population. Furthermore, the male population from van Hilst *et al.,* (2015) shared the closest resemblance to this study in terms of demographics (males aged 14-24 years). However, the 33.0% period prevalence of low back pain amongst the male participants was significantly lower than the 63.2% period prevalence of this study. An explanation for this result may be attributed to two factors. The average age of the male participants from the van Hilst *et al.,* (2015) study was higher (18 years) compared to the average age (15 years) in this study. Furthermore, only 21 males participated in their study compared to the 68 males who participated in this study. Therefore, this low representation of only 21 males may have led to the significant difference in results.

It should also be noted that this study determined the point prevalence of low back pain at the beginning of the season (25.0%), mid-season (32.4%) and at the end of the season (22.1%) (Table 4.1). To the best of our knowledge, no other studies have determined the point prevalence of low back pain at various intervals throughout the season. Therefore, this study was not able to draw comparisons with regard to these intervals. Nonetheless, an area of concern should be raised as the prevalence of this study was 63.2%. This figure is far higher than Swain *et al*., (2014), who showed the prevalence of low back pain in the general adolescent population to be 37.0%. Also taking into consideration Maher *et al*., (2016), who stated that low back pain during adolescence is a significant risk for developing low back pain as an adult.

5.3 Characteristics of low back pain

The characteristics of low back pain are discussed according to the location, chronicity, disability and treatment sought.

5.3.1 Location of low back pain

The results of this study showed the most common area for participants to experience low back pain was middle low back pain (39.5%), followed by bilateral low back pain (34.9%), left sided low back pain (14.0%), right sided low back pain (9.0%) and lastly low back pain with gluteal pain (2.3%) (Figure 4.1). The results show there are few

cases of referred pain as only 2.3% of participants experienced pain referring into the gluteal region.

Previous studies conducted on field hockey players have only mentioned pain in the general low back region and have not provided the specific location of pain within that region. This study to the best of our knowledge would be the first to do so, and therefore comparing results between studies could not be made. However, according to the areas where low back pain was most commonly experienced, it would likely point to the erector spinae muscles (Figure 2.4 and Table 2.1). This would support Shan *et al.,* (2013), who found that repeated flexion and rotational movements of the vertebral column causes activation of the erector spinae muscle group, and as a result increases the risk of low back pain. Pain along the midline of the low back may also point to Hadjipavlou *et al*., (2008) who stated that rotation of the vertebral column places annular fibres of the lumbar intervertebral disc under a mechanical disadvantage and therefore a combination of forward flexion, compression and rotational movements increases the risk for disc degeneration and injury.

Low back pain was also experienced more commonly on the left versus the right side. This is possibly due to the asymmetric activity of hockey as it is only played right handed i.e. the ball may only come into contact with the flat surface of the stick which is located on the left side of the hockey stick, and faces towards the left side of the player (Collier *et al*., 2016), and thus players swing through to the left side. This would support the statements made by Pope *et al.,* (2002) who stated that asymmetry in muscular activity can result in unequal or uneven stress placed on various other structures of the spine due to mechanical imbalances.

5.3.2 Chronicity of low back pain

Most participants experienced low back pain for a relatively short duration of time, as the majority experienced it for only a few hours (32.6%). This was followed by a few days (27.9%), a few minutes (23.3%) and lastly 1-3 weeks (16.3%) (Figure 4.2). Collectively this means 83.8% of participants experienced low back pain for less than eight days. No participants experienced low back pain for 4-12 weeks or 12 weeks or more. These results differ slightly to the findings of Haydt *et al.,* (2012), who showed

the following duration of pain results; 1-7 days (64.0%), 8-14 days (10.0%), 15-21 days (8.0%), 22-28 days (2.0%), 1-3 months (10.0%), and lastly more than three months (4.0%). Possible explanations for the varying results may be due to the different duration of pain options that were given to participants, the difference in demographics, and lastly the sample size. The study by Haydt *et al.,* (2012) was conducted on a female population with an older age range of 18-24 years. Furthermore, Haydt *et al.,* (2012) had a larger sample size (n = 90) compared to the sample size of this study (n = 68). Nonetheless, both studies showed that most participants experienced low back pain for less than 8 days, which supports the literature that majority of low back pain episodes will resolve in less than six weeks (Melloh *et al.,* 2011).

The results of both studies also showed that chronic low back pain was not common, as Haydt *et al.,* (2012) concluded that only 4.0% of participants experienced chronic low back pain, and the results of this study showed 0% percent of participants experienced chronic low back pain. A possible explanation for this may be due to the age of the participants in both studies. Melloh *et al.,* (2011) found the median age of persistent low back pain to be 43.9 years. The average age of participants in this study was 15.37 years and the average age of participants from Haydt *et al.,* (2012) was 19.22 years. Therefore, participants in both studies have had less years exposed to low back pain due to their young age.

Interestingly however, 62.8% of participants experienced low back pain during a previous hockey season. It is therefore evident that if participants experienced low back pain during a previous season they were more likely to develop low back pain in a future playing season. This potential risk may therefore cause individuals to develop chronic low back pain later in life if it reoccurs each playing season. This also establishes that field hockey is likely a cause or at least a contributing factor to low back pain as the episodes of back pain are consistent each season.

5.3.3 Disability due to low back pain

Most participants did not experience low back pain that was classified as a disability (79.1%) (Figure 4.3). However, the 20.9% of participants who did experience pain

classified as a disability is considerably higher than the findings in a study conducted by O'Sullivan, (2005) who reported that up to 10.0% of individuals experience disability due to low back pain. It should be noted however, that Wand *et al.,* (2010) concluded in a study that self-reported disability measures are influenced greatly by the participants' psychological status and thus participants might report what activities they think they are unable to perform rather than what they are actually physically capable of performing. Nonetheless, one cannot rule out the importance of these results as this is an adolescent population, many of whom are undergoing growth spurts with rapid skeletal growth. This may be a possible explanation for the high percentage of participants experiencing self-reported disability. Other studies have also shown the risk for injuries and pain amongst adolescents undergoing rapid skeletal growth (Grady and Goodman, 2010; DiFiori *et al.,* 2014; DiFiori, 2010; DiFiori *et al.,* 2016; Caine *et al.,* 2008).

Interestingly however, with regard to the 20.9% of participants who experienced self-reported disability, missing practices or matches due to low back pain was not common (7.0%). Additionally, in the case where practices or matches were missed the maximum number was only two (Table 4.4). Furthermore, most participants (86.0%) did not have to adjust the way they play due to their low back pain. However, in the case where adjustments were made to play, there was a common thread with difficulty bending forwards/forward flexion and thus players tried to maintain a more upright posture (Table 4.5). This would support the possible mechanisms leading to low back pain in chapter two. This includes the type of movement, repetition and fatigue, and posture. As a result of these mechanisms it is understandable that forward flexion would be difficult to perform, as this places strain on the affected muscles in the low back region that are fatigued or injured.

