THE EPIDEMIOLOGY OF MUSCULOSKELETAL PAIN IN DRESSAGE RIDERS IN KWAZULU-NATAL : A CROSS SECTIONAL STUDY

By

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Dissertation submitted in fulfilment of the academic requirements for the degree of Master of Health Sciences in the department of Chiropractic, Faculty of Health Sciences, Durban University of Technology, Durban

I, Jessica Alberts, do declare that this dissertation is representative of my own work in both conception and execution (except where acknowledgements indicate to the contrary)

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07 April 2026

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PREFACE

The research work described in this dissertation was completed in the Department of Chiropractic, Durban University of Technology, from January 2022 to April 2025, under the supervision of Professor Sean Chetty and the co-supervision of Doctor Desiree Varatharajullu.

These studies represent original work by the author and have not otherwise been submitted in any form for any degree or diploma to any tertiary institute. Where use has been made of the work of others, it is duly acknowledged in the text.

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DECLARATION – PLAGIARISM

I, Jessica Alberts, declare that

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DEDICATION

To my parents — thank you for your unconditional support and love throughout my university career. Thank you for all your patience and encouragement throughout the tough moments and always standing by my side.

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ABSTRACT

Background:

Previous studies indicate that horse riders experience a high prevalence of equestrian-related injuries and back pain; however, these studies have combined different horse-riding disciplines, assessed back pain only in elite dressage riders, or reported on the prevalence of equestrian-related injuries. There is a scarcity of research on dressage horse riders in South Africa and on musculoskeletal pain in this population. Therefore, this study addresses the prevalence of musculoskeletal pain in dressage riders in South Africa, thus bridging the gap between research done on horse riders in other countries and horse riders in South Africa.

Aim:

To investigate the prevalence of musculoskeletal pain in dressage horse riders in KwaZulu-Natal.

Objectives:

1. To determine the point and period (one year) prevalence of musculoskeletal pain in dressage riders in KwaZulu-Natal.
2. To investigate the selected risk factors (the velocity of horse riding, the time spent horse riding, the type of saddle being used, the number of horses being ridden, the mechanical differences in the horse's movement, history of previous horse-riding injury) on the prevalence of musculoskeletal pain in dressage horse riders in KwaZulu-Natal.
3. To determine the impact of musculoskeletal pain in dressage riders in KwaZulu-Natal.
4. To determine the association between the prevalence of musculoskeletal pain and selected risk factors.

Results:

A total of 89 participants completed the questionnaire, resulting in an 81.65% response rate. The majority of riders (83%) had a history of experiencing musculoskeletal pain at some point during riding, with low back pain being the most common region (65%). A majority of 89% of riders were currently experiencing musculoskeletal pain, with low back pain being reported as the most common region (48%), followed by neck pain, mid-back pain and knee pain (25%). The musculoskeletal pain was most described as being sharp (62%) and

tight/spasm (57%). Strenuous riding (28%) and riding multiple horses a day (28%) were reported to be the most contributing factors for aggravating musculoskeletal pain.

Conclusion:

This study has revealed the prevalence of musculoskeletal pain in the different anatomical regions in dressage horse riders, adding to the body of literature on musculoskeletal pain in horse riders. The study emphasised the different biomechanical demands on dressage riders and how the rider is impacted, adding to the importance of adequate treatment methods for the different sporting disciplines.

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LIST OF ABBREVIATIONS

BPI	–	Brief Pain Inventory
FEI	–	Fédération Equestre Internationale
IASP	–	International Association of the Study of Pain
KZN	–	KwaZulu-Natal
LBP	–	Low back pain
MSK	–	Musculoskeletal
SA	–	South Africa
SAEF	–	South African Equestrian Federation
DSA	–	Dressage South Africa / Dressage SA

CHAPTER ONE OVERVIEW OF THE STUDY

1.1 INTRODUCTION

This study employed a quantitative descriptive research approach, conducting an assessment of the prevalence of musculoskeletal (MSK) pain in dressage horse riders performed in KwaZulu-Natal, South Africa (SA). The study used a two-part quantitative sport-specific questionnaire. Previous studies conducted in this field reported that horse riders experienced a high prevalence of equestrian-related injuries and back pain; however, these studies have either combined the different horse-riding disciplines or have only assessed back pain in elite dressage riders or have only reported on the prevalence of equestrian-related injuries. According to Williams and Tabor (2017:31), horse riders can be categorised into experienced, professional, amateur and leisure horse riders. This study aimed to investigate the epidemiology of MSK pain in dressage horse riders in KwaZulu-Natal. In this chapter, the study background, problem statement, the study's objectives and the significance of the study are discussed.

1.2 BACKGROUND TO THE STUDY

Equestrian sport is a unique sport with its foundation based on the horse-rider partnership. Optimal performance within equestrian sport is achieved when both horse and human interact efficiently at the same time (Douglas *et al*. 2012: 54). Research on equestrian sports, especially dressage, is significantly less common in SA than in other sports disciplines. Additionally, there is a global scarcity of literature addressing MSK pain in equestrian riders. Despite increasing interest in equestrianism, studies focusing on the physical challenges, injuries, and chronic pain faced by riders are limited. This paucity of research in this field underscores a need for further investigation into the specific MSK issues that dressage riders encounter, which could lead to better training methods and injury prevention strategies.

Equestrian-related injuries may range from head, neck, spinal, chest, abdomen and extremity injuries (Samuels *et al.* 2022: 172). In a cohort study by Hoffmann *et al.* (2023: 2) on 95 horse-related injuries in a level one trauma centre, 60.6% of horse riders presented with trauma induced from falling off a horse. Upper extremity injuries were most prevalent, consisting of 52.5% of injuries, while lower extremity injuries accounted for only 20.2% of cases. Papachristos *et al.* (2014: 1486) reported that 29% of horse riders who had sustained an equestrian related injury experienced pain for more than six months after the injury. The study also reported that between 4–64 months post-injury, 42% of injured horse riders

returned to work with decreased ability. In a small retrospective study conducted at a major trauma centre in KwaZulu-Natal, Wessels *et al.* (2019: 55) reported 104 animal-related injuries, of which 29 were equestrian-related injuries. Most of the equestrian-related injuries were due to horse-kick injuries to the head, abdomen, chest and groin. Some injuries were sustained from falling from the horse (Wessels *et al.* 2019: 55). Previous studies published by Kraft *et al.* (2007: 4) and Deckers *et al.* (2020:9) demonstrated that 81% of horse riders are likely to experience back pain.

Lewis and Kennerley (2017: 260) reported in a study investigating the pain prevalence in elite dressage riders that 74% of elite dressage riders competed with back pain; however, this study only included elite dressage riders. Another horse-riding related study conducted in SA is the (unpublished) research dissertation by a chiropractic student at the University of Johannesburg LBP prevalence in competitive show jumping riders. Peens (2020: 23) showed that from a sample of 100 show jumpers, 42% were experiencing LBP at the time of the study and 81% of participants had experienced LBP previously. In a recent study in SA on the prevalence of LBP in competitive dressage riders, Handley (2021: 27) reported that 71% of competitive dressage riders suffered from LBP in the last month prior to the study and 56% suffered from LBP for more than 6 months prior to the evaluation.

In a small retrospective study by Wang *et al.* (2022: 2), on chiropractic treatment for equestrian-related MSK injuries, a majority of 57.7% of study participants received treatment for chronic injuries. Wang *et al.* (2022:2) further reported that 60% of the chronic injuries, as well as 10% of the overuse injuries, were sufficiently treated and managed, and that no further chiropractic treatments were required. The remaining participants received ongoing management treatment. Overall, the study indicates that chiropractic treatment may be of great benefit for equestrian-related MSK injuries. The majority of studies performed on equestrian-related injuries and back pain are based in high-income countries; however, the medical care, loss of productivity and roles in society vary between high-, middle- and low-income countries which does not allow for an accurate comparison of MSK pain between economically different countries (Blyth *et al.* 2019: 36).

Equestrian based activities in SA differ from international standards. One difference is that SA has drier and warmer climates, more agricultural space for paddocks to allow horses more outdoor time compared to European countries, and is more efficient in providing services to the horse riders using employed stable assistants (Harrison 2016). These differences may impact riders differently compared to international riding.

This study aimed to address the lack in literature about the prevalence of MSK pain experienced in dressage horse riders from a South African context, as there is a scarcity in

the literature on MSK pain in South African horse riders. This might offer the chance to contrast South African horse riding with that of other international countries. Moreover, this study also adds to the current body of literature and improves the available data on the prevalence of MSK pain found among dressage riders perceived by the public and healthcare professionals. Lastly, the study may provide more clarity and understanding of the complexity of the sport and the impact that it has on the athlete riders.

1.3 PROBLEM STATEMENT

Equestrian sport, specifically dressage, is not commonly researched in SA in comparison to other sporting disciplines. There is limited literature globally on MSK pain in equestrian riders. Previous studies conducted indicated that horse riders experienced a high prevalence of equestrian-related injuries (Hoffmann *et al.* 2023:2) and back pain (Kraft *et al.* 2007: 4; Deckers *et al.* 2020: 9), whether occurring from working on the ground with a horse or from riding the horse. Most research published on equestrianism is based on international riders, includes and compares multiple disciplines in one study or specifically focuses on LBP (Lewis and Kennerley 2017: 260; Deckers *et al.* 2020: 8).

There is a lack of literature focusing mainly on dressage horse-riding in SA and specifically on MSK pain in dressage horse riders. Harrison (2016) commented on the clear differences between stable yards in SA compared to international stable yards, which may have a marked effect on equestrianism. Therefore, this study addresses the paucity in the literature on MSK pain in dressage horse riders. The study population consisted of dressage horse riders in KwaZulu-Natal, which introduces additional South African context into the literature.

1.4 AIM OF THE STUDY

To investigate the prevalence of MSK pain in dressage horse riders in KwaZulu-Natal.

1.5 OBJECTIVES OF THE STUDY

- To determine the point and period (one year) prevalence of MSK pain in dressage riders in KwaZulu-Natal.
- To investigate the selected risk factors (the velocity of horse riding, the time spent horse riding, the type of saddle being used, the number of horses being ridden, the mechanical differences in the horse's movement, history of previous horse-riding injury) on the presence of MSK pain in dressage horse riders in KwaZulu-Natal.
- To determine the impact of MSK pain in dressage riders in KwaZulu-Natal.

1.6 SIGNIFICANCE OF THE STUDY

MSK pain has been recognised as a global burden, being reported regionally and nationally across the globe by the Global Burden of Disease and the World Health Organization (World Health Organization 2022). MSK pain may lead to a variety of negative health impacts especially causing impairment within individuals' daily living routine (Blyth *et al.* 2019: 36). Horse riding is considered a high risk sport for injuries with a high occurrence of equestrian-related injuries (Papachristos *et al.* 2014: 1484). Back pain among horse riders is common, with a prevalence of 81%, and 88% of back pain was experienced in professional riders (Deckers *et al.* 2020: 6). Many studies on equestrianism have either assessed back pain in horse riders or have assessed equestrian-related injuries. There is a lack of literature on MSK pain in horse riders.

Equestrian activities in SA are different from those in other countries. The climate in SA is drier and warmer and there is more agricultural land for paddocks, which gives horses more outdoor time compared to European countries. SA also provides better services to horse riders by employing stable assistants (Harrison 2016). These differences may impact riders differently compared to international riding.

This study aimed to address the lack in literature on the prevalence of MSK pain experienced in dressage horse riders from SA. As there is no research conducted on MSK pain in SA horse riders, this research has created the opportunity to compare SA horse riding to international horse riding. This study adds to the limited existing body of knowledge and improves the available data on the prevalence of MSK pain found amongst dressage riders. In addition, the study provides a better understanding of the complexity of the sport and the impact that it has on the athlete riders.

1.7 OUTLINE OF THE DISSERTATION

Chapter One

Chapter One gave an outline of the study. The introduction was presented and the study's background, problem statement, the study's objectives and the significance of the study were discussed. Chapter One outlined the dissertation and concluded with a summary of the chapter.

Chapter Two

Chapter Two introduces the definitions, reviews relevant literature and concludes with a summary of the chapter.

Chapter Three

The research methodology, including an introduction, the study design, study setting, population, sampling process, data collection process, data analysis, ethical considerations, and summary of the chapter are presented.

Chapter Four

Chapter Four presents the results of data collected from the questionnaire and summary of the chapter.

Chapter Five

Chapter Five discusses and interprets the results and gives a summary.

Chapter Six

Chapter Six concludes the study and outlines the limitations and recommendations.

1.8 SUMMARY OF THE CHAPTER

In this chapter, a brief background on horse-riding and pain related to horse riding were discussed. The problem and significance of the literature and study were examined, which established a paucity in the literature, motivating the necessity to conduct this study. The outline of the objectives and dissertation was indicated.

CHAPTER TWO LITERATURE REVIEW

2.1 INTRODUCTION

Chapter Two consists of a comprehensive review of the current literature available on horse riders, equestrianism and MSK pain. This chapter gives the definitions and concepts of horse riding and MSK pain on a global, African and South African scale. The literature for this chapter was obtained from different search engines such as Google Scholar, Springer, DUT online library, PubMed and Wiley.

2.2 KEY DEFINITIONS AND CONCEPTS

2.2.1 Horse Rider

The Oxford English Dictionary (2023) described a horse rider as “one who rides a horse”, and the term equestrian is described as “a person skilled in horse riding”. Defining and categorising the horse rider is a complex task, as explored by Williams and Tabor (2017:31), who reported that the individual characteristics of horse riders vary as each rider develops their own ideals, skills, experiences and status, which also influences their connection and relationship with the horse. Experienced riders are described as horse riders with over 3000 hours of riding experience, including well-developed flatwork, jumping and competition ability (Williams and Tabor 2017:31). Flatwork riding consists of any type of riding that does not involve the horse jumping but is mostly a type of riding that is used to school a horse on a relatively flat surface area (Diedericks 2025). Professional horse riders are riders who have a form of employment in working and riding horses or coaching. Horse riders who compete regularly but equestrianism is not their main occupation are known as amateur riders. In addition, horse riders who predominantly hack and partake in the occasional unaffiliated equestrian activities are referred to as leisure riders. Hacking describes a non-competitive, leisurely style of riding which consists of riding outside of an arena, mostly along the roads or on trails (Guerin 2023). Inexperienced horse riders with less than 3 000 hours of horse-riding experience are termed novice riders.

For the relevance of this study, to categorise the level of horse riders, the professional rider is described as a rider with a well-developed flatwork, jumping and competition ability. A professional rider could also be categorised as a rider whose form of employment consists of working and riding horses or a horse rider who competes regularly in competitions. The experienced rider is described as a rider with well-developed, competent flatwork and jumping ability and moderate competition ability; a horse rider who partakes in monthly or bi-monthly competitions; or a horse rider who does weekly dressage riding. The amateur

rider is defined as a rider who has less than 3000 hours of riding experience or a rider who mostly hacks and partakes in the occasional dressage experience.

2.2.2 Dressage

The Oxford English Dictionary (2023) defined dressage as the art or discipline of training a horse for obedience and good behaviour, focusing on control, flexibility, and balance. The Cambridge Dictionary (2024) further elaborated, describing dressage as “the training of a horse to perform specific, carefully controlled movements as directed by the rider, or the execution of these movements as a sport or in competition”. The equestrian discipline of dressage may be defined as a performance by rider and horse which consists of a five to eight minute flatwork test. The entire dressage test is made up of a series and sequence of gaits and patterns, which are evaluated by a judge and each receive a separate score (Douglas *et al.* 2012: 58; Hobbs *et al.* 2020: 2).

2.3 MUSCULOSKELETAL PAIN

2.3.1 Musculoskeletal (MSK)

The Cambridge Dictionary (2024) defined MSK as “relating to the muscles and skeleton and including bones, joints, tendons and muscles”. Furthermore, MSK pain may be defined as pain originating from bones, joints, ligaments, tendons, muscles and/or multiple body areas or regions (Safiri *et al.* 2021: 856; WHO 2022: 1).

2.3.2 Pain

The International Association of the Study of Pain (IASP) defined pain as an “unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage” (IASP 2020). The IASP elaborated on this definition by adding six caveats regarding the experience and etymology of pain (IASP 2020). Pain is organised into different classes based on its intensity, the region and/or the period of occurrence. Acute pain is described as pain that’s onset is sudden and has a short duration of less than three months and is often associated with a known cause (Schmidt and Wllis 2007: 35). Subacute pain occurs for at least six weeks but not more than three months and, therefore, it is described as a subset of acute pain. Chronic pain is described as pain occurring for three months or more and is often associated with an unknown or uncertain cause. Acute pain, in contrast, has been distinguished as a risk factor for the progression into chronic pain (Schmidt and Wllis 2007: 35; Bonezzi *et al.* 2020: 2).

2.4 GLOBAL VIEW

2.4.1 Equestrianism in the Context of a Global View

Horse riding is a unique sport in comparison to other sporting disciplines as it is complicated by the dynamic partnership between a horse and its rider. The rider and the horse both have individual personalities that shape the horse-rider relationship (Williams and Tabor 2017: 31). The personality of a rider differs between the various categories of riders and disciplines, which may influence their riding.

The globalisation of equestrianism has evolved from the historical concept of using horses as a purpose of transport to the progression of using horses in recreational riding and for commercial tourism (Ollenburg 2005: 48). In developed nations, recreational horse riding has expanded to approximately 20 million active horse riders, being popular in Europe, Canada, the United States of America and South America. Many other countries, such as Germany, France, and Hungary, have established national bodies to promote equestrianism as local riding organisations expanded (Ollenburg 2005: 48).

Recreational horse riding is diversified into many different recognised disciplines, such as show jumping, dressage, three-day eventing, cross-country, endurance and many other disciplines (Hedenborg 2014: 6). Hedenborg (2014: 6) elaborated that those many disciplines developed into international sports, initiating the formation of the Fédération Equestre Internationale (FEI) as a governing body in the 1950s. The international events categorised under the FEI include dressage, show jumping, eventing, endurance, driving, reining, vaulting and para-equestrian disciplines. The FEI has allowed for the affiliation of 132 national federations.

Ollenburg (2005: 49) described the commercialisation of equestrianism as the limited and basic interaction between horses and humans and, therefore, products from commercial equestrian tourism cannot belong to any riding discipline. Commercial equestrianism consists of guided horse trails and tours, farm stays for guests, horse riding clinics and camps, and horse-drawn carriages.

The growing rate of the equestrian economy has given rise to a new development where equestrianism is not only used for leisurely activity but has allowed for the development of a new labour working environment, such as the New Zealand stable hands being predominantly females or a family-run equestrian stable yard (Adelman 2017: 6). Adelman (2017: 7) expanded on the view of equestrianism over different ages and communities by indicating how the use of pony clubs and riding centres has created an encouraging environment for young children to participate in equestrian activities. The study further

elaborated on the development of unique equestrian programmes for committed elderly riders and older people who are not horse riders, which has allowed for the opportunity to take up equestrian activities or continue with their riding ambitions, especially for individuals from urban middle classes. However, elderly individuals from rural, cultural communities continue to ride horses due to their circumstances of living in less developed communities, as seen in Brazil and urban middle classes.

Equestrian sport has been viewed for many years as a sport equalising gender participation as men and women are able to compete on equal terms (Adelman and Thompson 2017: 5). This concept holds some truth as both genders compete against each other using the same standards and rules. However, this concept has changed in recent years as literature has shown that some equestrian practices, such as horse racing within SA, are predominantly male dominated depending on the individualised elements of the equestrian workload and sport (Adelman and Thompson 2017: 5).

2.4.2 Dressage in the Context of a Global View

There are seven disciplines of equestrian-related activities recognised by the FEI; the three of the seven disciplines that are highly recognised at the Olympic competition level are dressage, show jumping and three-day eventing (Douglas *et al.* 2012: 53; Gates and Lin 2020: 17). The equestrian discipline of dressage may be defined as a performance by rider and horse which consists of a five to eight minute flatwork test consisting of limited movements and sustained muscular contractions by the rider (Douglas *et al.* 2012: 58). This performance is a pre-defined test which is evaluated by a judge or judges who then award the performance with a percentage score. The entire dressage test is made up of a sequence of gaits and patterns, which each receive an individual score from a judge. These individual scores are added together to calculate the final percentage for the test (Hobbs *et al.* 2020: 2). Optimal performance in horse riding can only be achieved through both horse and rider performing adequately at the same time (Douglas *et al.* 2012: 54).

A review by Stickland (2022), including countries from Asia, Europe, North and South America and Oceania, reported on the global dressage economy, stating that it was estimated that in 2019, 3 000 riders were competing at FEI level dressage, ranging from pony riders to professional and para riders. However, the study acknowledged that many riders may not compete at any level or may only compete at non-affiliated dressage competitions. Consequently, this makes it difficult to estimate the total number of dressage riders nationally and internationally. Nevertheless, Stickland (2022) estimated a total of 167 000 dressage riders worldwide with a 12% uncertainty rate. According to the latest 2022

annual report by the FEI, it was estimated a total of 722 FEI dressage events and 3 926 FEI dressage athletes were registered globally (FEI 2022).

2.4.3 Musculoskeletal Pain in the Context of a Global View

The global burden of disease study has categorised the cause of MSK pain into the categories of arthritic causes, gout, back and neck pain, and a group of other causes, which comprise autoimmune causes, inflammatory causes and disorders of joints, ligaments, tendons and muscles (Blyth *et al.* 2019: 35).

According to El-Tallawy *et al.* (2021: 185), MSK pain may be severe and localised. When the pain is localised to the joints, individuals experience certain postures or activities that aggravate or ease the pain. The symptoms associated with MSK pain may vary from feeling as though the muscle has been overworked or strained, to body stiffness, aches or fatigue (El-Tallawy *et al.* 2021: 185). In an earlier study by Leeuw *et al.* (2007: 78), the complexity of pain was described as compromising of psychological, behavioural, and cognitive elements. These elements were considered in the fear-avoidance model of pain (Vlaeyen and Linton 2000: 317). Individuals suffering from pain often experience a fear of injury or re-injury, activities and pain. However, this fear around experiencing pain may give rise to the anticipation of pain, creating anxiety around it, which may lead to the avoidance of activities.

The Global Burden of Disease may have greatly underestimate the extent of MSK pain, especially when categorising the cause of MSK pain (Blyth *et al.* 2019: 37). Many non-specific MSK conditions arise from no specific tissue-based causes but still contribute to a low level of pain and disability. Alternatively, other pain and MSK conditions causing disability are not acknowledged as pain or a burden (Blyth *et al.* 2019: 37). El-Tallawy *et al.* (2021: 182) reported that MSK pain may also arise from sprained muscles, fractures causing pain and others, as well as most adults experiencing MSK pain due to overuse or injury. This is supported by Sire *et al.* (2021: 2), that MSK pain may arise from sports-related injuries, which are specific to the characteristics and physical stresses related to the specific sport.

