An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini Municipality

By

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Dissertation submitted in partial compliance with the requirements of the master's degree in technology: Chiropractic
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I, Jonathan Blackburn, do declare that this dissertation is representative of my own work in both conception and execution (except where acknowledgements indicate the contrary).

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DEDICATION

I dedicate my research to my friends and family. Thank you for your endless love and support throughout this journey. I would also like to thank the doctors, specifically Dr Johann Raats, Professor De Groot, and Dr Pienaar, who helped me overcome cancer in 2017 and for giving me a second chance at life.

ACKNOWLEDGEMENTS

My sincere appreciation goes to the following people:

My supervisor, Professor Julian David Pillay, thank you for your expert guidance throughout this journey. I truly appreciate your patience, professionalism and effort. It has been a privilege to work under your supervision.

My co-supervisor, Dr Fazila Ally, I cannot thank you enough for the impact that you have had on my life. Your passion for teaching has fuelled my own love of learning, and your genuine care and encouragement, especially during the challenges of my chemotherapy, has meant more than words can express. Thank you for always going beyond what is expected of you, both in the classroom and in life.

To my incredible parents, Geoffrey and Anita, thank you for your unwavering support and constant encouragement. I truly would not be here today without your love, strength, and belief in me, especially in moments when even the doctors had lost hope. Your faith carried me through the darkest times. I dedicate this thesis to you, with all my love and gratitude.

To my best friend and brother, Michael: through life and its challenges, I have never felt alone. Thank you for always being a phone call way. Your faith, encouragement and support has been a pillar for me to lean. I am endlessly grateful for you.

To my incredible sisters, Natalie and Christine, thank you for your continuous support throughout this journey. Your kindness and support have brought light during difficult times.

To my statistician, Dr Gill Hendry, thank you for your time and assistance with the interpretation of the data and calculations of the statistics. You always went the extra mile for me, and it has not gone unnoticed. Thank you.

ABSTRACT

Background: Field hockey is a high intensity sport that exposes players to intrinsic, extrinsic, and overuse injuries. An overuse injury that appears to be neglected in field hockey epidemiological research is Medial Tibial Stress Syndrome (MTSS TII).

Objectives: This study aimed to determine the self-reported prevalence of MTSS TII in club hockey players within the eThekwini Municipality, any potential contributing possible risk factors that may contribute to its development, and identify the treatment-seeking strategies employed by these players.

Methods: A quantitative, cross-sectional study was conducted to determine the prevalence and potential risk factors of MTSS TII among club hockey players in the eThekwini Municipality, KwaZulu-Natal, South Africa. An online self-administered questionnaire was distributed via the Durban Hockey Association to registered adult players (older than 18 years old) competing for clubs within the municipality. The questionnaire explored the demographics, potential risk factors contributing to MTSS TII, a MTSS TII assessment tool, MTSS TII history and education, and management of the condition.

Results: Among the 137 participants, 10.9% (n=15) were self-diagnosed with MTSS TII. A higher prevalence of MTSS TII was found in women (60%) compared to men. A significant association was found between MTSS TII and duration of shoe use (Fisher's exact test = 12.328, p=0.007), with 40% of those with MTSS TII used their hockey shoes for less than six months compared to 9% of those without MTSS TII. A total of 55 participants (40.1%) had a history of MTSS TII or had been diagnosed by a licenced practitioner. Physiotherapy was the most frequently consulted medical service (85%), with stretching (88.9%), massage (88.9%), and strapping (74.1%) reported as the most frequently used treatments. Notably, only 13.1% of participants reported receiving any education about MTSS TII from coaches or team staff (p<0.01).

Discussion and conclusions: MTSS TII is a relatively common occurrence in field hockey players, particularly among women. This study clarifies the prevalence, potential risk factors, education, and management of MTSS TII in field hockey players. The results of this study, particularly the high percentage of players with a history of shin splints, indicate the need for injury prevention strategies.

Keywords: Field hockey, Medial Tibial Syndrome Type II, prevalence, possible risk factors, management

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CHAPTER 1 – INTRODUCTION

1.1 BACKGROUND

Field hockey is one of the most popular sports in KwaZulu-Natal (KZN), South Africa, with an estimated number of 19 981 school hockey players (Foundation, 2018). Field hockey is a high intensity sport that requires significant practice and playing hours to compete at the highest level. Due to the high level of physical activity and competitive nature of the sport, players are required to practice multiple times per week and many players are expected to train privately. This exposes players to injuries that are related to overtraining, including strains, sprains, and shin splints (Sánchez-Migallón *et al.* 2024).

A 2016 study of injury data of major international field hockey tournaments identified that the number of injuries per 1000 hours of playing time was 23.4 to 44.2 in women and 20.8 to 90.9 in men (Theilen *et al.* 2016). A study by Manaf, Justine, and Hassan (2021) on the prevalence of musculoskeletal injuries in Malaysian hockey players, found that 63% of the sample assessed experienced lower limb injuries, and identified sprains and strains to be the most common musculoskeletal injuries. This study found that 30% of all injuries resulted from overuse (Manaf, Justine and Hassan 2021).

In 1976, the International Hockey Federation made it mandatory for all major international tournaments to take place on artificial turf, such as AstroTurf. This led to the mass transition from grass to synthetic surfaces. This artificial turf provides a consistently flat surface upon which to play and requires relatively low maintenance, allowing for fast flowing hockey. However, as beneficial as this surface has been for hockey, the surface is firm and lacks the cushioning provided by natural grass fields. This lack of shock absorption during high intensity play, can lead to increased mechanical stress in the lower limb, resulting in shin splints and tibial stress fractures (Olive 2023).

Medial Tibial Stress Syndrome Type II (MTSS TII) is an overuse injury that appears to be a neglected topic in current sports medicine literature. MTSS TII, otherwise known as shin splints, is an exercise-induced condition that affects the lower limb. MTSS TII can affect the lower limbs unilaterally or bilaterally, but is more commonly unilateral (Kousar *et al.* 2024). Hockey, which involves a significant amount of running, training on hard surfaces, and high levels of playing time, provides all the possible risk factors for the development of MTSS TII (Deshmukh Jr *et al.* 2022).

MTSS TII were first defined in 1966 by the American Medical Association as a discomfort in the region of the lower leg due to excessive running on firm surfaces or overuse of the ankle flexors (Brewer and Gregory 2012). This discomfort or pain occurs over an area of greater than five centimetres over the distal posteromedial tibia. The diagnosis of MTSS TII should exclude the possibility of a tibial stress fracture and/or compartment syndrome (Franklyn and Oakes 2015).

While the pathophysiology of MTSS TII remains unclear, recent literature has theorised that the condition is caused by a periosteal reaction occurring at the junction of the posterior tibialis and the medial tibia (Deshmukh Jr *et al.* 2022). Training on hard surfaces, incorrect footwear, and overtraining can cause excessive stress at this junction, leading to the rate of microdamage exceeding the rate of tissue repair, which results in an inflammatory response (Hashim *et al.* 2024).

This debilitating condition can hinder an individual's performance and lead to an extended period of inactivity during recovery. This period of inactivity carries a financial burden for both the individual and the team they represent, especially at a club hockey level, in which most teams do not have the financial means to assist a player with medical complaints (Barboza *et al.* 2018).

The first step of injury prevention is to identify the extent to which a condition affects a particular population and then which possible risk factors might contribute to its development. Whilst the prevalence and risk factors of MTSS TII have been widely studied in runners (Deshmukh Jr *et al.* 2022) and soldiers (Sobhani *et al.* 2015), limited research has been conducted on field hockey players. The purpose of this study was thus to observe the prevalence of MTSS TII amongst club hockey players and identify any correlation between possible risk factors and the development of the condition.

1.2 AIMS AND OBJECTIVES

1.2.1 Aim

The aim of this study was to determine the prevalence of MTSS TII amongst club hockey players within the eThekwini Municipality and to determine any factors that may contribute to the development of the condition.

1.2.2 Objectives

- To determine the self-reported prevalence of MTSS TII amongst club hockey players in the eThekwini Municipality, KZN, South Africa.
- To examine the perceived factors associated with the development of MTSS TII among club hockey players.
- To determine the association, if any, between MTSS TII and the selected factors (footwear, playing surface, exposure to strength and conditioning, and history of shin splints).
- To determine the current treatment strategies that club hockey players use to manage MTSS TII.

1.3 RESEARCH PROBLEM

MTSS TII is a prevalent overuse injury amongst athletes, particularly those who participate in high impact sports such as hockey (Barboza *et al.* 2018).

Whilst MTSS TII has been identified as a common overuse injury among runners and soldiers, a significant gap exists in epidemiological data regarding prevalence and possible risk factors among club hockey players. This gap is problematic in practice because, without population-specific data, coaches, clinicians, and players are unable to implement evidence-based injury prevention strategies, optimise training loads, or provide timely interventions, which may increase the risk of injury, recurrence, and reduced performance.

Additionally, factors that may influence the development of MTSS TII, such as demographics, training frequency, playing surface, and footwear, are poorly understood in this population, which limits the ability to implement targeted risk-reduction strategies.

1.4 STUDY RATIONALE

Field hockey is a high intensity sport that requires a significant amount of training to allow teams to compete at the highest level. As beneficial as increased training may seem in obtaining positive results, it exposes players to overuse injuries such as MTSS TII, which has been found to be amongst the top 10 most common overuse injuries in individuals participating in sports (Rees *et al.* 2021). Research has shown that there is a high injury rate amongst field hockey players (Barboza *et al.* 2018). Common hockey-related injuries include muscle strains, ankle sprains, facial injuries, knee injuries, and chronic overuse injuries, including MTSS TII. Sultana *et al.* (2016) studied MTSS TII in athletes from clubs in Dhaka, Bangladesh, and identified a strong correlation between hockey and the development of MTSS TII (Sultana *et al.* 2016). However, this study did not i) focus primarily on hockey players, but rather a large pool of athletes; ii) include any information pertaining to possible risk factors specific to hockey, but rather sport in general; and iii) explore treatment options selected by athletes when they developed the condition.

The popularity of field hockey in South Africa has increased dramatically since the establishment of the South African Hockey Association in August 1992. The men's and women's national teams have competed in major international tournaments, such as the Olympic Games, Commonwealth Games, and the Hockey World Cup, thereby raising the profile of field hockey in South Africa (Said 2023). KZN has an estimated number of 19 981 school hockey players, 847 more than the province of the Western Cape. Many of these school hockey players will progress to club hockey level once they complete their secondary education (Hockey 2023). Therefore, a need exists for further research into the relationship between MTSS TII and hockey players, especially in South Africa, as it is a nation that competes at the highest level of sport. The results of this study may be used to improve understanding of the prevalence and factors associated with MTSS TII in club hockey players. Furthermore, this study may offer insight into the current management of MTSS TII, both through professional care and self-administered strategies, and assess how these practices align with existing medical literature.

1.5 STUDY DELINEATION

Chapter 1 introduced the topic of MTSS TII. It provided background information on the condition, club hockey, and the association between the two factors. The aims, objectives, and the rationale for the study were discussed.

Chapter 2 discusses the literature relating to shin MTSS TII, club hockey, and the association between MTSS TII and the development of the condition in this population.

Chapter 3 explains the methodology of the study. It includes the study design, study population, participant recruitment, sample size, sampling strategy, measurement tool, review panel, pilot study, study procedure, and ethical considerations.

Chapter 4 is presented as a manuscript prepared for submission to an academic journal and encompasses the introduction, methodology, results, discussion, strengths and limitations, and conclusion.

Chapter 5 discusses the results obtained from this study. Information pertaining to prevalence and possible risk factors of MTSS TII in club hockey players within the eThekwini Municipality is described and discussed in the context of relevant available literature.

Chapter 6 provides a conclusion and elaborates on the limitations of this study. This section also makes recommendations for future studies.

CHAPTER 2 – LITERATURE REVIEW

2.1 BACKGROUND

Field hockey is an outdoor game of stick and ball with its foundation stretching back to 2000 BCE (Federation 2025a). This ancient game has since developed into a highly strategic affair between two teams of 11 players each, namely 10 outfield players and one goalkeeper (McGuinness *et al.* 2019; Lim, Sim and Kong 2021). Field hockey is governed by the International Federation of Sport, a board overseeing over 130 member nations. These nations compete at the highest level in international tournaments such as the Federation Internationale de Hockey (FIH) World Cup and the Olympic Games (Federation 2025a).

Since the inception of the South African Hockey Association in 1992 (Hockey 2002), the sport has gained popularity among both men and women. As of 2025, the South African men's national team is ranked 11th, and the female national team ranked 21st in the world (Federation 2025b). This rise in popularity of hockey in South Africa has spearheaded the development of hockey clubs nationally and resulted in an increasing number of school children participating in the sport (House 2024).

Field hockey is one of the most popular sports in KZN, South Africa, with an estimated number of 19 981 school hockey players (Foundation 2018). Once secondary school is complete, many of these students continue playing hockey at their university or hockey club. Currently, KZN has 17 hockey clubs, of which 15 are located in the eThekwini Municipality. According to the Durban Hockey Association, 1 188 hockey players compete in this region.

Given the high intensity and physically demanding nature of field hockey, players are susceptible to various injuries (Murtaugh 2009; Barboza *et al.* 2018). These injuries are often acute and traumatic but can also be as a result of overuse. One overuse injury that appears to be neglected in field hockey players is MTSS TII, also known as shin splints. This study examined the prevalence of MTSS TII among field hockey players and investigate possible correlations between possible risk factors and the development of the condition.

2.2 ANATOMY OF THE LEG

The leg is defined as a region of the body that lies between the knee and the ankle (Cantrell, Imonugo and Varacallo 2019; Lim, Sim and Kong 2021). This region comprises two long bones, namely the fibula laterally and the tibia medially. The tibia articulates with the femur, forming the tibiofemoral joint superiorly. The distal head of the tibia articulates with the talus bone of the ankle, forming the talocrural joint. The proximal aspect of the fibula articulates with the proximal tibia, forming the superior tibiofibular joint. Distally, the fibula attaches to the tibia at the concave fibular notch (Manganaro and Alsayouri 2019). Aside from these two attachment points, the tibia and fibula are also connected along their shafts by a fibrous structure referred to as the syndesmosis (Lotti, Tsampau and Bonan 1990; Anand Prakash 2020).

The leg consists of four muscular compartments: anterior, lateral, deep posterior, and superficial posterior (Mostafa, Graefe and Varacallo 2023).

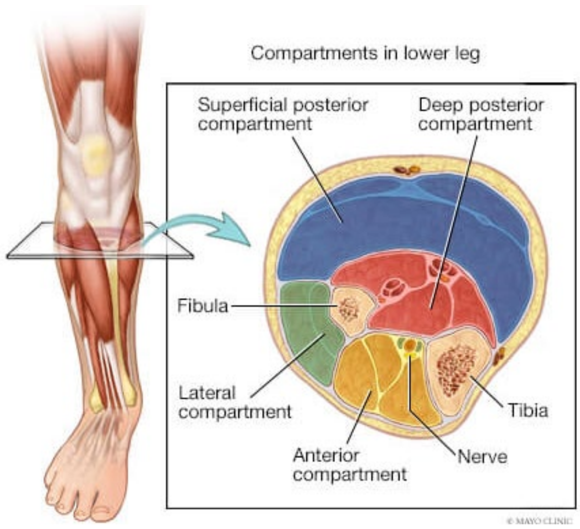

Figure 2.1 Muscular compartments of the leg (Clinic 2025)

The anterior compartment consists of four muscles, namely the fibularis tertius, extensor hallucis longus, extensor digitorum longus and anterior tibialis. This compartment receives a nerve supply from the deep fibular nerve and a blood supply from the anterior tibial artery. The lateral compartment of the leg consists of the fibularis longus and fibularis brevis muscles. This area receives a nerve supply from the superficial fibular nerve and a blood supply from the fibular artery (Khan et al. 2018).

The deep posterior compartment of the leg also comprises four muscles, these include the flexor hallucis longus, flexor digitorum longus (FDL), and popliteus, and tibialis posterior muscle. This compartment receives a nerve supply from the tibial nerve and a blood supply from the posterior tibial artery. Lastly, the superficial posterior compartment consists of the soleus, plantaris, and gastrocnemius muscles. This compartment receives a nerve supply from the tibial nerve and a blood supply from the posterior tibial artery (Mostafa, Graefe and Varacallo 2023).

The tibia and fibula, like many other bones in the body, is covered by the periosteum, a thin fibrous layer of connective tissue. The periosteum consists of two distinct layers: an outer fibrous layer and an osteoblastic inner layer. The outer layer can be further subdivided into a superficial inelastic collagenous portion and a deep fibroelastic portion. The superficial portion of the fibrous layer has a rich neural and vascular network. The deep fibroelastic portion has greater elasticity and is the attachment point for tendons (Dwek 2010).