Furthermore, of the individuals who experienced low back pain, 27.9% also experienced other injuries. The most common area injured was the knee (25.0%), followed by foot and ankle, hamstring and groin (16.7%) and lastly head/concussion (8.3%) (Table 4.6). These results support Ellapen *et al*., (2014) who also found the knee to be the most common injury site. The results also support Rishiraj *et al*., (2009), Dick *et al.,* (2007), and Sharma *et al.,* (2012) who all found the ankle/foot to be common areas of injury in field hockey players.

5.3.4 Treatment of low back pain

Over the years there have been a large number of management and prevention methods developed. However, the management and treatment of low back pain still remains a major challenge amongst musculoskeletal conditions (Hill *et al*., 2011). Therefore, improving the management of LBP could potentially minimise the long term effects (Hill *et al*., 2011). Encouragingly, most participants (88.4%) had access to medical professionals at school, matches or training. Of these participants, 39.5% had access to a combination of a Physiotherapist, Chiropractor and a Biokineticist (Figure 4.5). Other medical professionals available included: a Physiotherapist only (13.2%), a Nurse only (13.2%), a Chiropractor only (7.9%), a Biokineticist only (7.9%), Other (7.9%), a Medical Doctor only (5.3%) and a combination of a Medical Doctor, Nurse and Other (5.3%) (Figure 4.5).

However, only 44.2% of participants received medical treatment for their low back pain. Of these participants, they were mostly treated by a Chiropractor (42.1%). This is encouraging as evidence based practice (EBP) places spinal manipulative therapy high on the list as a favourable treatment for low back pain (Ladeira, 2011). Additionally, Foster *et al.,* (2018) also noted that spinal manipulative therapy may be used in the treatment of low back pain. Other medical professionals who provided treatment included: Physiotherapists (26.3%), Biokineticists (15.8%), Medical Doctors (10.5%), and lastly Nurses (5.3%) (Figure 4.4).

Unfortunately, 53.5% of participants who visited a medical professional for treatment did not receive advice on how to manage or treat their low back pain. This is a worrying statistic as the systemic review completed by Ladeira, (2011) as well as the study completed by Foster *et al.,* (2018) found that patient education was one of the most important aspects of evidence based practice (EBP) for the management and treatment of low back pain.

Of the remaining 46.5% of participants who did receive management/treatment advice for their low back pain, 55.0% were advised to stretch and 10.0% were advised to stretch and rest (Table 4.8). This is a high percentage of participants who were advised

to stretch, considering stretching is not mentioned as an effective choice in the management and treatment of low back pain (Ladeira, 2011; Foster *et al.,* 2018). Other advice received included: exercises (5.0%), ice (5.0%), ischaemic compression (5.0%), low back strength exercises (5.0%), physiotherapy (5.0%), stretch and core exercises (5.0%), and lastly a combination of stretch, rest, and use of a foam roller (5.0%) (Table 4.8).

With regard to self-treatment, 58.1% of participants treated their low back pain by themselves. It is noted that some participants treated their low back pain by themselves as well as receiving treatment from a medical professional. Of the 58.1% of participants who used self-treatment, 28.0% treated their low back pain with stretching (Table 4.7). Additionally, many other participants used stretching combined with one or two other forms of self-treatment such as rest, ice, massage or topical treatments (Table 4.7). Neither Ladeira, (2011), nor Foster *et al.,* (2018) mention stretching as a favourable treatment option for low back pain.

Overall it is unfortunate that most participants did not receive any advice on how to manage or treat their low back pain, and in the case where advice was given, only a small number of participants were advised to perform specific exercises to help their low back pain. This is not encouraging, as EBP guidelines note the importance of both patient education and exercises for effective management/treatment options of low back pain (Ladeira, 2011; Foster *et al.,* 2018). Therefore, medical practitioners should be placing more emphasis on these two areas.

5.4 Selected risk factors

The selected risk factors are discussed according to the following; demographics, equipment, and health and lifestyle. Furthermore, demographics encompasses the following; height and body mass, age, ethnicity, level of competition, frequency of play, playing position, and participation in other sports during the season.

5.4.1 Height and body mass

With regard to height, non-case prevalence participants had a mean height of 170.84cm and period prevalence participants had a mean height of 174.67cm. Although the participants who experienced low back had a taller mean height, the results between height and low back pain were found to be statistically insignificant (p = 0.134) (Table 4.9). With regard to body mass, non-case mean body mass was found to be 62.40kgs and period prevalence mean body mass was 66.00kgs. The results between body mass and low back pain were also statistically insignificant (p = 0.120) (Table 4.9). The results of this study differ from some studies, as Shiri *et al.,* (2010) concluded that increased body mass amongst individuals increases the risk for low back pain. Additionally, Caine *et al.,* (2008) stated that a higher body mass will create greater forces on joints and surrounding soft tissue, thus increasing the risk for injury of that individual. However, Shiri *et al.,* (2010) made mention that it is particularly individuals who are overweight who have a higher prevalence of low back pain. The participants in this study had an average body mass of only 66kgs and are considered to be fairly fit as they play hockey regularly.

5.4.2 Age

Non-case prevalence participants had a mean age of 15.28 years and the period prevalence group had a mean age of 15.42 years. The youngest player was 13 years old and the eldest was 18 years old. The results between age and low back pain were found to be statistically insignificant (p = 0.715) (Table 4.10), indicating that age was not found to be a risk factor. It should be noted however, that it would be difficult to find a statistically significant result between age and low back pain in this study, as the study was completed on the adolescent population only. Thus, there was not a wide variety of ages to compare. Nevertheless, the period prevalence of 63.2% (Table 4.1) does suggest that low back pain is highly common in the adolescent field hockey population in the eThekwini Municipality.

5.4.3 Ethnicity

The most common ethnic group was White (72.1%), followed by African (11.8%), Indian (10.3%), Coloured (4.4%), and lastly Other (1.5%) (Figure 4.1). The White ethnic group experienced the highest period prevalence of low back pain (n = 34) compared to other ethnic groups (Table 4.11). However, due to the minimal representation of other ethnic groups, it was not possible to provide a conclusive result. The low representation from other groups resulted in Pearson's Chi-squared tests being unable to determine an association between ethnicity and low back pain, as a *p* value could not be calculated due to too many small cell counts in the data (Table 4.11). Moreover, to the best of our knowledge, no previous field hockey studies have included ethnicity. As such, ours is the first study that has attempted to determine if there is an association between low back pain and ethnic groups in field hockey.

5.4.4 Level of competition

Previous studies have determined that athletes may be more susceptible to risk taking behaviour as well as being more aggressive at a higher competition level (Murphy *et al.,* 2003). Additionally, elite athletes had a higher prevalence of low back pain compared to that of the control groups with physically active individuals (Fett *et al.,* 2017). Furthermore, Hoskins, (2012) stated that young athletes may still have poor technique when transitioning to a higher level of specialisation (provincial or national team), thus increasing the risk for back pain.