Blyth *et al.* (2019: 35) stated that there is an expected rise in the global burden related to pain as painful MSK conditions are related to an increase in age. However, a more concerning aspect of global aging is that less-developed countries, such as the central African countries and some middle Eastern countries (The World Bank 2025) are aging more rapidly compared to more-developed countries. This may set the precedence that less-developed countries are at a greater risk of experiencing MSK pain more predominantly than more developed countries. Blyth *et al.* (2019: 36) raise the concerns

about the Global Burden of Disease methodology not including the economic differences between low-, middle- and high-income countries. Economic differences between countries may negatively or positively impact the medical care received and the productivity lost due to the impact of pain. Dissimilarly, El-Tallawy *et al.* (2021: 184) stated that rural and urban populations experience the same prevalence of MSK pain and that industrialised countries experience a higher prevalence of MSK pain as a global burden. However, the poor epidemiological data in low- and middle-income countries result in poor estimations of the global prevalence of pain related to those countries.

There is controversy in the literature regarding MSK pain in athletes. According to Legault, Descarreaux and Cantin (2015: 2), adolescent athlete population is at risk for injuries when exposed to extremely high levels of training or inappropriate methods of training. Adolescent athletes who did daily exercise for one hour or more experienced increased risks of MSK complaints of the lower extremities but conversely reported to have decreased complaints related to back pain. In a cross-sectional study by Goes *et al.* (2020: 2), which assessed MSK injuries in athletes, each sport modality is reported to present with a difference in prevalence and location of MSK injury.

Zemkova, Kovåcikova and Zapletalova (2020: 22) verified that the training load in individual athletes, including horse riders, and team sports may be associated with the occurrences of back problems. Zemkova, Kovåcikova and Zapletalova (2020: 23) continued to report the importance of acknowledging the relationship between pain and the effects of physiological loading of the spine in athletes reporting back pain as the athletes undergo adaptations in pain limits and may experience greater tolerances to pain at rest. This relationship was supported through the evidence that athletes and a normally active control experienced a difference in pain perception and processing (Zemkova, Kovåcikova and Zapletalova 2020: 22). The diversity of MSK injuries across different sporting modalities highlights the importance of research within each sport to allow for the assessment of athlete health and to create programmes specific for injury prevention and training within different sporting modalities.

2.5 CONTEXT IN AFRICA AND SOUTH AFRICA

2.5.1 Dressage in the Context of South Africa

Equestrian-based activities at stable yards in SA differ from international standards. SA has drier and warmer climates compared to European countries that receive rain throughout the year. The constant supply of rain within the European countries results in rich grazing, which may be a health risk for horses and the ground being wet and slippery is a risk for horses

to injure themselves; therefore, horses spend most of their time standing in the stable. The long days of standing indoors can have a negative influence on the horse's mental health. SA has more agricultural space for paddocks and arena facilities, along with a drier climate, which allows for horses to have more outdoor time compared to European countries. SA is more efficient in providing services to the horse riders through employing stable assistants, which decreases the amount of stable yard work performed by the rider (Harrison 2016).

McNeil (2013: 17) stated that although dressage in SA remains a minority sport, it receives support to enhance dressage training and shows. This is achieved through using international judges to judge at local and national shows and host clinics to help riders gain more exposure to current training methods and judging standards. Dressage standards are also improved through importing horses from overseas that are already trained for the higher dressage levels.

The South African equestrian structure is constructed with the South African Equestrian Federation (SAEF) as the representative and governing body for the various equestrian disciplines in SA (SAEF 2024). The SAEF is the officially registered federation with the South African Sports Confederation and Olympic Committee. It maintains and governs the relationship between SA equestrian sport and the FEI. Underneath SAEF is the discipline of dressage, which is represented through the Dressage SA Council. This council is responsible for supporting dressage riders, horses and officials in SA and within each province. It is also responsible for administering the rules and regulations of the discipline (Dressage SA 2024).

The 2022 annual FEI report on SA reported a total of 199 registered FEI equestrian athletes. When compared over 15 years, there was a calculated 72% decrease in FEI registered athletes. There were only 29 South African FEI registered dressage riders in the year 2022 (FEI 2022). The current 2024 FEI database indicates that SA has a total of 141 registered FEI athletes across all disciplines (FEI 2024). In the 2023 SAEF President's annual report, it was calculated that dressage memberships consisted of 17% of the memberships across the disciplines (SAEF 2023).

2.5.2 Musculoskeletal Pain in the Context of South Africa

The South African economy has been reported to have a wide mix of economic statuses across the different sectors of the economy but has, overall, been classified as an upper-middle-income country along with Mauritius, Botswana, Namibia, Guinea, Gabon and Libya (Jobarteh 2024). Briggs *et al.* (2023: 130) stated that the burden of disease in low- and middle-income countries is greatly affected by MSK pain, injury and health impairments. This burden is also affected by the delayed, deprioritised health response for MSK pain in

low- and middle-income countries. Briggs *et al.* (2023: 131) further reported that within low- and middle-income countries, there is a gap in acknowledgement around creating and initiating appropriate health care system solutions for MSK health conditions, which may be due to the lower-resourced status of low- and middle-income countries. South African healthcare consists of public and private healthcare but there are many discrepancies within and between the two systems (Ernstzen *et al.* 2023: 2). Ernstzen *et al.* (2023: 7) identified the following factors that may contribute to the difficulties in providing adequate healthcare to the population: organisation of the primary health care level, differences in practice patterns, difficulty in accessing healthcare, the accessibility of equipment, healthcare that is not patient specific, language barriers, and diversity amongst cultures. These factors may contribute to the chronic pain experienced by the population.

In a large survey consisting of 10 336 participants by Kamerman *et al.* (2020: 1630), on chronic pain in South African adults, it was reported that 18.3% of adults reported having chronic pain, resulting in a mean of one in five South African adults experiencing chronic pain. It was reported that the limbs were the most frequently affected body site for chronic pain, followed by the back region. Most individuals experiencing chronic pain reported having a poor health status. Findings by Kamerman *et al.* (2020: 1631) supported the statement by El-Tallawy *et al.* (2021: 184), as Kamerman *et al.* (2020: 1631) reported no association between the incidence of chronic pain and sociodemographic factors, such as education, living and wealth, employment status and access to health care in the South African adult population. However, Kamerman *et al.* (2020: 1634) were unable to explain or investigate why those factors do not affect the prevalence of chronic pain.

2.6 THE PREVALENCE OF MUSCULOSKELETAL PAIN IN DRESSAGE HORSE RIDERS

Horses often exhibit unpredictable behaviour, which predisposes horse riders to injury. Injury risk is further increased by the increased height of the rider on the horse, the velocity of horse riding, the kicking force and the weight of the horse (Hoffmann *et al.* 2023: 1). In a cohort study by Hoffmann *et al.* (2023: 2), of 95 horse-related injuries in a level one trauma centre, 60.6% presented with trauma induced from falling off a horse. Upper extremity injuries were most prevalent, consisting of 52.5% of injuries and 20.2% were counted for lower extremity injuries. These results are reinforced by a study by Acton *et al.* (2019: 1065) indicating that the majority of equestrian-related injuries occurred from being mounted on a horse. The body regions that were most commonly injured while mounted on a horse were the upper extremity and trunk. The head and neck were the second most common region for injury. Fractures were the most common injury type to occur while mounted. Most horse-

riding injuries occurred due to falling from the horse but some also occurred from the horse bucking, rearing or spooking. The study done by Hoffman *et al.* (2023:2) and Acton *et al.* (2019: 1064) assessing the occurrence of traumatic horse-related injuries that presented to trauma centre through obtaining medical records from the hospitals, found that some fatal injuries were not reported, however, the occurrence of traumatic injuries are risk factors for the development of chronic musculoskeletal pain.

Horse riders who ride for an occupation more commonly sustain upper extremity injuries compared to horse riders who ride as a non-occupational sport and who are more commonly thrown from a horse or sustain head injury (Samuels *et al.* 2022: 173). In contrast, Deckers *et al.* (2020: 9) stated that professional riders are more likely to experience back pain at some time in their riding career compared with amateur riders. Professional riders experience an incidence rate of 88% compared to 73% in amateur riders. The prevalence of pain was further investigated by Lewis and Kennerley (2017: 260), who stated that 74% of elite dressage riders experience and compete with back pain; of the 74%, 62% reported the pain to be of chronic duration. In a cross-sectional study by Kraft *et al.* (2009: 2209) using magnetic resonance imaging (MRI) to investigate any significant findings on the lumbar spine in elite riders, 88% of riders reported a history of LBP and most riders had signs of disc degeneration on MRI, however there was no correlation between LBP and lumbar disc degeneration. Interestingly, dressage riders had a higher incidence of signs of disc degeneration compared to show jumpers and vaulters (Kraft *et al.* 2009: 2209). However, these reported findings include the combination of disciplines or only investigate the prevalence of back pain in elite dressage riders and did not assess the prevalence between the different levels of dressage horse riders.

In a South African research dissertation on the incidence of LBP in competitive show jumping riders, Peens (2020: 23) reported that, from a sample of 100 show jumpers, 42% experienced LBP at the time of the study. Of the 42% experiencing LBP, 66.7% of show jumpers suffered from LBP for one year or more, 42,9% experienced pain daily and 88.1% experienced intermittent pain frequency. Peens (2020: 27) revealed that 81% of riders had experienced LBP before.

In a recently published South African study investigating how prevalent LBP was in competitive dressage riders, Handley (2021: 27) reported that out of a sample of 100 riders, 71% of competitive dressage riders suffered from LBP over the course of a month and 56% suffered from LBP for more than six months. Among the 56% suffering from LBP, 36.4% experience the pain daily and 79.2% experience intermittent pain. In a research dissertation on adult horse riders who sustained horse riding injuries in KwaZulu-Natal by Catlin (2010: 99), in a sample size of 175 participants, 90.3% of riders reported having injuries due to

riding. The most prevalent injury to occur was muscle strains, followed by fractures. Regarding the locations of injuries, the head was reported as the most common site of injury, low back injury was the second most common site, followed by the shoulder. The studies completed by Handley, Peens and Catlin were potentially limited by a small group of riders participating in the research, therefore, only representing a small portion of the competitive dressage and equestrian population. The combination of results from this study adds to the research gathered by Handley(2021: 27), Peens (2020: 23) and Catlin (2010: 99).

2.7 RISK FACTORS ASSOCIATED WITH MUSCULOSKELETAL PAIN IN DRESSAGE HORSE RIDERS

Pain in dressage riders may arise from multiple factors (Lewis and Kennerly 2017: 260). These contributing factors may include the type of saddle being used, the number of horses being ridden, the mechanical differences in the horse's movement, history of previous horse-riding injury, and the weather.

2.7.1 Posture and Muscular Imbalances

Dressage seat and posture require a central riding position composed of the rider's shoulder, hip and heel being in vertical alignment with each other (Eckardt, Munz and Witte 2014: 1294). Eckardt, Munz and Witte (2014: 1298) indicated that dressage riders may have a postural tilt to the right during active riding; this asymmetry may be influenced by a difference between left and right knee flexion and/or extension during sitting trot, which may indicate asymmetrical biomechanics in the riders' extremities. Advanced riders differ in their riding position compared to novice riders as advanced riders adapt their position to sit more upright, causing their upper body to be closer to the vertical, which causes decreased range of motion within their trunk, as well as the elbows and knees. Expert riders tend to carry their arms more out in front of their body and have more of an extension in their elbows (Heidbuchel *et al.* 2023: 6).

To adopt to the central vertical position of dressage, horse riders externally rotate their hips, to maintain the external rotation of the hips riders will contract the gluteus median and minimus muscles as well as gluteus maximus to assist in the abducted hips, therefore, the rider will adopt a final position of abducted, extended and externally rotated hips. However, when this position is accompanied by increased tightness of the external hip rotator muscles, it will cause the hips to increase in external rotation, which may result in immobilising the riders' pelvis during riding (Cejudo *et al.* 2020: 10). Horse riders

experiencing LBP were shown to have decreased hip flexion and knee flexion flexibility compared to horse riders who had no low back (Cejudo *et al.* 2020: 9).

Gonzalez and Sarabon (2020: 7) reported significant differences in muscle modes between amateur and advanced horse riders. At a walk and trot, advanced riders activated their core muscles sooner and to a high degree. This may indicate that advanced riders maintain full engagement of their core muscles during riding, which may be due to the vertical trunk alignment of advanced riders while riding. Advanced riders had higher vastus lateralis muscle activity compared to novice riders, this may be due to advanced riders riding with wider hip angles and more internal rotation of the knee.

At the trot, it was shown that advanced riders have a more balanced and less tense sequence of muscle activation, which indicated that advanced riders have a better capability of preparing for the impact of the horses' movement at a neuromuscular level. Whereas novice riders had more chaotic activation across muscle groups, indicating that novice riders have a decreased ability to prepare and adjust to the horses' movements (Gonzalez *and* Sarabon 2020: 11).

Dressage horse riders adapt to a different riding style and technique compared to the other equestrian disciplines. Dressage riders ride with longer stirrups compared to showjumpers who ride with shorter stirrups. The longer stirrup length changes the dressage riders' position to adapt a more upright alignment, allowing for a more natural lumbar lordosis, whereas showjumpers adapt a flatter lumbar lordosis (Gines-Diaz *et al.* 2019: 533). The adaptation of the riding positions causes dressage riders to develop a hypokyphotic morphotype of the thoracic spine compared to showjumpers, who develop a hyperkyphotic morphotype (Gines-Diaz *et al.* 2019: 535). This difference in spinal morphotype between horse riding disciplines supports the need to evaluate the pain in horse riders separately between the disciplines.

2.7.2 Gait

The biomechanical demands are important when investigating the MSK system. There is a distinct difference in biomechanical movement of the rider between the various gaits of the horse and the diverse levels of riding (Douglas *et al.* 2012: 60). A rising trot requires the rider to activate the thigh muscle more, which induces more movement through the knees and hips. During cantering, the rider must use more muscle activity to stabilise their position. Throughout the horse's gait cycle, the rider moves their pelvis and shoulders in the opposite direction to maintain stabilisation and coordination with the horse. The rider also moves their elbows backwards and forwards to maintain contact with the bit (Douglas *et al.* 2012: 60). The bit is a metal instrument that is paced in the horses' mouth, reins are connected to

the bit which are held by the rider while riding for control and communication with the horse (Luke *et al*. 2023: 1). However, when investigating the asymmetry of movement patterns Douglas *et al.* (2012: 60) reported that majority of riders who displayed asymmetrical riding positions had their thoracic girdle rotated to the left. This asymmetry then translated into the left shoulder having increased movement at the right canter, and in the left canter, the right shoulder had increased movement. Furthermore, the asymmetry caused greater muscle activity stress which, in turn, increases the risk of injury.

During the natural movement of a horse, the horse tends to distribute more of its weight onto its forehand to position its centre of mass to its lowest point on its back, corresponding to the saddle region (Heidbuchel *et al.* 2023: 6). When doing dressage riding and flatwork riding, the horse needs to engage their hindquarters, which positions the centre of mass more backwards on the horse's back. Expert riders ride more collected gaits by using their seat and legs to encourage the horse to engage its hindquarters. Novice riders competing in lower-level dressage, ride more working gaits which is described as between the collected and medium gait (Heidbuchel *et al.* 2023: 6). A study by Heidbuchel *et al.* (2023: 6) gathered that novice riders rode with more force through the reins during medium canter compared to expert riders indicating that expert riders are more balanced with a more stable hand position. Additionally, Heidbuchel *et al.* (2023: 6) found that during collected canter, expert riders have less variability in trunk movement and angle. This may suggest that skilled riders have a more well-adjusted and steadier riding position through the horses' gaits compared to novice riders. In contrast, a South African study by Handley (2021: 30), on LBP in competitive dressage riders, revealed that there was an association between sitting trot and cantering causing an increase in LBP

2.7.3 Training Intensity

Research based around the physiological demands of horse riding varies and is limited due to the significant differences in riding style between disciplines; however, the different movements of the horse result in a change of physiological demands on the rider. The faster the horse moves and the more complex the movement is, the greater the chances of an increase in heart rate (Douglas *et al.* 2012: 58). Douglas *et al.* (2012: 59) reported that oxygen consumption increased as the horses' gait increased correlating to an increase in metabolic expenditure and, therefore, the higher the level of horse riding, the greater the need for aerobic fitness and conditioning.

A horse rider's performance and the horses' performance are affected by the rider's level of fitness; this difference is clear between competitive and leisure riders, as leisure riders may lack the appropriate conditioning, therefore, placing unrealistic expectations on their bodies

during riding. Horse riding may not be a high-intensity sport in comparison to individual or team sports but the level of activity is intense enough to create training adaptations as energy expenditure is affected by the changes in riding positions and changes in a horse's gait. (Best *et al.* 2023: 2). Handley (2021: 32) revealed that 38% of dressage riders experiencing LBP in the last month rode less than six hours a week, and only 26.8% of dressage riders experiencing LBP rode more than eight hours a week. The high intensity of training and the adaptation of an incorrect riding posture may lead to the development of increased stress on the spinal column and increased risk of spinal disorders. It has been reported that 43% of horse riders present with unbalanced spinal curvatures, and 52% present with unbalanced lumbar curvatures (Gines-Diaz *et al.* 2019: 537).

2.7.4 Competitions

In the study by Peens (2020:31) on the prevalence of LBP in show jumpers in SA, it was revealed that 55% of show jumpers experienced LBP when competing, and the majority of these riders reported that the pain is aggravated with competing or riding. Show jumpers also reported experiencing LBP after a competition or riding. It was correlated by Peens (2020: 33) that horse riders who did less jumping or spent less time riding had a decreased prevalence of experiencing LBP.

Similar findings were reported by Handley (2021:30), revealing that 48.1% of competitive dressage riders experienced LBP while riding or competing and 39% reported that the pain gets worse with riding or competing and 46.8% reported having LBP after riding or competing. In contrast, Handley (2021:30) also reported that 71.8% of dressage riders who had experienced LBP in the last month only rode for one or no shows in a month.

2.7.5 Length of Riding Career

In a retrospective study by Papachristos *et al.* (2014:1487), on the severity of equestrian-related injuries, it was reported that experienced riders are less at risk of sustaining equestrian-related injuries than inexperienced riders; however, experienced riders more commonly sustain more severe injuries. Alternatively, in a study by Deckers *et al.* (2020: 9), professional riders experienced a higher prevalence of back pain compared to amateur riders, indicating that the level of riding may be a contributing factor to horse riders experiencing back pain. Of note, Handley (2021: 36) reported that dressage horse riders experiencing LBP for more than six months mostly had 20 years of riding experience or more.

2.7.6 Saddle Type and Stirrup Length

The saddle allows for the most significant force to be transmitted between the horse and the rider. The patterns of force delivery through the saddle are in sequence with the horse's movement creating a cyclical pattern of force distribution between the horse and rider (Bye and Lewis 2020: 75). In a study by Bye and Lewis (2020: 80), on saddle and stirrup forces on a horse simulator, it was suggested that experienced riders can stabilise their weight distribution compared to novice riders who have a more variability. However, most riders had increased right-side saddle forces in all settings. Furthermore, when Bye and Lewis (2020: 81) assessed the stirrup forces, it was found that most riders distributed their weight onto the left stirrup.

Deckers *et al.* (2020: 9) further reported that the saddle type being used during riding is also a contributing cause to the occurrence of back pain, as riders only using jumping saddles more commonly experienced back pain. Horse riders who ride with jumping saddles are reported to be more at risk of developing back pain when compared to riders who ride with a dressage saddle (Deckers *et al.* 2020: 9). Additionally, 62% of elite dressage riders reported that the saddle design was a causative factor for back pain (Lewis and Kennerley 2017: 260).

2.7.7 History of Equestrian-Related Injuries

In a small retrospective study in Southern California conducted by Wang *et al.* (2022: 2), most riders had more than one anatomical location of injury or pain including the spinal regions, extremities and head. More than half of the horse riders reported having chronic injuries due to previous trauma or from overuse injuries. Overuse injuries and blunt trauma, such as falling off a horse, a horse falling on the rider or being kicked by a horse, are common causes of injury which may result in chronic symptoms and dysfunction. However, Lewis and Kennerley (2017: 261) reported that 57% of elite dressage riders experiencing pain did not associate the pain with an old or current horse-riding injury; this finding may indicate that the nature of the pain may be resulting from the intensity and duration of riding.

Papachristos *et al.* (2014: 1485) identified that the head is the most prevalent region of injury, as well as the region to sustain the most serious injuries. The spine was the second most prevalent region of injuries, thereafter the thorax, face, and then the upper limb and lower limb. Wessels *et al.* (2019: 55) reported on animal-related injuries at a major trauma centre in SA, concluding that 27% of animal-related injuries were due to horse-related injuries. Most of the equestrian-related injuries were due to horse-kick injuries to the head, abdomen, chest and groin. Some injuries were sustained from falling from the horse.

2.7.8 Non-Riding Related Injuries

Non-riding related injuries may also occur, such as being bitten by a horse, pulled by a horse or being hit by a horses' head due to sudden movements of the horse. Further injuries may also occur during the general handling of the horse while doing activities such as grooming, feeding and saddling (McCrory and Turner 2005: 9).

2.8 IMPACT OF MUSCULOSKELETAL PAIN IN HORSE RIDERS

Upon elaborating on the global burden of pain, Enright and Goucke (2016: 529) stated that surgery and trauma contribute to 25% of the chronic pain burden. In Victoria, Australia; Papachristos *et al.* (2014: 1486) reported that 43% of horse riders had ongoing pain and disability between zero to six months post-injury. Between six to 12 months post-injury, 58% experienced ongoing moderate to severe pain and between 74% to 79% of horse riders experienced none to mild pain and disability for more than 12 months post-injury. Papachristos *et al.* (2014: 1486) further stated that between four to 64 months post injury, 42% of injured horse riders returned to work with decreased ability. Spinal and head injuries were conveyed to have the most significant impact on the riders, requiring more than six months off work. The study conducted by Papachristos (2014: 1486) adequately reports the acute and chronic pain experienced by riders after a traumatic equestrian related injury, however, the study does not go into detail on how the pain affects the horse riders riding ability or daily living. A study by Cejudo *et al.* (2020: 6) showed that equestrian athletes with LBP had lower training volumes compared to asymptomatic equestrian athletes. Horse riders who experienced moderate to severe pain mostly consisted of horse riders between the ages of 18 to 35 years of age and those older than 45 years of age. Catlin (2010: 100) reported that 31% of adult horse riders in KwaZulu-Natal who had injuries missed competitions due to their injuries but 54.5% of injured horse riders continued to compete.

2.9 TREATMENT OF MUSCULOSKELETAL PAIN IN HORSE RIDERS

Horse riders experiencing muscular tightness and imbalances of lower limb muscles can partake in a flexibility programme specified to their restricted range of motion (Cejudo *et al.* 2020: 10). They may also experience pain related to overuse and chronic injuries. In a small retrospective study by Wang *et al.* (2022: 2) on chiropractic treatment for equestrian-related MSK injuries, a majority of riders (57.7%) received treatment for chronic injuries, which were suspected to be caused by previous trauma or overuse injuries. Wang *et al.* (2022: 2) continued to report that 60% of the chronic injuries as well as 10% of the overuse injuries were sufficiently treated and managed, that no further chiropractic treatments were required. The remaining patients received ongoing management treatments. These injuries

occurred from falling off a horse or the horse falling on the rider. The study by Wang *et al.* (2022: 2) indicated that chiropractic treatment may be of great benefit for equestrian-related MSK injuries. The study by Wang *et al.* (2022: 2) consisted of a very small sample size of 19 patients with an overall of 127 treatment visits which may not adequately represent the impact of chiropractic treatment on MSK injuries in horse riders. Catlin (2010: 100) reported that 85.2% of horse riders in KwaZulu-Natal received treatment for their injuries. Physiotherapy was the most favoured type of treatment received, followed by chiropractic treatment.