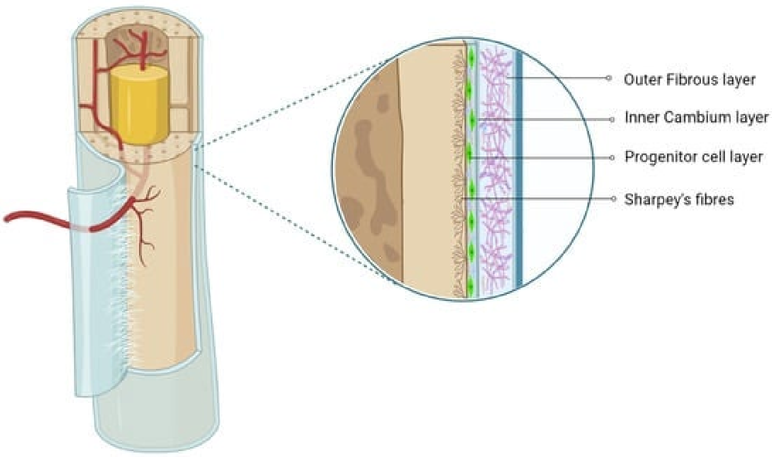

Figure 2.2 Layers of the periosteum (Jeyaraman *et al.* 2021)

The inner layer of the periosteum, often referred to as the cambium, consists of osteoblasts, fibroblasts, and mesenchymal progenitor cells—all of which play a role in bone growth. The thickness of this layer has been shown to decrease with age (Dwek 2010; Šromová, Sobola and Kaspar 2023). The periosteum is connected to bone by bundles of collagen fibres referred to as Sharpey's fibres. Sharpey's fibres act as the junction between the bone and the crural fascia, the fascial sheath surrounding the muscles in the leg (Crous 2021).The muscles that are most commonly associated with MTSS TII are the soleus, FDL, and tibialis posterior (Deshmukh Jr *et al.* 2022). It is believed that when these muscles are exposed to increased mechanical stress (either due to intrinsic or extrinsic factors), increased load is placed on the Sharpey's fibres, resulting in an inflammatory response, which in turn is thought to be the cause of MTSS TII (McClure and Oh 2023).

The soleus is a large powerful muscle of the posterior leg originating at the soleal line of the tibia and proximal fibula, with an insertional point at the dorsum of the heel via the calcaneal tendon (Hatzantonis *et al.* 2011; Kimura *et al.* 2021). This muscle is one of the three triceps surae muscles involved in plantarflexion of the ankle joint. Emerging anatomical evidence suggests that the soleus may also have fibres originating from the distal posteromedial aspect of the tibia, a region commonly implicated in MTSS TII (Matin 1988; Singh, Wadhwani and Sharma 2025).

Figure 2.3 The soleus muscle (Levarda 2024)

The FDL begins at the middle third of the tibia's posterior surface and extends down to attach at the base of the distal second to fifth phalanges. This muscle is primarily responsible for flexion of the lateral four interphalangeal joints but also plays a role in plantarflexion of the talocrural joint and inversion at the subtalar joint (Grujičić 2023). Given its anatomical course along the posteromedial tibia, the FDL is considered a contributing factor in the development of MTSS TII through repetitive stress and traction on the tibial periosteum (Beck and Osternig 1994; Brown 2016).

Figure 2.4 The flexor digitorum longus (Grujičić 2023)

The tibialis posterior muscle arises from the interosseous membrane, as well as the surrounding surfaces of the fibula and tibia. The muscle inserts into three attachment points, including the navicular tuberosity, medial cuneiform, and the base of the second to fourth metatarsal bones. The tibialis posterior lies adjacent to the tibia, separated only by the fascial sheath that surrounds the muscle. This muscle spans the length of the posteromedial tibia, passes posterior to the medial malleolus, and crosses the medial arch of the foot. This unique anatomical orientation allows for pronation and inversion of the foot (Corcoran and Varacallo 2022).

Figure 2.5 The tibialis posterior (Gorman 2022)

2.3 FIELD HOCKEY INJURIES

Hockey is a high intensity sport that exposes players to both traumatic and overuse injuries (Orooj, Nuhmani and Muaidi 2016). A 2016 study of injury data of major field hockey tournaments identified that the injury rates ranged from 23.4 to 44.2 per 1000 hours of play in women, and from 20.8 to 90.9 in men. It was also reported that most injuries sustained were trauma-related, mostly caused by the ball striking a player (Theilen *et al.* 2016). A study by Manaf, Justine, and Hassan (2021), on the prevalence of musculoskeletal injuries in Malaysian hockey players, found that 51% of the sample studied experienced lower limb injuries, and identified sprains and strains to be the most common musculoskeletal injuries (Manaf, Justine and Hassan 2021).

Hockey-related injuries can be categorised into three primary types, namely extrinsic (external), intrinsic (internal), and overuse injuries (Leelavathy and Madhu 2021).

2.3.1 Extrinsic Injuries

Extrinsic injuries in field hockey are caused by external forces such as impacts from the stick or ball, falls on hard playing surfaces, or collisions with other players or the goalpost. These injuries are often acute and severe in nature, representing approximately 60% to 80% of all injuries sustained in the sport (Leelavathy and Madhu 2021). Examples of extrinsic injuries include fractures, sprains, and contusions.

A sprain is defined as the stretching or tearing of a ligament, which is a band of fibrous connective tissue linking bones together at joints (Struijs and Kerkhoffs 2010). Sprains are among the most common extrinsic injuries in field hockey, with the ankle being the most frequently affected site. Ankle sprains account for approximately 40% of all sports-related sprain injuries (Jungmann *et al.* 2023). Manaf *et al*. (2021) reported that sprains and strains comprise 63% of all hockey-related injuries, with the ankle joint accounting for 18.6% of cases (Manaf, Justine and Hassan 2021). This high incidence is attributed to the sport’s dynamic and explosive movements, which place significant mechanical stress on the ankle ligaments.

Traumatic fractures occur when an external force such as a direct impact from sticks, balls, other players, or the ground, exceeds the bone's structural capacity, leading to a break or crack in the bone. These forces can lead to acute fractures, particularly in vulnerable areas such as the wrist and hand. Acute fractures account for 5% to 10% of all sports injuries (Robertson and Wood 2015). A study conducted in 2007 on high school athletes found that fractures represented 5% of the total lower extremity diagnoses, with the ankle being the most commonly fractured site (42%) (Fernandez, Yard and Comstock 2007; Wang *et al.* 2019). According to the study entitled "*Injury Patterns Among Female Field Hockey Players"*, fractures accounted for 16.4% of all injuries, with wrist and hand bones being the most commonly affected sites (Murtaugh 2001; Hanlon *et al.* 2020).

Contusions and haematomas are soft tissue injuries resulting from blunt force trauma, typically from a ball or stick (Orooj, Nuhmani and Muaidi 2016). These injuries are highly prevalent in field hockey due to frequent contact from external objects. Jamison and Lee (1989) identified contusions and haematomas as the most common extrinsic injuries, comprising 64% of all reported cases. Although generally less severe than fractures, these injuries can still impair performance and, hence, require appropriate management (Jamison and Lee 1989; Barboza *et al.* 2018).

2.3.2 Intrinsic/Internal Injuries

Intrinsic or internal injuries result from forces generated within the body, typically involving overuse, biomechanical stress, or acute internal strain without external trauma. These injuries are less common than extrinsic ones, accounting for 11% to 18.5% of all field hockey injuries (Orooj, Nuhmani and Muaidi 2016).

Field hockey is characterised by rapid acceleration, deceleration, pivoting, and directional changes, all of which can place substantial stress on muscles, tendons, ligaments, and cartilage. When the internal load surpasses tissue tolerance, especially during fast movements, injuries such as strains or tears can occur.

Strains involve the overstretching or tearing of muscle fibres or tendons, whereas tears can affect both muscles and supportive connective tissues such as ligaments and cartilage. These injuries often result from poor biomechanics, fatigue, or inadequate warm-up prior to high-intensity activity (Zheng 2024).

2.3.3 Overuse Injuries

Overuse injuries occur when excessive, repetitive mechanical stress is placed on an area of the body without adequate rest and recovery, leading to inflammation and tissue damage (Brenner *et al.* 2024). A study conducted by Manaf, Justine and Hassan (2021) found that 38% of injuries in Malaysian hockey players resulted from overuse (Manaf, Justine and Hassan 2021). Another study examining common acute and chronic musculoskeletal injuries among female adolescent field hockey players in South Africa identified that the hip and lower back were the most common sites of chronic musculoskeletal injury (Ellapen, Bowyer and Van Heerden 2014). This is believed to be due to the semi-crouched posture in which hockey players tend to play. Other prevalent overuse injures that have been identifed among hockey players, include iliotibial band syndrome, tibial stress fractures, lower back pain, plantar fascitis, patellofemoral pain syndrome, tendonitis, and MTSS TII (Orooj, Nuhmani and Muaidi 2016).

Despite its relevance in field hockey, MTSS TII appears to be a neglected topic in the current sports medicine literature. Hockey involves a significant amount of running, training on hard surfaces, and high levels of playing time—all possible risk factors in the development of shin splints (Deshmukh Jr *et al.* 2022).

A 2016 study of MTSS TII in club athletes in Dhaka City, Bangladesh, identified a prevalence of 25.9% across the four sports assessed (Sultana *et al.* 2016). This study compared the prevalence of MTSS TII in cricket, hockey, football, and tennis players. Hockey players were found to have the highest prevalence amongst the four sports (34.6%) (Sultana *et al.* 2016). The study conducted by Sultana *et al*. (2016) appears to be the only study that has investigated MTSS in hockey players. Thus, a gap exists in the literature in terms of the prevalence and sport-specific factors associated with MTSS TII amongst field hockey players.

2.4 MEDIAL TIBIAL STRESS SYNDROME TYPE II

2.4.1 Introduction to Medial Tibial Stress Syndrome

Medial Tibial Stress Syndrome is an ‘umbrella’ term used for exercise-induced pain that occurs along the posteromedial border of the tibia and can be classified into three subtypes (Detmer 1986; Bosnina *et al.* 2023). Type I, which refers to tibial microfracture or cortical fracture, is caused by repetitive stress or overload of the tibia, leading to small breaks within the bone. Type I presents with pinpoint pain in the region of the middle to lower third of the tibia. The pain is sharp in nature due to the break in periosteum and can present with bruising and oedema (Teaff 2019). A 2022 study found that tibial stress fractures were the most common lower-extremity stress fracture, accounting for 49% of cases among individuals diagnosed with stress fractures, particularly within athletic and military populations (da Rocha Lemos Costa *et al.* 2022).

Type II refers to periostalgia that occurs at the periosteal-fascial junction between the tibia and its surrounding musculature, including the tibialis posterior, soleus, and the FDL (Becker, Nakajima and Wu 2018). This subtype is often referred to as shin splints and presents with diffuse pain along the posteromedial aspect of the tibia. The condition is aggravated by physical activity and relieved by rest. This is considered the mildest of the three subtypes, but if not managed correctly, can lead to Type I or, eventually, Type III (Bhusari and Deshmukh 2023).

Type III refers to chronic compartment syndrome affecting the anterior compartment of the lower leg. This is considered the most serious of the three subtypes and occurs due to increased pressure within the fascial sheath that surrounds the affected muscle (Tarabishi *et al.* 2023). This condition presents with severe pain in the lower leg, especially during physical activity. This can be accompanied by vascular and neurological symptoms due to compromise of the neurovascular structures within the compartment (Buerba *et al.* 2019).

2.4.2 Medial Tibial Stress Syndrome Type II (MTSS TII)

Medial Tibial Stress Syndrome Type II was first defined in 1966 by the *American Journal of Sports Medicine* as discomfort experienced in the legs from running on hard surfaces or due to excessive use of the ankle flexors (Bates 1985).

The nonspecific term of shin splints has long been used to describe a broad spectrum of leg pain brought on by repetitive foot to ground impact. This ‘umbrella’ term has been used to describe a wide range of leg conditions including tibial stress fracture, chronic compartment syndrome, popliteal artery entrapment, and strains of the tibialis anterior and posterior. The ambiguity of this term can undermine effective diagnosis, treatment, and understanding for both athletes and the public (Beck 1998; Winters 2020).

In the context of this research, a more recent and accurate definition for MTSS TII, otherwise known as shin splints, is an exercise-induced overuse injury characterised by a periosteal reaction typically occurring over an area of more than 5cm at the distal third of the medial border of the tibia due to overload of the surrounding musculature, namely the tibialis posterior, soleus, and FDL (Winters 2020).

A 2018 study by Winters *et al*. demonstrated that MTSS TII can be diagnosed through a thorough medical assessment, including patient history taking and physical examination. This study identified the diagnostic criteria for MTSS TII. These included, exercise-induced pain localised along the distal two-thirds of the medial tibial border, pain that was exacerbated by physical activity and reduced with rest, and palpable tenderness over an area exceeding 5cm along the medial tibia. Additionally, the diagnosis required the exclusion of symptoms indicative of chronic compartment syndrome or tibial stress fractures. This method was found to be highly reliable, showing an inter-rated reliability coefficient of 0.89 (Winters *et al.* 2018).

In addition to clinical evaluation, magnetic resonance imaging (MRI) is the preferred imaging method in the diagnosis of MTSS TII, as it can provide detailed visualisation of soft tissue and bone. Key features of MTSS TII seen on MRI include bone marrow oedema, periosteal oedema, and the absence of cortical reabsorption or fracture lines (Neto, Duarte and Gastaldi 2020). A MRI can rule out other possible differential diagnoses including stress fractures, muscle strains, and chronic compartment syndrome (Aoki *et al.* 2004; Mohile *et al.* 2020).

2.4.3 Aetiology of MTSS TII

MTSS TII appears to be common amongst individuals who participate in activities that involve repetitive ground contact, such as running, marching, and jumping. These high-impact motions result in repetitive stress of the tibia, potentially contributing to the condition (Ramteke and Jaiswal 2024). Whilst three theories have emerged in the literature concerning the aetiology of MTSS TII, each discussing different anatomical structures and pathological mechanisms; none have been definitively proven.

In a study titled "*Basic principles of nuclear medicine techniques for detection and evaluation of trauma and sport medicine injuries*", Matin theorised that a potential cause of MTSS TII symptoms was the disruption of the Sharpey's fibres that anchor the soleus muscle and its fascia to the cortical bone of the distal tibia. This irritation is believed to trigger an osteoblastic response leading to increased bone remodelling, producing a longitudinal elongated injury presentation of the distal third of the posteromedial tibia (Matin 1988; de Oliveira *et al.* 2024).

Saxena, O'Brien, and Bunce (1990) conducted a study to investigate which muscle might contribute to the development of MTSS TII. Through dissection, they found that the posterior tibialis muscle originates from the distal third of the medial tibia, precisely where MTSS TII symptoms are typically localised. Given the biomechanical risk factors associated with MTSS TII and the role of the posterior tibialis in stabilising the lower leg, its overuse could potentially contribute to the condition. However, a limitation of this study was its small sample size, as dissections were performed on only 10 specimens (Saxena, O'Brien and Bunce 1990; Tweed, Campbell and Avil 2008; Winters 2018).

In contrast, a 1994 study by Beck and Osternig yielded conflicting findings. Their dissection of 50 cadaveric lower limbs showed that only the soleus and flexor FDL muscles originated from the posteromedial tibia and not the tibialis posterior muscle. Based on their findings, they concluded that a longitudinal traction-induced periostitis, caused by the soleus muscle acting on the distal posteromedial tibia, was the most likely mechanism behind MTSS TII symptoms (Beck and Osternig 1994; Brown 2016).

In summary, while various theories implicate specific muscular and structural components, a definitive cause remains unclear. This outlines the complexity of the condition and emphasises the need for further research to clarify its aetiology.

2.4.4 Pathophysiology of MTSS TII

Similar to aetiology, the exact pathophysiology of MTSS TII remains unclear. The primary mechanism in its development is believed to be bone overload and a resulting stress reaction. Repetitive impact activities, such as running and jumping, expose the tibia to bending forces and, when these forces exceed the tibia's ability to remodel, a stress reaction takes place, resulting in periosteal oedema (Reshef and Guelich 2012; Kuwabara *et al.* 2021).

Another mechanism that is believed to be involved in MTSS TII is traction periostitis. During repetitive activity, the soleus, FDL, and tibialis posterior muscles exert a pulling force on the periosteum at the posteromedial tibia. If this force is sustained, the resulting tension can lead to irritation of the periosteum resulting in a local inflammatory reaction, leading to pain and tenderness of the distal third of the posteromedial tibia (Franklyn and Oakes 2015).

2.4.5 Prevalence of MTSS TII

MTSS TII is recognised as one of the most prevalent overuse injuries (Bhusari and Deshmukh 2023). Despite its frequent occurrence, limited epidemiological research has been undertaken to determine its precise prevalence rates.

A 2020 study observing if high soleus activity during stance phase in runners was a possible risk factor in the development of shin splints identified a MTSS TII prevalence between 13.6% and 20%. This study also identified that shin splints contributed up to 60% of all lower limb injuries (Naderi, Moen and Degens 2020).

Supporting these findings, Patel *et al*. (2020) identified an MTSS TII prevalence of 69.5% in a population of recreational marathon runners, where it affected 55.3% of women and 44.7% of men, suggesting a notable gender difference in susceptibility (Patel and Patil 2020). However, this is contrary to the findings of the 2022 study titled "*Prevalence of medial tibial stress syndrome in secondary high school sports players*", which reported that shin splints were more common in men as compared to women. This study also noted a prevalence of 56.3% among the 60 participants who met the inclusion criteria. Another important finding from this study was that participants with increased foot pronation were more likely to develop MTSS TII in comparison to those without (Vavekar 2020).