With regard to level of competition (school team), the u14A team and the 2nd XI team experienced the highest period prevalence of low back pain (75.0%). This was followed by the 1st XI team (69.2%), u16A team (58.8%), u16B team (55.6%), and lastly the u14B team (44.4%) (Table 4.12). The results between level of competition (school team) and low back were found to be statistically insignificant (p = 0.680) (Table 4.12). Although the results were statistically insignificant as a risk factor, one can still see the prevalence was higher in the more competitive teams (1st and 2nd XI teams and both A teams) compared to that of both B teams, which experienced the lowest prevalence of low back pain. Therefore, the results of this study do not contradict previous studies which have determined that performing at a higher

competition level increases the prevalence of low back pain (Murphy *et al.,* 2003; Fett *et al.,* 2017; Hoskins, 2012).

With regard to the level of competition (representative team), 37 participants were selected for a representative team (Table 4.13) It should be noted that most of the individuals who play for the A teams or the 1st XI team are the individuals who are selected for a representative team. Additionally, one must first be selected for a District team, before being selected for KZN Schools Hockey. Once individuals have been selected for this team, an inter-provincial tournament is held. Following the completion of this tournament, the South African Schools Hockey teams are selected. The participants who represented KZN Schools Hockey had the highest period prevalence of low back pain (68.0%). The participants who represented a District team had a period prevalence of 50.0% and the participants who represented South African Schools Hockey also had a period prevalence of 50.0% (Table 4.13). The results between level of competition (representative team) and low back pain were found to be statistically insignificant (p = 0.760) (Table 4.13). As with the school teams, the results were statistically insignificant, however, one can also see the higher level of competition (KZN Schools Hockey) showed a higher prevalence of low back pain compared to that of a lower level of competition (District team). Although the South African Schools Hockey team represents the highest level of competition, only two participants in this study represented this team. Therefore, the above result (50.0% prevalence) may have been influenced by the limited representation of this team.

5.4.5 Frequency of play

Frequency of play investigated: number of matches played during the season, number of times played per week (during the season), and number of years played. With regard to number of matches played during the season, non-case participants played an average of 21.72 matches, while period prevalence participants played an average of 22.98 matches (Table 4.14). With regard to number of times played per week, non-case participants played an average of 4.68 times per week, while period prevalence participants played an average of 4.93 times per week (Table 4.14). With regards to the number of years played, non-case participants played for an average of 5.84 years, while period prevalence participants played for an average of 6.79 years (Table 4.14).

The results were statistically insignificant between number of matches played during season and low back pain (p = 0.579) (Table 4.14). Additionally, the results showed no association between number of times played per week (during the season) and low back pain (p = 0.497) (Table 4.14). There was however, a trend observed with the number of years playing field hockey and low back pain (p = 0.079) where those who had played for slightly longer were more likely to have experienced low back pain (Table 4.14). The results of this study support other studies which have shown that higher training volumes attribute to a high prevalence of back pain (Fett *et al.,* 2017; and Hoskins, 2012). Furthermore, Caine *et al.,* (2008) indicated that older gymnasts had higher injury rates than younger gymnasts which was possibly caused due to a greater accumulation of exposure to the sport. This leads to a possible explanation as to why a trend was observed between number of years playing field hockey and low back pain. Participants who have played field hockey for a greater number of years would have a higher accumulation of exposure to the combined forward flexion and rotation movements involved in field hockey over the years, thus potentially increasing the risk for injury.

5.4.6 Playing position

Due to the limited and conflicting information amongst studies conducted on field hockey, it is difficult to compare results as to what playing position experiences the highest prevalence of low back pain. For example, Sharma *et al.,* (2012) found goalkeepers to have the highest prevalence, followed by defenders and midfielders and lastly forwards. Ellapen *et al.,* (2014) found that defenders had the highest rate of low back pain cases, followed by forwards, midfielders and lastly goalkeepers. This study faced the same outcome as previous studies with providing conflicting results. Participants who played both the defender or midfield position had the highest period prevalence of low back pain (100.0%). Followed by defenders (66.7%), goalkeepers (62.5%), forwards (61.5%), midfielders (56.3%) and lastly midfield or forward (0%) (Table 4.15). Furthermore, a p value was not able to be calculated due to too many small cell counts in the data (Table 4.15). With the information gathered from previous studies and the insignificant p value findings of this study, it is unclear as to which position experiences low back pain more frequently.

5.4.7 Participation in other sports during the season

Most participants did not participate in other sports during the field hockey season (n = 40; 58.8%). Participants who did participate in other sports had a 66.7% period prevalence of low back pain. Those who did not participate in other sports, had a 62.5% period prevalence of low back pain (Table 4.16). Furthermore, there was no association found between participating in other sports during the field hockey season and low back pain (p = 0.27) (Table 4.16). No other field hockey studies to our knowledge have attempted to determine if there as an association between participating in other sports and low back pain in field hockey.

5.4.8 Equipment

Equipment investigated: footwear used, protective attire and comfortability of attire. With regard to footwear used, those wearing trail-shoes/cross trainers had the highest prevalence of low back pain (LBP) (70.0%). Those wearing hockey boots had a LBP prevalence of 62.3%, and those wearing running shoes had a LBP prevalence of 0% (Table 4.17). It is also noted that most participants used hockey boots with a total count of 57 participants (83.8%). There was no association found between low back pain and footwear used (p = 0.383) (Table 4.17).

With regard to protective attire used, most participants used shin pads (n = 60; 88.2%). However, playing with shin pads and an ankle guard had the highest prevalence of LBP (100.0%). It should be noted however, that only one participant used this combination of protective attire. Therefore, this is not a true reflection of the population. Additionally, those who wore no protective attire had a LBP prevalence of 80.0%. Those who wore shin pads had a LBP prevalence of 61.7%, and finally those who wore shin pads and a knee-guard had a LBP prevalence of 50.0% (Table 4.17). Due to the high use of shin pads and lack of other protective equipment used, the data had a large number of small cell counts. Therefore, Pearson's Chi-squared test could not calculate a p value for this category (Table 4.17).

With regard to comfortability of attire, most participants found their attire to be comfortable (n = 65; 95.6%). Furthermore, those who found their attire to be comfortable had a LBP prevalence of 63.1%, and those who did not find their attire to be comfortable had a LBP prevalence of 66.7% (Table 4.17). There was no association found between low back pain and comfortability of attire (p = 0.900) (Table 4.17).

Previous studies conducted on field hockey have not included whether or not equipment is a risk factor for the development of low back pain (van Hilst *et al.,* 2015; Haydt *et al.,* 2012; Murtaugh, 2001; and Sharma *et al.,* 2012). However, Ellapen *et al.,* (2014) showed that prosthetic ankle support did not enhance the athletic performance of field hockey players. Additionally, DiFiori *et al.,* (2014) stated that protective attire may increase the chance for injury but there is a lack of clinical data to confirm this. Moreover, Brantingham *et al.,* (2006) noted that equipment may alter biomechanics which entail, may increase the chance for injury. However, there is no way to show whether or not participants in this study experienced altered biomechanics as a result of their equipment. The results of this study and the lack of clinical data in previous studies show that equipment is an area in which further study is needed. Particularly, in the area of how footwear and protective attire may alter the biomechanics of field hockey players.