Physiotherapy treatment focusing on muscle motor control and general mobility directed at the pelvic and lower torso region have shown to decrease the risk of rider asymmetry and help improve balance (Heidbuchel *et al.* 2023: 2). This is supported by Gines-Diaz *et al.* (2019: 538) on the assessment of misalignments of the sagittal spine, recommending that exercise programmes or rehabilitative programmes can aid in addressing any imbalances. An aligned posture and a balanced spine can potentially improve the horse and rider performance as the rider is able to keep the correct posture, which helps the horse support the required movements (Gines-Diaz *et al.* 2019: 538). It is recommended that each discipline adopt the correct stirrup length related to the type of riding to decrease the risk of developing MSK pain, such as dressage riders riding with a longer stirrup length (Cejudo *et al.* 2020: 10).

2.10 SUMMARY OF THE CHAPTER

Previous studies by Douglas *et al.* (2012), Lewis and Kennerly (2017), and Deckers *et al.* (2020) assessed specific factors, especially related to back pain in horse riders, by incorporating and comparing multiple horse-riding disciplines in the study. Dressage horse riders adapt to a different riding style and technique compared to the other equestrian disciplines. Most literature on horse riders includes the combination of disciplines or only investigates the prevalence in elite dressage riders and does not combine the different categories of dressage horse riders. The difference in categories of dressage riding correlates to the time spent riding as well as the prevalence of pain between professional and amateur horse riders. These differences are important as studies have shown that they may influence the pain experienced by a horse rider.

CHAPTER THREE RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the methodology applied to conduct the research. The study design, study setting, study population, sampling process, data processing and ethical considerations are discussed in this chapter.

3.2 STUDY DESIGN

A research study design is the strategy that is used by researchers to establish a valid approach to answering research questions through collecting and analysing data (Ranganathan and Aggarwal 2018: 184). There are several different types of study designs, including qualitative, quantitative, descriptive, analytical, observational, and experimental. Bloomfield and Fisher (2019: 28) elaborated on the types of quantitative research design by describing descriptive research design as information and variables about a particular characteristic being identified and examined in a single sample, which are then measured, described and interpreted in a systematic manner.

This study used a quantitative, descriptive research method, as a relationship between variables is tested and any association between their cause and effect is investigated (Bloomfield and Fisher 2019: 27). The design implemented for this study was derived from a descriptive correlation design. Baker (2017: 174) described the correlation design as the method used to compare and portray the association between variables, even if there may or may not be an influence between variables.

The questionnaire underwent a pre-testing procedure through a focus group and a pilot study. A focus group provided the opportunity to collect relevant data related to the research, allowing for the improvement of the research design and questionnaire, as described by Sim and Waterfield (2019: 3004). The focus group aimed to allow for the researcher to gain information and guidance from the group rather than provide corrective information regarding the research and questionnaire.

To allow for the accurate process of development and validity of the questionnaire, conducting a pilot study assisted in ensuring the credibility of the questionnaire. (Story *et al.* 2019: 196). In (2017: 601) stated that the pilot study guides the researcher with regard to the techniques and processes involved in the main study through aiding in the planning and alterations of the main study. The procedures of the main study were reflected through the pilot study. The inclusion and exclusion criteria of the participants was assessed. The pilot study tested the suitability of the data collection method (In 2017: 601). The participants

selected for the focus group and pilot study were important to maintain the validity and reliability of the pre-testing procedure. Therefore, the category of participants who were selected was able to relate to different aspects of the research study, which ensured an overall comprehensive evaluation of the research study.

3.3 STUDY SETTING

A study setting includes the population, location and period of where and when the research was conducted. With permission obtained from Dressage SA and the South African Equestrian Federation (SAEF), this study was conducted at the relevant dressage shows within KZN. Permission was obtained from each respective show holder before proceeding with data collection at the event. The researcher spent the duration of the day at each show, approaching participants.

Dressage SA is an organisation that supports dressage riders, horses and officials in SA. The organisation is responsible for creating and regulating the rules of dressage in SA. The SAEF is the national governing body representing all equestrian sports in SA. The SAEF is responsible for governing the official association with the International Federation for Equestrian Sport (FEI) as well as participating in any interactions between equestrian riders and the South African government.

3.4 STUDY POPULATION

A study population is a subgroup of the target population that constitutes the subjects for the selection of the sample. A study population consists of recruited participants who are both eligible and available for the study (Hu 2014: 6412). This study's population consisted of dressage horse riders in KwaZulu-Natal between 18 to 60 years of age. The study population included horse riders whose primary discipline is dressage but some of these riders may partake in additional disciplines.

Table 3.1 has been provided by Dressage SA and indicates the total number of registered dressage horse riders within KwaZulu-Natal.

Table 3.1: Study population of dressage horse riders in KwaZulu-Natal, including the number of riders competing in the different grades.

Athletes in SA competing in Dressage	1020
Total competing athletes in KZN	109
By Area	
eThekwini	66
Midlands	12
Ballito	13
Camperdown	18
By Grades	
FEI Grades	7
Advanced	10
Medium	9
Elementary Medium	10
Elementary	21
Novice	46
Preliminary	6

3.5 SAMPLING PROCESS

A sampling process is the procedure of selecting participants from the study population. A sampling process ensures the process of reliability in representing the entire study population, thereby eliminating the risk of sampling bias (Martinez-Mesa *et al.* 2016: 326).

3.5.1 Sampling Techniques

Sampling techniques are separated into probability and non-probability techniques. Probability sampling is based on random selection, which enables equal opportunity for each case in the population to be selected. Random sampling, systematic sampling, stratified sampling, and cluster sampling are all examples of probability sampling. Non-probability sampling consists of the researcher using subjective judgment to select the sample (Berndt 2020: 224). Types of non-probability sampling can be expanded into quota sampling, purposive sampling snowball sampling and convenience sampling. (Berndt 2020: 224; Stratton 2021: 373).

In this study, horse riding participants were selected through the method of convenience sampling drawn from the dressage population within KwaZulu-Natal. A convenience

sampling technique was used due to the small study population and small sample size. This technique is useful for preliminary research that is being conducted as it allows for quick and efficient gathering of preliminary data on the research topic (Simkus and Mcleod 2023: 3). Participants are selected on criteria that allows for easy accessibility, availability and willingness to participate (Etikan *et al.* 2016: 2). The inclusion criteria must be met by all participants to partake in the study. For this study participants were approached physically at dressage related events and asked if they would be willing to participate in the study.

3.5.2 Sample Size

A sample size consists of a group of participants who were selected from the study population, representing a portion of the population. To calculate the minimum sample size required to represent the target population, a sample size formula was applied with the use of a sample size calculator. Using a confidence level of 95% and a margin of error of 5%, it was calculated that an adequate representative sample size to achieve was 86 participants from a population size of 109 (Loubser 2022) (Appendix A). The assumed prevalence estimate is calculated to 86 using a standard normal deviate or 1.96 for a confidence level of 95%, a desired precision of 0.096 and estimated prevalence of 71% of the condition based on the study by Handley (2021:27).

3.6. SAMPLING CHARACTERISTIC

3.6.1 Inclusion Criteria

- Participants were between the ages of 18 and 60 years of age.
- Dressage was the primary discipline which the participants participated.

3.6.2 Exclusion Criteria

- Participants who participated in the focus group and pilot study.
- Participants who participated in less than three hours of dressage riding per week.
- Participants who were not willing to sign the consent form (Appendix B)
- Participants who completed the questionnaire at a previous dressage competition.

The eligibility of the inclusion and exclusion criteria was assessed and confirmed by the researcher through asking the participants if they met the criteria or not.

3.7 DATA COLLECTION PROCESS

A quantitative research questionnaire uses numerically rated questions through the method of closed-ended questions, which are converted into indicators and graphs. Qualitative research questionnaires make use of open-ended questions, which allow participants to openly share their thoughts, allowing for more in-depth information (Ahmad *et al.* 2019: 2831).

Traditional self-administered questionnaires have a greater response rate in comparison to online surveys. The higher response rate of traditional questionnaires allows for better reliability and generalisability of the questionnaire, decreasing the risk of study bias (Mutepfa and Tapera 2018: 6). Mutepfa and Tapera (2018: 12) additionally reported that online questionnaires have their advantages. However, online questionnaires should be used in addition to traditional questionnaires and should not replace the use of traditional questionnaires.

A self-administered questionnaire was developed and distributed accordingly. The questionnaire consisted of a two-part sport-specific questionnaire, developed from the adaptation of relevant information from surveys used in research by Lewis and Kennerley (2017: 260), Pendock (2018: 116) and Deckers *et al.* (2020: 8) (**Table 3.2**). The questionnaire consisted of closed-response and open-response questions. The questionnaire took approximately five to seven minutes to complete and consisted of four pages.

The second part of the questionnaire consisted of a brief pain inventory (BPI) being adapted into the questionnaire to assess the disability of MSK pain in horse riders (Cleeland 2009: 5). The BPI allows for an assessment of the severity of pain and to what extent the pain interferes with various aspects of life (Stanhope 2016: 496). A study by Atkinson *et al.* (2011: 564) supported that the BPI is valid in assessing pain intensity and the level of activity interference and affective interference that pain has on an individual and how it influences their activities of daily living.

Table 3.2: Layout of the pre-testing questionnaire

Part 1:	**Sport-specific questionnaire**	
Section 1:	Demographic data	Deckers *et al.* (2020: 9)
Section 2:	Horse riding background	Deckers *et al.* (2020: 9); Lewis and Kennerley (2017: 260).
Section 3:	Musculoskeletal pain	Deckers *et al.* (2020: 9); Lewis and Kennerley (2017: 260); Pendock (2018: 116)
Part 2:	**Brief Pain Inventory**	(Cleeland 2009: 5)

Once the Durban University of Technology Institutional Research Ethics Committee (IREC) gave provisional ethical approval to conduct the research, both a focus group and followed by a pilot study were conducted to minimise the risk of researcher bias, non-response bias, recall bias and self-report bias related to the research (Story and Tait 2019: 199). Through the input of the focus group and pilot study questions remained objective to ensure personal opinions were minimalised, the design of the questionnaire was assessed by both groups allowing for the questions to be better understood which assisted with a better response rate from participants and minimised recall bias and self-report bias.

Gatekeepers' permission was requested from the Dressage SA and SAEF to conduct research on dressage horse riders in KwaZulu-Natal (Appendix C). Participants for the study were recruited by requesting permission from each show holder to conduct research at the relevant dressage event (Appendix D). Horse riders were physically approached to ask for participation in the study. Each participant was allowed to read the letter of information (Appendix E). If they chose to proceed, participants were required to sign the informed consent (Appendix B) before proceeding to answer the questionnaire (Appendix F). Data collection continued until the minimum representative sample required was achieved, avoiding the risk of data analysis not being statistically significant.

Participants were recruited from these dressage events until the minimum sample size requirement was achieved:

- 18th and 19th of May 2024 – DSA challenge – Centreline shows
- 25th of May 2024 – Biomechanics clinic
- 8th of June 2024 – Centreline Winter show and Youth Champs warm-up
- 27th July 2024 – KZN Dressage Championship

All data collected will be stored in its original form for a minimum of five years; thereafter, the data will be destroyed. The data have been stored in the Durban University of Technology Chiropractic Department. The data are made accessible to the researcher. All data have been stored against a numerical code rather than against the participant's personal information.

3.8 PRE-TESTING OF THE DATA COLLECTION TOOLS

3.8.1 Focus Group

A focus group provided the opportunity to collect relevant data related to the research, allowing for the improvement in the research design and questionnaire (Sim and Waterfield

2019: 3004). Participants were encouraged to freely discuss and share their thoughts and ideas related to the research and questionnaire. The focus group was provided with a letter of information about the research (Appendix G), a letter of informed consent (Appendix H), a confidentiality statement (Appendix I) and a questionnaire (Appendix J) to be evaluated and discussed.

The focus group consisted of:

- The researcher.
- The research supervisors.
- A qualified chiropractor with experience in quantitative research.
- A master's chiropractic student with experience in quantitative research.
- A professional dressage rider.
- An amateur dressage rider.

3.8.1.1 Inclusion Criteria for the Focus Group

- Participants 18 years of age or older.

3.8.1.2 Exclusion Criteria for the Focus Group

- Participants who did not sign the consent form (Appendix H) and confidentiality agreement (Appendix I).
- Participants who were unable to understand and comprehend the purpose of the focus group and research.
- Participants who were not willing to abide by online meeting etiquette, such as being punctual, dressing appropriately, speaking only when everyone has their turn and being polite and respectful to others in the focus group.

3.8.1.3 Procedure With Which the Focus Group Was Conducted

- The participants for the focus group were recruited through email, and the relevant participants were provided with a letter of information (Appendix G) about the research, including an agenda of the focus group meeting.
- Once participants were contacted and agreed to participate in the focus group, a Microsoft Teams meeting was arranged at a convenient date for each participant with a scheduled one-hour session. The use of Microsoft Teams allowed for the meeting to be video recorded and transcribed, allowing for meeting minutes to be accurately and reliably stored.
- The focus group was provided with a consent form (Appendix H), a confidentiality statement (Appendix I) and a questionnaire (Appendix J) that was evaluated and discussed.

- Before the commencement of the meeting, the researcher read out the letter of information about the research, informed consent and confidentiality agreement to ensure that all participants were adequately informed about the research and the focus group. The researcher also went through online etiquette before starting the meeting, ensuring an appropriate and timely meeting procedure.
- Participants were allowed the opportunity to ask questions regarding the procedure of the focus group and to clarify any misconceptions that the participants may have.
- Each participant was obligated to sign the informed consent and confidentiality agreement before further discussions about the research and questionnaire could commence.
- The researcher read out each question of the questionnaire, then provided the opportunity for the participants to review the question. The participants then decided collectively whether they approved of the question or not.
- Once the focus group was concluded, the researcher revised the importance of confidentiality and anonymity regarding the participants and research.

3.8.2 Pilot Study

- The pilot study consisted of one amateur dressage rider and one professional dressage rider.

3.8.2.1 Inclusion Criteria

- Participants were between the ages of 18 and 60 years of age.
- Dressage was the primary discipline that the participants participated in.
- Symptomatic and asymptomatic participants.

3.8.2.2 Exclusion Criteria

Participants who were not willing to sign the consent form (Appendix K) or the confidentiality agreement (Appendix L).

3.8.2.3 Procedure With Which the Pilot Study Was Conducted

- Once ethical clearance was granted from IREC and the focus group was conducted, the pilot study commenced.
- Participants were approached individually on different occasions. Each participant was offered a letter of information about the research (Appendix M), an informed consent (Appendix K) and a confidentiality agreement (Appendix L).
- Once the consent form and confidentiality agreement were signed, the questionnaire (Appendix N) and the questionnaire evaluation form (Appendix O) were handed to

the participant. The questionnaire evaluation form allowed for appropriate feedback from the pilot study participants about their experiences and suggestions related to the questionnaire.

3.8.3 Main Study Data Collection

Once the focus group and pilot study were completed and full approval (Appendix P) was received from IREC, the main study data collection began:

- Permission was requested from each show holder to conduct research at the relevant dressage competition (Appendix D).
- Horse riders were physically approached to ask for participation in the study. Each participant was allowed to read the letter of information (Appendix E). If they were willing to proceed, participants were required to sign the informed consent (Appendix B) before they proceeded to answer the questionnaire (Appendix F).
- All data collected were encoded and anonymised with a numerical code as a form of identification (i.e. participant 01, participant 02, and so forth), which ensured anonymity and privacy of all personal information. All data were stored against the numerical code rather than against the participants' personal information.
- All procedures throughout the research project were clearly and accurately recorded to demonstrate that the appropriate research practice had been followed.
- Once enough data had been collected and encoded, the data were sent to a qualified statistician to be processed.

3.9 DATA ANALYSIS

Quantitative data are data collected into numerical records. Data analysis is used to reveal and compare underlying patterns and relationships from the raw numerical data collected from the relevant research (Albers 2017: 218). Summary statistics were reported as histograms, frequencies, percentages for categorical data, and means/standard deviations for ordinal/continuous data. For comparison purposes, cross-tabulation with the chi-square test was used to compare categorical responses. One-way ANOVA was used to compare ordinal/continuous responses between groups, and correlation analyses for testing relationships between ordinal/continuous responses where only one effect is tested. Statistica 14 was used to do the statistical analyses. The reliability of the pain interference and pain severity will be analysed through using the Cronbach's alpha calculation.(Kidd 2023) (Appendix Q).

Correlation may also be shown through the use of various graphs, such as scatterplots. This is established through the linear relationship between quantitative variables. The

variables are identified, and data on each variable is collected. There is no intervention done on the variable before, during or after the data collection. Data are collected at one general point (Baker 2017: 176).

The data gathered explores many potential associations between factors which however also creates the risk of having a type 1 error. Therefore, there may be a non-significant association that may have been misinterpreted as being significant creating a falsely 'significant' association (Kaur and Stoltzfus 2017: 269)

3.10 RESEARCH RIGOUR

Zamanzadeh *et al.* (2015: 165) defined validity as the research instruments' ability to accurately represent the true findings from the population. Content validity is the ability of specific items in a questionnaire to accurately represent the content. According to Peeters and Harpe (2020: 1128), construct validity focuses on an instrument's ability to measure any underlying variable or phenomenon of interest. Reliability can be simplified as the precision of the research instrument and the data. Reliability and validity are measured congruently as the consistency of data contributes towards the validity of an instrument (Peeters and Harpe 2020: 1129).

Throughout the research procedure, validity and reliability were taken into account. To ensure an accurate sample size, a sample size formula was applied with use of a sample size calculator (Appendix A). Using a confidence level of 95 and a margin error of 5%, it is calculated that the adequate sample size is to achieve 86 participants from a population size of 109 (Loubser 2022). Data collection continued until the minimum sample size required was achieved to avoid the risk of not statistically significant data analysis.

The questionnaire underwent a pre-testing procedure through a focus group and a pilot study to allow for improvement in the research design and questionnaire (Sim and Waterfield 2019: 3004). The pilot study tested the suitability of the data collection method (In 2017: 601). The participants selected for the focus group and pilot study were important to maintain the validity and reliability of the pre-testing procedure. Therefore, the category of participants selected was able to relate to different aspects of the research study, which ensured an overall comprehensive evaluation of the research study.

3.11 ETHICAL CONSIDERATIONS

3.11.1 Autonomy and Voluntary Participation

Autonomy can be described as each individual's worth and their ability to make rational decisions as well as moral choices, each individual of sound mind has the right to exercise

their self-determination (Varkey 2021: 19). All participants have the freedom of choice to participate in the study and are entitled to withdrawal from the study at any time within their own free will. There are no consequences involved if the participant chooses to withdraw from the study.

3.11.2 Informed Consent

Informed consent requires for the participant to understand and decide competently, the participant receives a full disclosure of the research, the participant can comprehend the disclosure, the participant acts voluntarily in deciding and giving their consent for participation (Varkey 2021: 19). All participants were over the age of 18, thus over the legal age requirement of giving informed consent. Participants were informed about the content of the research (Appendix E) and were required to sign an informed consent form before proceeding with the questionnaire (Appendix B).

3.11.3 Anonymity

Anonymity was maintained by not collecting any identifying information regarding the participants, such as participants' name, surname, contact details, physical address and photos. Through the use of third-party software services, participants' internet protocol addresses may become available contradicting to the concept of anonymity; however, the use of data pseudonymisation was adapted by replacing participants' information with numerical values as a form of identification (such as participant 01, participant 02, and so forth), which ensured anonymity and privacy of all information (Bhandari 2021; Varkey 2021: 19)

3.11.4 Confidentiality

The confidentiality of all participants was kept private by encoding and anonymising all personal identification information with a numerical code as a form of identification (i.e. participant 01, participant 02), which will ensure anonymity and privacy of all information. All data were stored against the numerical code rather than against the participants' personal information. Confidentiality was maintained by storing and maintaining all participant data on a password-protected computer and hard drive.

3.11.5 Beneficence

Beneficence may be defined as maintaining the well-being of participants in the research study. The study will prove to benefit all participants and non-participants by adding vital information to the limited volume of knowledge regarding back pain in horse riders. The results and information obtained from this study may provide an improved understanding

within the health care professions of back pain related to the equestrian sport (Varkey 2021: 18).

3.11.6 Non-Maleficence

Non-maleficence is defined as “not harm”. All questionnaire content was psychologically sensitive to ensure no or minimal psychological effects on the participants. The study did not involve any risk of physical, social or legal harm. All participants were protected from any potential harm, which was reassured through the process of a pilot study and a focus group. Participants could also complete a questionnaire review, allowing them the opportunity to raise any concerns or complaints regarding the questionnaire (Varkey 2021: 18).

3.11.7 Justice

Justice is defined as the fair, equitable and appropriate inclusion of participants within the research study. Participants were not excluded from the research based on their race, ethnicity, gender or culture, ensuring that all participants receive a fair and justice just opportunity to participate in the research (Varkey 2021: 20).

3.11.8 Management of Research Data and Records

All data collected will be stored in its original form for a minimum of five years; thereafter, all electronic data will be deleted and all hard copy data will be destroyed. The data have been stored in the Durban University of Technology Chiropractic Department. The data have been made accessible to the researcher. If publication is made and the research is in the public domain, the data will, upon request, be made available to other researchers through the approval of the principal investigator. In the instance of the researcher leaving the university, there is a combined responsibility of the university and the researcher to maintain the accurate storage of data sets. All data were stored against numerical codes rather than against the participants’ personal information.

3.12 SUMMARY OF THE CHAPTER

The study adapted a quantitative study design with a descriptive research method consisting of a questionnaire-based data collection tool. A focus group and pilot study were conducted as pre-testing tools to ensure the validity and reliability of the research method. For the main procedure of data collection, participants were approached at various equestrian events to complete the questionnaire with the assurance that the inclusion and exclusion criteria were adhered to. All ethical considerations of the participants were

adhered to, such as autonomy, anonymity, confidentiality, beneficence, non-maleficence, justice, informed consent and management of data and records.

CHAPTER FOUR RESULTS

4.1 INTRODUCTION

Chapter Four presents the results attained from the statistical evaluation of the data collected from the questionnaire. Only tables and graphs of statistical relevance are discussed in this chapter, whereas, the statistical data of low relevance to the study's objectives are represented in the chapter, with the associated tables and graphs included.

4.2 SAMPLE SIZE AND RESPONSE RATE

An adequate minimal sample size of 86 participants was required for this study to represent the portion of the population accurately. A total of 89 questionnaires were completed by the participants of a study population of 109 dressage riders in KZN, resulting in an 81.65% response rate.

4.3 DEMOGRAPHICS

4.3.1 Age, Gender, Weight and Height

The mean age, weight and height of all participants is displayed in **Table 4.1**. The different gender statistics gathered from the 89 participants that completed the questionnaire revealed 94% of participants were female.