A 2018 study by Biekendaal *et al.* identified a high incidence of MTSS TII among Dutch physical education teacher education students. Of the 221 participants, 55 developed shin splints, representing an incidence of 25%. Another key finding was the association with possible risk factors, namely the relationship between shin splints and an increased BMI, female sex, and a previous history of MTSS TII. The 39% of the female participants who participated in this study presented with MTSS

TII symptoms, compared with 21% of male participants (Bliekendaal *et al.* 2018), a finding which appears to concur with the Patel and Patil's (2020) study.

A study in Pakistan observing the prevalence of shin splints in rugby players found that of 70 participants, 14 (24%) experienced MTSS symptoms during activity (Hussain *et al.* 2018).

To our knowledge, studies by Sultana *et al.* (2016), Merrett (2003), and Petrick, Laubscher, and Peters (1993) are the only ones that have explored the prevalence of MTSS TII in hockey players. Sultana *et al.* (2016) conducted a study comparing the prevalence of MTSS TII among athletes in cricket, hockey, football, and tennis. They reported an overall prevalence of 25.9% across the four sports, with hockey players exhibiting the highest prevalence at 34.6% (Sultana *et al.* 2016). Merrett (2003) followed 22 elite hockey players over the 2002–2003 season and found that MTSS TII was one of the most common lower limb injuries, second only to ankle sprains (Merrett 2003). Similarly, Petrick, Laubscher, and Peters (1993) examined lower limb injuries in 151 female high school first-team hockey players and identified an MTSS TII prevalence of 34% (Petrick, Laubscher and Peters 1993).

MTSS TII is not only confined to athletic populations and has been shown to affect military personnel. Yates and White (2004) identified an incidence of 35% amongst 124 naval recruits. It was also identified that the condition was more prevalent in the female participants (53%) in comparison to the male participants (28%). Another key finding from this study was that recruits with a more pronated foot posture were more likely to develop shin splints (Yates and White 2004; Helmhout and Beutler 2017).

Despite the well-documented prevalence of MTSS TII in runners and soldiers, there remains a gap in the research investigating its occurrence in field hockey. It is believed that a better understanding of prevalence and possible risk factors in this sport would allow for the development of injury prevention strategies.

2.5 BURDEN OF MTSS TII

Depending on the severity, recovery from MTSS TII can range from two to six weeks (Bhusari and Deshmukh 2023). In severe cases, surgery may be required and, while the results from surgery are promising, the recovery time however is increased to three to six months (Alfayez, Ahmed and Alomar 2017). This time away from activity can place a physical, financial, and psychological burden on the individual, and in the case of professional sport, affect their team or franchise.

2.5.1 The Physical Burden

Whilst MTSS TII is a debilitating condition that can vary from mild to severe, if not managed correctly, it can progress into tibial stress fractures (Bhusari and Deshmukh 2023). These extended periods of injury result in muscular atrophy and neurological inhibition in and around the site of pain, leading to further injuries up the kinematic chain due to biomechanical changes (Neely 1998). Nandlall *et al.* (2020), while observing lower back pain and lower limb injury on lumbar multifidus function in soccer players, identified that players who had suffered a lower limb injury had a decrease in lumbar multifidus thickness. The multifidus plays a key role in lower back stability because, without it, the lower back is exposed to more mechanical force (Nandlall *et al.* 2020).

2.5.2 The Financial Burden

The development of an overuse injury such MTSS TII places financial pressure on an individual and, in the case of a professional athlete, their sport team or franchise. The financial impact on the individual stems from the need for professional medical care, including diagnostic testing, treatment, rehabilitation, and education. As mentioned previously, time away from activity can vary with severity. In the most severe of cases, surgery may be required. To our knowledge, there are no studies that have specifically assessed the financial implications of MTSS TII in sport.

Williams et al. (2025) observed the financial cost of injuries and its association with team success in professional cricket and identified that the average yearly cost of injuries across all teams assessed was R3.87 million. This study also mentioned that teams that had a high cost due to injuries (more than R1.2 million) were more likely to accumulate fewer points in the league (Williams *et al.* 2025). In a professional sporting environment, teams are required to continue paying salaries for athletes, placing further financial pressure on the franchise. In 2020, it was reported that roughly £45 million was spent per season by each English Premier League football team on covering wages, prize money, and medical care, in a study conducted from the 2013–2014 to the 2016–2017 football season (Eliakim *et al.* 2020).

2.5.3 The Psychological Burden

MTSS TII is a debilitating condition that can force athletes to take extended periods of rest to allow for healing, which may cause psychological distress (Deshmukh Jr *et al.* 2022). Haugen (2022) studied the mental health and psychological impact of injury in sport and identified that athletes are prone to a wide variety of mental illnesses, including anxiety, depression, and eating disorders. These conditions are caused by the significant pressure placed on athletes to perform at the highest level (Endo, Sekiya and Raima 2023). Unfortunately, when faced with injury and uncertainty, many athletes succumb to mental health struggles (Endo, Sekiya and Raima 2023). Another challenge faced by athletes is the uncertainty of possible reinjury. MTSS TII has been shown to return if biomechanical factors are not effectively addressed, which can lead to a lack of psychological readiness to return to sport (Hashim *et al.* 2024). While this reflects what is known about injury and mental health in sport more broadly, there is currently no published research specifically examining the psychological impact of MTSS TII.

2.6 RISK FACTORS FOR MTSS TII

Possible risk factors for MTSS TII can be separated into two categories: intrinsic and extrinsic. Intrinsic risk factors refer to anatomical abnormalities that could lead to the development of the condition. Extrinsic risk factors refer to external influences, often sport-specific, that contribute to the development of the condition (Pizzari, Green and van Dyk 2020).

Considering possible risk factors in active individuals, Winkelmann *et al.* (2016), determined that of the 100 possible risk factors for MTSS TII assessed, only nine had a moderate to strong correlation with the development of the condition. These possible risk factors included a high BMI (body mass index), increased navicular drop, augmented plantarflexion range of motion, decreased dorsiflexion range of motion, increased quadriceps range of motion, increased ankle inversion, increased ankle eversion, increased hip internal rotation, and increased hip external rotation (Winkelmann *et al.* 2016).

Extrinsic risk factors, which are generally sport-specific, are integral to the initial onset and development of the condition. Examples of extrinsic factors include footwear with limited support, running on hard surfaces, overtraining, and training errors.

This study aimed to identify a correlation between specific risk factors and the development of MTSS TII in club hockey players. These risk factors included age, gender, BMI, footwear, playing surface and training errors.

2.6.1 Age

Cai *et al.* (2024) found a strong correlation between aging and the development of musculoskeletal disorders and injuries (Cai *et al.* 2024). As an individual gets older, sarcopenia begins to take place, which in turn leads to a decrease in muscle mass and muscle strength, exposing the individual to an increased risk of musculoskeletal injuries including strains, fractures, and muscle tears (Janssen *et al.* 2004; Baker 2017). Although research examining the relationship between aging and MTSS TII is limited, a meta-analysis by Pillai, Thiyagarajan, and Elayaperumal (2025) reported that the risk of MTSS TII increases by approximately 12% with each additional year of age among runners, likely due to cumulative mechanical loading over time, reduced tissue elasticity, and reduced recovery capability (Pillai, Thiyagarajan and Elayaperumal 2025).

2.6.2 Gender

A study observing overuse injuries in gender-comparable sports in high school athletes identified that girls were more likely to develop an overuse injury (56.1%) than boys (43.9%) (Bunstine *et al.* 2024). According to Yates and White (2004), a strong correlation exists between gender and the development of shin splints. Of the 40 female participants in their study, 53% developed shin splints while only 28% of the 84 men developed the condition (Yates and White 2004).

This association is believed to be due to differences in muscle mass. Women have been reported to be only 66% as strong as men in their lower body (Miller *et al.* 1993; Ben Mansour *et al.* 2021).

2.6.3 Body Mass Index

Body mass index is a formula that uses the height and weight of an adult to place them into a category of being either underweight, normal, or overweight (Nuttall 2015). According to Richmond, Kang and Emery (2013), observing if BMI is a risk factor for sport injury, individuals with a higher BMI have a greater risk of sustaining a sporting injury. Newman *et al.* (2013), in their study of possible risk factors associated with MTSS TII, identified a strong correlation between a higher BMI and development of the condition (Newman *et al.* 2013). This is believed to be due to heavier impact loading placing more stress on anatomical structures in the lower limb. Lower BMI in female runners (less than19 years) has been linked with the development of stress fractures (Wright *et al.* 2015).

2.6.4 Footwear

Footwear plays an important role in alleviating or exacerbating the risk of developing MTSS TII (Bhusari and Deshmukh 2023). Footwear with limited cushioning or biomechanical support exposes the lower leg to an increase in mechanical forces.

Footwear needs to provide stability to the foot during locomotion. A lack of arch support, either due to design or shoe degradation, can lead to over pronation, a biomechanical abnormality characterised by excessive inward roll of the foot (Amin and Moroz 2017). Over pronation has been shown to be a risk factor in the development of MTSS TII as it increases the eccentric loading of the tibialis posterior muscle, which in turn places excessive mechanical stress on the posteromedial tibia (Jones 2023).

De la Fuente *et al.* (2019) compared the impact forces between barefoot runners and those with custom-built insoles, and determined that the use of custom soles can appropriately diminish the impact forces that contribute to the development of MTSS TII. The custom insoles were designed to support the rear foot and medial arch of the foot, allowing for increased foot stability and a reduction in impact forces through the tibia (De la Fuente *et al.* 2019).

2.6.5 Playing Surface

Another risk factor associated with the development of MTSS TII is running on hard surfaces (Pohl *et al.* 2008; Deshmukh Jr *et al.* 2022). In 1976, the International Hockey Federation made it mandatory for all major international tournaments to take place on AstroTurf, an artificial turf made from synthetic fibres rather than grass. This surface is firm and lacks cushioning in comparison to field hockey played on natural grass. High intensity and lack of shock absorption can lead to increased mechanical stress in the lower limb, resulting in shin splints and tibial stress fractures (Olive 2023).

2.6.6 Training Errors

A sudden increase in training load, intensity, and duration without adequate periods of rest and recovery has been associated with the development of MTSS TII (Bhusari and Deshmukh 2023). This increase in load exposes the surrounding musculature including the tibialis posterior muscle, soleus, and FDL to excessive mechanical stress, leading to an inflammatory response (Bouché and Johnson 2007; Noh 2018). Inadequate rest means that the rate of damage exceeds the rate of repair at the junction between the surrounding musculature and the tibia (DeLacerda 1980; Winters 2018). Training errors can include high training frequency with inadequate rest, a training plan that lacks progression, and inadequate warmups.

The effectiveness of a structured warm-up prior to activity has been well documented (Woods, Bishop and Jones 2007; Silva *et al.* 2018; Sople and Wilcox III 2025). Owoeye *et al*. (2018) conducted a study to determine if a warm-up including neuromuscular exercises reduced the risk of acute ankle sprain injury in youth football and basketball players. It was concluded that the prescribed exercises reduced the risk of acute ankle sprains by 32% (Owoeye, Palacios-Derflingher and Emery 2018). Ding *et al.* (2022) observed the effectiveness of warm-up programmes across 15 randomised controlled trials and concluded that a warm-up intervention reduced the injury rate ratio by 36% amongst children and adolescents. A well-structured warm-up including stretching, strengthening, balance exercises, landing drills, and sport-specific exercises showed the greatest potential to reduce lower limb injury (Herman *et al.* 2012; Sople and Wilcox III 2025).

2.7 MANAGEMENT OF MEDIAL TIBIAL STRESS SYNDROME TYPE II

The basis for MTSS Type II management is conservative treatment focusing on reducing inflammation and promoting healing in the region of the medial tibia (McClure and Oh 2023).

2.7.1 Prevention

The most effective way to manage any musculoskeletal condition is to prevent it from developing in the first place. There are nine possible risk factors that carry a moderate to strong correlation with the development of shin splints (Winkelmann *et al.*, 2016), which include a high BMI, increased navicular drop, increased plantarflexion range of motion, decreased dorsiflexion range of motion, increased quadriceps range of motion, increased ankle inversion, increased ankle eversion, increased hip internal rotation, and increased hip external rotation. These, along with extrinsic risk factors relating to field hockey, should be thoroughly assessed to prevent the occurrence of shin splints (Winkelmann *et al.* 2016).

2.7.2 Recommended Treatment Regimen for the Initial Onset of MTSS TII

Once tissue damage has occurred and the acute inflammatory phase has begun, it is advised that the PEACE protocol is implemented (Rizvi *et al.* 2025). PEACE stands for protect, elevate, avoid anti-inflammatories, compress, and educate (Dubois and Esculier 2020). Galbraith and Lavallee (2009) recommended a combination of 15 to 20 minutes of cryotherapy and rest in the acute phase of injury (Galbraith and Lavallee 2009; Kuwabara *et al.* 2021).

Once pain has reduced and loading is more tolerable, it is advised to begin the LOVE protocol (Dubois and Esculier 2020; Rizvi *et al.* 2025). LOVE stands for load, optimism, vascularisation, and education. This should be undertaken via a graded progression strategy that slowly increases load to build up tolerance (Dubois and Esculier 2020).

2.7.3 Conservative Treatment Options

Conservative treatment can be provided by healthcare professionals, including, but not limited to, chiropractors, physiotherapists, biokineticists, osteopaths, and acupuncturists. Treatment options for MTSS TII include soft tissue release, joint manipulation techniques, electrotherapy modalities including shockwave and ultrasound, and strapping techniques (Crous 2021). Many of these professionals also provide patient education and guidance for rehabilitation (Galbraith and Lavallee 2009; Kuwabara *et al.* 2021).

Joint manipulation or mobilisation techniques often used by chiropractors and physiotherapists may be used to correct biomechanical imbalances in the lower back, pelvis, and hips. This is used to restore symmetry and motion in the respective areas to allow the body to function optimally (DeStefano 2011; Arora, Erosa and Danesh 2019).

A 2017 study examining the effectiveness of extracorporeal shockwave treatment for shin splints in military cadets determined that participants who received shockwave therapy in combination with a specific exercise programme were able to run without pain for longer than participants who only received the specific exercise programme after four weeks—an average of 17 minutes and 33 seconds compared to four minutes and 48 seconds (Gomez Garcia *et al.* 2017).

Smith, Winn and Parette (1986) compared ultrasound, ice massage, Iontophoresis, and phonophoresis in the treatment of shin splints, and found that all four modalities reduced perceived pain and increased range of motion in comparison to the control. This study concluded that no single treatment modality was more effective than any of the other modalities assessed (Smith, Winn and Parette 1986). A more recent study conducted in 2022 found that ultrasound-guided prolotherapy injection has a significant medium-term effect at reducing pain in participants with MTSS TII (Padhiar *et al.* 2021).

A randomised control trial undertaken in 2023 observed the treatment of MTSS TII using a lower leg brace over a period of 24 weeks. The brace was designed to create counter pressure at the musculotendinous junction of the soleus, an inferomedial torsion of the soleus, and compression of the periosteum at the distal third of the posteromedial tibia. The brace group experienced a significant reduction in MTSS severity score from week 5 through to week 24 in comparison to the placebo group. Participants who received the brace were able to return to activity after five weeks. The MTSS score of the placebo group was unchanged over the 24-week period and these participants were unable to return to full pain-free activity (McNamara *et al.* 2023).

The application of kinesiology tape (KT) for shin splints has shown mixed results (Guo *et al.* 2022). A 2017 study comparing the effectiveness of KT with rigid tape and no tape in athletes with acute shin splints identified no significant benefit in the use of KT in managing the condition (Sharma and Sinha 2017). However, a more recent study conducted in 2024 on athletes diagnosed with shin splints identified short-term improvements in pain reduction, plantar pressure distribution, and postural control when using KT (Saki, Shayesteh and Ramezani 2024).

The use of orthotics can be advised as a strategy for conservative management (Naderi *et al.* 2022). Supportive inserts are believed to help distribute load onto non-injured structures, often resulting in an immediate reduction in symptoms (Del Duchetto *et al.* 2024). The use of orthotics, if recommended, should be included in an integrated treatment plan, and not be a standalone option for athletes suffering from lower limb injuries (Del Duchetto *et al.* 2024). A study observing the effectiveness of orthotic shoes in 500 long distance runners noted that 75.5% of the participants who used orthotic shoe support had complete resolution or great improvement in their lower limb injuries (Gross, Davlin and Evanski 1991; Bhusari and Deshmukh 2023).

It is advised that athletes should be pain free for at least two weeks before returning to exercise (Bhusari and Deshmukh 2023). During these first two weeks, cardiovascular exercises such as running or cycling can be attempted if no associated exacerbation of symptoms is experienced. After the first two weeks, a graded exercise plan is advised. On days of training, it is recommended to include a warm-up before and a cool-down after the training session (Naderi *et al.* 2022; Bhusari and Deshmukh 2023).

Regardless of the conservative treatment approach, a thorough case history, physical examination, and lower limb regional examination should be completed to rule out other potential differential diagnoses. Examination should also include an assessment of biomechanical abnormalities and intrinsic risk factors that may predispose patients to the development of shin splints.

2.7.4 Surgical Intervention

Surgical intervention for MTSS TII is very rare but remains an option in severe MTSS TII that is not improving with conservative care (McClure and Oh 2023). Åkermark, Ljungdahl and Johansson (1991) observed the long-term results of fasciotomy performed on athletes with MTSS TII and determined that 95% of men and 73% of woman that underwent surgery were free of symptoms or had improved at the time of follow up (34 months after surgery). A majority of 95% of men and 82% of women returned to sport after surgical intervention (Åkermark, Ljungdahl and Johansson 1991; Vogels *et al.* 2021).