5.4.9 Health and lifestyle

Health and Lifestyle investigated the following: warming up before play, diet/nutrition, frequent hydration during training and matches, and aerobic fitness levels. With regard to warming up before play, almost all participants reported that they warm up before playing (n = 67; 98.5%). 64.2% of participants that warm up before play experienced low back pain. The single participant who did not warm up before play did not experience low back pain (Table 4.18). Pearson's Chi-squared test found the results between warming up and low back pain to be statistically insignificant (p = 0.186) (Table 4.18). This supports Behm *et al.,* (2015) who found no effect of static stretching and proprioceptive neuromuscular facilitation stretching in relation to all-cause injury or overuse injuries in athletes. They further noted there is conflicting evidence whether stretching prior to physical activity can reduce exercise induced muscle soreness

(Behm *et al.,* 2015). However, Behm *et al.,* (2015) did conclude that dynamic stretching produced small to moderate performance improvements when performed a few minutes prior to physical activity.

With regard to diet and nutrition, most participants reported a moderately healthy diet (n = 35; 51.5%). Participants who reported a very healthy diet or an unhealthy diet experienced the highest prevalence of LBP (100.0%). It is noted however, that only two participants reported a very healthy diet and only a single participant reported an unhealthy diet. Participants who reported a moderately healthy diet experienced a LBP prevalence of 62.9%, and those who reported a healthy diet experienced a LBP prevalence of 60.0% (Table 4.18). Pearson Chi-squared test found the results between low back pain and nutrition to be statistically insignificant (p = 0.597) (Table 4.18). Certain studies have found that unhealthy food which is high in refined carbohydrates and sugar may lead to inflammation and pain (Juanola-Falgarona *et al.,* 2014; Maffetone and Laursen, 2016). This is a possible explanation of the results which show an unhealthy diet and a moderately healthy diet experienced a higher prevalence of low back pain compared to those who had a healthy diet.

With regard to hydration, participants who frequently hydrated during matches and training had a LBP prevalence of 59.7%. The participants who did not hydrate frequently during matches and training had a LBP prevalence of 100.0%. Pearson's Chi-squared test found the results to be statistically significant (p = 0.050) between hydration and low back pain (Table 4.18). Those individuals who did not hydrate frequently were significantly more likely to experience low back pain. This finding supports the literature of Clearly *et al.,* (2005) who found dehydration to increase microdamage of muscle and the exacerbation of delayed onset muscle soreness (DOMS). Additionally, the hot and humid climate of Kwazulu-Natal may have played a part in these results. This further supports Clearly *et al.,* (2005) and Jones *et al.,* (2008) who cautioned that individuals exercising in hot and humid weather should take frequent rehydration breaks. Racinais *et al.,* (2015) also concluded that both acclimatisation and staying euhydrated to reduce dehydration is essential and one of most important intervention's athletes can take to reduce physiological strain during exercise in hot weather. Furthermore, Jones *et al.,* (2008) determined that fatigue severity was significantly higher (70%) in dehydrated participants compared to that of

the euhydrated participants with a *p* value of 0.009. An increase in fatigue has already been shown in 2.6.2 to be a precursor to strain and injury (van Tulder *et al*., 2007). Therefore, these studies conducted by Cleary *et al.,* (2005), Jones *et al.,* (2008) and Racinais *et al.,* (2015) together with the significant findings of this study indicate the importance of staying sufficiently hydrated during physical activity in hot and humid weather.

With regard to aerobic fitness level, the study used the Discovery Vitality fitness level and description classification. Participants who reported an acceptable level of fitness experienced a LBP prevalence of 69.2%. Participants who reported a good fitness level, experienced a LBP prevalence of 63.3%. Lastly participants who reported an excellent fitness level experienced a LBP prevalence of 50.0% (Table 4.18). The results showed that participants with a lower level of aerobic fitness had a higher prevalence of low back pain. However, Pearson's Chi-squared test found the results between aerobic fitness levels and low back pain to be statistically insignificant (p = 0.520) (Table 4.18). These results support that the literature has conflicting views on the relationship between aerobic fitness and low back pain, as some studies have found no association while others have found an association (Östenberg and Roos, 2000; Andersen *et al.,* 2006; Smeets *et al.,* 2006; Heneweer *et al.,* 2012).

5.5 Conclusion

Low back pain in the male adolescent field hockey population in the eThekwini Municipality is common, and is slightly higher than previous studies conducted. There is general lack of information from previous studies into the characteristics of low back pain as well as the selected risk factors for low back pain in field hockey. Therefore, this study has provided valuable information which can be added to the literature, such as the significant finding (p = 0.050) between insufficient hydration and low back pain. This study can further help players, coaches and medical professionals with treatment, management and prevention of low back pain in field hockey players.

Chapter Six

Conclusion, Limitations and Recommendations

6.1 Introduction

This chapter draws conclusions from the results and discussion of the study as to how low back pain (LBP) affects male adolescent field hockey players in the eThekwini Municipality. The chapter presents key findings, strengths of the study, as well as entailing some limitations. Moreover, recommendations for future studies are highlighted, with an emphasis towards achieving a greater understanding of LBP in field hockey players.

6.2 Key findings

- A LBP period prevalence of 63.2% and a LBP incidence of 38.2% was found.
- The point prevalence of LBP at the beginning of the season, mid-season and end of season were as follows: 25.0%, 32.4% and 22.1%.
- The most common location of LBP was middle LBP (39.5%).
- 62.8% of participants experienced low back pain during a previous playing season.
- 20.9% of participants who experienced LBP classified it as a disability.
- 53.5% of participants who visited a medical professional for treatment did not receive advice on how to manage or treat their low back pain.
- Significant associations were found between hydration and low back pain (p = 0.050) i.e. those individuals who did not hydrate frequently were significantly more likely to experience low back pain.
- A trend was observed with the number of years playing field hockey and low back pain (p = 0.079), where those who have played for longer were more likely to have experienced low back pain.

6.3 Strengths of the study

To our knowledge, this is the first field hockey study to determine the following:

- The incidence of LBP in the male population.
- The point prevalence of LBP at the beginning of the season, mid-season, and at end of the season.
- The characteristics of LBP in terms of the location and disability.
- The selected risk factors specifically relating to LBP.

6.4 Limitations

- This study specifically included four government high schools within the eThekwini Municipality. Unfortunately, two of these schools declined to participate in the study, which resulted in a smaller target population.
- This study only included male adolescent participants.
- Participants were required to take the questionnaire home for their parents to sign the consent form. They were then required to return the questionnaire once this was completed. This may have led to a decreased participation rate.
- The questionnaire was administered at the end of playing season and participants were asked to recall information about their low back pain. It is possible that participants may have made errors or forgotten information over the duration of the playing season. The questionnaire did however undergo both a focus group and pilot study in order to ensure minimal error or bias. The researcher was also present on the day of data collection to help with any questions or queries related to the study.