Table 4.1: A summary of the participants' gathered data described by age, weight, height and their statistical analysis

	N		Median	Q1	Q3	Minimum	Max
	Valid	Missing					
Age	89	-	40	26	50	18	65
Weight (kg)	89	-	65	58	70	43	100
Height(cm)	89	-	165	160	170	150	196

4.4 HORSE RIDING BACKGROUND

4.4.1 Level of Riding

Most horse riders categorised themselves as experienced riders (n=51/89; 57%), followed by 21/89 (24%) participants categorised as amateur riders and 17/89 (19%) riders categorised as professional riders.

4.4.2 Years of Riding

The average number of years riding is displayed in **Table 4.2**. Most riders have been riding for 14 to 34 years as the 25th percentile was 14 and the 75th percentile was 34.

Table 4.2: The average number of years riding

	N	Median	Mean	Std Deviation	Min	Max
Years of riding	89	21	24.57	13.74	3	56

4.4.3 Average Number of Hours a Day and Days Per Week Spent Riding and Frequency of Competing in Shows

Table 4.3 displays the combined results of the average number of hours a day spent riding, the average number of days per week spent riding and the frequency of competing in shows.

Table 4.3: The combined results of the average number of hours a week spent riding, the average number of days per week spent riding and the frequency of competing in shows

		No. of cases	Percentage (%)
Hours a day	30min–1hr	45	51
	2hrs–3hrs	27	30
	3hrs–4hrs	6	7
	More than 4hrs	11	12
Days per week	1–2 days	5	6
	2 –3 days	9	10
	3 – 4	25	28
	5 or more days	50	56
Frequency of competing in shows	Do not compete	16	18
	Less than once a month	20	22
	1–2 times a month	43	48
	3–4 times a month	6	7
	4–5 times a month	3	3
	6 or more times a month	1	1

4.5 MUSCULOSKELETAL PAIN HISTORY

Musculoskeletal pain was a common occurrence in riders as 83%(N=74) of riders reported to have experienced musculoskeletal pain at some point related to riding. Additionally, LBP was the most common region where riders experienced pain at some point related to riding as reported in **Table 4.4** with a median of 3 per participant as Q1 was 2 and Q3 was 7.

Table 4.4: Prevalence of musculoskeletal pain and the region pain was experienced (N=89)

		Percentage (%)
Region	Low back	65

	Shoulder	36
	Knee	34
	Neck	30
	Hip	30
	Mid-back	27
	Foot and ankle	19
	Wrist and hand	10
	Elbow	2

The majority of the dressage riders who had experienced MSK pain at some point related to riding received treatment for their pain (84%). Other types of treatment consisted of massage, osteopathic treatment and fascia release (**Table 4.5**). Most participants received 1 type of treatment as the mode of 1 however, the median was 2 with a Q1 of 1 and Q3 of 5.

Table 4.5: Treatment received for musculoskeletal pain (N=89)

		Percentage (%)
Type of treatment	Chiropractor	64
	Physiotherapy	38
	Orthopaedic surgeon	13
	General practitioner	7
	Other	6
	Homeopath	4
	Occupational therapist	1

4.6 CURRENT MUSCULOSKELETAL PAIN

4.6.1 Musculoskeletal Pain in the Last Year and Regions

Table 4.6 indicates from the 89%(N=66) of riders had experienced MSK pain related to riding, among the 74 riders who had MSK pain in the last year, as well as the regions where MSK pain was experienced. The median of **table 4.6** was 2 with a Q1 of 1 and Q3 of 6.

Table 4.6: Musculoskeletal pain in the last year and regions (N=74)

		Percentage (%)
Region	Low back	48
	Neck	25
	Mid-back	25
	Knee	25
	Shoulder	24
	Hip	21
	Foot and ankle	12

	Wrist and hand	4
	Elbow	2

4.6.2 Generalised Character of Musculoskeletal Pain

To better understand the complexity of pain, participants were given a selection of options in an attempt to adequately describe their pain as displayed in **Table 4.7**. In **Figure 4.1,** the character of MSK pain is analysed through the number of cases reported. Most participants experienced 2 types of pain characters with a mode of 2 and the median resulting in 3 with a Q1 of 1 and Q3 of 8.

Table 4.7: Character of musculoskeletal pain

			Percentage (%)			
		N	Sometimes	Often	Constantly	Only when severe
Character	Aching	56	38	43	16	4
	Dull	26	54	35	12	–
	Sharp	26	62	15	4	19
	Shooting	23	43	13	4	39
	Stabbing	20	50	25	–	25
	Throbbing	19	37	37	16	11
	Tightness/spasm	51	27	57	12	4
	Burning	17	29	35	6	29

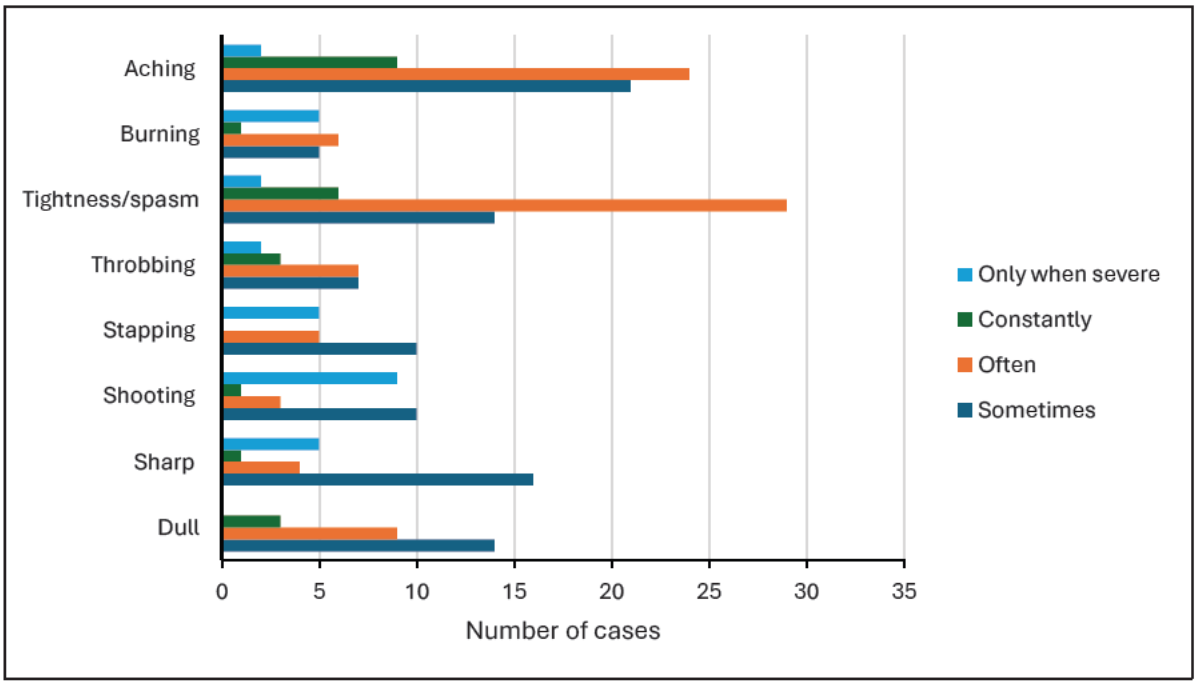

Figure 4.1: Character of MSK pain described by the number of participants

4.6.3 Musculoskeletal Pain Aggravating Factors

Figure 4.2 demonstrated the comparisons of horse riding related risk factors that may cause an increase in pain. Other factors mentioned include riding a horse with an abnormal or unbalanced gait and not riding.

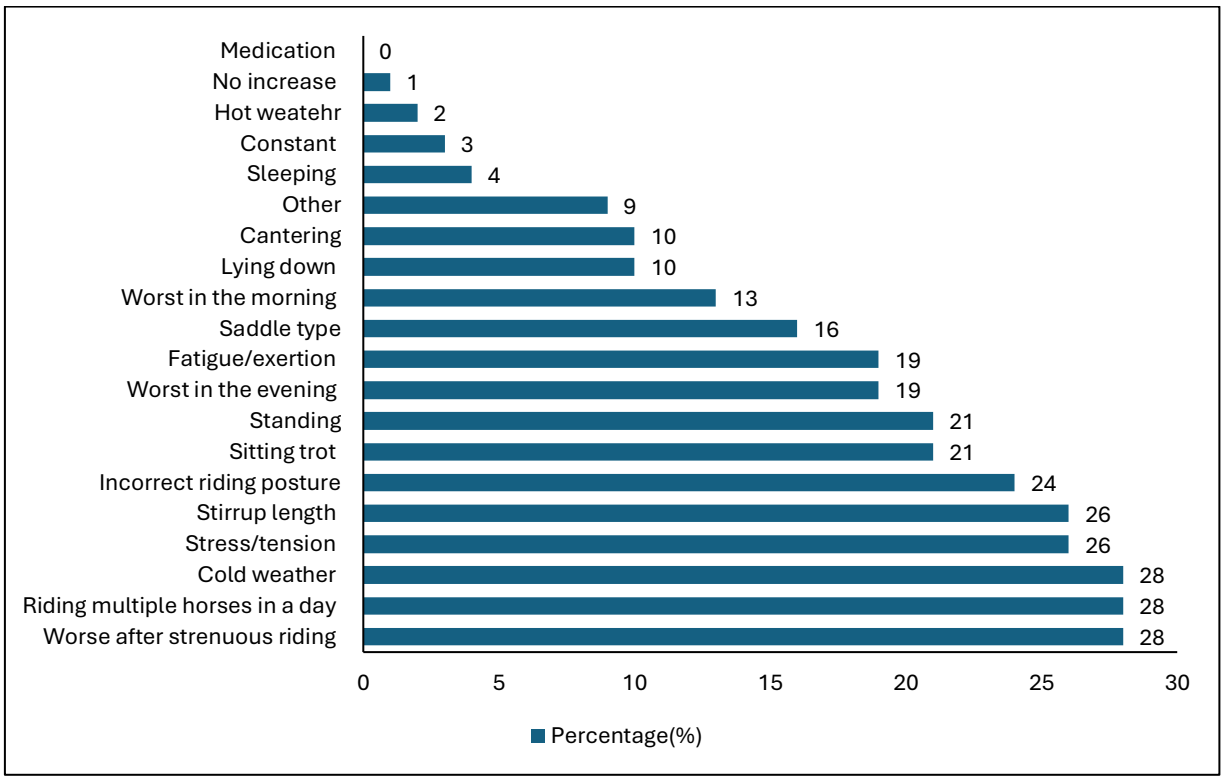

Figure 4.2: Musculoskeletal pain aggravating factors (N=89)

4.6.4 The Effect of Musculoskeletal Pain on Riding

Table 4.8 translates the statistics of how riders reported the effect that MSK pain had on their riding.

Table 4.8: The effect of musculoskeletal pain on riding

		No. of cases	Percentage (%)
Continue to ride	Yes	68	97
	No	2	3
Affect performance	Yes	39	56
	No	31	44

4.6.5 History of Musculoskeletal Injuries Related to Horse-Riding

Musculoskeletal injuries were a prevalent occurrence, as reported in **Table 4.9.** When comparing whether injuries were related to dressage or not, 81% of riders reported that their injuries were not related to dressage however there is a small percentage (33%) of riders

that reported that their injuries were dressage related. Other types of injuries consisted of concussions or injuries from being kicked by a horse.

Table 4.9: Musculoskeletal injuries related to horse-riding

	Percentage (%)	
	Injuries related to dressage	**Injuries not related to dressage**
Fractures	18	42
Dislocations	6	16
Sprains	15	26
Strains	13	25
Other	1	10

4.6.6 Treatment for Current Musculoskeletal Pain

The majority of riders received treatment for their MSK injuries in the last year. Other treatments consisted of massage, Pilates, yoga, gyming and stretching (**Table 4.10**).

Table 4.10: Treatment for current musculoskeletal pain

	Percentage (%)
Chiropractic	46
Medication	39
Physiotherapy	24
Other	12
None	9
Natural medication	8
Surgery	–

4.6.7 Classification of Pain

Pain may be a subjective occurrence reliant on the individual experiencing pain and the history of injuries sustained. **Table 4.11** indicates how riders classified their experience of pain.

Table 4.11: Classification of pain frequency

	No. of cases	Percentage
Acute	23	33
Subacute	8	11
Chronic	39	56

4.7. BRIEF PAIN INVENTORY

The purpose of the BPI scale was to assess the level of disability that MSK pain may have on horse riders. It assessed the severity of pain and to what extent MSK pain interfered with various activities of daily living (Cleeland 2009: 5; Stanhope 2016: 496). Each item was scaled on a zero to 10 numeric rating scale, where “0” indicated the least and “10” indicated the worst, relief of pain from treatments “0” indicated no relief, and “10” indicated complete relief. **Table 4.12** displays the results from the BPI questionnaire.

Table 4.12: Brief pain inventory scores

	N	Median	Q1	Q3	Min	Max
Your pain at its worst	70	6	5	8	2	10
Your pain at its least	70	1	0	2	–	6
Your pain on average	70	3	2	4	–	8
How much pain do you have right now	70	2	0	4	–	9
How much relief have you had from pain treatments	63	7	6	8	–	10
Interference with general activity	70	3	2	6	–	10
Interference with mood	70	4.5	2	6	–	10
Interference with walking	70	3	1	5	–	10
Interference with normal work	70	3	1	5	–	8
Interference with relations with other people	70	0	0	3	–	8
Interference with sleep	70	3.5	1	6	–	10
Interference with the enjoyment of life	70	2.5	0	5	–	10

4.7.1 Pain Severity

Table 4.13 shows the average pain severity rating.

Table 4.13: Pain severity breakdown

	N	Median	Q1	Q3	Min	Max
Pain severity	63	3.4	2.6	4.4	1.2	7.0

4.7.2 Pain Interference

Table 4.14 shows the data obtained regarding the pain interference rating, which revealed that pain had mild to moderate interference in daily activity based on the average pain interference rating.

Table 4.14: Pain Interference breakdown

	N	Median	Q1	Q3	Min	Max
Pain interference	70	2.85	1.8	4.2	0.0	7.57

4.7.3 Pain Severity Reliability Analysis

The reliability of the BPI pain severity scores is presented in **Table 4.15**. The reliability analysis is calculated using Cronbach's alpha. The reliability is measured on a scale between zero to one. The higher the score or the closer the score is to one, the greater the reliability of the test (Tavakol and Dennick 2011: 53). The Cronbach's alpha is 0.72, which indicates a good reliability of the BPI pain severity questionnaire.

Table 4.15: Pain Severity reliability analysis

	Cronbach's Alpha	Standardised alpha	Itm-Totl	Alpha if
	(95% confidence interval)		Correl.	deleted
BPI Variable	0.72(0.58, 0.80)	0.73		
Your pain at its worst			0.42	0.69
Your pain at its least			0.4	0.7
Your pain on average			0.73	0.59
How much right now			0.6	0.62
How much relief (reversed)			0.34	0.73

In addition, **Table 4.16** shows the Cronbach's alpha of the BPI pain interference questionnaire which revealed a good reliability score.

Table 4.16: Pain Interference reliability analysis

	Cronbach's Alpha	Standardised alpha	Itm-Totl	Alpha if
	(95% confidence interval)		Correl.	deleted
	0.86(0.79, 0.90)	0.86		
BPI Variable			0.66	0.83
Mood			0.66	0.83
Walking ability			0.5	0.85
Normal work			0.56	0.84
Relations with other peoples			0.71	0.82
Sleep			0.5	0.85
Enjoyment of life			0.78	0.81

4.8 MUSCULOSKELETAL PAIN AND ASSOCIATED FACTORS

The following cross-tabulations compare MSK pain and the related factors that may or may not cause an increase in pain. The related statistics were analysed using Fisher's exact test, *p*-value. The Fisher's exact test allows for testing if the variables are independent by comparing the *p*-value to a significant alpha level of 0.05. Therefore, if the *p*-value is less

than or equal to alpha, it indicates that there is a substantial association between the variables. If the *p*-value is greater than the alpha, it signifies that there is no association among the variables (Sauro and Lewis 2012: 75–80) All percentages are displayed as row percentages.

Only tables of significant association are presented in this chapter; those indicating low association are presented in Appendix R.

4.8.1 Neck Pain and Incorrect Riding Posture

A significant association (*p*=0.02) exists between incorrect posture and neck pain (**Table 4.17**).

Table 4.17: Neck pain and incorrect riding posture

				Neck Pain (Percentage %)		
				Yes	**No**	***p*-value**
Associated risk factors		Incorrect riding posture	Yes	40.74 (n=11)	16.13 (n=10)	0.02
			No	59.26 (n=16)	83.87 (n=52)	

4.8.2 Neck Pain and Fatigue/Exertion

Table 4.18 indicates a significant association (*p*=0.03) between neck pain and fatigue/exertion.

Table 4.18: Neck pain and fatigue/exertion

			Neck Pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Fatigue/ Exertion	Yes	33.33 (n=9)	12.90 (n=8)	0.03
		No	66.67 (n=18)	87.10 (n=54)	

4.8.3 Neck Pain and Sitting Trot

Even though the *p*-value (0.09) indicates no significant difference, there is the possibility to indicate that there is no association between sitting trot being an aggravating factor for neck pain (**Table 4.19**).

Table 4.19: Neck pain and sitting trot

			Neck Pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Sitting trot	Yes	33.33 (n=9)	16.13 (n=10)	0.09

			No	66.67 (n=18)	83.87 (n=52)	

4.8.4 Neck Pain and Saddle Type

Table 4.20 signifies that there is no significant association between saddle type being an aggravating factor for neck pain (*p*=0.03).

Table 4.20: Neck pain and saddle type

			Neck Pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Saddle type	Yes	29.63 (n=8)	9.68 (n=6)	0.03
		No	70.37 (n=19)	90.32 (n=56)	

4.8.5 Neck Pain and Stress/Tension

A significant association (*p*<0.01) exists between stress/tension being an aggravating factor for neck pain, as well as being a distinct difference between riders having neck pain, compared to riders not having neck pain. Stress/tension was an aggravating factor (**Table 4.21**).

Table 4.21: Neck pain and stress/tension

				Neck Pain (Percentage%)		
				Yes	**No**	***p*-Value**
Associated risk factors		Stress/Tension	Yes	48.15 (n=13)	16.13 (n=10)	<0.01
			No	51.85 (n=14)	83.87(n=52)	

4.8.6 Mid-Back Pain and Riding Multiple Horses in a Day

Riding multiple horses in a day may be an aggravating factor (*p*=0.03) for mid-back pain (**Table 4.22**).

Table 4.22: Mid-back pain and riding multiple horses in a day

			Mid-back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Riding multiple horses in a day	Yes	45.83 (n=11)	21.54 (n=14)	0.03
		No	54.17 (n=13)	78.46 (n=51)	

4.8.7 Mid-Back Pain and Incorrect Riding Posture

A significant association (p<0.01) is between mid-back pain and incorrect riding posture being an aggravating factor (**Table 4.23**).

Table 4.23: Mid-back pain and incorrect riding posture

			Mid-back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Incorrect riding posture	Yes	54.17(n=13)	12.31(n=8)	<0.01
		No	45.83(n=11)	87.69(n=57)	

4.8.8 Mid-Back Pain and Standing

No significant association (p=0.04) exists between standing aggravating mid-back pain (**Table 4.24**).

Table 4.24: Mid-back pain and standing

			Mid-back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Standing	Yes	37.50 (n=9)	15.38 (n=10)	0.04
		No	62.50 (n=15)	84.62 (n=55)	

4.8.9 Mid-Back Pain and Stress/Tension

Stress/tension was not an aggravating factor for mid-back pain, although there is the possibility of a close association (p=0.01) between stress/tension becoming a significant aggravating factor (**Table 4.25**).

Table 4.25: Mid-back pain and stress/tension

			Mid-back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stress /tension	Yes	45.83 (n=11)	18.46 (n=12)	0.01
		No	54.17 (n=13)	81.54 (n=53)	

4.8.10 Low Back Pain and Worse After Strenuous Riding

Table 4.26 indicates a significant dissociation (p=0.03) between strenuous riding and LBP.

Table 4.26: Low back pain and worse after strenuous riding

			Low back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Worse after strenuous riding	Yes	36.21 (n=21)	12.90 (n=4)	0.03
		No	63.79 (n=37)	87.10 (n=27)	

4.8.11 Low Back Pain and Worse in the Morning

A significant difference (p=0.05) was discovered between LBP not being worse in the morning (**Table 4.27**).

Table 4.27: Low back pain and worse in the morning

			Low back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Worse in the morning	Yes	18.97 (n=11)	3.23 (n=1)	0.05
		No	81.03 (n=47)	96.77 (n=30)	

4.8.12 Low Back Pain and Sitting Trot

Table 4.28 suggests no significant association (p<0.01) that sitting trot aggravates low back pain.

Table 4.28: Low back pain and sitting trot

			Low back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Sitting trot	Yes	31.03 (n=18)	3.23 (n=1)	p<0.01
		No	68.97 (n=40)	96.77(n=30)	

4.8.13 Low Back Pain and Stress/Tension

There was significantly little association (p=0.05) between LBP and stress/tension (**Table 4.29**).

Table 4.29: Low back pain and stress/tension

			Low back pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stress/tension	Yes	32.76 (n=19)	12.90 (n=4)	0.05
		No	67.24 (n=39)	87.10 (n=27)	

4.8.14 Shoulder Pain and Worse in the Evening

A significant difference (p<0.01) was noted among participants that they did not have increased shoulder pain in the evening (**Table 4.30**).

Table 4.30: Shoulder pain and worse in the evening

			Shoulder pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Worse in the evening	Yes	37.50 (n=12)	8.77 (n=5)	<0.01
		No	62.50(n=20)	91.23(n=52)	

4.8.15 Shoulder Pain and Standing

There is a significant association (p<0.01) between standing and shoulder pain (**Table 4.31**).

Table 4.31: Shoulder pain and standing

			Shoulder pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Standing	Yes	37.50 (n=12)	12.28 (n=7)	<0.01
		No	62.50 (n=20)	87.72 (n=50)	

4.8.16 Saddle Type and Shoulder Pain

There is a significant association (p=0.03) between saddle type not being a risk factor for increased shoulder pain (**Table 4.32**).

Table 4.32: Saddle type and shoulder pain

			Shoulder pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Saddle type	Yes	28.13 (n=9)	8.77 (n=5)	0.03
		No	71.88 (n=23)	91.23 (n=52)	

4.8.17 Wrist and Hand Pain and Stress/Tension

There is a significant association (p<0.01) between stress/tension being an aggravating factor for wrist and hand pain (**Table 4.33**).

Table 4.33: Wrist and hand pain and stress/tension

			Wrist and hand pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stress/tension	Yes	77.78 (n=7)	20 (n=16)	<0.01

		No	22.22 (n=2)	80 (n=64)	

4.8.18 Hip Pain and Stirrup Length

Although **Table 4.34** signifies that hip pain is not aggravated by stirrup length, there may be a trend (p=0.02) for stirrup length to become a common aggravating factor for hip pain.

Table 4.34: Hip pain and stirrup length

			Hip pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stirrup length	Yes	44.44 (n=12)	17.74 (n=11)	0.02
		No	55.56 (n=15)	82.26 (n=51)	

4.8.20 Knee Pain and Worse in the Evening

There is significantly association (p<0.01) between knee pain not being worse in the evening (**Table 4.35**).