2.8 SUMMARY

MTSS TII, commonly referred to as shin splints, is a debilitating condition affecting athletes across many sporting disciplines. It is characterised by medial shin pain on movement and is usually relieved by rest. MTSS TII is believed to be caused by a periosteal reaction at the junction of the tibialis posterior muscle and the distal medial aspect of the tibia due to excessive loading of the muscle and is often seen in athletes who over train.

Field hockey, a high-impact sport played on hard surfaces, involving frequent running, cutting, and pivoting movements can place repetitive stress on the lower limbs. While regular physical activity is beneficial, these demands can increase the risk of overuse injuries such as MTSS TII, especially when combined with high training loads or suboptimal biomechanics. The risk is further heightened in individuals with higher BMI and is more commonly observed in female athletes. Early identification and effective management of MTSS TII are crucial to prevent injury progression, reduce time away from sport, and mitigate long-term effects on performance and musculoskeletal health.

CHAPTER 3 – METHODOLOGY

3.1 BACKGROUND

In this chapter, the methodology used in conducting the epidemiological study of MTSS TII in club hockey players in the eThekwini Municipality is outlined. The study design, study setting, study population, participant recruitment, sample size, sampling strategy, measurement tool, study procedure, ethical guidelines, and statistical analysis methods are discussed.

3.2 STUDY DESIGN

A quantitative research approach was used to determine the prevalence and possible risk factors of MTSS TII in club hockey players in the eThekwini region. Quantitative research is a method that aims to collect, analyse, and explicate numerical data to identify patterns and test a particular hypothesis (Ghanad, 2023). This approach was well-suited to the objectives of the study.

A cross-sectional online survey was used to determine the self-reported prevalence of MTSS TII in club hockey players, any association between field hockey and MTSS TII, and possible risk factors contributing to the development of the condition.

3.3 STUDY SETTING

This study was conducted in the eThekwini Region of KwaZulu-Natal, South Africa.

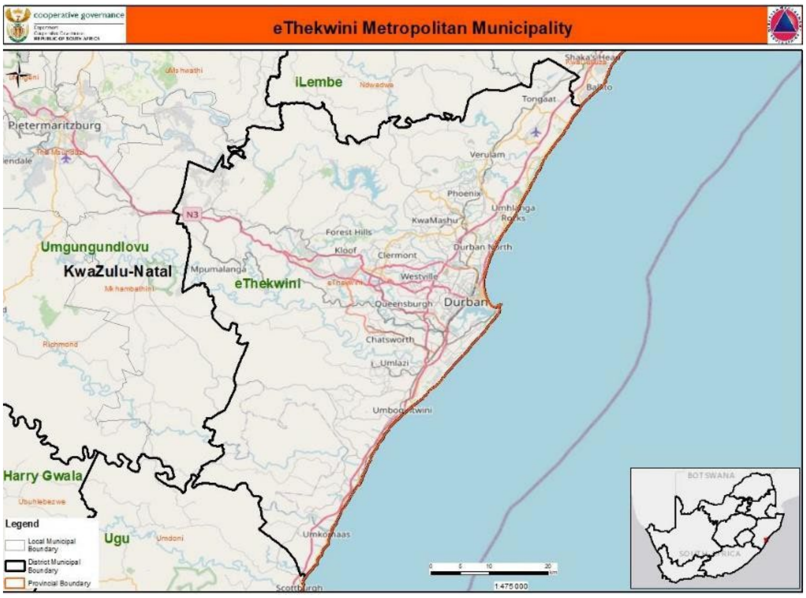

Figure 3.1 A map of the eThekwini Municipality

Only hockey players based in the eThekwini region were eligible to take part in the study. Table 3.1 shows all the hockey teams that participated in the KZN club hockey league. Teams such as the University of Kwazulu-Natal (Pietermaritzburg), and Umhlali Impi's did not fall within the eThekwini region, thus players representing these teams were not included in the study.

Table 3.1 Hockey clubs competing in KZN

CLUB NAME	HOME VENUE - ASTRO	MEN'S TEAMS	LADIES TEAMS
NORTHWOOD CRUSADERS	NWOOD	5	6
ROVERS	DURBAN HIGH SCHOOL (DHS)	2	2
DURBAN UNIVERSITY OF TECHNOLOGY (DUT)	3 SCHOOLS	1	1
RIVERSIDE	RIVERSIDE	7	6
GONGS	QUEENSMEAD	2	3
MUNIES	QUEENSMEAD	1	1
THOMAS MORE	T/MORE	0	3
KEARSNEY	KEARSNEY	4	4
INK	QUEENSMEAD	2	0
DURBAN CLASSIC HOCKEY CLUB (DCHC)	QUEENSMEAD	0	1
DURBAN HOCKEY CLUB (DHC)	QUEENSMEAD	0	2
UMHLALI IMPIS	ASHTON - BALLITO	3	3
UKZN DBN	QUEENSMEAD	2	2
UKZN PMB	PMB	1	1
WESTVILLE OLD BOYS (GRYPHONS)	WESTVILLE GIRLS HIGH	3	3
KLOOF OLD BOYS (KOB)	T/MORE	0	1
VARSITY COLLEGE	DANVILLE	4	3
		37	**42**

The questionnaire was disseminated online via the Durban Hockey Association. The association agreed to send the questionnaire via email to the respective coaches within the eThekwini region. It was requested that they share the form on their team WhatsApp group. This adhered to the principles of participant confidentiality as the researcher would not have access to private email addresses or cell phone numbers; all online communication occurred via the Durban Hockey Association.

3.4 STUDY POPULATION

The study population comprised of both male and female hockey players who fulfilled the following inclusion and exclusion criteria:

Inclusion criteria:

- A hockey player registered at a club within the eThekwini Municipality.
- Aged 18 years and older.

Exclusion criteria:

- Participants who have not provided informed consent for participation.
- Participants who are not registered with an official hockey club within the eThekwini Municipality.
- Players under the age of 18 years old.

3.5 PARTICIPANT RECRUITMENT

Recruitment was undertaken via the Durban Hockey Association. A letter of information was relayed via the Association to each of the coaches in the eThekwini region (Appendix A). Teams that expressed a willingness to participate in the study received the letter of informed consent to be completed by the individual players. Once ethical approval had been obtained, the online questionnaires were distributed to each of the teams for completion and submission.

3.6 SAMPLE SIZE

According to the Durban Hockey Association, there are 1 188 club hockey players in the eThekwini region. The initial required sample size was calculated as 291 participants, assuming a significance level of .05 and a margin of error of .05. The sample size was determined using Cochran's formula.

$$n_0 = \frac{z^2 \cdot p \cdot (1-p)}{e^2}$$

Where

e: desired level of precision, the margin of error.

p: the fraction of the population (as a percentage) that displays the attribute.

z: a value representing the area under the normal distribution curve to the left of z.

However, challenges were encountered during data collection, namely low participation rates and a high number of participants who did not meet the inclusion criteria. Given these challenges, discussion with the consulting statistician was undertaken to explore the possibility of adjusting the required sample size.

The sample size was recalculated using Cochrane's formula for a known finite population, based on a revised prevalence value of 0.11. This value was derived from the reviewed data, indicating that the probability of MTSS TII among the population was approximately 11%.

The formula used was as follows:

$n0 = (z^2 * p * (1-p)) / e^2$

where z is the z-score, p is the estimated population proportion, and e is the desired margin of error.

Applying the relevant values:

$n0 = (1.96^2 * 0.11 * 0.89))/0.05^2$

= 151 (rounded up)

For a finite population of size N (1188), the adjusted sample size (n) was:

$n = n0 / (1 + n0/N)$

= 151 / (1+151/1188)

= 134 (rounded up)

A sample size of 134 was thus calculated using the formula described. On the 19th of June 2025 permission was obtained via the faculty and institutional research committees (Appendix B) to formally adjust the sample size.

3.7 SAMPLING STRATEGY

A probability sampling method was used with non-probability convenience sampling to obtain the predetermined number of participants required. The questionnaire was disseminated to all the club hockey players in the region, and the responses received were based on those players opting to complete the questionnaire.

3.8 MEASUREMENT TOOL

An online questionnaire was used to obtain the required information from the sample being investigated. The first page of the questionnaire was the consent form followed by two screening questions pertaining to age and player registration status. The remainder of the online questionnaire consisted of five sections, namely 1) demographics, 2) hockey experience, 3) MTSS assessment tool (Winters *et al*. 2017), 4) selected possible risk factors, and 5) treatment seeking behaviours.

The MTSS assessment tool was used to diagnose participants effectively with MTSS Type II via self-reported symptomatology. The tool was modified by reducing the contained medical terminology and adding a question. Google Forms was used to design the questionnaire, and the responses were collected using Google Sheets. Table 3.2 includes the questions used to diagnose MTSS TII and distinguish them from Type I – Tibial Stress Fracture and Type III – Chronic Exertional Compartment Syndrome.

Table 3.2 MTSS Type II assessment tool

11 Respond YES or NO to the following questions:

	YES	NO	N/A
11.1 Do you have any pain that occurs on the inside of your middle to lower shinbone during exercise?			
11.2 Is the pain mentioned above relieved by rest?			
11.3 Did the pain in this region happen after trauma to this area?			
11.4 Does any pain in your lower leg prevent you from exercising?			
11.5 Do you get a deep aching, cramping or burning pain that occurs in your calf/posterior compartment of the lower leg during exercise?			
11.6 If you press on the inside of your shin bone, is it painful over an area greater than 5cm?			
11.7 Do you have any visible swelling or redness in the area?			
11.8 Do you get numbness and/or pins and needles in the feet during exercise?			
11.9 Has an x-ray or MRI confirmed that a fracture is present in the shinbone?			
11.10 Do you experience weakness in the affected leg?			
11.11 Do you have any difficulty lifting the front part of your foot?			
11.12 Is there any bruising at the site of the pain?			

The questions in the assessment tool were obtained and modified from a study by Winters et al (2017). The responses were analysed by a qualified physiotherapist, Siobhan Bottomley, who determined the number of participants whose responses were consistent with a diagnosis of MTSS TII.

A diagnosis of MTSS TII was confirmed when the participant answered ‘Yes’ to questions 11.1 and 11.2, provided that the diagnosis of chronic compartment syndrome, direct trauma to the tibia, and tibial stress fractures were excluded.

Chronic compartment syndrome was suspected if neurological or vascular symptoms were present, as indicated by a response of ‘Yes’ to questions 11.6, 11.7, 11.9, and 11.10.

Stress fracture was suspected if the participant responded ‘Yes’ to questions 11.6, 11.8, or 11.11. If the mechanism of pain was due to trauma to the tibia, ‘Yes’ to question 11.3 confirmed this.

The literature matrix in Table 3.3 presents a structured overview of key studies that guided the formulation of the online questionnaire used in this study.

Table 3.3 Literature matrix

Section:	Title of Article/Study:	In-Text Reference:
Demographics	CrossFit: Injury Prevalence and main Risk Factors	(da Costa *et al*. 2019)
Hockey Experience	The prevalence and risk factors of hamstring injuries among field hockey players at a hockey club in Pretoria, South Africa	(Coetzee 2020)
MTSS Type II Assessment Tool	Medial Tibial Stress Syndrome can be diagnosed reliably using history and physical examination	(Winters *et al*. 2018)
Selected Risk factors	The prevalence and risk factors of hamstring injuries among field hockey players at a hockey club in Pretoria, South Africa	(Coetzee 2020)
Management	An injury profile of musculoskeletal injuries in CrossFit athletes in KwaZulu-Natal, South Africa	(Simmons and Pillay 2025)

The questionnaire utilised for this research was developed using several published sources to ensure it was both reliable and evidence based. The demographic section was guided by the work of da Costa *et al.* (2019), which provided a useful structure for collecting background information (da Costa *et al.* 2019). Coetzee (2020) captured hockey-specific experience and possible risk factors. This study focused on similar injury patterns in field hockey players. The section related to MTSS TII was shaped by the findings of Winters *et al.* (2018), who highlighted the importance of history taking for reliable diagnosis (Winters *et al.* 2018). Lastly, the management section was developed using a study by Simmons and Pillay (2025), which provided insight into how athletes typically manage injuries.

Together, these sources helped form a well-rounded and focused questionnaire suited to the needs of this research.

3.8.1 Validation of Research Instrument

The research instrument underwent content validity through an expert review panel, followed by pilot testing to refine the questionnaire before full data collection.

A review panel was conducted via TEAMS to validate the questionnaire after Institutional Research Ethics Committee (IREC) provisional approval had been obtained. The panel included:

- The researcher.
- The supervisor and co-supervisor.
- Two participants who had played hockey at a club level but were not registered to play.
- An individual who had experience in quantitative research.

A letter of information and a consent form were read and signed by the possible participants (Appendix C). A structured validation approach was used during the review process to ensure that feedback was systematic and aligned with the aims of the study. Panel members were guided to evaluate the questionnaire against predefined criteria, rather than providing unstructured comments. While a formal quantitative validation tool was not employed, a standardised validation guide was used to direct discussion and feedback. The panel was asked to consider the relevance of each question to the research objectives, the clarity and ease of understanding for a non-medical population, the appropriateness of terminology, the logical flow and sequencing of items, the potential for ambiguity or misinterpretation, and the practicality of completing the questionnaire online. Attention was given to the MTSS Type II assessment section, where the panel assessed whether the modified questions accurately reflected the diagnostic criteria described by Winters et al. (2017) and whether the distinctions between MTSS Type II, tibial stress fracture, and chronic exertional compartment syndrome were clear within a self-report format. Feedback was discussed collectively, consensus was reached on all suggested amendments, and minor revisions were made. The revised questionnaire was then used in the pilot study to confirm usability and participant understanding prior to full data collection.

A 2016 study titled; "*Online Case Study of Google Forms*" researched the advantages of Google Forms in data collection. Some of the advantages included the ability to reach a large population regardless of geographical location, cheaper administration of questionnaires, and simple collection and analysis of data. (Harinarayana, 2016). Google Forms adheres to the General Data Protection

Regulation and all data collected are protected by Google's security infrastructure (Chernikov, 2023).

3.8.2 Pilot Study

A pilot study is a pre-run testing trial to assist a researcher in identifying if there are any discrepancies in the questionnaire and if any of the participants are unable to understand any of the questions (In 2017). This allowed for corrections to be made before the questionnaire was distributed to the wider sample of club hockey players. Additionally, five hockey players over the age of 18 who were selected to complete the online questionnaire and to provide feedback on the questionnaire. The information obtained from the pilot study facilitated the finalisation of the questionnaire for circulation.

3.9 STUDY PROCEDURE

Once full ethical approval (BIREC 335 /24) had been granted by IREC (Appendix D) and the relevant permission had been obtained from the Durban Hockey Association (Appendix E), the online questionnaire was sent to the Durban Hockey Association for distribution. The Association then sent the questionnaire to all coaches in the eThekwini region, who in turn shared the questionnaire on their team WhatsApp Messenger group for players to provide feedback. A letter of information was sent with the questionnaire. The first page of the questionnaire was a letter of consent and only once agreed upon were the participants able to continue. The name of the participants remained anonymous and was not recorded on the questionnaire. Due to the low response rate, the researcher travelled to each of the hockey clubs to present the study to the hockey coaches.

3.10 DATA COLLECTION

Data collection commenced on 9 April 2025, following full ethical clearance (BIREC 335 /24) granted by the IREC (Appendix D). The primary method of dissemination involved distribution of the questionnaire through the Durban Hockey Association, who circulated it to all club hockey coaches within the eThekwini Municipality. In addition to this channel, direct contact was made with the chairpersons of the four major clubs of Riverside, Westville, Crusaders, and Kearsney, all of whom agreed to distribute the questionnaire within their respective clubs. The initial circulation of questionnaires garnered responses from 113 participants. On the 29 April 2025, the Durban Hockey Association agreed to send the questionnaire out via the respective communication channels for a second time, resulting in a further 11 responses across the eThekwini teams.

To increase response rates, further efforts were made by the researcher visiting various hockey clubs in person. During these visits, participants were invited to access the questionnaire via a QR code linking directly to the online survey. By 6 May 2025, the allocated travel budget had been exceeded, and a total of 137 responses had been collected. As a result, a request was submitted to the Institutional Research Ethics Committee (IREC) to amend the required sample size. This request was approved on the 19th of June 2025, reducing the target sample size from 291 to 134 participants.

3.11 ETHICAL CONSIDERATIONS

3.11.1 Non-Maleficence

This study carried very low risk to participants as it required no treatment or intervention. Participants were required to fill out an online questionnaire. The questionnaire did not require the participants' personal information.

3.11.2 Informed Consent

A letter of information was provided prior to the receipt of informed consent to ensure that participants were fully informed of the objectives and procedures of the study and made aware that all responses would remain anonymous. The participants provided consent before filling out the online questionnaire.

3.11.3 Justice

All participants were treated fairly and without prejudice. Although inclusion and exclusion criteria were included in this study, participants were not judged or excluded based on demographics, hockey ability, fitness, and past medical history.

3.11.4 Beneficence

Results from this study were sent to the Durban Hockey Association. Information on prevalence and possible risk factors of MTSS Type II was made available for coaches and players for educational purposes.