6.5 Recommendations

- A larger population of male adolescent field hockey players should be included in future studies. This could include other municipalities in the KwaZulu-Natal province or a national study that includes all provinces in South Africa. This

would ensure a greater understanding of low back pain and could provide more accurate data due to a larger sample size.

- Studies could include both the male and female adolescent population and draw comparisons between both genders.
- Future studies should attempt to have more parents present on the day of data collection. This will limit the number of questionnaires being taken home and could result in a higher response rate.
- Studies in the future could attempt to obtain data throughout the playing season rather than at the end of the season. This may limit participants from forgetting or having difficulty recalling information.

6.6 Conclusion

Low back pain in male adolescent field hockey is a common phenomenon. The results of this study, although limited to a select group of adolescents, showed a slightly higher prevalence of LBP to that of previous studies. More importantly, even though most participants did not experience low back pain classified as a disability, low back pain still had a large impact on participants, as nearly half of participants consulted with a medical professional for treatment. The study further indicates the need for frequent hydration during matches and training as inadequate hydration was found to be significantly related to low back pain. We highlight this as a novel finding and recommend special consideration to this by athletes and coaches. Moreover, the need for the development of strategies in the prevention and management of low back pain in field hockey is further recommended.

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Appendices

Appendix A: Parent Letter of Information

PARENT/LEGAL GUARDIAN LETTER OF INFORMATION

Dear Parent/Legal Guardian,

I am a Chiropractic Masters student at the Durban University of Technology (DUT), currently undertaking my dissertation. I humbly ask for permission for your son to take part in my research.

I have permission from the Institutional Research Ethics Committee at DUT and the Kwazulu-Natal Department of Education.

Title of research study: The epidemiology of low back pain in male adolescent field hockey players in the eThekwini Municipality.

Researcher:
Dale de Wit
[B. Tech Chiropractic]

Research Supervisor:
Prof JD Pillay
[PhD Physiology]

Brief introduction and purpose of the study:
Due to the nature of hockey, players repeatedly perform combined flexion and rotational movements of the lumbar spine through various hitting and pushing techniques, these combined movements as well as the semi crouched position have been shown to increase the risk of developing low back pain (LBP). Studies have also shown that LBP during adolescence is a significant risk factor for developing LBP as an adult. The purpose of the study is to gain information about low back pain in male adolescent field hockey players in the eThekwini municipality via a questionnaire.

Outline of the Procedures:
Questionnaires along with the Letter of Information and Consent and the Letter of Information and Assent will be handed out at the school of your son. These will either be taken home with your son so that you their parent/legal guardian can read and sign the Letter of Information and Consent, and then collected by the researcher at your son's school at a later arranged date, or the questionnaire will be completed and collected on the same day provided that you the parent/legal guardian of your son is there to read and sign the Letter of Information and Consent. Your son will need to read and sign the Letter of Information and Assent. The researcher will be present to address any concerns, questions or queries. The name of the

school and the name of your son will remain anonymous and will not be placed on the questionnaires.

Inclusion and Exclusion:
Inclusion criteria**:**

- Male adolescents who participate in field hockey.

Exclusion criteria**:**

- If your son took part in the pilot study
- If you the parent/legal guardian have not read and signed the Letter of Information and Consent.
- If your son does not read and sign the Letter of Information and Assent.
- If your son does not complete the questionnaire.

Risks or discomforts to participants:
There should not be any risks or discomfort to your son.

Benefits:
Understanding the epidemiology of LBP in male adolescent hockey players can help health professionals with the prevention, treatment and management of those individuals.

Reason/s why the Participant May Be Withdrawn from the Study:
Participation is voluntary and your son is free to withdraw at any stage.

Remuneration:
Your son will not be offered remuneration for taking part.

Costs of the Study:
Your son will not need to cover any costs of the study.

Confidentiality:
Your son's information will be kept confidential and will be kept in the DUT Chiropractic Department for five years, after which it will be destroyed by shredding.

Research-related Injury:
Your son will not be injured in this study and thus no injury related compensation will be granted.

Persons to Contact in the Event of Any Problems or Queries:

Researcher:

Dale de Wit: 031-373 2205/2512

Research Supervisor:

Prof JD Pillay: 031-373239

Institutional Research Ethics Administration on 031 373 2375.

Complaints can be reported to: Director; Research and Postgraduate Support, Prof S. Moyo on 031 373 2577 or moyos@dut.ac.za

Appendix B: Parent/Legal Guardian Consent

Parent/Legal Guardian Consent

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

- I hereby confirm that I have been informed by the researcher, Dale de Wit, about the nature, conduct, benefits and risks of this study – Research Ethics Clearance Number: **REC 102/17**,
- 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 Childs sex, 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 computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and Childs 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 Childs participation will be made available to me.

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

I, Dale de Wit, 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	Date	Signature

Appendix C: Learner Letter of Information

LEARNER LETTER OF INFORMATION

Dear Learner,

I am Chiropractic Masters student at the Durban University of Technology (DUT), currently undertaking my dissertation. I Humbly ask for your participation in my research.

I have permission from the Institutional Research Ethics Committee at DUT and the Kwazulu-Natal Department of Education.

Title of research study: The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality.

Researcher:
Dale de Wit
[B. Tech Chiropractic]

Research Supervisor:
Prof JD Pillay
[PhD Physiology]

Brief introduction and purpose of the study:
Epidemiology is a branch of medicine that collects information to help understand how often a disease or condition occurs and the distribution of that disease. This helps to understand how that disease can be controlled. Due to the nature of hockey, players repeatedly perform combined forward bending and twisting movements of the lumbar spine through different hitting and pushing techniques, these combined movements as well as the semi crouched position have been shown to increase the risk of developing low back pain (LBP). Studies have also shown that LBP during adolescence is a significant risk factor for developing LBP as an adult. The purpose of the study is to gain information about low back pain in male adolescent field hockey players in the eThekwini municipality via a questionnaire.

Outline of the Procedures:
Questionnaires along with the Letter of Information and Consent and the Letter of Information and Assent will be handed out at your school. These will either be taken home with you so that your parent/legal guardian can read and sign the Letter of Information and Consent, and then collected by the researcher at your school at a later arranged date, or the questionnaire will be completed and collected on the same day if your parent/legal guardian is there to read and sign the Letter of Information and Consent. You will need to read and sign the Letter of Information and Assent. The researcher will be there to address any concerns, questions or queries. The name of the school and your name will remain anonymous (of unknown name) and will not be placed on the questionnaires.

Inclusion and Exclusion:
Inclusion criteria**:**

- Male adolescents who participate in field hockey.

Exclusion criteria**:**

- If you took part in the pilot study
- If your parent/legal guardian has not read and signed the Letter of Information and Consent.
- If you do not read and sign the Letter of Information and Assent.
- If you do not complete the questionnaire.