Table 4.35: Knee pain and worse in the evening

			Knee pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Worse in the evening	Yes	36.67 (n=11)	10.17 (n=6)	<0.01
		No	63.33 (n=19)	89.83 (n=53)	

4.8.21 Knee Pain and Cold Weather

There is a significant association (p<0.01) between cold weather being an aggravating factor for knee pain (**Table 4.36**).

Table 4.36: Knee pain and cold weather

			Knee pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Cold weather	Yes	60 (n=18)	11.86 (n=7)	p<0.01
		No	40 (n=12)	88.14 (n=52)	

4.8.22 Knee Pain and Standing

There is a significant association (p=0.03) between standing not being an aggravating factor for knee pain (**Table 4.37**).

Table 4.37: Knee pain and standing

			Knee pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Standing	Yes	36.67 (n=11)	13.56 (n=8)	0.03
		No	63.33 (n=19)	86.44 (n=51)	

4.8.23 Knee Pain and Stress/Tension

Table 4.38 indicates that there may be a possibility (p<0.01) for stress/tension to become a common aggravating factor for knee pain.

Table 4.38: Knee pain and stress/tension

			Knee pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stress/tension	Yes	46.67 (n=14)	15.25 (n=9)	<0.01
		No	53.33 (n=16)	84.75 (n=50)	

4.8.24 Knee Pain and Stirrup Length

Stirrup length is not a common aggravating factor (p=0.04) for knee pain (**Table 4.39**).

Table 4.39: Knee pain and stirrup length

			Knee pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Stirrup length	Yes	40 (n=12)	18.64 (n=11)	0.04
		No	60 (n=18)	81.36 (n=48)	

4.8.25 Foot and Ankle Pain and Cold Weather

Table 4.40 indicates that most participants reported that cold weather was an aggravating factor for foot and ankle pain signifying a significant association between the two factors (p=0.02).

Table 4.40: Foot and ankle pain and cold weather

			Foot and ankle pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Cold weather	Yes	52.94 (n=9)	22.22 (n=16)	0.02
		No	47.06 (n=8)	77.78 (n=56)	

4.8.26 Foot and Ankle Pain and Standing

Standing may not be an aggravating factor for foot and ankle pain although there was a significant difference (*p*=0.04) between participants having foot and ankle pain and participants not having foot and ankle pain (**Table 4.41**).

Table 4.41: Foot and ankle pain and standing

			Foot and ankle pain (Percentage%)		
			Yes	**No**	***p*-value**
Associated risk factors	Standing	Yes	41.18 (n=7)	16.67 (n=12)	0.04
		No	58.82 (n=10)	83.33 (n=60)	

4.8.27 Foot and Ankle Pain and Stress/Tension

There is a possibility (*p*=0.03) for stress tension to be a common aggravating factor for foot and ankle pain (**Table 4.42**).

Table 4.42: Foot and ankle pain and stress/tension

			Foot and ankle pain (Percentage %)		
			Yes	**No**	***p*-value**
Associated risk factors	Stress/tension	Yes	47.06 (n=8)	20.83 (n=15)	0.03
		No	52.94 (n=9)	79.17 (n=57)	

4.8.28 Tables of low statistical significance related to musculoskeletal pain and associated risk factors

Tables 4.43 to 4.50 may show possible trends in association, however, the *p*-values indicate no significant association between factors.

Table 4.43: Neck pain and associated contributing risk factors

			Neck pain (Percentage %)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	33.33	25.81	0.61
		No	66.67	74.19	
	Riding multiple horses a day	Yes	33.33	25.81	0.61
		No	66.67	74.19	
	Worst in the evening	Yes	29.63	14.52	0.14
		No	70.37	85.48	
	Worst in the morning	Yes	18.52	11.29	0.50
		No	81.48	88.71	
	Lying down	Yes	11.11	9.68	1.00
		No	88.89	90.32	
	Cold weather	Yes	29.63	27.42	1.00
		No	70.37	72.58	
	Cantering	Yes	14.81	8.06	0.45
		No	85.19	91.94	
	Sleeping	Yes	7.41	3.23	0.58
		No	92.59	96.77	
	Sanding	Yes	25.93	19.35	0.58
		No	74.07	80.65	
	Constant	Yes	7.41	1.61	0.22
		No	92.59	98.39	
	Stirrup length	Yes	25.93	25.81	1.00
		No	74.07	74.19	
	Other	Yes	14.81	6.45	0.24
		No	85.19	93.55	

Table 4.44: Mid-back pain and associated contributing risk factors

			Mid-back pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	29.17	27.69	1.00
		No	70.83	72.31	
	Worst in the evening	Yes	18.46	18.46	0.77
		No	79.17	81.54	
	Fatigue/Exertion	Yes	25.00	16.92	0.38
		No	75.00	83.08	
	Worst in the morning	Yes	12.50	13.85	1.00
		No	87.50	86.15	
	Lying down	Yes	16.67	7.69	0.24
		No	83.33	92.31	
	Cold weather	Yes	37.50	24.62	0.29
		No	62.50	75.38	
	Cantering	Yes	16.67	7.69	0.24
		No	83.33	92.31	
	Sleeping	Yes	12.50	1.54	0.06
		No	87.50	98.46	
	Sitting trot	Yes	20.83	21.54	1.00
		No	79.17	78.46	
	Constant	Yes	4.14	3.08	1.00
		No	95.83	96.92	
	Saddle type	Yes	25.00	12.31	0.19
		No	75.00	87.69	
	Stirrup length	Yes	29.17	24.62	0.79
		No	70.83	75.38	
	Other	Yes	4.17	10.77	0.44
		No	95.83	89.23	

Table 4.45: Low back pain and associated contributing risk factors

			Low back pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Riding multiple horses a day	Yes	32.76	19.35	0.22
		No	67.24	80.65	
	Incorrect riding posture	Yes	29.31	12.90	0.12
		No	70.69	87.10	
	Worst in the evening	Yes	24.14	9.68	0.16
		No	75.86	90.32	
	Fatigue/Exertion	Yes	24.14	9.68	0.16
		No	75.86	90.32	
	Lying down	Yes	12.07	6.45	0.49
		No	87.93	93.55	
	Cold weather	Yes	31.03	22.58	0.46
		No	68.97	77.42	
	Cantering	Yes	12.07	6.45	0.49
		No	87.93	93.55	
	Sleeping	Yes	5.17	3.23	1.00
		No	94.83	96.77	
	Sanding	Yes	25.86	12.90	0.18
		No	74.14	87.10	
	Constant	Yes	5.17	0.00	0.55
		No	94.83	100.00	
	Saddle type	Yes	20.69	6.45	0.13
		No	79.31	93.55	
	Stirrup length	Yes	24.14	29.03	0.62
		No	75.86	70.97	
	Other	Yes	12.07	3.23	0.25
		No	87.93	96.77	

Table 4.46: Shoulder pain and associated contributing risk factors

			Shoulder pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	34.38	24.56	0.34
		No	65.63	75.44	
	Riding multiple horses a day	Yes	25.00	29.82	0.81
		No	75.00	70.18	
	Incorrect riding posture	Yes	25.00	22.81	0.80
		No	75.00	77.19	
	Fatigue/Exertion	Yes	18.75	19.30	1.00
		No	81.25	80.70	
	Worst in the morning	Yes	18.75	10.53	0.34
		No	81.25	89.47	
	Lying down	Yes	15.63	7.02	0.27
		No	84.38	92.98	
	Cold weather	Yes	34.38	24.56	0.34
		No	65.63	75.44	
	Cantering	Yes	12.50	8.77	0.72
		No	87.50	91.23	
	Sleeping	Yes	6.25	3.51	0.62
		No	93.75	96.49	
	Sitting trot	Yes	28.13	17.54	0.29
		No	71.88	82.46	
	Constant	Yes	6.25	1.75	0.29
		No	93.75	98.25	
	Stress/Tension	Yes	37.50	19.30	0.08
		No	62.50	80.70	
	Stirrup length	Yes	18.75	29.82	0.32
		No	81.25	70.18	
	Other	Yes	12.50	7.02	0.45
		No	87.50	92.98	

Table 4.47: Wrist and hand pain and associated contributing risk factors

			Wrist and hand pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	22.22	28.75	1.00
		No	77.78	71.25	
	Riding multiple horses a day	Yes	55.56	25.00	0.11
		No	44.44	75.00	
	Incorrect riding posture	Yes	44.44	21.25	0.21
		No	55.56	78.75	
	Worst in the evening	Yes	22.22	18.75	0.68
		No	77.78	81.25	
	Fatigue/Exertion	Yes	0.00	21.25	0.20
		No	100.00	78.75	
	Worst in the morning	Yes	33.33	11.25	0.10
		No	66.67	88.75	
	Lying down	Yes	22.22	8.75	0.22
		No	77.78	91.25	
	Cold weather	Yes	33.33	27.50	0.71
		No	66.67	72.50	
	Cantering	Yes	11.11	10.00	1.00
		No	88.89	90.00	
	Sleeping	Yes	11.11	3.75	0.35
		No	88.89	96.25	
	Sitting trot	Yes	33.33	20.00	0.40
		No	66.67	80.00	
	Sanding	Yes	33.33	20.00	0.40
		No	66.67	80.00	
	Constant	Yes	11.11	2.50	0.28
		No	88.89	97.50	
	Saddle type	Yes	33.33	13.75	0.15
		No	66.67	86.25	
	Stirrup length	Yes	11.11	27.50	0.44
		No	88.89	72.50	
	Other	Yes	0.00	10.00	1.00
		No	100.00	90.00	

Table 4.48: Hip pain and associated contributing risk factors

			Hip pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	40.74	22.58	0.12
		No	59.26	77.42	
	Riding multiple horses a day	Yes	29.63	27.42	1.00
		No	70.37	72.58	
	Incorrect riding posture	Yes	33.33	19.35	0.18
		No	66.67	80.65	
	Worst in the evening	Yes	18.52	19.35	1.00
		No	81.48	80.65	
	Fatigue/Exertion	Yes	22.22	17.74	0.77
		No	77.78	82.26	
	Worst in the morning	Yes	14.81	12.90	1.00
		No	85.19	87.10	
	Lying down	Yes	11.11	9.68	1.00
		No	88.89	90.32	
	Cold weather	Yes	40.74	22.58	0.12
		No	59.26	77.42	
	Cantering	Yes	18.52	6.45	1.12
		No	81.48	93.55	
	Sleeping	Yes	3.70	4.84	1.00
		No	96.30	95.16	
	Sitting trot	Yes	29.63	17.74	0.26
		No	70.37	82.26	
	Sanding	Yes	22.22	20.97	1.00
		No	77.78	79.03	
	Constant	Yes	3.70	3.23	1.00
		No	96.30	96.77	
	Saddle type	Yes	14.81	16.13	1.00
		No	85.19	83.87	
	Stress/Tension	Yes	33.33	22.58	0.08
		No	66.67	77.42	
	Other	Yes	11.11	8.06	0.69
		No	88.89	91.94	

Table 4.49: Knee pain and associated contributing risk factors

			Knee pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	30.00	27.12	0.81
		No	70.00	72.88	
	Riding multiple horses a day	Yes	30.00	27.12	0.81
		No	70.00	72.88	
	Incorrect riding posture	Yes	26.67	22.03	0.79
		No	73.33	77.97	
	Fatigue/Exertion	Yes	23.33	16.95	0.57
		No	76.67	83.05	
	Worst in the morning	Yes	20.00	10.17	0.21
		No	80.00	89.83	
	Lying down	Yes	13.33	8.47	0.48
		No	86.67	91.53	
	Cantering	Yes	6.67	11.86	0.71
		No	93.33	88.14	
	Sleeping	Yes	10.00	1.69	0.11
		No	90.00	98.31	
	Sitting trot	Yes	26.67	18.64	0.42
		No	73.33	81.36	
	Constant	Yes	3.33	3.39	1.00
		No	96.67	96.61	
	Saddle type	Yes	16.67	15.25	1
		No	83.33	84.75	
	Other	Yes	3.33	11.86	0.26
		No	96.67	88.14	

Table 4.50: Foot and ankle pain and associated contributing risk factors

			Foot and ankle pain (Percentage%)		
			Yes	No	P Value
Associated contributing risk factors	Worse after Strenuous riding	Yes	35.29	26.39	0.55
		No	64.71	73.61	
	Riding multiple horses a day	Yes	41.18	25	0.23
		No	58.82	75.00	
	Incorrect riding posture	Yes	17.65	25	0.75
		No	82.35	75	
	Worst in the evening	Yes	23.53	18.06	0.73
		No	76.47	81.94	
	Fatigue/Exertion	Yes	35.29	15.28	0.08
		No	64.71	84.72	
	Worst in the morning	Yes	11.76	13.89	1
		No	88.24	86.11	
	Lying down	Yes	11.76	9.72	0.68
		No	88.24	90.28	
	Cantering	Yes	23.53	6.94	0.06
		No	76.47	93.06	
	Sleeping	Yes	5.88	4.17	0.58
		No	94.12	95.83	
	Sitting trot	Yes	17.65	22.22	1
		No	82.35	77.78	
	Constant	Yes	0	4.17	1
		No	100	95.83	
	Saddle type	Yes	23.53	13.89	0.46
		No	76.47	86.11	
	Stirrup length	Yes	41.18	22.22	0.13
		No	58.82	77.78	
	Other	Yes	0	11.11	0.34
		No	100	88.89	

4.9: ANALYSIS OF VARIANCE

To determine if the independent variable in a group produces variation in the dependent variable, a one-way analysis of variance between groups was conducted and presented as the outcome measure (Braun 2012: 2)

4.9.1. Relief from Pain Treatments

Table 4.51 presents the difference between specific population means using ANOVA and reversed test scores. The closer the mean score is to zero on a scale of zero to 10, the more relief the patient received from pain treatments. There is a significant difference (p<0.01) in relief of pain from chiropractic treatment, as participants receiving chiropractic treatment had significantly more relief from pain (3.41) compared to participants not having chiropractic treatment (4.14). Chiropractic treatment also had the lowest mean score (3.41) compared to all other treatment methods, indicating that chiropractic treatment possibly provided better pain relief compared to other methods listed (**Table 4.51**).

Table 4.51: Relief from pain treatments

			Pain relief (reversed) Mean	Pain relief (reversed) Std. Dev	F–test	*p*-value
Treatment	Medication	No	3.54	1.6	2.80	0.10
		Yes	4.46	2.54		
	Natural medication	No	4.05	2.26	0.003	0.95
		Yes	4	1.83		
	Physiotherapy	No	4.17	2.3	0.36	0.55
		Yes	3.81	2.02		
	Chiropractic	No	5.23	2.43	11.30	<0.01
		Yes	3.41	1.8		
	Other	No	4.14	2.27	0.27	0.60
		Yes	3.73	1.9		

4.9.2 Horse Riding Background and Musculoskeletal Pain in the Last Year

There is no significant connection between the number of years riding, hours a day riding, days per week riding or competition and pain in the last year. However, there may be a trend that the number of times a participant competes in shows could become a factor that influences the experience of pain (p=0.12) (**Table 4.52**).

Table 4.52: Horse riding background and musculoskeletal pain in the last year

			Pain in the last year		
			Yes	**No**	***p*-value**
Horse riding background	Years Riding	Mean	24.23	24.88	0.90
		Std. dev	13.34	13.5	
	Hours a day riding	Mean	1.91	1.63	0.47
		Std. dev	1.03	1.06	
	Days per week	Mean	3.35	3.38	0.94
		Std. dev	0.85	21.06	
	How often compete	Mean	2.73	2.13	0.12
		Std. dev	1.02	1.13	

4.9.3: Hours a Day Riding and Location of Pain

Table 4.53 presents the relationship between hours a day spent riding and the location of pain. It is evident that the hours a day spent riding had a significant association with shoulder pain in dressage riders (p<0.01). Although there was no statistically significant association found, there are trends that increased amount of time spent riding may result in increased levels of neck, mid-back, low back, wrist and hand, hip and knee pain.

Table 4.53: Hours a day riding and location of pain

			Hours a day		
			Mean	**Std. Dev**	***p*-value**
Location of pain	Neck	No	1.75	0.96	0.31
		Yes	2	1.15	
	Mid-back pain	No	1.72	1	0.14
		Yes	2.09	1.06	
	Low back pain	No	1.72	1	0.38
		Yes	1.91	1.04	
	Shoulder pain	No	1.65	0.93	p<0.01
		Yes	2.33	1.15	
	Wrist and hand pain	No	1.79	1.04	0.38
		Yes	2.25	0.5	
	Hip pain	No	1.74	1.02	0.24
		Yes	2.05	1.03	
	Knee pain	No	1.75	1.02	0.31
		Yes	2	1.02	
	Foot and ankle pain	No	1.86	1.07	0.22
		Yes	1.45	0.52	

4.9.4. Days Per Week and Location of Pain

No statistically significant relationship was reported between these variables but there is a possible association between increased days per week spent riding and participants having shoulder pain (p=0.06). There are also trends indicating that days per week spent riding

may have associations with experiencing LBP and wrist and hand pain but, alternatively, there is the trend that the number of days spent riding per week has no association with participants experiencing pain in the different MSK regions. (**Table 4.54**).

Table 4.54: Days per week and location of pain

			Days per week		
			Mean	**Std. Dev**	***p*-value**
Location of pain	Neck	No	3.37	0.9	0.65
		Yes	3.27	0.83	
	Mid-back pain	No	3.36	0.81	0.85
		Yes	3.32	1.09	
	Low back pain	No	3.24	0.97	0.23
		Yes	3.47	0.77	
	Shoulder pain	No	3.25	0.94	0.06
		Yes	3.67	0.58	
	Wrist and hand pain	No	3.33	0.89	0.35
		Yes	3.75	0.5	
	Hip pain	No	3.34	0.93	0.91
		Yes	3.37	0.68	
	Knee pain	No	3.34	0.88	0.93
		Yes	3.36	0.9	
	Foot and ankle pain	No	3.38	0.89	0.30
		Yes	3.09	0.83	

4.9.5. Horse Riding Background and Level of Riding

There are noteworthy differences in the hours a day spent riding, days per week spent riding and competitions per month between professional, experienced and amateur riders. Professional riders spend more hours a day riding as well as riding more days a week and partaking in more shows a month compared to the experienced and amateur rider (**Table 4.55**).

Table 4.55: Horse riding background and level of riding

	Professional rider		**Experienced rider**		**Amateur rider**		
	Mean	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**	***p*-value**
Hours a day	3.35	1.02	1.55	0.64	1.19	0.4	<0.01
Days per week	4	0	3.29	0.87	2.95	0.07	<0.01
How often compete in a month	3.06	1.04	2.69	0.99	1.95	0.86	<0.01

4.10 CONCLUSION

The study received a good response rate with the sample size required. Most participants were female and most riders were around 39 years of age. The riders mostly categorised themselves as experienced riders with an average of 24 years of riding experience. Current MSK pain was prevalent amongst the riders, with LBP being reported as the most common region to experience pain. Riding multiple horses a day, strenuous riding, cold weather, stress and stirrup length were all prominent aggravating factors for MSK pain. Most riders were receiving treatment for their pain.

CHAPTER FIVE DISCUSSION

5.1 INTRODUCTION

Chapter Five reports on the interpretation of the results displayed in Chapter Four. The results are compared to similar studies discussed in the literature review. This chapter discusses relevant statistical data reported in conjunction with literature related to the results of the study.

5.2 SAMPLE SIZE, RESPONSE RATE AND DEMOGRAPHICS

The study had an 81.65% response rate, with 89 out of the 109 participants completed the questionnaire. It was reported that the total population of competing dressage riders in KwaZulu-Natal is 109 (Loubser 2022). The study received a sufficient response rate to provide an accurate representation of competing dressage riders within KZN. Within a South African context, it was found that 17% of memberships across all equestrian disciplines consisted of dressage memberships but no population size was provided (SAEF 2023).

The age population for the study ranged between the oldest rider being 65 years of age and the youngest rider 18 years of age (**Table 4.1**). The diversity in age range is explained through the study by Adelman and Thompson (2017: 7), who stated that unique equestrian programmes have allowed committed elder riders to continue their riding careers but have also encouraged new riders to develop their riding careers. The average weight of participants was 65.47kg and the average height was 166.29 cm (**Table 4.1**).

Adelman and Thompson (2017: 5) stated that the equestrian sport allows for equalised gender participation as men and women compete on the same standard and rules; however, the literature has shown that some equestrian disciplines are predominantly male-dominated. The gender results for this study show that 94% of participants were female and 6% were male, this may indicate that dressage within KZN is a female-dominated discipline. The same was also found in the study by Peens (2020:16) on competitive show-jumpers in Johannesburg with a 77% female demographic. Handley (2021:21) reported a 96% female demographic in competitive dressage riders in Johannesburg. The female-dominated prevalence of dressage may be due to the rhythmic and co-ordinated characteristics of the sport as explained by Douglas *et al.* (2012: 58) and Hobbs *et al.* (2020: 2).

5.3 HORSE RIDING BACKGROUND

Riders develop their values and skills as they gain experience in riding, which also influences the relationship with the horse. The individual characteristics of a horse rider can be a complex task to define and categorise, as evaluated by Williams and Tabor (2017: 31). This study found that 57% of horse riders defined themselves as experienced riders, followed by 24% defining themselves as amateur riders, and only 19% defined themselves as professional riders.

The years and hours a day spent riding also impact how a rider defines their level of riding. The average number of years riding in this study was approximately 24,57 years. The maximum number of years riding was 56 years, and the minimum amount was three years (**Table 4.2**). The majority of riders rode for five or more days a week, accounting for 51%, and most riders rode for 30 minutes to 1 hour (51%). Competing in shows plays a pivotal role in the advancement of a rider's experience and their level of riding. This study showed that 81% of all dressage riders compete in shows but the majority only compete one to two times a month (48%) (**Table 4.3**). These statistics are motivated by the study completed by Williams and Tabor (2017: 31) that, since most riders defined themselves as experienced riders, it correlates to most of the riders riding frequently during the week and regularly competing in shows.

Participants who classified themselves as professional riders rode for an average of 3.35 hours a day, an average of four days a week and competed in approximately three shows a month. Experienced riders rode for an average of 1.55 hours a day, an average of three days a week and competed in approximately 2.7 shows a month. Amateur riders rode for an average of 1.19 hours a day, an average of three days a week and competed in approximately 2 shows a month (**Table 4.47**). There is a substantial difference in the riding background between professional horse riders and experienced and amateur horse riders ($p<0.01$) but there is no significant difference in the riding background between experienced and amateur horse riders, as both rode for around the same number of hours a day and days per week. Horse riders classifying themselves may create a subjective and biased result, as there are many factors that a rider personally considers, such as their levels of riding, the number of years they have been riding and the level at which they ride and compete at. These factors and the personal opinion of the rider create a complex result of defining professional, experienced and amateur riders which may a limiting factor to adequately classifying and interpreting the different categories of dressage riders.