3.11.5 Data Storage

All research data were submitted to the chiropractic department for storage. All electronic data were secured using a password and were accessible only to the researcher, supervisor, co-supervisor, research head, and the head of the chiropractic department. After five years, all electronic data will be deleted.

3.11.6 Ethical Clearance

Gatekeeper permission was obtained from the Durban Hockey Association on 14 November 2023 (Appendix A), before the commencement of data collection. Full ethical approval to conduct the study was obtained from the IREC on 9 April 2025 and a clearance number of BIREC 335/24 was provided (Appendix D).

3.12 STATISTICAL ANALYSIS

The ‘raw’ data for the quantitative component were coded and exported into a Microsoft Excel spreadsheet.

The data were then statistically analysed using SPSS Version 28. Descriptive analysis using categorical variables and frequency tables was used to provide a summary of the data relating to prevalence, possible risk factors, and management of MTSS TII in club hockey players.

To explore relationships between two categorical variables, a chi-square test of independence was conducted using cross-tabulations. If the data did not meet the assumptions required for this test, a Fisher’s exact test was used instead. Statistical significance was set at $p < 0.05$.

3.13 SUMMARY

This chapter outlined the methodology used in investigating the epidemiology of MTSS among club hockey players in the eThekwini Municipality. It explained the study design, setting, and target population, along with the recruitment process and sampling strategy used to ensure a representative sample. The rationale behind the chosen sample size was explained, and the measurement tool selected for data collection was described in terms of reliability and validity. Furthermore, this chapter provided an overview of the study procedures followed to maintain accuracy and consistency throughout the research process. Lastly, the ethical considerations and approvals obtained were discussed to emphasise the study's adherence to research ethics and participant protection, and the statistical analysis methods were outlined.

CHAPTER 4 – MANUSCRIPT

This chapter presents the key findings of this study in the form of a manuscript, which will be submitted to the *South African Journal of Sports Medicine*.

An Epidemiological Study of Medial Tibial Stress Syndrome and Related Management Strategies in Club Hockey Players in the eThekwini Municipality.

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Abstract:

Background: Field hockey is a high intensity sport that exposes players to intrinsic, extrinsic, and overuse injuries. An overuse injury that appears to be neglected in field hockey epidemiological research is Medial Tibial Stress Syndrome (MTSS).

Objectives: To determine the self-reported prevalence of MTSS in club hockey players within the eThekwini Municipality, Kwazulu-Natal (KZN), South Africa, identify factors that may contribute to its development, and identify the treatment-seeking strategies employed by these players.

Methods: A questionnaire-based study, administered to 177 field hockey players in the eThekwini region, was conducted. Of these, 137 participants met the inclusion criteria and were included in the study. The questionnaire explored demographics, potential contributing factors, a MTSS assessment tool, MTSS history and education, and management of the condition.

Results: Among the 137 participants, 10.9% (n=15) were self-diagnosed with MTSS. There was a higher prevalence of MTSS in women (60%) compared to men. A significant association was found between MTSS and duration of shoe use (Fisher's exact test = 12.328, p=0.007), with 40% of those with MTSS having used their hockey shoes for less than six months compared to 9% of those without MTSS. A total of 55 participants (40.1%) had a history of MTSS or had been diagnosed by a licenced practitioner. Physiotherapy was the most frequently consulted healthcare service (85%), with stretching (88.9%), massage (88.9%), and strapping (74.1%) reported as the most frequently used treatments. Notably, only 13.1% of participants reported receiving any education about MTSS from coaches or team staff.

Conclusions: MTSS is a relatively common occurrence in field hockey players, particularly among women. This study provides insight into the prevalence, associated factors, education, and management of MTSS in field hockey players. The results of this study, particularly the high percentage of players with a history of MTSS, indicate the need for injury prevention strategies.

Keywords: Field hockey, Medial Tibial Syndrome, prevalence, risk factors, management.

4.1 INTRODUCTION

Field hockey is a high intensity sport played by two teams of 11 players competing for 60 minutes, divided into four 15-minute quarters [1]. While games of stick and ball date back to 2000 BCE, modern hockey was formalised in the 19th century England [2]. Today, it is one of the most competitive sports globally, with teams competing in events including the Federation Internationale de Hockey (FIH) World Cup and Olympic Games.

In South Africa, the sport has seen steady growth since the formation of the South African Hockey Association in 1992 [3]. The province of KZN stands out as a key region where field hockey is among the most popular school sports, with approximately 19 981 school hockey players [4]. Once secondary school is complete, many players progress onto university teams or local clubs, with the eThekwini Municipality home to 15 of the province’s 17 clubs and 1188 registered players.

Field hockey, characterised by repetitive sprinting, abrupt changes in direction, and prolonged weight-bearing activity, exposes players to considerable physical strain [5]. While acute injuries such as contusions and fractures are commonly reported

[6], overuse injuries such as MTSS or "shin splints" have not been extensively researched in the context of field hockey.

MTSS, characterised by pain along the posteromedial border of the tibia due to repetitive stress and microtrauma [7], has been widely studied in runners and military populations [8,9]. However, there is limited epidemiological data examining its prevalence in individual sports. Given the high biomechanical demands of field hockey and extended periods of weight-bearing activity on hard surfaces, MTSS is particularly relevant to athletes of this sport. Despite its clinical significance, the condition is frequently underdiagnosed and poorly managed, increasing the risk of chronic pain, stress fractures, and diminished athletic performance [11].

This study aimed to determine the prevalence of MTSS among club-level field hockey players. Additionally, it examined the associations between MTSS and selected factors, including turf usage, footwear type and duration of shoe use, access to strength and conditioning programs, warm-up and cool-down practices, and a history of shin splints. The study also explored the strategies used for management, ranging from self-directed care to professional healthcare interventions.

4.2 METHODS

4.2.1 Study Design

An online questionnaire-based cross-sectional study was undertaken to gather information from field hockey players on the prevalence, selected factors, and management of MTSS in the population.

4.2.2 Study Population

The study included a sample of club hockey players in the eThekwini Municipality, a region of KZN, South Africa. The hockey players were required to be 18 years old or older and registered with a hockey club based in eThekwini to participate in this study.

4.2.3 Sample Size

The estimated total of 1188 field hockey players in the eThekwini region (Provided by the Durban Hockey Association) served as our finite population. Preliminary data suggested the prevalence of the characteristic of interest was 11% ($p = 0.11$). After applying Cochran's formula and incorporating the finite population correction, we found that a sample of 134 players would achieve both precision and representativeness relative to the known population.

4.2.4 Ethical Considerations

Gatekeeper permission was obtained from the Durban Hockey Association on 14 November 2023. Clearance from the institutional Research Ethics Committee (IREC) was obtained on the 9th of April 2025. Informed consent was obtained from participants following receipt of a comprehensive letter of information. All responses remained confidential.

4.2.5 Measuring Tool

The questionnaire was created by reviewing similar studies with similar surveys. It was then modified to align with the objectives set out for this study. The questionnaire comprised of five sections. Section one consisted of questions pertaining to demographics; section two was participation in hockey; section three was the assessment tool used to diagnose shin splints; section four comprised questions pertaining to possible contributing factors; and lastly, section five addressed management of the condition. Content Validity was established through review by an expert panel comprising the main supervisor, co-supervisor, the researcher, a statistician, and two individuals with club hockey experience. Once corrections were made, a pilot study was conducted with five club hockey players who met the inclusion criteria of the study. Once this was completed and clearance was obtained from IREC., final corrections were made to the questionnaire which was then sent out to hockey players on the 14th of April 2025.

4.2.6 Statistical Analysis

The data obtained from the online questionnaire were coded and exported to Microsoft Excel. The data were then statistically analysed using SPSS Version 28. Descriptive analysis using categorical variables and frequency tables was used to provide a summary of the data relating to prevalence, contributing factors, and management of MTSS in club hockey players. To explore relationships between two categorical variables, a chi-square test of independence was conducted using cross-tabulations. If the data did not meet the assumptions required for this test, a Fisher's exact test was used instead. Significance level was set at $p<0.05$.

4.3 RESULTS

A total of 177 individuals responded to the online questionnaire. Of these, eight declined to participate and were therefore not included in the study. Among the 169 individuals who consented to participate, 12 were excluded because they were not registered club hockey players for the 2025 season, and 20 were excluded for being under the age of 18. After these exclusions, 137 responses were thus deemed eligible and included in the statistical analysis.

Table 4.1 Participant demographics (N = 137)

Variable	Mean	Standard Deviation	Maximum	Minimum
Age (years)	29.94	10.91	18	67
Height (m)	1.72	0.21	1.20	1.97
Weight (kg)	75.45	16.70	34.00	128
Body mass index (Kg/m^2)	25.29	4.58	17.36	39.47

Of the 137 participants, 84 (61.3%) competed in the male leagues, and 53 (38.7%) competed in the female leagues. Table 4.1 summarises the demographic information of the sample. There was no significant relationship between demographics and the development of MTSS. A higher proportion of women than men reported MTSS, however, this difference was not statistically significant (p =0.072). There was no significant difference in mean age between participants with and without MTSS (p=0.437). Similarly, body mass index (BMI) did not differ significantly between those with MTSS and those without the condition (p=0.567).

4.3.1 Hockey Participation

Of the 137 players surveyed, 84 played in the men's league and 53 in the women's league. Among men, 78 (92.9%) did not present with MTSS, while six (7.1%) did. In contrast, among women, 44 (83.0%) did not present with MTSS, and nine (17.0%) did, indicating a higher proportion of MTSS cases among female players.

The most common weekly hockey exposure was two to less than four hours, reported by 76 players (55.5%). This group also accounted for the highest number of MTSS cases (n=7; 46.7% of all MTSS cases). Notably, four players with MTSS (26.7%) reported playing less than two hours per week, while no MTSS cases were observed among those playing more than eight hours weekly (n=3).

In terms of competitive level, most players competed in Super League 1 (*n*=46; 33.6%) and Division 1 (n =32; 23.4%). MTSS was most commonly observed among those in Super League 1 and Super League 2, each contributing four cases (26.7%), followed by Division 3 (three cases; 20.0%).

Regarding hockey experience, the majority of players (*n*=76; 55.5%) had more than 10 years of club-level play. However, the highest proportion of MTSS cases occurred among those with 1 to <5 years of experience (*n*=7; 46.7%), followed by those with more than 10 years (*n*=5; 33.3%).

When examining player positions, defenders (*n*=46; 33.6%) and midfielders (*n*=44; 32.1%) were the most common, followed by forwards (*n*=40; 29.2%) and goalkeepers (*n*=7; 5.1%). Among those diagnosed with MTSS, midfielders accounted for the largest share (*n*=6; 40.0%), with forwards and defenders contributing four cases each (26.7%), and goalkeepers one case (6.7%).

4.3.2 Prevalence of Medial Tibial Stress Syndrome

Of the study participants, 10.9% met the criteria for diagnosis with MTSS. A majority of 89% of participants either did not present with MTSS symptoms, or had symptoms associated with tibial stress fracture, hockey-induced trauma, or chronic compartment syndrome; these participants did not meet the criteria for a specific diagnosis of MTSS.

Of the 15 participants who met the diagnostic criteria for MTSS based on their responses to the questionnaire, nine were female, and six were male. The prevalence was therefore 17% among women and 7.1% among men. This gender discrepancy was not statistically significant (*p*=0.072).

4.3.3 Selected Factors

Most participants reported training (92.7%, *n*=127) and playing matches (96%, *n*=131) on water-based artificial turf. Among those diagnosed with MTSS (*n*=15), 14 trained and all 15 played on this surface. Similarly, the majority without MTSS (*n*=122) also trained (92.6%) and competed (95.1%) on water-based artificial turf, indicating high usage across all participants.

Shoe type was not significantly associated with MTSS. Most participants (77%, *n*=106) wore regular hockey shoes, and 11 of the MTSS cases used these, while four wore alternative footwear. However, a significant relationship was found between MTSS and the duration of shoe use, with participants using their current shoes for less than six months more likely to be diagnosed (p=0.007; Fisher's = 12.328). Shoe replacement intervals varied, with most replacing shoes every 12–18 months (n=45), followed by over two years (n=43), though MTS cases were spread across all intervals.

Furthermore, 12 participants reported using orthotics, three of whom (25%) had MTSS, compared to 9.6% (n=12) of non-users. This difference was not statistically significant.

Warm-up and cool-down routines were not significantly associated with MTSS. Most participants reported warming up "often" or "always" (n=101) and cooling down "rarely" or "sometimes" (n=96), with MTSS cases distributed across all categories (p=0.900).

Of the 27 participants with access to a strength and conditioning coach, 22.2% (n=6) had MTSS, compared to 8.2% (n=9) of those without access. The association was assessed using a Chi-square test of independence; however, as expected cell counts were <5, Fisher's Exact Test was used for interpretation. This difference approached, but did not reach, statistical significance (χ^2 = 4.383, p= 0.036; Fisher's = 0.077). Lower leg strengthening was reported by 73 participants, with a slightly higher proportion of MTSS cases (13.7%) compared to those not doing such exercises (7.8%), though the difference was not significant. Only 16.1% participants (n=22) had modified their training or playing habits to prevent MTSS, with no significant association found.

A prior history of MTSS was reported by 40.1% (n=55) of participants. Among those currently diagnosed with MTSS, 66.7% (n=10) had a history of the condition, compared to 36.9% (n=45) of those without symptoms, a statistically significant association (p=0.026; Fisher's = 0.048). Of those with a prior history (n=55), 50.9% of the participants (n=28) reported recurrence. Among the MTSS group, 80% (n=8) experienced recurrent symptoms, compared to 20% (n=2) with a single past episode, suggesting a potential link between recurrence and current MTSS (p=0.042; Fisher's = 0.078).

4.3.4 Management of MTSS

Education and treatment

Of the 137 hockey players who responded to the questionnaire, only a small percentage (13.1%) of them had received education on MTSS from a coach or club member. The majority (86.9%) indicated that they had not received such information. Additionally, only 19.7% of the participants reported seeking treatment from a qualified medical practitioner for MTSS/shin pain, while 80.3% of the cohort had not pursued professional care.

Practitioners consulted

Among the 27 players who reported seeking treatment for MTSS or pain in the shins, physiotherapists were the most frequently consulted healthcare professional. A total of 23 (85%) of the 27 participants reported seeing a physiotherapist ($p < 0.001$). Chiropractors were the second most frequently consulted practitioner (41%), followed by biokineticists (19%), general practitioners (15%), and medical specialists (11%).

Table 4.2 Practitioners consulted and treatment provided

		Frequency (%)		n	p-value
		Yes	No		
Practitioner consulted	Chiropractor	11 (41)	16 (59)	27	.442
	Physiotherapist	**23 (85)**	4 (15)	27	<.001
	General Practitioner (GP)	4 (15)	**23 (85)**	27	<.001
	Specialist (Orthopaedic surgeon)	3 (11)	**24 (89)**	27	<.001
	Sports medicine practitioner	5 (19)	**22 (81)**	27	.002
	Pharmacist	2 (7)	**25 (93)**	27	<.001
	Bio-kineticist	10 (37)	17 (63)	27	.248
	Other	2 (7)	**25 (93)**	27	<.001
Treatment	Chiropractic Manipulation	7 (26)	**20 (74)**	27	.019
	Dry Needling	14 (52)	13 (48)	27	1.000
	Massage	**24 (89)**	3 (11)	27	<.001
	Shockwave	9 (33)	18 (67)	27	.122
	Strapping	**20 (74)**	7 (26)	27	.019
	Stretching	**24 (89)**	3 (11)	27	<.001
	Application of heat	16 (59)	11 (41)	27	.442
	Application of cold	17 (63)	10 (37	27	.248
	Pain medication	16 (59)	11 (41)	27	.442
	Injections of medication	2 (7)	**25 (93)**	27	<.001

Treatments provided by healthcare professionals

Of the 137 participants, 27 received treatment from a healthcare professional for MTSS. The most commonly reported treatments used were massage and stretching, each used by 89% (*n*=24, *p*=0.001), and strapping, reported by 74% (*n*=20, *p*=0.019). Chiropractic care was less commonly used, reported by 26% (*n*=7), and did not show a statistically significant difference (*p*=0.248).

Self-treatment of MTSS

One third (*n*=46) of the participants reported self-treating their MTSS without consulting a practitioner, while the majority (66.4%, *n*=91) did not engage in self-directed management.

Among those who did self-treat, a diverse range of strategies was employed, with many using a combination of rest, icing, massage, and strapping. Cold therapy was the most frequently used strategy (*n*=19), followed closely by rest from activity (*n*=17), and a significant number in comparison to heat therapy (*n*=4). Stretching and mobility exercises appeared in at least 15 responses, followed by strapping/taping and massage techniques (manual or foam rolling), both receiving 13 responses. Only nine participants utilised strength training, exercise or rehabilitation. Oral medication, including anti-inflammatories, was utilised by four participants.

A few participants noted more specific interventions such as changing footwear, orthotics, and using an electronic muscle stimulation machine. The wide variation in responses and use of mixed or improvised strategies highlight a lack of consistent, evidence-based guidance.

4.4 DISCUSSION

Prevalence of MTSS in Club Hockey Athletes

The present study found that 10.9% of club hockey players within the eThekwini Municipality were affected by MTSS. This prevalence is lower than previously reported rates across active populations, including 13.6% to 20% among runners [11], 25% in physical education teacher students [12], and as high as 35% in military recruits [8]. Although the prevalence in hockey players is somewhat lower than in high-impact sports such as distance running or military training, the burden remains clinically relevant and supports growing evidence that MTSS is a common overuse injury in sports involving repetitive lower-limb loading.