Risks or discomforts to participants:
There should not be any risks or discomfort to you.

Benefits:
Understanding the epidemiology of LBP in male adolescent hockey players can help health professionals with the prevention, treatment and management of those individuals.

Reason/s why the Participant May Be Withdrawn from the Study:
Participation is voluntary and you are free to withdraw at any stage.

Remuneration: (Remuneration is a payment to you)
You will not be offered remuneration for taking part.

Costs of the Study:
You will not need to cover any costs of the study.

Confidentiality: (Confidentially is to be kept a secret)
All your information will be kept confidential and will be kept in the DUT Chiropractic Department for five years, after which it will be destroyed by shredding.

Research-related Injury:
You will not be injured in this study and thus no injury related compensation will be granted.

Persons to Contact in the Event of Any Problems or Queries:

Researcher:

Dale de Wit: 031-373 2205/2512

Research Supervisor:

Prof JD Pillay: 031-373239

Institutional Research Ethics Administration on 031 373 2375.

Complaints can be reported to: Director; Research and Postgraduate Support, Prof S. Moyo on 031 373 2577 or moyos@dut.ac.za

Appendix D: Learner Assent

Learner Assent

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Dale de Wit, about the nature, conduct, benefits and risks of this study – Research Ethics Clearance Number: **REC 102/17**,
- 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 sex, age, date of birth, initials and diagnosis will be collected and put together into a study report in a way that prevents me from being identified by my name
- In view of what is needed for the research, I agree that the data collected during this study can be put together in a computerized system by the researcher.
- I may, at any stage, without judgement or harm, withdraw my consent and participation in the study.
- I have had enough opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that any important new findings that happen during the course of this research which may be about my participation will be made available to me.

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

I, Dale de Wit, 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	Date	Signature
_____	_____	_____
Full Name of Legal Guardian	Date	Signature

Appendix E: Principal Letter of Information

PRINCIPAL LETTER OF INFORMATION

Dear Principal,

I am a Chiropractic Masters student at the Durban University of Technology (DUT), currently undertaking my dissertation. I humbly request your permission for selected learners at your school to take part in my research.

I have permission from the Institutional Research Ethics Committee at DUT and the Kwazulu-Natal Department of Education.

Title of research study: The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality.

Researcher:
Dale de Wit
[B. Tech Chiropractic]

Research Supervisor:
Prof JD Pillay
[PhD Physiology]

Brief introduction and purpose of the study:
Due to the nature of hockey, players repeatedly perform combined flexion and rotational movements of the lumbar spine through various hitting and pushing techniques, these combined movements as well as the semi crouched position have been shown to increase the risk of developing low back pain (LBP). Studies have also shown that LBP during adolescence is a significant risk factor for developing LBP as an adult. The purpose of the study is to gain information about low back pain in male adolescent field hockey players in the eThekwini municipality via a questionnaire.

Outline of the Procedures:
Questionnaires along with the Letter of Information and Consent and the Letter of Information and Assent will be handed out at the schools of the participants. These will either be taken home with the participants so that their parent/legal guardian can read and sign the Letter of Information and Consent, and then collected by the researcher at the participant's school at a later arranged date, or the questionnaire will be completed and collected on the same day provided that the parent/legal guardian of the participant is there to read and sign the Letter of Information and Consent. The Participants will need to read and sign the Letter of

Information and Assent. The researcher will be present to address any concerns, questions or queries. The name of the school and name of the participants will remain anonymous and will not be placed on the questionnaires.

Inclusion and Exclusion:

Inclusion criteria**:**

- Male adolescents who participate in field hockey.

Exclusion criteria**:**

- Participants who took part in the pilot study
- Participants in which their parent/legal guardian has not read and signed the Letter of Information and Consent.
- Participants that do not read and sign the Letter of Information and Assent.
- Participants that do not complete the questionnaire.

Risks or discomforts to participants:

There should not be any risks or discomfort to participants.

Benefits:

Understanding the epidemiology of LBP in male adolescent hockey players can help health professionals with the prevention, treatment and management of those individuals.

Reason/s why the Participant May Be Withdrawn from the Study:

Participation is voluntary and the participant is free to withdraw at any stage.

Remuneration:

The participant will not be offered remuneration for taking part.

Costs of the Study:

The participant will not need to cover any costs of the study.

Confidentiality:

All participant information will be kept confidential and will be kept in the DUT Chiropractic Department for five years, after which it will be destroyed by shredding.

Research-related Injury:

Participants will not be injured in this study and thus no injury related compensation will be granted.

Persons to Contact in the Event of Any Problems or Queries:

Researcher:

Dale de Wit: 0721251618 or 031-373 2205/2512

Research Supervisor:

Prof JD Pillay: 031-373239

Institutional Research Ethics Administration on 031 373 2375.

Complaints can be reported to: Director; Research and Postgraduate Support, Prof S. Moyo on 031 373 2577 or moyos@dut.ac.za

Appendix F: Principal Permission

PRINCIPAL PERMISSION

NAME……....

POSITION……

SIGNATURE……

DATE……

Appendix G: Kwazulu-Natal Department of Education Letter of Information

DEPARTMENT OF EDUCATION LETTER OF INFORMATION

Dear Sir/Madam,

I am a Chiropractic Masters student at the Durban University of Technology (DUT), currently undertaking my dissertation. I humbly request your permission for selected learners at selected high schools to take part in my research. The research involves male adolescent field hockey players.

I have permission from the Institutional Research Ethics Committee at DUT.

Title of research study: The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality.

Researcher:
Dale de Wit
[B. Tech Chiropractic]

Research Supervisor:
Prof JD Pillay
[PhD Physiology]

Brief introduction and purpose of the study:
Due to the nature of hockey, players repeatedly perform combined flexion and rotational movements of the lumbar spine through various hitting and pushing techniques, these combined movements as well as the semi crouched position have been shown to increase the risk of developing low back pain (LBP). Studies have also shown that LBP during adolescence is a significant risk factor for developing LBP as an adult. The purpose of the study is to gain information about low back pain in male adolescent field hockey players in the eThekwini municipality via a questionnaire.

Outline of the Procedures:
Questionnaires along with the Letter of Information and Consent and the Letter of Information and Assent will be handed out at the schools of the participants. These will either be taken home with the participants so that their parent/legal guardian can read and sign the Letter of Information and Consent, and then collected by the researcher at the participant's school at a later arranged date, or the questionnaire will be completed and collected on the same day provided that the parent/legal guardian of the participant is there to read and sign the Letter of Information and Consent. The Participants will need to read and sign the Letter of Information and Assent. The researcher will be present to address any concerns, questions or queries. The name of the school and name of the participants will remain anonymous and will not be placed on the questionnaires.

Inclusion and Exclusion:
Inclusion criteria**:**

- Male adolescents who participate in field hockey.

Exclusion criteria**:**

- Participants who took part in the pilot study
- Participants in which their parent/legal guardian has not read and signed the Letter of Information and Consent.
- Participants that do not read and sign the Letter of Information and Assent.
- Participants that do not complete the questionnaire.