5.4 MUSCULOSKELETAL PAIN HISTORY

Musculoskeletal pain may arise from many non-specific MSK conditions and causes such as sprained muscles, fractures and overuse injuries all of which are common occurrences in sport-related injuries from the physical stresses experienced in the specific sport (Blyth *et al.* 2019: 37; El-Tallawy *et al.* 2021: 182; Sire *et al.* 2021: 2). When reporting on the history of MSK pain in horse riders, 74 (83%) horse riders reported that they had experienced MSK pain at some point within their riding carrier. Amongst those who had experienced MSK pain, 65% experienced LBP, followed by 36% of riders having experienced shoulder pain (**Table 4.4**).

The data revealed that 84% of the riders who have experienced MSK pain in the past received chiropractic treatment (**Table 4.5**). Similarly, Wang *et al.* (2022: 2) reported that in cases in which horse riders received treatment for equestrian-related MSK injuries, their injuries were mostly chronic injuries occurring from trauma or overuse injuries.

5.5 CURRENT MUSCULOSKELETAL PAIN

5.5.1 Musculoskeletal Pain in the Past Year and Regions

Horse riders are often at risk of injury due to the unpredictable behaviour of horses (Hoffmann *et al.* 2023: 1). This study showed that 66 (89%) of the 74 riders who had a history of experiencing MSK pain had experienced MSK pain within the last year, and eight (11%) riders did not experience the reoccurrence of MSK pain within the past year (**Table 4.6**). The most common region for riders to experience MSK pain in the past year was LBP (48%). Neck pain, mid-back pain and knee pain were all experienced similarly, with a prevalence of 25%. Shoulder pain was experienced in 24% of riders (**Table 4.6**). Most studies on horse riders reported on the back pain experienced by horse riders. Deckers *et al.* (2020: 9), Lewis and Kennerley (2017: 260) and Kraft *et al.* (2009: 2209) all reported on the increased prevalence of professional horse riders experiencing back pain. Kraft *et al.* (2009: 2209) also reported that dressage horse riders had a higher occurrence of disc degeneration on MRI findings.

In a South African context, the high incidence of LBP in this study is supported by the studies by Handley (2021: 27), that 71% of competitive dressage riders suffered from LBP for more than six months. However, these statistics did not regard the prevalence of knee and shoulder pain since extremity pain in dressage horse riders had not been investigated. Acton *et al.* (2019: 1065), Samuels *et al.* (2022: 173) and Hoffmann *et al.* (2023: 2) reported that most horse-related injuries occurred to the upper extremity and the head and neck were the second most common injury region. In a South African study, Catlin (2010: 99) reported

that the head was the most prevalent site of injury, thereafter the low back and then the shoulder region and, therefore, due to the common prevalence of extremity injuries in horse riders, the extremities may be a common region for riders to experience chronic pain.

5.5.2 Generalised Character of Musculoskeletal Pain

Pain may be a complex factor to understand and interpret, especially when described according to the International Association of the Study of Pain as “An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage” (IASP 2020; Baranowski *et al.* 2011: 209). El-Tallawy *et al.* (2021: 185) stated that symptoms such as stiffness, aches, fatigue and muscles feeling overworked are all varying features associated with MSK pain, which supports the evidence found in this study as most participants described their pain as aching (N=56) (**Table 4.7**). However, sharpness (62%) and tightness/spasm (57%) were also significant characteristics of pain experienced by participants (**Figure 4.1**). When reporting on the frequency of pain, it was described by most participants that tightness and aching were experienced often.

5.6 MUSCULOSKELETAL PAIN AGGRAVATING FACTORS AND ASSOCIATED FACTORS

It is important to establish the most prevalent horse-riding-related risk factors that may aggravate any MSK pain. El-Tallawy *et al.* (2021: 185) explained that certain movements and postures will either alleviate or aggravate the MSK pain experienced. Strenuous riding (28%) and riding multiple horses a day (28%) were reported to be the two most prevalent horse riding-related factors to cause an increase in MSK pain. Incorrect stirrup length (26%) and incorrect riding posture (24%) were also reported to be aggravating factors (**Figure 4.2)**. There are many associated factors that may or may not have an impact on MSK pain such as strenuous riding, cold weather, stress/tension, stirrup length and incorrect riding posture; therefore, it is important to establish which factors have and do not have a significant impact. This will allow to better understand the dynamics of the sport, the way the athlete is impacted and how to better manage the certain risk factors.

5.6.1 Neck Pain and Associated Factors

Incorrect riding posture had a possibility of being (p=0.02) an aggravating factor for neck pain, as 40.74% of riders experienced aggravated neck pain from incorrect riding posture, even though 59.26% reported that their neck pain was not aggravated by incorrect riding posture (**Table 4.17**). Heidbuchel *et al.* (2023: 6) explained that riders attempt to sit upright, which may cause a decreased range of motion within their trunk; therefore, any

asymmetries in the riding posture may be a contributing factor to neck pain as a compensatory factor resulting from asymmetrical biomechanics.

Stress/tension was a significant factor (p<0.01) associated provoking neck pain, with a prevalence of 48.15% (**Table 4.21**). Buscemi *et al.* (2019: 1135) explained that the psychological factor related to stress may have a significant impact on the MSK disorders and it was also described that perceived stress influenced the progression of neck pain, however, the effects of stress/tension may be a confounding factor between the association which may result in the misrepresentation of the effects of horse riding on neck pain. Alternatively, significantly no association (p=0.09) was found between an increase in neck pain with sitting trot (66.67%) (**Table 4.19**) and significantly no association (p=0.03) between saddle type and an increase in neck pain (70.37%) (**Table 4.20**). Sitting trot and saddle type are factors in close relationship with the lower extremity, low back region and possibly the thoracic region therefore the neck region is at low risk of being affected as it is located further away from the source of the risk (Eckardt, Munz and Witte 2014: 1298; Gonzalez *et al.* 2020:7; Douglas *et al.* 2012:60).

5.6.2 Mid-Back Pain and Associated Factors

There was a distinct association (p<0.01) between incorrect riding posture, causing an increase in mid-back pain with a prevalence of 54.17% experiencing an increase in pain compared to 45.83% that reported no increase in pain with incorrect riding posture (**Table 4.23**). This finding can be motivated by Heidbuchel *et al.* (2023: 6) that the vertical riding posture causes a decrease range of motion within the trunk. Gonzalez and Sarabon (2020: 11) also explained that a horse's movement required adequate neuromuscular activation to allow for riders to prepare for the impact of certain movements. Advanced riders have adapted more balanced muscle activation compared to novice riders, who have a decreased ability to adjust to a horse's movement, indicating that novice riders have a higher risk of riding with an incorrect riding posture, which may increase their risk of experiencing mid-back pain. Gines-Diaz *et al.* (2019: 535) added to the findings through the evidence that dressage riders have a more hypokyphotic thoracic spine. Douglas *et al.* (2012: 60) reported that there is increased asymmetrical movement through the thoracic spine of a rider during a ride in the canter gait, which results in increased stressed muscle activation. Any unbalanced sequence of movements being translated through a rigid trunk may be a risk factor for an increase in mid-back pain. The adaptation of a hypokyphotic spine and incorrect riding technique may be an aggravating combination for mid-back pain. This literature could also explain the possibility (p=0.03) that riding multiple horses a day

may be an aggravating factor for mid-back pain, as 45.83% of riders reported an increase in pain (**Table 4.22**).

5.6.3 Low Back Pain and Associated Factors

There was a significant dissociation (p=0.03) between strenuous riding being an associated factor to increasing LBP, as 63.79% of riders reported that their LBP was not aggravated by strenuous riding, compared to 36.21% that reported an increase in pain (**Table 4.26**). The findings from Handley (2021: 32) support the above statistics as Handley (2021: 32) reported that riders who rode fewer hours a week experienced LBP more frequently than those who rode more hours a week. However, the findings from Gines-Diaz *et al.* (2019: 537) and Lewis and Kennerley (2017: 261) contradict the aforementioned findings as Gines-Diaz *et al.* (2019: 537) revealed in their study that most horse riders presented with unbalanced lumbar curvatures, which created an increased risk of developing spinal disorders especially in high intensity training environments. Lewis and Kennerley (2017: 261) discussed that most dressage riders did not associate the origin of their pain with a horse-riding injury, which may indicate that intensity and duration of riding may be an influencing factor for pain.

A significant dissociation was also seen in sitting trot not being an aggravating factor for LBP (p<0.01), as 68.97% of riders with LBP reported no increase in pain related to sitting trot (**Table 4.28**). However, Handley (2021: 30) reported that sitting trot increased LBP in dressage riders. Eckardt, Munz and Witte (2014: 1298) stated that during active riding and sitting trot, there is a postural tilt in the riding indicated asymmetrical biomechanics, which may be a risk factor for increasing LBP.

5.6.4 Shoulder Pain and Associated Factors

The statistics on shoulder pain revealed that it is unlikely for shoulder pain to be aggravated in the evenings, as there was a significant association (p<0.01) between the two factors not influencing each other (**Table 4.30**). The same can be reported on standing having significantly no association with increasing shoulder pain (**Table 4.31**), as well as the saddle type being ridden in (**Table 4.32**). Hodgetts and Walker (2021: 13) explained that shoulder pain is easily affected by weather but mostly found to be worse in the mornings and aggravated with increased movement of the glenohumeral joint.

5.6.5 Wrist and Hand Pain and Associated Factors

Stress/tension had a signification association (p<0.01) with being an aggravating factor for wrist and hand pain (**Table 4.33**). Stress/tension may be seen as a confounding factor in the association as Aptel and Cnockaert (2002: 51) explained that stress is an associated

reaction to a physiological, emotional and behavioural response to situations that could be perceived as potentially harmful. Buscemi *et al.* (2019: 1127) stated that psychological factors may have a significant association with MSK pain disorders. Aptel and Cnockaert (2002: 53) further elaborated that due to the limitless number of risk factors, it is difficult to differentiate between the association of psychosocial factors and stress and their impact on MSK pain. Therefore, this occurrence of wrist pain being aggravated by stress/tension may be an incidental finding that may be influenced by many external factors.

5.6.6 Hip Pain and Associated Factors

Most participants reported that stirrup length did not aggravate their hip pain but there may be a possibility for stirrup length to be an aggravating factor in some instances, as there seems to be a likely association between the two factors (p=0.02) (**Table 4.34**). Cejudo *et al.* (2020: 10) reported on the discovery regarding the biomechanics of horse riders, whereby a horse rider's seat requires their hips to be externally rotated, abducted and extended. This results in contraction of their gluteus muscles, causing tightness of their external hip rotator muscle, and as such, the increased tightness of their external hip rotators causes a compensatory tightness of the pelvis and decreased hip flexion. Therefore, any discrepancy in stirrup length could negatively influence the biomechanics needed for riding and potentially aggravate any hip pain, as seen in the statistics in **Table 4.35**, there is a possibility for stirrup length to be an associated factor for hip pain.

5.6.7 Knee Pain and Associated Factors

Knee pain had a significantly association (p<0.01), with it being worse in the evenings (**Table 4.35**); there was a significant association (p<0.01) between cold weather aggravating knee pain (**Table 4.36**). In a review by Pienimaki (2002: 180), the effect of cold exposure being a factor to cause or increase MSK pain is uncertain but some association may be seen. Although most participants with knee pain reported that stress/tension was not an aggravating factor for knee pain (53.33%), there is a significant possibility (p<0.01) for stress/tension to become an aggravating factor for knee pain, with a reported association of 46.67% (**Table 4.38**). Buscemi *et al.* (2019: 1135) explained that stress is a multifactorial process that is influenced by an individual's life circumstances, which may explain why stress/tension may become an aggravating factor for any current pain experienced by an individual (Aptel and Cnockaert 2002: 53).

Stirrup length was reported to have no association with knee pain (p=0.04), as only 40% of participants with knee pain reported that stirrup length increased their knee pain, in comparison to 60% reporting that there was no influence (**Table 4.39**). This finding is contradictory to the statistics between the association of hip pain and stirrup length, since

the hip and knee are in close association with each other in the lower extremity biomechanical chain. However, it may be explained through the information from Gonzalez and Sarabon (2020: 7), who described that advanced riders ride with a wide hip angle and internally rotated knee, which creates a balance within the rider biomechanics, decreasing the risk of aggravated knee pain.

5.6.8 Foot and Ankle Pain and Associated Factors

Cold weather had a significant association (p=0.02) as an aggravating factor for foot and ankle pain (**Table 4.40**). Although most participants did not associate stress/tension with being an aggravating factor for foot and ankle pain, there is a possibility for the association (p=0.03) between stress/tension being an aggravating factor for foot and ankle pain (**Table 4.42**). These statistics could be an incidental finding as seen in wrist and hand pain and knee pain. The studies by Pienimaki (2002: 180), Aptel *et al.* (2002: 53) and Buscemi *et al.* (2019: 1135) explained that there are many environmental factors that may have an influence on MSK pain, creating uncertainty around associated factors therefore stress/tension may be an associated aggravating factor for current foot and ankle pain.

5.6.9 The Effect of Musculoskeletal Pain on Riding

It was common for riders to continue riding despite experiencing MSK pain (97%), even though most riders (56%) felt that MSK pain affected their riding performance (**Table 4.8**). Catlin (2010: 100) reports similar statistics, revealing that most riders (54.5%) continued to compete while injured. The findings of this study are supported by the study by Cejudo *et al.* (2020: 6), that horse riders experiencing LBP had decreased training intensity.

5.6.10 Hours A Day and Days Per Week Riding Association with the Location of Pain

There was a significant association (p<0.01) between increased hours a day spent riding and riders experiencing shoulder pain (**Table 4.53**). This association (p=0.06) was also seen in riders riding more days a week, experiencing shoulder pain (**Table 4.54**). These associations are unexpected as participants with shoulder pain did not report any other riding risk factors that increases shoulder pain. These statistics could be explained through the study by Heidbuchel *et al.* (2023: 6), that professional riders ride with their arms held out slightly more in front of their bodies with an extension position of their elbows. Douglas *et al.* (2012: 60) explained that throughout the dynamic movement of riding, a rider will move their shoulder in the opposite direction to their pelvis, as well as their elbows moving backwards and forwards throughout the gait cycles. Douglas *et al.* (2012: 60) also reported that many riders rotate their thoracic girdle to the left while riding, which causes increased movement in the left shoulder, resulting in increased muscle activation. This asymmetry in

movement during riding could be a predisposing factor to causing shoulder pain, especially with long hours of riding, as presented in **Table 4.54.**

5.7 HISTORY OF MUSCULOSKELETAL INJURIES RELATED TO HORSE-RIDING

Injuries not associated with dressage riding were the most common occurrence amongst dressage horse riders (81%). Fractures (42%) were the most predominant type of injury to occur, followed by sprains (15%) (**Table 4.9**). These results are reinforced by the study completed by Wang *et al.* (2022: 2), which revealed that most riders reported having sustained injuries due to trauma or overuse injuries. In a South African study by Wessels *et al.* (2019: 55), horse-kick injuries were prevalent animal-related injuries reported to a trauma centre, as well as falling off a horse. Alternative to the studies by Wang *et al.* (2022: 2) and Wessels *et al.* (2019: 55), Papachristos *et al.* (2014: 1485) identified that head injuries were the most prevalent and most serious horse-riding related injuries, followed by the spine being the second most common region for horse-riding related injuries.

5.8 TREATMENT FOR CURRENT MUSCULOSKELETAL PAIN

This study revealed that most riders received treatment for their MSK pain. Riders predominantly chose chiropractic treatment (46%). The use of medication for their pain was the second most common treatment method (**Table 4.10**). Wang *et al.* (2022: 2) revealed in a small study that most riders received chiropractic treatment for chronic injuries. Alternatively, Catlin (2010: 100), Gines-Diaz *et al.* (2019: 538) and Heidbuchel *et al.* (2023: 2) reported that physiotherapy was another common treatment method received by horse riders, as well as being beneficial for rehabilitation and injury prevention. Although this study has explored which treatment methods may provide relief from pain for dressage horse riders, Acton *et al.* (2019: 1063) and Hoffmann *et al.* (2023: 2) state it is important to understand the associated risk factors and injury patterns to develop adequate injury prevention strategies which may be achieved through the evidence gathered in this study (**Table 4.10** , **Table 4.51**)

5.9 RELIEF FROM PAIN TREATMENTS

This study revealed that chiropractic treatment provided significantly more pain relief compared to riders not receiving chiropractic treatment, as well as the possibility of chiropractic treatment providing better pain relief compared to other treatments received (**Table 4.52**). A study by Wang *et al.* (2022: 2) supports the use of chiropractic treatment for horse-riders as chronic injuries and overuse injuries sustained by horse-riders were

adequately treated and managed indicating that chiropractic treatment may be beneficial for horse-riders.

Another unexpected finding from the statistical data is that even though medication was the second most predominant method used to treat MSK pain, the use of medication did not provide adequate pain relief compared to chiropractic treatment and physiotherapy, as most participants indicated that medication did not effectively relieve their pain. This finding can be explained through the research by Gines-Diaz *et al.* (2019: 538), who stated that exercise or rehabilitative programmes may improve the imbalances in the movement of riders, which will improve the rider's performance. Therefore, if pain is arising from incorrect biomechanics and muscular imbalances, then pain medication will only provide temporary relief because the underlying cause of the pain is not being addressed, whereas chiropractic treatment, physiotherapy, and exercise treatments more commonly address the abnormal biomechanics.

5.10 CLASSIFICATION OF PAIN

Chronic pain is experienced as a global burden, and horse riders predominantly experienced their pain as being chronic (56%) (**Table 4.11**). The findings from Lewis and Kennerley (2017: 260) show that many riders reported their pain to be chronic. Wang *et al.* (2022: 2) supported this finding as it was reported that equestrian-related injuries were common causes that could develop into chronic symptoms and dysfunction.

5.11 BRIEF PAIN INVENTORY

Since pain may develop many disabling characteristics, it was important to assess how disabling MSK pain may be in dressage horse riders based on a BPI questionnaire. Important factors to report on are that the average rating for the worst pain is 6.32, and the average rating for current pain at the time of the questionnaire was 2.71 (**Table 4.12**). Pain severity averaged at 3.57 amongst participants (**Table 4.13**), and pain interference averaged at 3.22 (**Table 4.14**). These statistics indicate that although most riders reported having chronic pain (**Table 4.11**), the pain is not a severely disabling factor for dressage riders, correlating to the statistics that most dressage riders continue riding despite experiencing pain (**Table 4.8**).

A report by Papachristos *et al.* (2014:1468) showed that most riders recover to having mild or no pain and disability post injury, which supports the prevalent finding of a low pain severity score and low pain interference score in this study. When assessing the interference level of pain between daily activity, mood, walking, work ability, relations with others, sleep and enjoyment of life, mood was slightly affected by pain, with an overall

average of 4.14; relations with other people and enjoyment of life were least impacted by pain. Zemkova, Kovåcikova and Zapletalova (2020:22) added that athletes may experience higher pain tolerances especially when at rest which may clarify why pain was not reported as a prevalent interfering factor in the study. Besides the increase in pain threshold, the interaction with horses also has many mental health benefits with the potential of decreasing the risks of any negative mood disorders and enhancing mental health which may also account for the low interference level of pain (Anastasya *et al.* 2024: 42).

CHAPTER SIX CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The aim of this study was to investigate the prevalence of musculoskeletal pain in dressage horse riders in Kwa-Zulu Natal. Musculoskeletal pain is a prevalent occurrence amongst dressage riders, as 89% of riders reported to be experiencing current MSK pain. Most dressage riders experiencing current MSK pain reported their pain to be chronic and, therefore, experienced their pain for more than 6 months, addressing the point and period prevalence of MSK pain. The most common region for riders to experience pain was LBP (48%), followed by neck pain (25%), mid back pain (25%), knee pain (25%) and shoulder pain (24%). The most significant character of pain described by riders was an achy type of pain (N=56), followed by sharpness (62%) and tightness/spasm (57%), as riders experienced these characters often. These findings are significantly beneficial in understand the MSK pain patterns in dressage horse riders which has not been reported on before.

Related to investigating selected risk factors that may impact the incidence of MSK pain, strenuous riding and riding multiple horses a day were the most significant aggravating factors, alongside cold weather, stress/tension, stirrup length, incorrect riding posture, sitting trot and standing. These factors all influenced the neck pain, mid back pain, wrist and hand pain, hip pain, knee pain and foot and ankle pain experienced by a rider. Increased hours a day spent riding and riding more days a week had a significant association with riders experiencing shoulder pain. Most riders also reported having a history of injuries not related to dressage, most commonly fractures and sprains, which is also a potentially significant risk factor for aggravating pain. Understanding the associated risk factors is important in developing relevant pain prevention and awareness strategies to avoid and correct any contributing risk factors.

When determining the impact that MSK pain may have on dressage horse riders, the BPI questionnaire revealed that most riders reported a low rating for current pain and pain interference, as well as most riders reporting low pain severity. These reports correlate to most riders who stated that they continue to ride despite experiencing pain, even though they felt their riding performance was affected by their pain experienced. The riders also reported low pain interference level with general activity, mood, walking, work ability, relations with others, sleep and enjoyment of life. Chiropractic treatment was the most preferred form of treatment used by riders, followed by medication, although riders who used medication to treat their pain reported that it did not provide adequate relief from the

pain experienced. Riders reported significant pain relief from chiropractic treatments and other treatment methods such as yoga, Pilates and stretching.

Accompanied by the literature on the different biomechanical demands on a horse rider, the study has added literature on the different regions that dressage horse riders may be experiencing pain, other than just LBP, which could assist future research studies on how these differing biomechanical demands influence a rider. The study has added to the literature on how pain affects horse riders but also which treatment methods are more effective on dressage horse riders.

6.2 LIMITATIONS

According to Queiros, Faria and Almeida (2017: 381), the reliability of questionnaire data depends on the survey type and the truthfulness of the answers from the participants. Questionnaires do not capture the emotions or behaviour of the participants; this may be a significant limitation as pain is a subjective interpretation by an individual. Choy (2014: 101) indicated that a large sample size is required for effective quantitative research, which may be difficult to obtain with a lack of resources, especially in developing countries. This study has a reasonably small sample size as the study population is limited to KwaZulu-Natal, which is a limitation in maintaining a generalised perspective of MSK pain in dressage horse riders in SA. The insufficient statistical data on the population of horse-riders, and specifically dressage horse riders in SA, makes it difficult to compare the data gathered in KZN to dressage riders in SA. Many dressage riders may also be competing at non-affiliated competitions, resulting in uncertainty regarding the estimation of the number of dressage riders.

They study explored a wide variety of risk factors that may have resulted in confounding variables which could potentially have distorted the associations between the risk factors. A more concise examination of equestrian-related risk factors could have created more precision in the analysis of risk factors related to MSK pain in dressage riders.

6.3 RECOMMENDATION

To better represent equestrian disciplines, future studies should aim at a larger population size to increase the number of questionnaires answered to allow for adequate statistical information. This could be achieved through an online questionnaire platform sent out to all riders throughout all the provinces. It would also be advantageous for future studies to include a wider variety of equestrian disciplines to assess how the pain in different anatomical regions differs between the disciplines, especially since every discipline is unique with different biomechanical demands on the rider. There is the potential for future

studies to further explore in more depth the specific equestrian-related risk factors that affect MSK in riders as this study covered a wide variety of different risk factors.