A significant proportion (40.1%) of the participants reported a previous history or diagnosis of MTSS, indicating a recurrent pattern of injury in this athletic sample. These findings underscore the importance of early identification and management of MTSS in order to prevent chronicity or time-loss from training and competition.

Demographic Patterns and Possible Contributing Factors

MTSS was more prevalent among female athletes, comprising 60% of the diagnosed cases. This is consistent with existing literature suggesting that female athletes are at higher risk for overuse injuries involving the lower extremities [13,14]. Several factors may contribute to this disparity, including anatomical and biomechanical differences, lower bone mineral density, muscle mass differences, and hormonal influences that may affect musculoskeletal resilience [14,15]. Although gender differences were observed, no statistically significant associations were found between MTSS and other demographic variables, such as age or BMI.

Interestingly, the study found a statistically significant relationship between the presence of MTSS and the duration of use of a specific pair of shoes. Athletes who reported using their current footwear for less than six months were more likely to present with symptoms of MTSS. This trend may suggest a reactive behaviour rather than a direct causal link, whereby players experiencing discomfort switch footwear in an attempt to manage early symptoms. This highlights the complex interaction between equipment, injury perception, and athlete behaviour.

Education and Awareness

Despite the prevalence of MTSS, only 13.1% of athletes reported receiving any form of educational intervention or preventative instruction from coaching staff regarding MTSS. This reflects a significant gap in injury education and awareness at the club level. A lack of formal education may delay recognition and lead to inappropriate or delayed management. As seen in other high-intensity sports, educational interventions targeting both athletes and coaches have the potential to reduce injury incidence through early symptom recognition and appropriate training modifications [17].

Management and Treatment Approaches

Among those affected, 85% of the participants sought treatment from physiotherapists, making this the most commonly consulted healthcare provider. Treatment methods largely involved conservative approaches, such as massage and stretching (89%), as well as strapping techniques (74%). These methods are consistent with current evidence-based practice for managing MTSS, which emphasises reducing pain, restoring flexibility, and improving functional performance [17].

For self-care, participants commonly employed cold therapy, rest, and stretching methods that align with standard acute injury protocols and reflect widely accepted practices for managing overuse injuries in sport [18]. While these methods may offer temporary symptom relief, effective long-term management often requires a structured plan guided by professionals. This includes load management, biomechanical correction, and targeted rehabilitation to address underlying causes and reduce the risk of recurrence [19].

4.5 STRENGTHS OF THIS STUDY

To our knowledge., this study represents the first of its kind. While studies have examined MTSS in athletic populations that included hockey players, there appears to be no clear indication that any study has been undertaken to solely observe the epidemiology of MTSS in club hockey players anywhere in the world. This study elucidates on important information pertaining to the prevalence, possible contributing factors, and management of MTSS in hockey players, which can inform targeted injury prevention efforts. Coaches can use this information to adjust training loads, implement appropriate conditioning programmes, and educate players on early symptom recognition and prevention techniques, ultimately reducing the risk and recurrence of MTSS.

4.6 LIMITATIONS OF THIS STUDY

This study has several limitations that should be acknowledged. First, data collection was conducted through an online questionnaire, which did not allow for in-person clinical examination or palpation of the medial tibia, which is considered the most accurate method for diagnosing MTSS. The reliance on self-reported data may have affected the accuracy of MTSS identification. Second, the timing of the questionnaire dissemination at the beginning of the season coincided with a period of relatively low training intensity and duration. This may have contributed to a lower reported prevalence of MTSS because symptoms may not yet have fully developed in many athletes.

Additionally, the study's age restriction of 18 years and older excluded a substantial number of younger players. Many club hockey athletes compete at a school level and this demographic may have limited the generalisability of the findings. The percentage of participants reporting a past history of MTSS suggests that MTSS remains a common issue among hockey players, highlighting the need for broader sampling. Future research should aim to expand the sample size, including younger athletes, to more comprehensively assess the prevalence and the possible risk factors associated with MTSS across all levels of club hockey.

4.7 CONCLUSION

This study identifies Medial Tibial Stress Syndrome (MTSS) as a common condition among club hockey players, with a higher prevalence in female athletes. The association between shorter shoe usage and MTSS likely represents a reactive response to early symptoms, rather than a contributing cause. Additionally, the lack of education on MTSS among participants observed in this study highlights a significant gap in athlete knowledge and injury prevention practices. These findings underscore the importance of implementing targeted educational strategies to enhance awareness, support early detection, and improve the management of MTSS.

To advance our understanding, future research should explore the underlying causes of MTSS and assess the effectiveness of tailored prevention strategies that address the physical demands and risk profiles of hockey players, ultimately aiming to reduce injury rates and promote long-term athletic performance and general well-being.

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CHAPTER 5 – DISCUSSION

5.1 BACKGROUND

This chapter discusses the results of the study as presented in Chapter 4, including various aspects of MTSS TII in club hockey players including demographics, participation in hockey, prevalence, possible risk factors, and injury management strategies. The objectives of the research will be expounded upon in this chapter, with references to relevant literature to support the discussion.

5.2 PREVALENCE OF MEDIAL TIBIAL STRESS SYNDROME TYPE II

The present study identified a self-reported prevalence of 10.9% for MTSS TII among club hockey players. This prevalence is lower than that reported in some other athletic groups, which may be due to several practical and methodological factors. Data were collected at the start of the season, when training intensity and volume are generally lower, possibly reducing symptom reporting. MTSS TII was also identified through an online questionnaire rather than clinical assessment, meaning some cases may have been missed. Finally, only players aged 18 years and older were included, excluding younger athletes who compete at school level and could be at risk. Despite these limitations, the finding contributes to the limited epidemiological data available for this specific population, as to our knowledge, only three studies to date have examined MTSS TII in field hockey players.

A 1993 study by Petrick, Laubscher, and Peters titled '*Lower Leg Overuse Injuries in High School First Team Schoolgirl Hockey Players*' found that of the 151 participants who met the criteria for the study, 43 (27%) had experienced lower limb injuries. Of these injuries, 59% (*n*=28) of the participants did not seek professional medical advice and were not diagnosed, 34% (*n*=14) were diagnosed with shin splints, 5% were diagnosed with compartment syndrome, and 2% experienced stress fractures (Petrick, Laubscher and Peters 1993).

Similarly, a 2016 study titled, '*Shin splints among sports persons of different reputed clubs in Dhaka city*' set out to determine the prevalence of MTSS TII in athletes that played hockey, cricket, football, and tennis. The study identified a prevalence of 25.9% across the four sporting disciplines (Sultana *et al.* 2016). Hockey had the highest sport-specific prevalence, with 34.6% of the sample being diagnosed with shin splints, more than three times the number in this study.

A 2003 study of 22 elite field hockey players, all of which sustained at least one injury between 2002 and 2003, identified that shin splints was the second most common injury sustained after ankle sprains, primarily affecting players playing in a forward position (Merrett 2003). While this study did not quantify overall prevalence, its findings highlight shin splints as a significant concern among high-performance hockey players, aligning with the injury patterns noted in our sample.

Beyond the context of hockey, the prevalence of MTSS TII observed in this study aligns with findings reported in other sporting disciplines, particularly among runners. A systematic review by Lopes *et al.* (2012) reported a prevalence of 9.5% and an incidence ranging from 13.5% to 20% in runners (Lopes *et al.* 2012). However, a more recent study by Patel and Patil found a markedly higher prevalence of 69.5% among recreational runners, suggesting considerable variability based on training status, intensity, and population characteristics (Patel and Patil 2020).

MTSS TII has also been widely documented in military populations. Yates and White (2004) conducted a study involving 124 individuals undergoing basic military training and reported an incidence of 35%, with 40 participants developing MTSS during the observation period (Yates and White 2004). Similarly, Campbell *et al*. (2018) identified a prevalence of 56% among Army Reserve Officer Training Corps cadets. These figures indicate that both running and military training environments, which typically involve repetitive impact and high training loads, are associated with a comparable or elevated likelihood of developing MTSS TII than the levels observed in this hockey population.

5.3 DEMOGRAPHICS

5.3.1 Age

In this study there was no significant correlation found between age and the development of MTSS TII. The mean age of participants who met the diagnostic criteria was 27.9 years old, compared to 30.2 years old for those who did not, with no significant difference observed (t (135) = 0.779, p =0.437). The ages of those who met the diagnostic criteria ranged from 19 to 51 years old, with the majority (10 out of 15) falling within the 20 to 30 year old age range, further supporting the conclusion that age alone may not be a predictive factor.

These findings align with those from a similar study conducted in Saudi Arabia, which also found no significant association between age and MTSS TII development. Instead, the Saudi Arabian study identified environmental and training-related possible risk factors as more influential contributors (Hashim *et al.* 2024). In contrast, a meta-analysis by Pillai, Thiyagarajan, and Elayaperumal (2025) reported that the risk of MTSS TII increased by approximately 12% for each additional year of age among runners, potentially due to cumulative mechanical loading over time (Pillai, Thiyagarajan and Elayaperumal 2025).

A broader scoping review by Saad *et al*. (2025) revealed mixed findings, suggesting that while older, experienced athletes may benefit from biomechanical adaptation and reduced injury risk, age was associated with higher injury rates among ultramarathon runners (Saad *et al.* 2025).

Furthermore, research on military cadets undertaken by Yates and White (2004) did not establish age as a significant factor in the development of MTSS TII, likely due to the narrow age range of participants in this population (Yates and White 2004). Overall, although age may play a modest role in MTSS TII risk in broader or older athletic populations, findings from this study and others with younger cohorts suggest that age is not a reliable independent predictor. The relationship between age and the development of MTSS TII remains inconclusive across the literature.

5.3.2 Gender

Of the participants who met the diagnostic criteria, nine were women and six men, and 17% of the women who participated in this study met the criteria, compared to 7% of the male participants. While the proportion of women was larger than that of men, this is considered insignificant (p=0.072) as this is a projection of the sample assessed and cannot be extrapolated onto the entire population.

The proportion of women affected in this study is comparable to previous research reporting a higher prevalence of MTSS TII among female athletes. Yates and White (2004) found that female military recruits were twice as likely to develop MTSS TII compared to men (12.6% vs. 6.4%). While the overall prevalence reported in that study was slightly lower than that observed in this study, the relative difference between sexes is similar (Yates and White 2004).

Bennet *et al*. (2001) examined 125 high school athletes and found that 21% of the female athletes developed MTSS TII compared to 10% of the men. This study identified reduced cortical bone thickness and lower tibial bone density as significant predictors for MTSS TII, both more commonly seen in women (Bennett *et al.* 2001). A 2007 study titled '*Medial Tibial Stress Syndrome in High School Cross-Country Runners*' also noted that the condition was more common in women (Plisky *et al.* 2007).

Biomechanical differences may also play a role. Anatomical factors such as a wider pelvis and increased femoral adduction in women can influence lower limb biomechanics, potentially leading to increased tibial internal rotation and greater loading of the tibia. Previous research has shown that runners with a history of tibial stress fracture demonstrate increased hip adduction, knee abduction, and knee internal rotation (Milner, Davis and Hamill 2005).

In addition to biomechanical factors, hormonal influences and lower bone density associated with energy deficiency may further increase susceptibility to bone stress injuries in women. Lin et al. (2018) reported that women are generally more prone to bone stress injuries, which supports the trend observed in the present study. While these factors were not directly measured, they provide an explanation for the higher proportion of female participants affected (Lin *et al.* 2018).

Overall, although the difference between sexes was not statistically significant, the findings of this study align with existing literature suggesting that female athletes may be at a higher risk of developing MTSS TII. The results highlight the importance of considering sex-related physiological and biomechanical factors when assessing risk and developing prevention strategies for MTSS TII.

5.3.3 Body Mass Index

Body mass index is a method that uses the height and weight of an individual to categorise them as underweight, normal, overweight, or obese. Normal BMI values range from 18.5 to 24.9. Values below 18.5 are considered underweight, and above 24.9 overweight, with a value over 30 categorised as obese.

In this study, an independent samples T test was used to determine whether BMI differed between individuals with or without MTSS TII. The mean BMI across the sample was 25.3, with values ranging from 17.4 to 39.5. Participants with MTSS TII had a slightly higher BMI (mean 25.9) compared to those without MTSS TII. However, statistical analysis found this to be insignificant. These results suggest that BMI is not a significant contributing factor in the development of MTSS TII.

These findings appear to contrast with current existing literature. A systematic review and meta-analysis of 10 papers by Newman *et al.* (2013) identified that an increased BMI is significantly associated with an increased risk of developing shin splints. Similarly, additional studies focusing on both runners and military personnel have supported this association (Yagi, Muneta and Sekiya 2013; Hamstra-Wright, Bliven and Bay 2015). In a comprehensive investigation assessing over 100 possible risk factors for MTSS TII in physical active individuals, primarily runners and military personnel, Winkelmann *et al*. (2016) identified elevated BMI as one of four primary risk factors contributing to its development (Winkelmann *et al.* 2016).

During activities such as running or marching, the tibia bends and bows in response to mechanical loading, resulting in microtrauma. The body responds to this microtrauma by adapting and strengthening (Frost 1994; Rowe, Koller and Sharma 2018). When weight is too high in relation to height, this can increase mechanical loading and cause stress to exceed the repair threshold, resulting in conditions such as MTSS TII (Hamstra-Wright, Bliven and Bay 2015).

Lower BMI is more commonly associated with the development of stress fractures. This has been seen in both male and female military personnel (Jacobs, Cameron and Bojescul 2014) and in female runners (Wright *et al.* 2015). This is believed to be due to reduced bone density, relative energy deficiency, and menstrual dysfunction, all strongly associated to lower body fat and lean muscle mass. Higher BMI is seen as protective against stress fractures (Abbott *et al.* 2023).

5.4 CLUB HOCKEY PARTICIPATION

This study investigated whether various aspects of hockey participation had any association with MTSS TII.

The number of weekly playing hours demonstrated no clear association with the development of MTSS TII. Among the 15 participants who met the diagnostic criteria for MTSS TII, the majority reported playing for two to four hours per week (46.7%), while 26.7% reported playing less than two hours per week; 20% of the participants played for four to six hours per week; and only 6.7% reported playing between six and eight hours per week. No cases were reported in the category of players who played for more than eight hours per week. It is important to note that the majority of the participants (55.5%) fell into the two to four hour per week category.

Interestingly, these findings do not support the notion that increased training volume results a greater likelihood of lower extremity injuries, as reported in a study by Sugimoto *et al.* (2019). A 2020 study by Craddock, Buchholtz and Burgess (2020) entitled '*Does a greater training load increase the risk of injury and illness in ultramarathon runners?*' found that a low external training load can predispose runners to injuries. This is because the low training load does not prepare individuals for more challenging environments. Gabbett *et al*. (2016) supported this finding by concluding that a higher training load can enhance strength and performance, provided that it does not exceed tissue tolerance. Gabbett *et al.* (2016) also emphasised that injury is more than likely associated with sudden increases in training volume, as opposed to high training loads. A 2004 study by Yates and White concluded that an increase of 30% in training volume was a significant contributing factor in the development in MTSS TII (Yates and White 2004).

No significant association was found between MTSS TII and competitive division and team rank in the present study. Players with MTSS TII were distributed across all divisions, with 26.7% each in Super League 1 and Super League 2, and the rest spread relatively evenly among lower divisions. Team rank (first team, second team, third team, and lower) was also unrelated to MTSS TII occurrence. Of the 137 players, approximately half (52.6%) competed at first-team level, with the remaining players distributed across second teams and lower-ranked teams. This study found that among the 15 players with MTSS TII, six (40.0%) represented first teams, while the remaining nine (60.0%) played on second teams or lower-tier teams. A 2024 study of injury types and incidence during football pre-season across different competitive levels revealed that elite athletes had the highest percentage of injuries in comparison to the sub-elite and amateur players. However, the elite group did demonstrate the lowest incidence of injuries, suggesting that high training volumes could be protective, provided there is graded progression (Marques *et al.* 2024).

Years of club hockey experience were not significantly associated with the presence of MTSS TII. Of the 15 players diagnosed with MTSS TII, one (6.7%) had played for less than one year, seven (46.7%) for one to under five years, two (13.3%) for five to 10 years, and five (33.3%) for more than 10 years. In comparison, among the 122 players without MTSS, eight (6.6%) had played for less than one year, 26 (21.3%) for one to under five years, 17 (13.9%) for five to 10 years, and 71 (58.2%) for more than 10 years. While a larger proportion of MTSS TII cases had between one and five years of playing experience compared to those without MTSS (46.7% versus 21.3%). This difference was not statistically significant. These results indicate that MTSS TII may occur across all experience levels, with a possible trend toward higher occurrence among less experienced players. Further investigation with a larger sample size may help clarify whether early playing years are a risk period for MTSS TII development.

A study by McCunn *et al*. (2017) theorised a potential explanation for this: as an athlete develops more playing experience, physical strength and technique are expected to improve, thus reducing the incidence of injury (McCunn *et al.* 2017). Interestingly, the opposite has been reported in non-elite athletes. A 2022 study found that, at a non-professional level, athletes with over 20 years of experience reported the highest incidence of injuries (Swanevelder *et al.* 2022). The results from these two studies indicate that increased experience can be protective, but as athletes age, the risk of injury increases.