Risks or discomforts to participants:
There should not be any risks or discomfort to participants.

Benefits:
Understanding the epidemiology of low back pain in male adolescent hockey players can help health professionals with the prevention, treatment and management of those individuals.

Reason/s why the Participant May Be Withdrawn from the Study:
Participation is voluntary and the participant is free to withdraw at any stage.

Remuneration:
The participant will not be offered remuneration for taking part.

Costs of the Study:
The participant will not need to cover any costs of the study.

Confidentiality:
All participant information will be kept confidential and will be kept in the DUT Chiropractic Department for five years, after which it will be destroyed by shredding.

Research-related Injury:
Participants will not be injured in this study and thus no injury related compensation will be granted.

Persons to Contact in the Event of Any Problems or Queries:

Researcher:

Dale de Wit: 031-373 2205/2512

Research Supervisor:

Prof JD Pillay: 031-373239

Institutional Research Ethics Administration on 031 373 2375.

Complaints can be reported to: Director; Research and Postgraduate Support, Prof S. Moyo on 031 373 2577 or moyos@dut.ac.za

Appendix H: Kwazulu-Natal Department of Education Permission

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Enquiries: Phindile Duma | Tel: 033 392 1063 | Ref.:2/4/8/1443

Mr D. Cameron
P.O. BOX 1566
Kloof
3640

Dear Mr Cameron

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **"THE EPIDEMIOLOGY OF LOW BACK PAIN IN MALE ADOLESENT FIELD HOCKEY PLAYERS IN THE ETHEKWINI MUNICIPALITY"**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from 26 January 2018 to 09 July 2020.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Phindile Duma at the contact numbers below.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

[redacted]

[redacted]

Dr. EV Nzama
Head of Department: Education

KWAZULU-NATAL DEPARTMENT OF EDUCATION
Postal Address: Private Bag X9137 • Pietermaritzburg • 3200 • Republic of South Africa
Physical Address: 247 Burger Street • Anton Lembede Building • Pietermaritzburg • 3201
Tel.: +27 33 392 1063 • **Fax.:** +27 033 392 1203• **Email:**Phindile.Duma@kzndoe.gov.za •**Web:**www.kzneducation.gov.za
Facebook: KZNDOE....Twitter: @DBE_KZN....Instagram: kzn_education....Youtube:kzndoe

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Appendix I: Questionnaire

QUESTIONNAIRE ON THE EPIDEMIOLOGY OF LOW BACK PAIN IN MALE ADOLESCENT FIELD HOCKEY PLAYERS IN THE ETHEKWINI MUNICIPALITY.

Dear Participant.

Welcome to my research study, please fill in all questions by indicating next to the option that best applies to you. Please note that all information provided is confidential.

To be measured by the researcher:
Height: _____
Weight: _____

Section A: Demographics (please circle appropriate answers)

1. **Age?** 12yrs 13yrs 14yrs 15yrs 16yrs 17yrs 18yrs 19yrs

2. **Race? (for statistical purposes)**
African Coloured Indian White Other

3. **What team do you play for?**
u14A u16A 1st XI
u14B u16B 2nd XI

4. **Do you represent one of the following teams?**
District team KZN Schools Hockey SA Schools Hockey None

5. **Number of matches played this season?**
(Please specify e.g. 3) _____

6. **Number of times you play hockey per week? (during the season)**
(Please specify e.g. 3) _____

7. **How many years have you played hockey for?**
(Please specify e.g. 3) _____

8. **What position do you play most often?**
Goalkeeper Defender Midfield/Link Forward

9. **Do you participate in any other sports during the hockey season?**
No Yes
If yes, please specify: _____

Section B: General (please circle appropriate answers)

1. **What footwear do you use?**

Running shoes Trail shoes/Cross-trainers Hockey boots Other

If other, please specify: _____

2. **Do you use any of the following attire? (you may circle more than one option)**

Shin pads Ankle-guard Knee-guard None

3. **Does your attire feel comfortable when playing?**

Yes No

If No, please specify:

_____

_____

4. **Do you warm up before playing?**

Yes No

Section C: Health and Lifestyle (please circle appropriate answers)

1. **Would you consider your diet to be healthy? (please circle one)**

-Very healthy (Only eating foods such as: fruits, vegetables, high protein foods etc)

-Healthy (Majority of the time eating foods such as: fruits, vegetables, high protein foods etc)

-Moderately healthy (Combination of healthy and unhealth foods)

-Unhealthy (Majority of the time eating foods high in sugar, takeaways, processed foods)

-Very unhealthy (Only eating foods high in sugar, takeaways, processed foods etc)

2. **Do you hydrate frequently during training and matches?**

Yes No

3. **Would you consider yourself to be fit? (please circle one)**

-Excellent (Highly trained exercisers at specific stages of their training programme)

-Good (Training at high intensities four to six times a week)

-Acceptable (Regularly active – a healthy level of fitness)

-Fair (Sporadically do exercise at low intensities)

-Poor (Physically inactive)

Section D: Low back pain

This box is a definition of low back pain for your understanding.

What is low back pain?
Low back pain is defined as being any pain that is located between the 12th rib and the skin fold below the buttocks/bum (gluteal muscles), which may be associated with or without leg pain (Krismer and Tulder, 2007)
Pain may include; stiffness, tightness, dull pain, sharp pain, pain running down leg.

If you have not experienced any low back pain during the hockey season you may ignore Section Four and Section Five and continue to answer Section F on Page 5.

1. **Have you experienced low back pain this season?** Yes No

If you answered yes to question 4, please indicate at what point in time you experienced this pain. (you may select more than one option)

-Beginning of season -Mid season -End of season

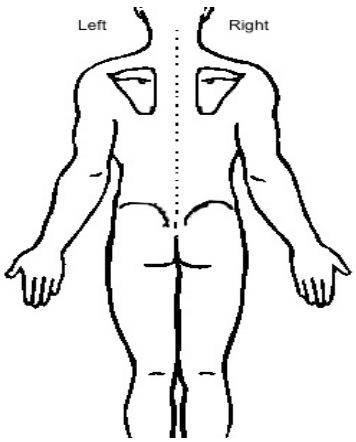
2. **Have you experienced low back pain during a previous hockey season?**

Yes No

3. **When did you experience low back pain this season? (you may circle multiple options)**
   - First training session of season
   - During training sessions
   - Post-training
   - During a match
   - Post-match

4. **Can you identify the location of your low back pain?**

Please mark with an 'X' on the suggested diagram to show the location in which you experienced or are currently experiencing low back pain.