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APPENDICES

Appendix A: Sample size calculation

C.A.T. Centre
Computer Assisted teaching

www.catcentre.yolasite.com

Dr Noleen D Loubser

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29 August 2022

Ms Jessica Alberts
59 Carlton Avenue
Dawncliffe
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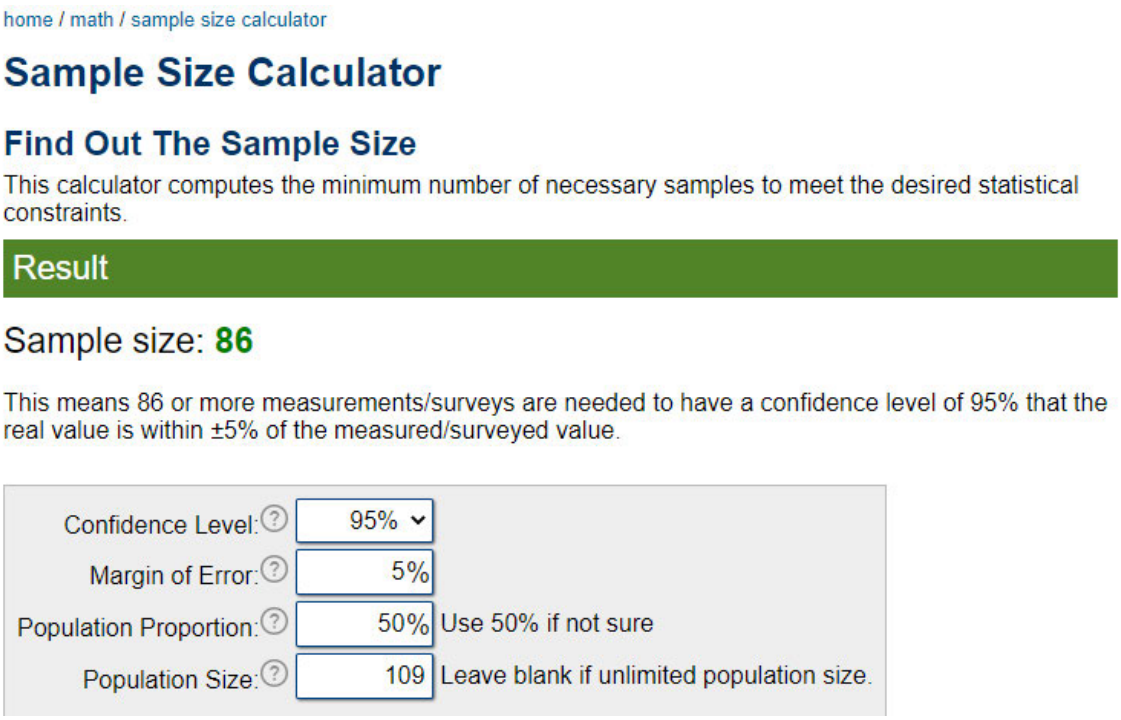
Durban
3629

Dear Jessica

Query about sample size

I have looked through your research proposal. If you intend to survey the whole of KwaZulu-Natal you are looking at a finite population of 109. When populations are small – around 100 or so – researchers often try to survey the whole population if appropriate and possible. To derive a sample size you may apply the sample size formula, or simply take advantage of the sample size calculators readily available online. I have used two such calculators, and both suggest a minimum sample size of 86 with a confidence interval of 95% and a margin of error of 5%. A screenshot is reproduced below for your information.



I hope this helps you. All the best with your research.

Kind regards

Noleen Loubser

Dr Noleen Loubser

(PhD Psychology, Witwatersrand)

Online Consultation:

- Academic Development and Support
- Postgraduate Research
- Research Design and Statistics
- Tutoring and Assignment Assistance
- Lifeskills Coaching
- Editing and Assistance for ESL/EFL

Appendix B: Main study consent form

CONSENT

Full Title of the Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal

Name of Researcher: Jessica Alberts

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Jessica Alberts about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: 032/24,
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, Jessica Alberts, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Jessica Alberts

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

Appendix C: Gatekeepers permission SAEF and DressageSA

23 April 2023
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern.

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal'.

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire.

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

Confidentiality of all participates will be maintained by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants personal information. Confidentiality will be maintained by storing and maintaining all participant data on a password-protected computer and hard-drive.

If you require any further information, please do not hesitate to contact me:
E-mail: jessicaalberts13@gmail.com
Cell: 0718886391

Supervisor contact information:
Professor Sean Chetty
Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: seanchetty@sun.ac.za
Direct Telephone: +27 083 707 4444
Dr Desiree Varatharajullu
Head of Department Chiriopractic
Email: desireev@dut.ac.za
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

[x] Yes. Permission given to conduct research study.

[ ] No. Permission not given to conduct research study.

Signature _

Name: Sharlene Venter Date: 25 April 2024

South African Equestrian Federation

Secretary General

23 April 2023
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern.

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal'.

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire.

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

Confidentiality of all participates will be maintained by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants personal information. Confidentiality will be maintained by storing and maintaining all participant data on a password-protected computer and hard-drive.

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Supervisor contact information:
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Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: seanchetty@sun.ac.za
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Dr Desiree Varatharajullu
Head of Department Chiriopractic
Email: desireev@dut.ac.za
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

☒ Yes. Permission given to conduct research study.

☐ No. Permission not given to conduct research study.

Signature

Name Belinda Sandwith Date 26.4.24

Appendix D: Show holder gate keepers permissions

Centreline Shows - Dressage 3A National Challenge

07 May 2023
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern.

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal'

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

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If you require any further information, please do not hesitate to contact me:
E-mail: [redacted]
Cell: 0718886391

Supervisor contact information:
Professor Sean Chetty
Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: [redacted]
Direct Telephone: +27 083 707 4444
Dr Desiree Varatharajullu
Head of Department Chiropractic
Email: [redacted]
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

☑ Yes. Permission given to conduct research study.

☐ No. Permission not given to conduct research study.

Signature _____

Name SHANA Date 18/05/24

25 May 2023
~~07 May 2023~~
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in Kwa/ulu-Natal'

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire.

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC)

Confidentiality of all participates will be maintained by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants personal information. Confidentiality will be maintained by storing and maintaining all participant data on a password-protected computer and hard drive.

If you require any further information, please do not hesitate to contact me.
E-mail: [redacted]
Cell: 0718886391

Supervisor contact information:
Professor Sean Chetty
Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: [redacted]
Direct Telephone: +27 083 707 4444
Dr Desiree Varatharajullu
Head of Department Chiropractic
Email: [redacted]
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

☑ Yes. Permission given to conduct research study.

☐ No. Permission not given to conduct research study.

Signature

Name ASHLEIGH SANDERSON

Date 25 05 2024

Centreline June Winter Show B Youth champs warm-up

07 May 2023
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal'.

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire.

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

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If you require any further information, please do not hesitate to contact me.
E-mail: [redacted]
Cell: 0718886391

Supervisor contact information
Professor Sean Chetty
Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: [redacted]
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Dr Desiree Varatharajullu
Head of Department Chiropractic
Email: [redacted]
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

☑ Yes. Permission given to conduct research study.

☐ No. Permission not given to conduct research study.

Signature

Name SHANA

Date 03.06.2024.

KZN Dressage Championships

07 May 2023
[41/43 M L Sultan Rd, Greyville, Durban, 4001]

Request for Permission to Conduct Research

To whom it may concern.

My name is Jessica Alberts, a final year MHSc chiropractic student at the Durban University of Technology. The research I wish to conduct for my masters dissertation entitled 'The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal'.

I am hereby seeking your consent to conduct the research at the dressage competitions, asking dressage horse riders to participate in a short questionnaire.

I have provided you with a brief layout of the research documents, including a letter of information regarding the study, which will be provided to each participant to read, the questionnaire and consent forms to be used in the research process, as well as a copy of the approval letter which I received from the Institutional Research Ethics Committee (IREC).

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If you require any further information, please do not hesitate to contact me.
E-mail: [illegible]
Cell: 0718886391

Supervisor contact information:
Professor Sean Chetty
Executive Head of Department Anaesthesiology and Critical Care Stellenbosch University
E-mail: [illegible]
Direct Telephone: +27 083 707 4444
Dr Desiree Varatharajullu
Head of Department Chiropractic
Email: [illegible]
Direct Telephone: 0782220942

Thank you for your time and consideration in this matter.
Yours sincerely,
Jessica Alberts
Durban University of Technology

☑ Yes. Permission given to conduct research study.

☐ No. Permission not given to conduct research study.

Signature

Name SHIWA

Date 27.07.2023.

Appendix E: Participant letter of information

LETTER OF INFORMATION: PARTICIPANT

Dear Participant,

Welcome to my study, I am a sixth-year chiropractic student at Durban University of Technology. I am doing my research for my degree in Masters of Health Science in Chiropractic.

Thank you for your willingness to partake in my research study. Your participation is very much appreciated.

Please see below all relevant details regarding the study.

Title of the Research Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal

Principal Investigator/s/researcher: Jessica Alberts; BHSc Chiropractic

Co-Investigator/s/supervisor/s: Supervisor Professor Sean Chetty (MBChB, FCA, PhD)

and Co-Supervisor Dr Desiree Varatharajullu (PhD in Health Sciences, M.Tech: Chiropractic, AdvDip: Business Administration)

Brief Introduction and Purpose of the Study:

Equestrian sport, specifically dressage, is not commonly researched in KwaZulu-Natal in comparison to other sporting discipline. Horse riding is a very unique sport compared to other sporting disciplines as it is complicated by a horse-rider partnership. Horse riding is considered a dangerous sport with the occurrence of equestrian related injuries estimated at 0.49-0.6 hospitalizations per riding hours. Equestrian related injuries may range from head, neck, spinal, chest, abdomen and extremity injuries. The multitude of contributing risk factors has a significant effect on the horse rider and their prevalence of musculoskeletal pain. There has also been a reported difference between the prevalence a pain experienced between professional and amateur horse riders. However, many studies on horse riders have only assessed the injuries encountered by horse riders or back pain and have combined and compared different disciplines within their study. Musculoskeletal pain may have a significant impact in interfering with daily activities. This study will only be investigating the prevalence of musculoskeletal pain in dressage horse riders and factors that may contribute to the prevalence of musculoskeletal pain. The study will also determine the impact of musculoskeletal pain risk factors in dressage horse riders. This study may add to the limited existing body of knowledge and improve the available data of the prevalence of musculoskeletal pain found amongst dressage riders perceived by the public and healthcare professionals. In addition, the study may provide a better understanding of the depth of the sport and how the athletes/riders are impacted

Outline of the Procedures:

The study has been reviewed and approval by the Durban University of Technology ethical research committees and all research processes have been completed to allow for the commencement of the study.

Permission is requested from each show holder to conduct research at the relevant dressage competition.

Each horse rider will be physically approached to ask for participation in the study. Each participant will be given the opportunity to read this letter of information, if they would like to proceed, participants will be required to sign the informed consent before proceeding to answer the questionnaire.

The duration of the questionnaire will take approximately 5-7 minutes to complete and consists of 4 pages.

All completed questionnaires collected will be encoded and anonymised. Participants to be included will be between the ages of 18 and 60 years of age, dressage must be the primary discipline and experiencing or not experiencing musculoskeletal pain.

Participants not willing to sign the consent form will be excluded from the study.

Risks or Discomforts to the Participant: You will not be involved in any risks or discomforts related to the study.

Reason/s why the participants may withdraw from the study: You are entitled to withdrawal from the study at any time within your own free will. There are no consequences involved if you choose to withdrawal from the study. The researcher may, under certain circumstances such as the participant falling within the exclusion criteria, decide to withdraw the participant from the study.

Benefits: This study may add to the limited existing body of knowledge related to the equestrian sport and equestrian athletes. This study will allow for the improvement of available data of the prevalence of back pain found amongst dressage riders perceived by the public and healthcare professionals.

Remuneration: You will not receive remuneration.

Costs of the Study: You are not required to pay any costs for being involved the study.

Confidentiality: Confidentiality of all participates will be kept private by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants' personal information.

Results: The study will result in a dissertation publication in the Durban University of technology Library

and potential online journal publication. Upon your request, you will be allowed access to the results once published.

Research-related Injury: This study does not involve any risk of research-related injury.

Ethics: All ethical concepts have been extensively considered and evaluated to ensure the study is ethically acceptable. Each participant has the freedom of choice to participate in the study. Informed consent has to be obtained before proceeding. No identifying information regarding the participant will be collected ensuring autonomy. All questionnaires collected will be encoded for confidentiality purposes. The well-being of the participant is always considered to ensure no harm occurs. All participants are fairly, equitable and appropriately included in the study. Race, ethnicity, gender or culture will not be an excluding factor in the study.

Request of permission: Permission will be requested from each show holder to conduct research at the relevant dressage competition.

Storage of all electronic and hard copies including tape recordings: All data collected will be stored in its original form for a minimum of five years, thereafter the data will be destroyed through shredding and electronic data that will be stored on a flash drive will be formatted. The data will be stored in the Durban University of Technology Chiropractic Department. The data will be made accessible to the researcher If publication is made and the research is in the public domain the data will, upon request, be made available to other researchers through the approval of the principal investigator. In the instance of the researcher leaving the University, there is a combined responsibility of the University and the researcher to maintain the accurate storage of data sets. All data will be coded rather than against the participants' personal information.

Persons to contact in the Event of Any Problems or Queries: Please contact the researcher (Jessica Alberts – 071 888 6391), my supervisors (Sean Chetty - 021-9389226 or Desiree Varatharajullu - 031 373 2533), or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support on researchdirector@dut.ac.za.

Appendix F: Final/ main questionnaire

Dear participant
Please see below the relevant questionnaire related to the research.
Part 1: Sport- specific questionnaire
Section 1: Demographic data
Section 2: Horse riding background
Section 3: Musculoskeletal pain
Part 2: Brief Pain Inventory
Please mark the most appropriate answer with tick, cross or circle. Please respond to all relevant open-ended questions where specified.

Key terms:

- Professional horse rider: A rider with a well-developed flatwork, jumping and competition ability; a rider whose form of employment consists of working and riding horses; or horse riders that compete regularly in competitions.
- Experienced horse rider: A rider with a well-developed, competent flatwork or jumping ability and moderate competition ability; a horse rider that partakes in monthly or bi-monthly competitions; a horse rider that does weekly dressage riding.
- Amateur horse rider: A rider who has less than 3000 hours of riding experience or a rider who mostly hacks and partakes in the occasional dressage experience.
- Musculoskeletal pain: Pain originating from bones, joints, ligaments, tendons and/or muscles (Safiri *et al*. 2021: 856).

Part 1: Sport-specific questionnaire			
Section 1: Demographic data			
1.1. Age			
1.2. Sex	Male	Female	Of non-discriminatory gender
1.3. Weight (kg)			
1.4. Height (cm)			

Section 2: Horse Riding Background						
2.1. Level of riding (please see beginning of questionnaire for clarification of terms).	Professional horse rider		Experienced horse rider	Amateur horse rider		
2.2. Years/months of riding						
2.3. Average number of hours a day spent riding.	30min–1hr	2–3hrs	3–4hrs	More than 4 hours		
2.4. Average number of days per week spent riding.	1–2days	2–3 days	3–4 days	5 or more days a week		
2.5. How often do you compete in shows?	Do not compete	Less than once a month	1-2 times a month	3-4 times a month	4-5 times a month	6 or more times a month

Section 3: Musculoskeletal pain history		
3.1. Have you ever experienced musculoskeletal pain at some point when riding?	Yes	No
If your answer is yes to the above question, please continue with the questionnaire. If no, this is the end of the questionnaire, thank you for participating.		
3.2. If yes, please indicate where the most intense pain was experienced	Neck pain	
	Mid-back pain	
	Low back pain	
	Shoulder pain	
	Elbow pain	
	Wrist and hand pain	
	Hip pain	
	Knee pain	
	Foot and ankle pain	
3.3. Have you ever received treatment for your pain?	Yes	No
If yes, please specify what treatment you received	Chiropractor	Physiotherapist
	Homeopath	Occupational therapist
	General practitioner	Orthopaedic surgeon
	Other :	
Current MSK pain		
3.4. Have you experienced this musculoskeletal pain in the last year.	Yes	No
If your answer is yes to the above question, please continue with the questionnaire. If no, this is the end of the questionnaire, thank you for participating.		
3.5. Location of pain	Neck pain	
	Mid-back pain	
	Low back pain	
	Shoulder pain	
	Elbow pain	
	Wrist and hand pain	
	Hip pain	
	Knee pain	
	Foot and ankle pain	
3.6. Any additional areas that you feel pain; please specify: such as abdomen and/or thorax region		

3.7. Character of pain. Please indicate which best describes how the pain feels and how often it occurs. If you have more than one location of pain, you may indicate for each area below.				
Description	Sometimes	Often	Constantly	Only when severe
Aching				
Dull				
Sharp				
Shooting				
Stabbing				
Throbbing				
Tightness/spasm				
Burning				

3.8. Do you continue to ride while experiencing musculoskeletal pain?	Yes		No	
3.9. Does the musculoskeletal pain affect your riding performance?	Yes		No	
3.10. Have you had any previous musculoskeletal injuries related to dressage?	Yes		No	
If yes to 3.10. ; please specify type of injury sustained:	Fractures	Dislocations	Sprains	Strains
	Other(please specify):			
3.11. Have you had any previous musculoskeletal injuries related to horse riding other than a dressage related injury?	Yes		No	
If yes to 3.11. ; please specify type of injury sustained:	Fractures	Dislocations	Sprains	Strains
	Other (please specify):			
3.12. Please indicate what factors may	Worst after strenuous riding	Riding multiple horses in a day	Incorrect riding posture	

contribute to an increased level of pain?	Worst in the evening	Fatigue/exertion	Hot weather
	Worst in the morning	Lying down	Cold weather
	Cantering	Sleeping	Medication
	Sitting trot	Standing	Constant
	Saddle type	Stress/tension	No increase
	Stirrup length	Other:	

3.13. What treatment do you use to manage the pain.	Medication	Natural medication	Physiotherapy	Chiropractic	Surgery
	Other (please, specify):				

3.14. Please indicate which classification your pain may be described as.	Acute (pain for less than 3months)	Subacute (pain between 3-6 months)	Chronic (pain for more than 6 months)

Part 2: Brief Pain Inventory											
Responses: Please tick the most appropriate number for each question related to your musculoskeletal pain. Each item is scaled on a 0–10 numeric rating scale, "0" indicates the least in and 10 indicates the worst (Cleeland 2009: 4).											
Question measure:	0	1	2	3	4	5	6	7	8	9	10
Your pain at its worst	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
Your pain at its least	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
Your pain on average	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
How much pain do you have right now	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
How much relief do you get from pain treatments	0 No relief	1	2	3	4	5	6	7	8	9	100% Complete relief
During increased levels of pain, pain has interfered with your:											
General Activity	0	1	2	3	4	5	6	7	8	9	10

	Does not interfere										Completely Interferes
Mood	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Walking ability	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Normal work (incl. work outside the home and house work.)	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Relations with other peoples	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Sleep	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Enjoyment of life	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes

Thank you for your participation in the research.

Appendix G: Focus group letter of information

LETTER OF INFORMATION: FOCUS GROUP

Dear Participant,

Welcome to the focus group, I am a sixth-year chiropractic student at Durban University of Technology. I am doing my research for my degree in Masters of Health Science in Chiropractic.

Thank you for your willingness to partake in the focus group for my research study. Your participation is very much appreciated.

Please see below all relevant details regarding the study.

Title of the Research Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal

Principal Investigator/s/researcher: Jessica Alberts; BHSc Chiropractic

Co-Investigator/s/supervisor/s: Supervisor Professor Sean Chetty (MBChB, FCA, PhD) and Co-Supervisor Dr Desiree Varatharajullu (PhD in Health Sciences, M. Tech: Chiropractic, AdvDip: Business Administration)

Brief Introduction and Purpose of the Study:

Equestrian sport, specifically dressage, is not commonly researched in KwaZulu-Natal in comparison to other sporting discipline. Horse riding is a very unique sport compared to other sporting disciplines as it is complicated by a horse-rider partnership. Horse riding is considered a dangerous sport with the occurrence of equestrian related injuries estimated at 0.49-0.6 hospitalizations per riding hours. Equestrian related injuries may range from head, neck, spinal, chest, abdomen and extremity injuries. The multitude of contributing risk factors has a significant effect on the horse rider and their prevalence of musculoskeletal pain. There has also been a reported difference between the prevalence a pain experienced between professional and amateur horse riders. However, many studies on horse riders have only assessed the injuries encountered by horse riders or back pain and have combined and compared different disciplines within their study. Musculoskeletal pain may have a significant impact in interfering with daily activities. This study will only be investigating the prevalence of musculoskeletal pain in dressage horse riders and factors that may contribute to the prevalence of musculoskeletal pain. The study will also determine the impact of musculoskeletal pain risk factors in dressage horse riders. This study may add to the limited existing body of knowledge and improve the available data of the prevalence of musculoskeletal pain found amongst dressage riders perceived by the public and healthcare professionals. In addition, the study may provide a better understanding of the depth of the sport and how the athletes/riders are impacted

Outline of the Procedures:

The participants for the focus group will be recruited through email, each participant will be provided with a letter of information about the research including an agenda of the focus group meeting.

A Microsoft teams meeting will be arranged at a convenient date for each participant with a scheduled one hour session. The use of Microsoft teams will allow for the meeting to be video recorded and

transcribed allowing for meeting minutes to be accurately and reliably stored. Before the commencement of the meeting the researcher will read out the letter of information about the research, informed consent and confidentiality agreement to ensure that all participants are adequately informed about the research and focus group. Participants will be allowed the opportunity to asks questions regarding the procedure of the focus group and to clarify any misconceptions that the participants may have.

Each participant will be required to sign the informed consent and confidentiality agreement before further discussions about the research and questionnaire can commence.

The researcher will read out each question of the questionnaire then provide the opportunity for the participants to review the question. The participants will then decide collectively whether they approve the question or not.

To be included in the focus group participants must be 18 years of age or older. Participants will be excluded for the following reasons; participants not willing to sign the consent form and confidentiality agreement; participants unable to understand and comprehend the purpose of the focus group and research; participants not willing to abide to online meeting etiquette such as being punctual, dressing appropriately, speaking only when each individual has their turn and being polite and respectful to others in the focus group.

Risks or Discomforts to the Participant: You will not be involved in any risks or discomforts related to the study.

Reason/s why the participants may be withdrawn from the Study: You are entitled to withdrawal from the study at any time within your own free will. There are no consequences involved if you choose to withdrawal from the study. The research may, under certain circumstances such as the participant falling within the exclusion criteria, decide to withdraw the participant from the study.

Benefits: This study may add to the limited existing body of knowledge related to the equestrian sport and equestrian athletes. This study will allow for the improvement of available data of the prevalence of back pain found amongst dressage riders perceived by the public and healthcare professionals.

Remuneration: You will not receive remuneration.

Costs of the Study: You are not required to pay any costs for being involved the study.

Confidentiality: Confidentiality of all participates will be kept private by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants' personal information.

Results: The study will result in a dissertation publication in the Durban University of technology Library and a

potential publication submission to the Dressage Council of SA and potential online publication. Upon your request, you will be allowed access to the results once published.

Research-related Injury: This study does not involve any risk of research-related injury.

Ethically: All ethical concepts have been extensively considered and evaluated to ensure the study is ethically acceptable. Each participant has the freedom of choice to participate in the study.

Informed consent has to be obtained before proceeding. No identifying information regarding the participant will be collected ensuring autonomy. All questionnaires collected will be encoded for confidentiality purposes. The well-being of the participant is always considered to ensure no harm occurs. All participants are fairly, equitable and appropriately included in the study. Race, ethnicity, gender or culture will not be an excluding factor in the study.

Request of permission: Permission will be requested from each show holder to conduct research at the relevant dressage competition.

Storage of all electronic and hard copies including tape recordings: All data collected will be stored in its original form for a minimum of five years, thereafter the data will be destroyed through shredding and electronic data that will be stored on a flash drive will be formatted. The data will be stored in the Durban University of Technology Chiropractic Department. The data will be made accessible to the researcher If publication is made and the research is in the public domain the data will, upon request, be made available to other researchers through the approval of the principal investigator. In the instance of the researcher leaving the University, there is a combined responsibility of the University and the researcher to maintain the accurate storage of data sets. All data will be coded rather than against the participants' personal information.

Persons to contact in the Event of Any Problems or Queries: Please contact the researcher (Jessica Alberts – 071 888 6391), my supervisors (Sean Chetty - 021-9389226 or Desiree Varatharajullu - 031 373 2533), or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support on researchdirector@dut.ac.za.

Appendix H: Focus group consent form

CONSENT

Full Title of the Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal.

Name of Researcher: Jessica Alberts

Statement of Agreement to Participate in the Focus Group:

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

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, Jessica Alberts, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Jessica Alberts	_____	_____
Full Name of Researcher	**Date**	**Signature**
_____	_____	_____
Full Name of Witness (If applicable)	**Date**	**Signature**
_____	_____	_____
Full Name of Legal Guardian (If applicable)	**Date**	**Signature**

Appendix I: Focus Group Confidentiality statement and code of conduct

IMPORTANT NOTICE: This form is to be read and filled in by every member participating in the focus group, before the meeting convenes.

CONFIDENTIALITY STATEMENT AND CODE OF CONDUCT: FOCUS GROUP

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

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

3. The information from this focus group will be made public in terms of a dissertation/thesis and/or journal publication, which will in no way identify any of the participants involved in this expert group.

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

5. All data generated from this expert group will be kept for five years in a secure location at Durban University of Technology and thereafter will be destroyed. Once this form has been read and agreed to, please fill in the appropriate information below and sign to acknowledge agreement. Please print in block letters:

FOCUS GROUP MEMBER: _____ SIGNATURE: _____

WITNESS NAME: _____ SIGNATURE: _____

RESEARCHER'S NAME: ___Jessica Alberts _____ SIGNATURE: _____

SUPERVISOR'S NAME: _____ SIGNATURE: _____

Appendix J: Two-part questionnaire —— focus group

Dear participant

Please see below the relevant questionnaire related to the research.

Part 1: Sport- specific questionnaire

- Section 1: Demographic data
- Section 2: Horse riding background
- Section 3: Musculoskeletal pain

Part 2: Brief Pain Inventory

Please mark the most appropriate answer with tick, cross or circle. Please respond to all relevant open-ended questions where specified.

Key terms:

- Professional horse rider: A rider with a well-developed flatwork, jumping and competition ability; a rider whose form of employment consists of working and riding horses; or horse riders that compete regularly in competitions.
- Amateur horse rider: A rider who has less than 3000 hours of riding experience or a rider who mostly hacks and partakes in the occasional dressage experience.
- Musculoskeletal pain: Pain originating from bones, joints, ligaments, tendons and/or muscles (Safiri, et al. 2021: 856).

Part 1: Sport-specific questionnaire			
Section 1: Demographic data			
1.1. Age			
1.2. Sex	Male	Female	Of non-discriminatory gender
1.3. Weight (kg)			
1.4. Height (cm)			
1.5. Profession/Occupation			

Section 2: Horse Riding Background				
2.1. Level of riding (please see beginning of questionnaire for clarification of terms).	Professional horse rider		Amateur horse rider	
2.2. Years/months of riding				
2.3. Average number of hours a day spent riding.	30min–1hr	2–3	3–4	More than 4 hours
2.4. Average number of days per week spent riding.	1–2	2–3	3–4	5 or more days a week

2.5. How often do you compete in shows?	Less than once a month	1-2 times a month	3-4 times a month	4-5 times a month	6 or more times a month

Section 3: Musculoskeletal pain history		
3.1. Have you ever experienced musculoskeletal pain at some point when riding?	Yes	No
If your answer is yes to the above question, please continue with the questionnaire. If no, proceed to the end of the questionnaire.		
3.2. If yes, please indicate where the most intense pain was experienced	Neck pain	
	Mid-back pain	
	Low back pain	
	Shoulder pain	
	Elbow pain	
	Wrist and hand pain	
	Hip pain	
	Knee pain	
	Foot and ankle pain	
3.3. Have you ever received treatment for your pain?	Yes	No
If yes, please specify what treatment you received	Chiropractor	Physiotherapist
	Homeopath	Occupational therapist
	General practitioner	Orthopaedic surgeon
	Other :	
Current MSK pain		
3.4. Have you experienced this musculoskeletal pain in the last year.	Yes	No
If your answer is yes to the above question, please continue with the questionnaire. If no, proceed to the end of the questionnaire.		
3.5. Location of pain	Neck pain	
	Mid-back pain	
	Low back pain	
	Shoulder pain	
	Elbow pain	
	Wrist and hand pain	
	Hip pain	
	Knee pain	
	Foot and ankle pain	

3.6. Any additional areas that you feel pain; please specify: such as abdomen and/or thorax region				
3.7. Character of pain. Please indicate the which best describes how the pain feels and how often it occurs.				
Description	Sometimes	Often	Constantly	Only when severe
Aching				
Dull				
Sharp				
Shooting				
Stabbing				
Throbbing				
Tightness/spasm				
Burning				

3.8. Do you ride throughout experiencing musculoskeletal pain?	Yes	No
3.9. Does the musculoskeletal pain affect your riding performance?	Yes	No
3.10. Have you had any previous musculoskeletal injuries related to dressage?	Yes	No
If yes to 3.10. ; please specify type of injury sustained:		
3.11. Have you had any previous musculoskeletal injuries related to horse riding other than a dressage related injury?	Yes	No
If yes to 3.11. ; please specify type of injury sustained:		
3.12. Do you partake in other physical activities other than horse riding?	Yes	No
	Walking	Gym/weight exercises

If yes to 3.12. ; Please specify the type of physical activity you partake in.	Running			Exercises classes	
	Swimming / Aqua classes			Other	
If yes to 3.12.; how many days per week?	1 - 2	2 - 3	3 - 4	> 5	
If yes to 3.12.; how long do you exercise for?	20 - 30 minutes	40–60 minutes	>60 minutes		
3.13. Are there any factors that contribute to an increased level of pain? Please indicate what factors are most applicable to you?	Worst in the morning	Sleeping	Fatigue/exertion		
	Worst in the evening	Lying down	Stress/tension		
	Changes in weather	Walking	Specific food		
	Standing	Running	Alcohol		
	Sitting	Reaching overhead	Medication		
	Bending over	Exercise	Other		
3.14. How do you manage your pain	Medication	Natural medication	Physiotherapy	Chiropractic	Surgery
	Other (please, specify):				

Part 2: Brief Pain Inventory											
Responses: Please tick the most appropriate number for each question related to your musculoskeletal pain. Each item is scaled on a 0–10 numeric rating scale, "0" indicates the least in the past 24 hours and 10 indicates the worst in the past 24 hours (Cleeland 2009: 4)											
Question measure:	0	1	2	3	4	5	6	7	8	9	10
Your pain at its worst in the past 24 hours	0 No pain	1	2	3	4	5	6	7	8	9	10 Pain as bad as you can imagine
Your pain at its least in the past 24 hours	0 No pain	1	2	3	4	5	6	7	8	9	10 Pain as bad as you can imagine
Your pain on average	0 No pain	1	2	3	4	5	6	7	8	9	10 Pain as bad as you can imagine
How much pain do you have right now	0 No pain	1	2	3	4	5	6	7	8	9	10 Pain as bad as you can imagine
In the past 24 hours, how much relief have you had from pain treatments	0 No relief	1	2	3	4	5	6	7	8	9	10 Complete Relief
During the past 24 hours, pain has interfered with your:											
General Activity	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes

Mood	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Walking ability	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Normal work (incl. work outside the home and house work.)	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Relations with other peoples	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Sleep	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Enjoyment of life	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes

Thank you for your participation in the research.

Appendix K: Pilot study consent form

CONSENT

Full Title of the Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal

Name of Researcher: Jessica Alberts

Statement of Agreement to Participate in the Pilot study:

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

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, Jessica Alberts, herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Jessica Alberts

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

Appendix L: Pilot study confidentiality statement and code of conduct

IMPORTANT NOTICE: This form is to be read and filled in by every member participating in the pilot study, before the meeting convenes.

CONFIDENTIALITY STATEMENT AND CODE OF CONDUCT: PILOT STUDY

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

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

3. The information from this focus group will be made public in terms of a dissertation/thesis and/or journal publication, which will in no way identify any of the participants involved in this expert group.

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

5. All data generated from this expert group will be kept for five years in a secure location at Durban University of Technology and thereafter will be destroyed. Once this form has been read and agreed to, please fill in the appropriate information below and sign to acknowledge agreement. Please print in block letters:

PILOT STUDY MEMBER: _____ SIGNATURE: _____

WITNESS NAME: _____ SIGNATURE: _____

RESEARCHER'S NAME: ___Jessica Alberts _____ SIGNATURE: _____

SUPERVISOR'S NAME: _____ SIGNATURE: _____

Appendix M: Pilot Study letter of information

LETTER OF INFORMATION: PILOT STUDY

Dear Participant,

Welcome to the pilot study, I am a sixth-year chiropractic student at Durban University of Technology. I am doing my research for my degree in Masters of Health Science in Chiropractic.

Thank you for your willingness to partake in the pilot study for my research study. Your participation is very much appreciated.

Please see below all relevant details regarding the study.

Title of the Research Study: The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal

Principal Investigator/s/researcher: Jessica Alberts; BHSc Chiropractic

Co-Investigator/s/supervisor/s: Supervisor Professor Sean Chetty (MBChB, FCA, PhD) and Co-Supervisor Dr Desiree Varatharajullu (PhD in Health Sciences, M. Tech: Chiropractic, AdvDip: Business Administration)

Brief Introduction and Purpose of the Study:

Equestrian sport, specifically dressage, is not commonly researched in KwaZulu-Natal in comparison to other sporting discipline. Horse riding is a very unique sport compared to other sporting disciplines as it is complicated by a horse-rider partnership. Horse riding is considered a dangerous sport with the occurrence of equestrian related injuries estimated at 0.49-0.6 hospitalizations per riding hours. Equestrian related injuries may range from head, neck, spinal, chest, abdomen and extremity injuries. The multitude of contributing risk factors has a significant effect on the horse rider and their prevalence of musculoskeletal pain. There has also been a reported difference between the prevalence a pain experienced between professional and amateur horse riders. However, many studies on horse riders have only assessed the injuries encountered by horse riders or back pain and have combined and compared different disciplines within their study. Musculoskeletal pain may have a significant impact in interfering with daily activities. This study will only be investigating the prevalence of musculoskeletal pain in dressage horse riders and factors that may contribute to the prevalence of musculoskeletal pain. The study will also determine the impact of musculoskeletal pain risk factors in dressage horse riders. This study may add to the limited existing body of knowledge and improve the available data of the prevalence of musculoskeletal pain found amongst dressage riders perceived by the public and healthcare professionals. In addition, the study may provide a better understanding of the depth of the sport and how the athletes/riders are impacted

Outline of the Procedures:

Participants for the pilot study will be recruited through WhatsApp and email, all participants are provided with a letter of information about the research, an informed consent (and confidentiality agreement. Once the consent form and confidentiality agreement has been signed, each participant will be emailed with a link to the online questionnaire as well as and additional link to a questionnaire evaluation form. To be included in the pilot study participants must be between the ages of 18 and 60 years of age. Dressage must be the primary discipline that the participants partake in. Participants may either be experiencing or not experiencing musculoskeletal pain. Participants will be excluded

from the study for the following reasons; participants that are not willing to sign the consent form and confidentiality agreement.

Risks or Discomforts to the Participant: You will not be involved in any risks or discomforts related to the study.

Reason/s why the participants may withdraw from the Study: You are entitled to withdrawal from the study at any time within your own free will. There are no consequences involved if you choose to withdrawal from the study. The research may, under certain circumstances such as the participant falling within the exclusion criteria, decide to withdraw the participant from the study.

Benefits: This study may add to the limited existing body of knowledge related to the equestrian sport and equestrian athletes. This study will allow for the improvement of available data of the prevalence of back pain found amongst dressage riders perceived by the public and healthcare professionals.

Remuneration: You will not receive remuneration.

Costs of the Study: You are not required to pay any costs for being involved the study.

Confidentiality: Confidentiality of all participates will be kept private by encoding and anonymising all personal identification information with numerical code as a form of identification (i.e. participant 01, participant 02), this will ensure anonymity and privacy of all information. All data will be stored against the numerical code rather than against the participants' personal information.

Results: The study will result in a dissertation publication in the Durban University of technology Library and a

potential publication submission to the Dressage Council of SA and potential online publication. Upon your request, you will be allowed access to the results once published.

Research-related Injury: This study does not involve any risk of research-related injury.

Ethically: All ethical concepts have been extensively considered and evaluated to ensure the study is ethically acceptable. Each participant has the freedom of choice to participate in the study. Informed consent has to be obtained before proceeding. No identifying information regarding the participant will be collected ensuring autonomy. All questionnaires collected will be encoded for confidentiality purposes. The well-being of the participant is always considered to ensure no harm occurs. All participants are fairly, equitable and appropriately included in the study. Race, ethnicity, gender or culture will not be an excluding factor in the study.

Request of permission: Permission will be requested from each show holder to conduct research at the relevant dressage competition.

Storage of all electronic and hard copies including tape recordings: All data collected will be stored in its original form for a minimum of five years, thereafter the data will be destroyed. The data will be stored in the Durban University of Technology Chiropractic Department. If publication is made and the research is in the public domain the data, the data will, upon request, be made available to other researchers.

Persons to contact in the Event of Any Problems or Queries: Please contact the researcher (Jessica Alberts – 071 888 6391), my supervisors (Sean Chetty - 021-9389226 or Desiree Varatharajullu - 031 373 2533), or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support on researchdirector@dut.ac.za.

Appendix N: Pre-pilot two-part questionnaire

Dear participant

Please see below the relevant questionnaire related to the research.

Part 1: Sport- specific questionnaire

- Section 1: Demographic data
- Section 2: Horse riding background
- Section 3: Musculoskeletal pain

Part 2: Brief Pain Inventory

Please mark the most appropriate answer with tick, cross or circle. Please respond to all relevant open-ended questions where specified.

Key terms:

- Professional horse rider: A rider with a well-developed flatwork, jumping and competition ability; a rider whose form of employment consists of working and riding horses; or horse riders that compete regularly in competitions.
- Experienced horse rider: A rider with a well-developed, competent flatwork or jumping ability and moderate competition ability; a horse rider that partakes in monthly or bi-monthly competitions; a horse rider that does weekly dressage riding.
- Amateur horse rider: A rider who has less than 3000 hours of riding experience or a rider who mostly hacks and partakes in the occasional dressage experience.
- Musculoskeletal pain: Pain originating from bones, joints, ligaments, tendons and/or muscles (Safiri, et al. 2021: 856).

Part 1: Sport-specific questionnaire			
Section 1: Demographic data			
1.1. Age			
1.2. Sex	Male	Female	Of non-discriminatory gender
1.3. Weight (kg)			
1.4. Height (cm)			

Section 2: Horse Riding Background						
2.1. Level of riding (please see beginning of questionnaire for clarification of terms).	Professional horse rider		Experienced horse rider		Amateur horse rider	
2.2. Years/months of riding						
2.3. Average number of hours a day spent riding.	30min–1hr	2–3hrs	3–4hrs	More than 4 hours		
2.4. Average number of days per week spent riding.	1–2days	2–3 days	3–4 days	5 or more days a week		
2.5. How often do you compete in shows?	Do not compete	Less than once a month	1-2 times a month	3-4 times a month	4-5 times a month	6 or more times a month

Section 3: Musculoskeletal pain history				
3.1. Have you ever experienced musculoskeletal pain at some point when riding?	Yes	No		
If your answer is yes to the above question, please continue with the questionnaire. If no, this is the end of the questionnaire, thank you for participating.				
3.2. If yes, please indicate where the most intense pain was experienced	Neck pain			
	Mid-back pain			
	Low back pain			
	Shoulder pain			
	Elbow pain			
	Wrist and hand pain			
	Hip pain			
	Knee pain			
	Foot and ankle pain			
3.3. Have you ever received treatment for your pain?	Yes	No		
If yes, please specify what treatment you received	Chiropractor	Physiotherapist		
	Homeopath	Occupational therapist		
	General practitioner	Orthopaedic surgeon		
	Other :			
Current MSK pain				
3.4. Have you experienced this musculoskeletal pain in the last year.	Yes	No		
If your answer is yes to the above question, please continue with the questionnaire. If no, this is the end of the questionnaire, thank you for participating.				
3.5. Location of pain	Neck pain			
	Mid-back pain			
	Low back pain			
	Shoulder pain			
	Elbow pain			
	Wrist and hand pain			
	Hip pain			
	Knee pain			
	Foot and ankle pain			
3.6. Any additional areas that you feel pain; please specify: such as abdomen and/or thorax region				
3.7. Character of pain. Please indicate the which best describes how the pain feels and how often it occurs.				
Description	Sometimes	Often	Constantly	Only when severe
Aching				
Dull				

Sharp				
Shooting				
Stabbing				
Throbbing				
Tightness/spasm				
Burning				

3.8. Do you continue to ride while experiencing musculoskeletal pain?	Yes	No
3.9. Does the musculoskeletal pain affect your riding performance?	Yes	No
3.10. Have you had any previous musculoskeletal injuries related to dressage?	Yes	No

If yes to 3.10. ; please specify type of injury sustained:	Fractures	Dislocations	Sprains	Strains
	Other(please specify):			
3.11. Have you had any previous musculoskeletal injuries related to horse riding other than a dressage related injury?	Yes		No	
If yes to 3.11. ; please specify type of injury sustained:	Fractures	Dislocations	Sprains	Strains
	Other (please specify):			

3.12. Please indicate what factors may contribute to an increased level of pain?	Worst in the morning	Sleeping	Fatigue/exertion
	Worst in the evening	Lying down	Stress/tension
	Changes in weather	Walking	Specific food
	Standing	Running	Alcohol
	Sitting	Reaching overhead	Medication
	Bending over	Exercise	No increase
	Other:		

3.13. What treatment do you use to manage the pain.	Medication	Natural medication	Physiotherapy	Chiropractic	Surgery
	Other (please, specify):				

3.14. Have you experienced this MSK pain in the past 24 hours	Yes	No
If your answer is yes to the above question, please continue with the questionnaire. If no, this is the end of the questionnaire, thank you for participating.		

Part 2: Brief Pain Inventory											
Responses: Please tick the most appropriate number for each question related to your musculoskeletal pain. Each item is scaled on a 0–10 numeric rating scale, "0" indicates the least in the past 24 hours and 10 indicates the worst in the past 24 hours (Cleeland 2009: 4)											
Question measure:	0	1	2	3	4	5	6	7	8	9	10
Your pain at its worst in the past 24 hours	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
Your pain at its least in the past 24 hours	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
Your pain on average	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
How much pain do you have right now	0 No pain	1	2	3	4	5	6	7	8	9	10 Intolerable pain
In the past 24 hours, how much relief have you had from pain treatments	0 No relief	1	2	3	4	5	6	7	8	9	10 Complete relief
During the past 24 hours, pain has interfered with your:											
General Activity	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Mood	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Walking ability	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Normal work (incl. work outside the home and house work.)	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Relations with other peoples	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Sleep	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes
Enjoyment of life	0 Does not interfere	1	2	3	4	5	6	7	8	9	10 Completely Interferes

Thank you for your participation in the research.

Appendix O: Questionnaire evaluation form

Dear pilot study participant,

Thank you for your co-operation in partaking in my research study.

To ensure improved accuracy and validity of the study questionnaire, could you please complete the follow question regarding the study and questionnaire.

Questionnaire evaluation form			
1. Did you understand the topic?	Yes	No	
2. Did you find the topic interesting?	Yes	No	A little
3. Did you understand the questions?	Yes	No	Some
3.1. If there are any question you did not understand, please specify which ones and why?			
4. To your understanding, Were the questions relevant to the topic?	Yes	No	Some
4.1.If there are any questions that you found were not relevant please specify which ones and why?			
5. How did find the length of the questionnaire.	Too short	Appropriate	To long
6. Did you understand the instructions regarding answering the questionnaire	Yes	No	
6.1. If no, please specify what you did not understand			

Thank you for your valuable participation in my research study.

Appendix P: IREC full approval

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

5 May 2024

Ms J Alberts
59 Carlton Avenue
Dawncliffe
Westville
Durban
3629

Dear Ms Alberts

The Epidemiology of Musculoskeletal Pain in Dressage Horse Riders in KwaZulu-Natal
Ethics Clearance Number: IREC 032/24

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 letter.

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 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 J K Adam
Chairperson: DUT-IREC

Appendix Q: Statistician data analysis

RE: J.ALBERTS Stats consultation

KM

Kidd, M, Prof [mkidd@sun.ac.za] <mkidd@sun.ac.za>

Wednesday, 26 April 2023 at 2:22 PM

To: Jessica Alberts

Statistical Analysis
Summary statistics will be reported as histograms, frequencies, percentages for categorical data, and means/standard deviations for ordinal/continuous data. For comparison purposes, cross tabulation with the chi-square test will be used to compare categorical responses. One-way ANOVA will be used to compare ordinal/continuous responses between groups, and correlation analyses for testing relationships between ordinal/continuous responses. Statistica 14 will be used to do the statistical analyses.

Prof Martin Kidd
Centre for Statistical Consultation
Dept of Statistics and Actuarial Sciences University of Stellenbosch Private Bag X1, Matieland 7602, South Africa
Tel: 8082561
Fax: 8083830
Cel: 0837334941

Appendix R: Plagiarism report

turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Jessica Alberts
Assignment title:	5th Submission
Submission title:	J.ALBERTS(21719348) Dissertation for examination copy.docx
File name:	J.ALBERTS_21719348_Dissertation_for_examination_copy.docx
File size:	203.45K
Page count:	70
Word count:	21,919
Character count:	118,698
Submission date:	08-May-2025 10:21AM (UTC+0200)
Submission ID:	2670042296

Appendix S: Editor's certificate

Helen Bond
IMPELA EDITING SERVICES
impelaediting@gmail.com
079 395 5873

29 April 2025

CERTIFICATE

Jessica Alberts

Dear Jessica

Thank you for using Impela Editing Services to edit your Master's thesis entitled "*THE EPIDEMIOLOGY OF MUSCULOSKELETAL PAIN IN DRESSAGE RIDERS IN KWAZULU-NATAL*".

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 DUT's 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)