Lastly, this study assessed whether there was an association between playing position and risk of MTSS TII. Studies by Fuller (1990), Dick *et al.* (2007), and Rishiraj, Taunton, and Niven (2009) reported hockey injuries according to player position. According to the results of these three studies, midfielders and forwards appear to sustain the most injuries (22-37%), followed by defenders (16-36%), and goalkeepers (4-19%) (Fuller 1990; Dick *et al.* 2007; Rishiraj, Taunton and Niven 2009). The findings reported in these studies align with results obtained from the present study. Among the 137 participants, midfielders made up the largest proportion of individuals with MTSS TII (40.0%, n=6), despite representing 32.1% of the total sample. Defenders and forwards each accounted for 26.7% (n=4 each) of the MTSS TII cases, while goalkeepers comprised a small proportion (6.7%, *n*=1). Despite the similar injury distribution compared to other studies on hockey players, statistical analysis revealed no significant relationship between player position and MTSS TII.

5.5 POSSIBLE RISK FACTORS FOR MEDIAL TIBIAL STRESS SYNDROME TYPE II IN CLUB HOCKEY PLAYERS

The following subsections examine the current study's findings alongside key literature to provide a broader perspective on these potential contributors to injury risk. The possible risk factors assessed included surface usage, footwear, exposure to strength and conditioning and a previous history of MTSS TII.

5.5.1 Surface Usage

This study found no association between surface usage and MTSS TII, likely because all participants trained and competed exclusively on AstroTurf. However, it is widely recognised that hard playing surfaces are strongly associated with the development of MTSS TII (Bhusari and Deshmukh 2023; Fatima *et al.* 2023). Dixon, Collop, and Batt (2000) reported that synthetic surfaces generate higher ground reaction forces compared to natural grass, leading to increased tibial bending stress, a key factor in the onset of lower limb injuries such as MTSS TII (Dixon, Collop and Batt 2000). Supporting this, Reilly and Borrie (1992) found that grass surfaces absorb 10% more energy than synthetic turf, offering greater shock absorption and reducing strain on the lower leg (Reilly and Borrie 1992). Notably, the only study comparing field hockey injuries on synthetic versus grass surfaces found that the overall injury rate was considerably higher on synthetic surfaces (Jamison and Lee 1989). More recent studies by Venishetty *et al*. (2024) and Mack *et al*. (2019) reported similar findings in National Football League athletes (Mack *et al.* 2019; Venishetty *et al.* 2024).

These findings suggest that surface type plays a meaningful role in injury risk, though its effect may not have been observable in the present study due to the lack of surface variability among participants. Future studies should include a larger sample of athletes who train and compete on both AstroTurf and natural grass and follow them over time in a prospective cohort design to more accurately assess the effect of surface type on the development of MTSS TII.

5.5.2 Footwear

This study found no association between the type of shoe used and MTSS TII. Interestingly, this study did, however, identify a relationship between duration of shoe usage and MTSS TII, with participants who used shoes for less than six months being more likely to be diagnosed. While this could suggest a reactive behaviour, where athletes change footwear in response to early shin discomfort, the present data do not allow us to confirm when or why shoes were changed. To determine whether this is truly a reactive behaviour, information on the timing of footwear changes relative to symptom onset and the reasons for those changes would be required. Therefore, it is unclear whether shorter shoe usage represents a response to MTSS TII or could contribute to its development. Regardless, previous research consistently highlights the importance of selecting appropriate footwear to reduce lower limb injury risk.

Studies by various researchers have addressed the importance of appropriate footwear in sporting activities. Kinchington, Ball, and Naughton (2011) conducted a 30-week study involving 59 elite rugby league players, comparing a control group with a group that followed a structured footwear programme, which included player education, shoe prescription, and regular rotation. The intervention group experienced significantly fewer lower limb injuries, higher comfort ratings, and fewer time-loss injuries. These results suggest that footwear education and personalised selection can play a vital role in reducing injury risk in high-impact team sports (Kinchington, Ball and Naughton 2011). Similarly, Malisoux *et al*. (2020) conducted a randomised controlled trial of 848 recreational runners, assigning them to either soft or hard cushioned running shoes. The study found that participants in the hard shoe group had a 52% higher risk of injury, with lighter runners (under 71.4 kg) experiencing an 80% increased injury risk in hard shoes. This highlights the need to match shoe cushioning to an athlete's body mass to minimise injury risk (Malisoux *et al.* 2020). In a broader review, Sun *et al*. (2020) analysed 63 studies to examine how various footwear constructions affect running biomechanics. The review found that soft midsoles can reduce impact forces, stiff midsoles (such as those with carbon plates) enhance propulsion, and minimalist shoes improve economy and foot strength, though they may increase forefoot and ankle stress (Sun *et al.* 2020). A study by Lavigne *et al*. (2023) examining shin splints in runners and athletes emphasises the importance of footwear that provides enough support for the foot and reduces uneven forces acting on the lower limb.

Collectively, these studies underscore that appropriate footwear selection based on comfort, biomechanical demands, and individual characteristics, is essential for optimising performance and reducing injury risk in sports.

5.5.3 Strength and Conditioning

This study found no significant relationship between the frequency of warm-up and cool-down routines and the incidence of MTSS Type II. Similarly, possible risk factors such as access to a strength and conditioning coach, participation in leg strengthening exercises, and training modifications aimed at prevention did not appear to influence the occurrence of MTSS Type II.

While no studies to date have directly examined the impact of including a structured warm-up and cool-down routine on the prevention of MTSS TII specifically, this question has been explored in broader athletic populations. In dancers, for example, a 2022 cross-sectional study found that those engaging in neuromuscular warm-ups experienced significantly fewer overuse injuries compared to those using traditional routines (Kaufmann *et al.* 2022). Likewise, a study in male volleyball players found that incorporating trunk and balance-focused warm-up elements did not reduce overall injury incidence but did significantly reduce overuse injury severity and total time lost due to injury (Muramoto and Kuruma 2022). In youth soccer, a randomised controlled trial by Hilska *et al.* (2021) evaluating a neuromuscular warm-up programme, observed a reduction in acute injuries with high adherence, although no significant change in overuse injury prevalence was detected. This study found that teams experienced a protective effect against injuries if they adhered to the neuromuscular training warm-up (Hilska *et al.* 2021).

In contrast, the role of cool-downs remains open to interpretation. Current literature, including a comprehensive narrative review by Van Hooren and Peake (2018), suggests that cool-down routines have minimal physiological benefit for injury prevention, including no clear impact on overuse conditions.

Overall, while dynamic and neuromuscular warm-up programmes show promise in reducing general injury risk and potentially reducing the severity of overuse injuries, more targeted research is needed to determine their role in the prevention of MTSS TII specifically.

5.5.4 History and Recurrence of MTSS TII

Among all participants in the present study, 40.1% (*n*=55) indicated a history of MTSS TII. Of those affected, just over half (51%) reported that the issue was recurring, while 49% stated it had occurred only once. A statistically significant relationship was found between having a history of MTSS TII and experiencing repeated episodes, suggesting that individuals who develop MTSS TII are more likely to encounter the condition again. This pattern points to a tendency for MTSS TII to become a chronic or recurring issue, rather than an isolated injury.

Studies by Yates and White (2004), Newman *et al* (2013), and Moen *et al* (2009) have demonstrated that a history of MTSS TII significantly increases the risk of recurrence. In a study on MTSS TII in British naval recruits, Yates and White (2004) found that individuals with a previous history of MTSS TII were at a notably higher risk of redeveloping the condition during basic training. While the study focused on a military population, its findings are highly relevant to athletic settings due to comparable physical demands and structured training regimens (Yates and White 2004). Supporting this, both Newman *et al*. (2013) and Moen *et al*. (2009) identified a prior history of MTSS TII as one of the most consistent and reliable predictors of future episodes across various athletic populations.

Additionally, Winters *et al*. (2013) emphasised the influence of intrinsic biomechanical factors that may help explain the recurring nature of MTSS TII once the condition has developed. Some of these include over pronation, decreased hip abduction strength, and reduced plantarflexion strength (Winters *et al.* 2013).

Collectively, these studies emphasise the chronic nature of MTSS TII and highlight the importance of addressing both prior injury and underlying biomechanical risk factors in their long-term prevention and management.

5.6 MANAGEMENT OF MEDIAL TIBIAL STRESS SYNDROME TYPE II IN CLUB HOCKEY PLAYERS

5.6.1 Professional Care

The current study found that only 27 players sought professional treatment for their MTSS TII. Among them, the majority (85.2%, *n*=23) consulted a physiotherapist, which was the only healthcare provider consulted at a statistically significant rate (p<0.001). Other professionals such as chiropractors, biokineticists, general practitioners, sports medicine doctors, orthopaedic specialists, and pharmacists were consulted less frequently.

The preference for physiotherapy is consistent with current recommendations, which highlight the importance of a comprehensive rehabilitation plan. This typically includes targeted stretching and strengthening exercises for the lower limbs, as well as manual therapy techniques to improve circulation and tissue flexibility (Ciszewski, Drelichowska and Azierski 2025).

Interestingly, this finding contrasts with a similar study conducted among club athletes in Dhaka, where only 36.7% of those with MTSS TII received physiotherapy (Sultana *et al.* 2016). This suggests that the players in our sample may have had better access to or awareness of physiotherapy services, or perhaps a stronger emphasis on early rehabilitation.

5.6.2 Treatment Methods Used by Practitioners

Massage and stretching were the most frequently used treatment methods among participants, each reported by 89% of those who sought care, followed by strapping (74%). Cold therapy (63%) and heat therapy (59%) were also commonly used, although to a lesser extent.

These approaches align with findings from existing literature. Tolbert and Binkley (2009), Deshmukh Jr *et al*. (2022), and Saki *et al*. (2024) all support conservative management strategies, and emphasised the importance of stretching programmes targeting muscles such as the hamstrings, gastrocnemius, and soleus (Tolbert and Binkley 2009; Deshmukh Jr *et al.* 2022). Deshmukh Jr *et al*. (2022) also advocated for cupping and cryotherapy. Meanwhile, Saki, Shayesteh, and Ramezani (2024) found that Kinesio taping had short-term benefits for pain relief and postural control in athletes (Saki, Shayesteh and Ramezani 2024).

These findings support the use of conservative, non-invasive treatments for MTSS TII, as reflected in the care approaches used in the eThekwini region. The high rate of physiotherapy use and the emphasis on manual therapy, stretching, and supportive techniques such as strapping are in line with both clinical guidelines and the wider literature.

5.6.3 Self-Treatment for MTSS TII

Among those who did self-treat, a diverse range of strategies was employed, with many using a combination of rest, icing, massage, and strapping. Cold therapy was the most frequently used strategy (reported alone or in combination in 19 responses), followed closely by rest from activity (*n*=17), a significant number in comparison to heat therapy (*n*=4). Stretching and mobility exercises were reported in 15 responses, followed by strapping/taping and massage techniques (manual or foam rolling), which both received 13 responses. Additionally, nine of the participants reported either strength training, exercise, or rehabilitation in their responses. The use of oral medication, including anti-inflammatories, was mentioned four times. A few participants also noted more specific interventions such as changing footwear, orthotics, and the use of an electrical muscular stimulation machine.

The findings of this study are consistent with current recommendations for managing MTSS Type II. Research by Bhusari and Phansopkar (2023) and Deshmukh Jr *et al* (2022) highlighted the importance of ice, rest, and anti-inflammatory medication during the acute phase of MTSS Type II.

Only a few players in this study reported engaging in rehabilitation as part of their recovery from MTSS TII. Furthermore, none mentioned implementing training modifications or following a graded return-to-play protocol, as recommended in the literature (Ciszewski, Drelichowska and Azierski 2025).

An important finding from this study was the small percentage of participants who received education on MTSS TII from coaching staff. Only 13.1% of the hockey players had ever been educated about the condition. A 1993 study titled '*Lower limb overuse injuries in school girl hockey players*' also identified that coaching staff had limited knowledge on MTSS TII and were unable to modify training to prevent the condition from occurring (Petrick, Laubscher and Peters 1993). This is further emphasised in a 2025 study which strongly recommended education of players and coaches on recognition, load progression, and management of MTSS TII (Ciszewski, Drelichowska and Azierski 2025). A study by Kwon and Jang (Kwon and Jang 2025) found that the more young athletes participated in education on sports safety, the less likely they were to sustain sporting injuries and more likely to develop good sporting safety habits.

5.7 SUMMARY

This study investigated the prevalence, possible risk factors, and management of MTSS TII among club hockey players in the eThekwini Municipality. MTSS TII was found to be relatively common in this population, emphasising its relevance in field-based team sports.

A significant association was identified between shoe replacement frequency and MTSS TII, with affected players more likely to change shoes within the first six months of wear—possibly indicating a link to biomechanical stress or an early response to symptoms. A previous history of MTSS TII also emerged as a strong predictor of recurrence, suggesting that MTSS TII is often a chronic rather than isolated condition.

Demographic factors such as age, sex, and BMI, along with hockey-specific variables such as playing position and training frequency, showed no significant association with MTSS TII onset. Additionally, only a small percentage of participants reported receiving any education on MTSS TII from coaching staff, highlighting a gap in preventative strategies.

These findings underscore the importance of targeted education and informed footwear practices in managing and preventing MTSS TII.

CHAPTER 6 – CONCLUSION

6.1 BACKGROUND

This chapter summarises the key findings of this epidemiological study on MTSS TII among club hockey players in the eThekwini Municipality. This study offers new insights into the prevalence, possible risk factors, and management practices of MTSS TII in a sport where this condition has been largely overlooked. The chapter also outlines the strengths and limitations of the study and provides recommendations for future research. Emphasis is placed on the need for greater awareness, prevention, and evidence-based management of MTSS TII in club hockey players.

6.2 KEY FINDINGS

- The prevalence of MTSS TII in club hockey players in the eThekwini Municipality was found to be 10.9%.
- Of the participants who met the diagnostic criteria, more women presented with MTSS TII (60%).
- Approximately 40.1% of the sample reported having previously experienced MTSS TII or being diagnosed with the condition by a licensed practitioner.
- A significant number of those with MTSS TII used a specific type of shoe for less than six months.
- A significant relationship was identified between suffering from MTSS TII and the time using a specific pair of shoes (p=0.007).
- Only 13.1% (n=18) of the sample reported receiving education on MTSS TII from hockey coaching staff.
- Of the 27 participants who sought professional treatment, 85% consulted a physiotherapist. Massage and stretching were the most commonly reported treatments utilised by healthcare professionals (89%). Strapping was also frequently administered (74%).
- Most participants used cold therapy, rest, and stretching to treat MTSS TII at home.

6.3 STRENGTHS OF THIS STUDY

To our knowledge, this study represents the first of its kind. While studies have examined MTSS TII in athletic populations that included hockey players, there appears to be no clear indication that any study has been undertaken to solely observe the epidemiology of MTSS TII in club hockey players anywhere in the world. This study clarifies important information pertaining to the prevalence, possible risk factors, and management of MTSS TII in hockey players, which can inform targeted injury prevention efforts. These findings provide evidence for coaches and practitioners by highlighting modifiable risk factors such as footwear duration and limited education on MTSS TII. They support targeted interventions including conditioning programs, symptom monitoring, and home-based management strategies to reduce the prevalence and recurrence of MTSS TII in club hockey players.

6.4 LIMITATIONS OF THIS STUDY

This study has several limitations that should be acknowledged. First, data collection was conducted through an online questionnaire, which did not allow for in-person clinical examination or palpation of the medial tibia, which is considered the most accurate method for diagnosing MTSS TII. As such, the reliance on self-reported data may have affected the accuracy of MTSS TII identification. Second, the timing of the questionnaire dissemination at the beginning of the season coincided with a period of relatively low training intensity and duration. This may have contributed to a lower reported prevalence of MTSS TII, as symptoms may not yet have fully developed in many athletes. Additionally, the study age restriction of 18 years and older excluded a substantial number of younger players. Many club hockey athletes continue to compete at a school level, and excluding this demographic may have limited the generalisability of the findings. The percentage of participants reporting a past history of shin MTSS TII suggests that MTSS TII remains a common issue among hockey players, highlighting the need for broader sampling.

6.5 RECOMMENDATIONS FOR FUTURE STUDIES

- Larger populations of hockey players should be included in future research.

- Future studies should include a physical examination as opposed to only using a questionnaire. This should include a physical screening for MTSS TII and risk factor assessment for more accurate results.
- To exclude differential diagnoses, future studies could include the use of MRI or intercompartmental pressure testing to rule out stress fractures or chronic compartment syndrome.
- As discussed in Chapter 4, neuromuscular warm-up before exercise has been shown to reduce overuse injuries. Future studies could look at the impact of neuromuscular warm-up on MTSS TII in club hockey players.

6.6 CONCLUSION

MTSS TII poses a challenge in athletic populations, with the potential to disrupt training and compromise performance. To our knowledge, this is the first study to investigate MTSS TII among club-level hockey players in the eThekwini Municipality.

The observed prevalence among club hockey players was similar to that reported in runners but lower than in military populations, indicating that MTSS TII affects athletes across a range of sporting contexts. While no significant links were found between MTSS TII and demographic or hockey-specific variables, the association with previous MTSS TII and duration of shoe usage points to modifiable contributing risk factors. Targeted prevention strategies may include regular rotation or replacement of footwear, monitoring shoe wear patterns, and educating players on selecting appropriate footwear to reduce the risk of injury.

While general self-care practices were commonly reported, engagement with evidence-based rehabilitation protocols and structured return-to-play strategies was limited. This reveals a critical gap in injury management knowledge that may be contributing to recurrence and delayed recovery.

These findings highlight the need for improved education around structured recovery and the incorporation of sport-specific injury prevention and management strategies within hockey training environments. By examining an underexplored population, this study broadens the epidemiological understanding of MTSS TII and lays the foundation for future interventions that can reduce injury burden and support athlete longevity.

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APPENDICES

APPENDIX A: LETTER OF INFORMATION

Title of Research Study: An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini municipality.

Principal Researcher: Jonathan Blackburn (BHSc: Chiropractic)

Supervisor: Professor Julian Pillay

Co-Supervisor: Dr Ally

Dear research participants

I am a final year student completing my research for my master's degree in chiropractic at DUT. I am very interested in better understanding the relationship of the development of shin Splints in Hockey players in terms of how prevalent the condition is, and what potential factors may be contributing to the development of this condition. I am a Hockey player myself, and I have seen first-hand how common this condition is amongst hockey players, but little to no research has been done to address this issue.

I would therefore like to invite you to participate in my research. Your time is appreciated and will assist in providing valuable information regarding shin splints in Durban Club Hockey Players.

What is Research?

Research is a systemic search for generalized new knowledge. Your participation will help us better understand the association of Shin Splints and Hockey and determine what might be contributing to the development of the condition. This information will provide valuable information to both coaches and players.

Outline of the Procedure:

The aim of this study is to determine the prevalence and contributing factors of Medial Tibial Stress Syndrome Type II in Club Hockey players that fall within the eThekwini Municipality. An online Questionnaire will be distributed to all the teams that fall within the municipality via WhatsApp Messenger and should only take 5 to 10 minutes to complete. This questionnaire will consist of four sections – General information and informed consent, sociodemographic information, questions pertaining to MTSS Type II, and the final section will be questions about contributing factors.

Risks to the participants:

There are no risks to you during this study.

Reasons why you may be withdrawn from the study:

If you are non-compliant and have not completed at least eighty percent of the questionnaire, the questionnaire will no longer be used in the research study. As a voluntary participant in this research study, you are free to withdraw from the study at any given time without giving a reason for withdrawal.

Benefits:

Your contribution to the study by volunteering to participate will help Chiropractors and other medical practitioners to obtain knowledge on the condition and its association with Hockey. It will also provide valuable information for coaches on how best to avoid the condition and keep their players playing at the highest level without developing an overuse injury such as shin splints. There is very limited research on Shin Splints in South Africa, very unusual as we are considered a very active nation. This research will be used to provide a stepping stone for further studies to be done in terms of prevalence in other sporting populations, further understanding pathophysiology, and how best to treat the condition.

Remuneration:

You will not be receiving any monetary or other type of remuneration for participation in this study.

Cost of the Study:

You will not be expected to cover any costs towards the study.

Confidentiality:

All participant's information is confidential. You will not be expected to record any personal details that could identify you. The result of this study will be used for research purposes only. Only the individuals (Professor Pillay, Dr Ally, and I, Jonathan Blackburn) that are directly involved in this study will be allowed to access these records.

Results:

Once the information has been collected, the results from the study will be published in the dissertation section of the DUT library, which can be taken out through normal library protocol. There will also be an online copy available to you through the DUT online library system.

Research related Injury:

There is no risk of injury that you can sustain by participating in this study.

Storage of all electronic and hard copies:

Once you complete the questionnaire, it will be stored on a computer and external storage device, will be kept for five years after which it will be deleted. Persons to contact should you have any problems or questions:

Should you wish to contact me, feel free to do so on 0717653839. Should you have any questions that you would prefer to be answered by an independent individual, feel free to contact my supervisor on the following numbers: Professor Julian Pillay at 0313732398 or Co- supervisor: Dr Fazila Ally at 0313732389. Alternatively, the Institutional Research Ethics Administrator can be contacted on (031) 373 2375. Any complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

Thank you for participating in my research study.

Jonathan Blackburn (DUT Chiropractic Research Student)

APPENDIX B: APPROVAL OF AMENDMENT

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

19 June 2025

Mr J S Blackburn
24 Chartwell Drive
Umhlanga

Dear Mr Blackburn

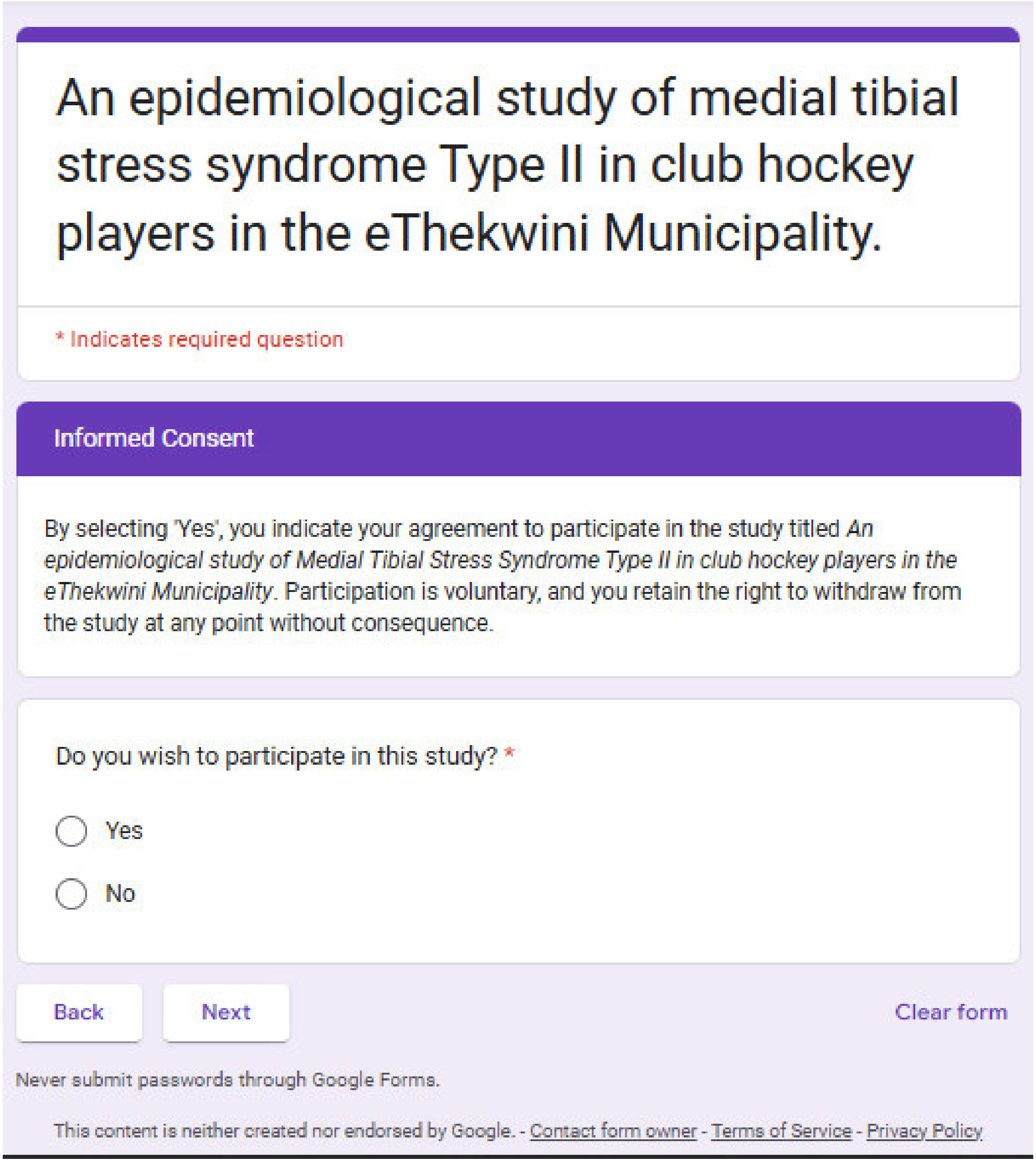
An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini Municipality.
Ethical Clearance number: 335/24

I am pleased to inform you that your application to change your sample size from 291 to 134 has been approved.

Yours Sincerely

Professor P Mashau
Chairperson: DUT-IREC

APPENDIX C: INFORMED CONSENT



An epidemiological study of medial tibial stress syndrome Type II in club hockey players in the eThekwini Municipality.

* Indicates required question

Informed Consent

By selecting 'Yes', you indicate your agreement to participate in the study titled *An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini Municipality*. Participation is voluntary, and you retain the right to withdraw from the study at any point without consequence.

Do you wish to participate in this study? *

- Yes
- No

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APPENDIX D: ETHICAL APPROVAL

INSTITUTIONAL RESEARCH ETHICS COMMITTEE

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

9 April 2025

Mr J S Blackburn
24 Chartwell Drive
Umhlanga

Dear Mr Blackburn

An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini Municipality
Ethical Clearance number BIREC 335/24

The DUT-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 DUT-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 DUT-IREC according to the DUT-IREC Standard Operating Procedures (SOP's).

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

It is compulsory for a student or researcher to apply for recertification on an annual basis. The failure to do so will result in withdrawal of ethics clearance. It is the responsibility of the researcher and the supervisor to apply for recertification.

Please note that you are required to submit a Notification of Completion of Study form together with an abstract to the DUT-IREC office on completion of your study.

Yours Sincerely

Prof P Mashau
Chairperson: DUT-IREC

APPENDIX E: GATEKEEPER PERMISSION

KWAZULU – NATAL COASTAL HOCKEY ASSOCIATION

Queensmead Hockey Stadium, 44 Teignmouth Road, Durban, 4001 KwaZulu Natal, South Africa
P.O. Box 41803, Rossburgh, 4072. Tel-: (031) 2061761, Fax – email: 086 459 6747, office@kznha.co.za

14 November 2023

TO WHOM IT MAY CONCERN

This is to confirm that KWAZULU NATAL HOCKEY ASSOCIATION gives Jonathan Blackburn permission to an Epidemiological study of Medical Tibial Stress Syndrome Type 2 shin splints in the Club Hockey players within the eThekwini Municipality.

Yours Sincerely

CHAIRLADY

SHARON VERNON

APPENDIX F: QUESTIONNAIRE

Questionnaire

An Epidemiological study of Medial Tibial Stress Syndrome Type II in Club Hockey players within the eThekwini Municipality

Thank you for participating in this survey. The purpose of this questionnaire is to gather information on the prevalence and perceived factors associated with shin splints among hockey players. Your input is valuable for understanding and addressing this issue. Please answer the following questions to the best of your knowledge and experience.

Unless otherwise instructed, for each question select the ONE response option that best applies to you.

Screening questions

1 Are you a registered hockey player with the Durban Hockey Association for the 2025 season?

Yes	No

2 Your age (in years)

Less than 18	18+

[if answered no to q1 or <18 to q2, the respondent will be thanked, and the process will stop]

Section 1: Demographics

3 What is your age in years? ___________________ years

4 Please measure your height and weight as accurately as possible and enter these measurements in the table below:

Height (m)	Weight (kg)

5 In which league do you play?

Men's league	Women's league

Section 2: Hockey participation

6 For how many hours per week, on average, do you play hockey? (Includes training and games)

<2 hours	2 - <4 hours	4 - <6 hours	6 – 8 hours	>8 hours

7 In what division does your hockey team play?

Super league 1	Super league 2	Division 1	Division 2	Division 3	Division 4

8 Which team do you represent?

First	Second	Third	Fourth	Fifth	Lower than fifth

9 For how many years have you been playing club hockey?

<1 year	1 - <5 years	5 – 10 years	>10 years

10 What is your primary position?

Goalkeeper	Defender	Midfielder	Forward

Section 3: Medial Tibial Stress Syndrome assessment tool

11 Respond YES or NO to the following questions:

	YES	NO	N/A
11.1 Do you have any pain that occurs on the inside of your middle to lower shinbone during exercise?			
11.2 Is the pain mentioned above relieved by rest?			
11.3 Did the pain in this region happen after trauma to this area?			
11.4 Does any pain in your lower leg prevent you from exercising?			
11.5 Do you get a deep aching, cramping or burning pain that occurs in your calf/posterior compartment of the lower leg during exercise?			
11.6 If you press on the inside of your shin bone, is it painful over an area greater than 5cm?			
11.7 Do you have any visible swelling or redness in the area?			
11.8 Do you get numbness and/or pins and needles in the feet during exercise?			
11.9 Has an x-ray or MRI confirmed that a fracture is present in the shinbone?			
11.10 Do you experience weakness in the affected leg?			
11.11 Do you have any difficulty lifting the front part of your foot?			
11.12 Is there any bruising at the site of the pain?			

Section 4: Perceived factors

12 On which ONE of the following surfaces do you **MOST OFTEN** play matches/practice?

	AstroTurf – water base	AstroTurf – sand base	Grass	Other
12.1 Practice				
12.2 Play matches				

13 What type of shoe do you usually use for hockey?

Regular hockey shoes	Other shoes, not specifically meant for hockey

14 For how long have you been using this type of shoe for hockey?

<1 month	1 - <6 months	6 - < 12 months	1 – 3 years	>3 years

15 In general, for how long do you play hockey in a pair of shoes before you replace them?

<6 months	6 - <12 months	12 - < 18 months	18 – 24 months	>2 years

16 Do you play hockey with orthotics/shoe inserts?

Yes	No

17 How often do you do an adequate warm up before hockey matches/training sessions?

never	rarely	sometimes	often	always

18 How often do you do an adequate cool down after hockey matches/training sessions?

never	rarely	sometimes	often	always

19 Do you have a strength and conditioning coach/professional that guides you through a warmup/cool down?

Yes	No

20 Do you engage in specific exercises or training to strengthen your lower legs?

Yes	No

21 Have you ever modified your training or playing habits to prevent shin splints?

Yes	No

22 Have you ever experienced shin splints before or been diagnosed with shin splints by a licensed medical practitioner?

Yes	No

22.1 If you responded YES to Question 22, has it occurred only once or is it a recurring issue?

only once	recurring

Section 5: Management of shin splints (MTSS Type II)

23 Have you ever been educated on the topic of shin splints and available treatment options by your hockey coach or member of staff at your hockey club?

Yes	No

24 Have you ever sought treatment from a practitioner for shin splints/pain in your shins?

Yes	No

24.1 If you responded YES to Question 24, which of the following practitioners have you consulted for shin splints/pain in the shins?

Practitioner	YES	NO
24.1.1 Chiropractor		
24.1.2 Physiotherapist		
24.1.3 General Practitioner (GP)		
24.1.4 Specialist (Orthopaedic surgeon)		
24.1.5 Sports medicine practitioner		
24.1.6 Pharmacist		
24.1.7 Biokineticist		
24.1.8 Other: please specify		

24.2 If you respond YES to Question 24, which of the following treatments have you received for shin splints?

Treatment	YES	NO
24.2.1 Chiropractic Manipulation		
24.2.2 Dry needling		
24.2.3 Massage		
24.2.4 Shockwave		
24.2.5 Strapping		
24.2.6 Stretching		
24.2. 7 Application of heat		
24.2.8 Application of cold		
24.2.9 Pain medication		
24.2.10 Injection of medication		

25. Have you ever ‘treated’ your own shin splints, instead of consulting a practitioner?

Yes	No

25.2 If you responded YES to question 25, how did you treat your shin splints?

____

____

THANK YOU FOR YOUR TIME

APPENDIX G: ETHICS CERTIFICATES

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Certificat Certificate
TRREE
Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Certificat de formation - Training Certificate
Ce document atteste que - this document certifies that
Jonathan Blackburn
a complété avec succès - has successfully completed
Archived - Module 1 - Introduction to Research Ethics
du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Clinical Trials Centre
The University of Hong Kong

Release Date: 2022/05/01

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY SIWF ISFM
Foederatio Pharmaceutica Helvetiae FPH Programmes de formation postgraduée et continue

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du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Clinical Trials Centre
The University of Hong Kong

Release Date: 2022/05/01

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

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du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2022/05/01

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

APPROVED BY SIWF FMH ISFM

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APPENDIX H: EDITOR'S CERTIFICATE

Helen Bond

IMPELA EDITING SERVICES

impelaediting@gmail.com

079 395 5873

13 August 2025

CERTIFICATE

Jonathan Blackburn

Dear Jonathan

Thank you for using Impela Editing Services to edit your Master's thesis entitled "*An epidemiological study of Medial Tibial Stress Syndrome Type II in club hockey players in the eThekwini Municipality*".

I have proofread for errors of grammar, punctuation, spelling, syntax and typing mistakes. I have formatted your work and checked the references (this means checking the formatting) according to the DUT Library's version of Harvard referencing.

Please note that Impela Editing accepts no responsibility for work changed after issuing this certificate.

I wish you the very best in your submission and your career.

Kind regards

Helen Bond (Bachelor of Arts, HDE)

APPENDIX I: PLAGIARISM REPORT

Revised Dissertation - Jonathan Blackburn 2025.docx

ORIGINALITY REPORT

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4	pmc.ncbi.nlm.nih.gov Internet Source	<1%
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