5. How long did the pain last?

A few minutes A few hours Days 1-3 weeks 4-12 weeks 12+ weeks

6. Did the pain cause you to miss practice or a match?

Yes No

If yes please indicated the number of practices or matches missed: _____

7. Did the pain cause you to adjust the way you play?

Yes No

If yes, please explain how:

_____

8. Have you experienced any injuries during the season?

Yes No

If yes, please specify. e.g. sprained left ankle

_____

_____

Section E: Treatment (please circle appropriate answers)

1. Did you receive medical treatment for your low back pain? Yes No

2. If yes, please indicate who you received treatment from:

-Medical Doctor -Chiropractor

-Physiotherapist -Biokineticist

-Nurse

-Other: please specify _____

3. Did you treat the pain yourself? Yes No

If yes, please specify (e.g. ice, stretch, rest etc.)

---

4. Are medical professionals available to you at school, matches or training?

Yes No

5. If yes, please indicate which of the following:

-Medical Doctor -Chiropractor

-Physiotherapist -Biokineticist

-Nurse

-Other: please specify _____

6. **Did you receive any advice on how to manage or treat your low back pain?**

Yes No

If yes, please specify (e.g. ice, stretch, rest etc.)

Section F: Disability

The Quebec Back Pain Disability Scale:

This questionnaire is about the way your back pain is affecting your daily life. People with back problems may find it difficult to perform some of their daily activities. We would like to know if you find it difficult to perform any of the activities listed below, because of your back. For each activity there is a scale of 0 to 5. Please choose one response option for each activity (do not skip any activities) and circle the corresponding number.

Did you find it difficult to perform the following activities because of your back?

	0. Not difficult at all	1. Minimally difficult	2. Somewhat difficult	3. Fairly difficult	4. Very difficult	5. Unable to do
1. Get out of bed	0	1	2	3	4	5
2. Sleep through the night	0	1	2	3	4	5
3. Turnover in bed	0	1	2	3	4	5
4. Ride in a car	0	1	2	3	4	5
5. Stand up for 20-30 minutes	0	1	2	3	4	5
6. Sit in a chair for several hours	0	1	2	3	4	5
7. Climb one flight of stairs	0	1	2	3	4	5
8. Walk a few blocks (300-400 m)	0	1	2	3	4	5
9. Walk several kilometres	0	1	2	3	4	5
10. Reach up to high shelves	0	1	2	3	4	5
11. Throw a ball	0	1	2	3	4	5
12. Run one block (about 100m)	0	1	2	3	4	5
13. Take food out of the refrigerator	0	1	2	3	4	5
14. Make your bed	0	1	2	3	4	5
15. Put on socks	0	1	2	3	4	5
16. Bend over to clean the bathtub	0	1	2	3	4	5
17. Move a chair	0	1	2	3	4	5
18. Pull or push heavy doors	0	1	2	3	4	5
19. Carry two bags of groceries	0	1	2	3	4	5
20. Lift and carry a heavy suitcase	0	1	2	3	4	5

Add the numbers for a total score: _____

THE END, THANK YOU FOR YOUR PARTICIPATION

Appendix J: Focus Group Letter of Information

Dear focus group participant,

Welcome to my study, I appreciate your participation.

Title of research study: The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality.

Researcher:
Dale de Wit
[B. Tech Chiropractic]

Research Supervisor:
Prof JD Pillay
[PhD Physiology]

Brief introduction and purpose of the study:
Due to the nature of hockey, players repeatedly perform combined flexion and rotational movements of the lumbar spine through various hitting and pushing techniques, these combined movements as well as the semi crouched position have been shown to increase the risk of developing low back pain (LBP). Studies have also shown that LBP during adolescence is a significant risk factor for developing LBP as an adult. The purpose of the study is to gain information about low back pain in male adolescent field hockey players in the eThekwini municipality via a questionnaire.

Procedure:
The purpose of the focus group is to assess, discuss and make any relative changes to the pre-focus group questionnaire as appropriate. An agreed upon date, venue, and time will be arranged via telephonic communication with all the members of the focus group. Prior to the commencement of the official focus group meeting, each participant will be required to fill in a confidentiality letter, as well as to sign a code of conduct. The focus group meeting will be chaired and minuted by the researcher. Any suggestions or amendments that are proposed by any participant will be scrutinized by the group and voted on. Only with a unanimous vote will an amendment be implemented. A list of amendments that are implemented will be made and used to adjust the questionnaire.

Risks or discomforts to participants:
There should not be any risks or discomfort to you.

Benefits:
Understanding the epidemiology of LBP in male adolescent hockey players can help health professionals with the prevention, treatment and management of those individuals.

Reason/s why the Participant May Be Withdrawn from the Study:
Participation is voluntary and you are free to withdraw at any stage.

Remuneration:
You will not be offered remuneration for taking part.

Costs of the Study:
You will not need to cover any costs of the study.

Confidentiality:
All your information will be kept confidential and will be kept in the DUT Chiropractic Department for five years, after which it will be destroyed by shredding.

Research-related Injury:
You will not be injured in this study and thus no injury related compensation will be granted.

Persons to Contact in the Event of Any Problems or Queries:

Researcher:
Dale de Wit: 031-373 2205/2512

Research Supervisor:
Prof JD Pillay: 031-373239

Institutional Research Ethics Administration on 031 373 2375.
Complaints can be reported to: Director; Research and Postgraduate Support, Prof S. Moyo on 031 373 2577 or moyos@dut.ac.za

Appendix K: Focus Group Informed Consent Form

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Dale de Wit, about the nature, conduct, benefits and risks of this study- Research Ethics Clearance Number: _____
- I have 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 sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of researches, I agree that the data collected during this study can be processed in a computerised system by the researcher. The information from this focus group will be made public in terms of a journal publication, which will in no way identify any participants of this research
- All information contained in the research documents and any information discussed during the focus group meeting will be kept confidential. This is especially binding to any information that may identify any of the participants in the research process.
- None of the information shall be communicated to any other individual or organization outside of this focus group as to the decisions of this focus group.
- I may, at any stage, 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 significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Please circle the appropriate answer

1-	Have you read the participant information sheet?	YES	NO
2-	Have you had the opportunity to ask questions regarding this study?	YES	NO

3- Have you received satisfactory answers to your questions? YES NO

4- Have you had the opportunity to discuss this study? YES NO

5- Have you received enough information about this study? YES NO

6- Who have you spoken to regarding this study? _

7- Do you understand the implications of your involvement in this study? YES NO

8- Do you understand that you are free to withdraw from this study at any time, without giving a reason for withdrawing, and without affecting your future health?

YES NO

9- Do you agree to voluntarily participate in this study? YES NO

If you answered NO to any of the above, please obtain the necessary information from the researcher and / or supervisor before signing.

Thank You!

Focus group member: _____ Signature: _____

Researcher's name: _____ Signature: _____

Appendix L: Focus group code of conduct

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

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

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

Member Represents	Members Name	Signature	Contact Details

Appendix M: IREC permission to conduct research

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

23 May 2018

IREC Reference Number: **REC 102/17**

Mr D C de Wit
P O Box 1566
Kloof
3640

Dear Mr de Wit

The epidemiology of low back pain in male adolescent field hockey players in the eThekwini municipality

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

Please note that FULL APPROVAL is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely,

[redacted]

Professor C E Napier
Deputy Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2018 -05- 23
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA