BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF SPORT SCIENCE

DEVELOPING ANKLE INJURY PREVENTION STRATEGIES FOR UNDER-14 FEMALE TENNIS PLAYERS IN HARARE CENTRAL DISTRICT SCHOOLS.

BY

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REG NUMBER: B225126B

A DESSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR THE BACHELOR OF SCIENCE DEGREE IN SPORTS SCIENCE AND MANAGEMENT

JUNE 2025

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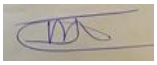
Signature:  Date: June 2025

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ACKNOWLEDGEMENTS

I would like to acknowledge the schools that granted permission for me to collect data within their institutions. Additionally, special thanks goes to my research supervisor, for her invaluable guidance and support throughout the study.

I am grateful to the under 14 female tennis players who participated in this study by answering the questionnaire, and also extent my heartfelt gratitude to the coaches, players and health staff who took their time to answer the interview questions. I would also like to extent my appreciation to the Chairperson, for the invaluable guidance during our workshops, which significantly enhanced my understanding of the research process.

My sincere thanks go to all the faculty members for their continuous support and mentorship, as well as to my classmates, whose collaborative discussions and encouragement have enriched my learning experience. Your contributions have been instrumental in the success of this study.

DEDICATION

I dedicate this research to my family members, whose unwavering support and encouragement have motivated me to work hard. I am deeply grateful to my research Supervisor, for her guidance and challenges she presented throughout my study. Finally I would like to thank my classmates for their constant encouragement during my research journey.

ABSTRACT

This study aimed to develop ankle injury prevention strategies for under-14 female tennis players in Harare Central District Schools. The study recognized a real need, given that ankle injuries have been shown to hinder athletes' overall sporting performance and participation in sporting activities generally. This study sought to quantify and characterize ankle injuries in this group of athletes, explore contributory factors to ankle injuries, assess current injury prevention strategies, and finally to design a program specific to the context of the group.

Mixed methods research included a quantitative and qualitative approach to inform the study. Quantitatively, 72 under-14 female tennis players were randomly sampled, and completed structured questionnaires focusing on injury prevalence and prevention methodologies. Qualitatively, and using purposive sampling 8 stakeholders were interviewed to inform regarding their lived experiences, understandings, knowledge, and perceptions around ankle injuries and ankle injury prevention strategies. Data analysis consisted of a statistical analysis of the quantitative data using SPSS, and a thematic analysis of the qualitative data using Vivo software, so that common trends and themes could be generated.

These findings illustrated a concern of high prevalence of ankle injuries, that participants had a past injury and were aware of their injury risks in the training environments that they would play in. Correlations indicated that even though players recognized the importance of warm-up exercises when it came to ankle strengthening exercises, they usually did not do them. The study had numerous biomechanical, training issues, and environmental factors that contributed to injury risk, including inappropriate footwear, training environments that had poor conditions and recovery in training schedules that did not allow for appropriate recovery. Participants voiced needing more education on injury prevention and the need more focused programs. Current injury prevention protocols generally deemed ineffective by players as they felt their needs were not made. Statistical analysis showed that 58% of the players reported having at least one ankle injury in their lifetime. In the past year 33% experienced ankle injuries with 60% of these injuries being sprains.

Overall, the study identified the urgency for players under 14 female tennis players in Harare to have specific ankle injury prevention strategies. Overall, the findings show the need to consider both intrinsic and extrinsic factors in injury prevention initiatives. Developing context-specific programs that included education, safe training environments, and injury prevention strategies may contribute towards protecting and improving safety and performance for young female players, and encourage long-term participation in tennis.

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CHAPTER ONE: THE PROBLEM AND ITS SETTING

1.1 Introduction

This chapter presents an introduction to the study on Developing Ankle Injury Prevention Strategies for under 14 Female Tennis Players in Harare Central District Schools. The purpose of the study is to explore the prevalence and causes of ankle injuries. This chapter outlines the Background to the Study, on the relevance of tennis and the importance of injury prevention in young female athletes; it also includes a Statement of the Problem, which describes the issue of ankle injuries and prevalence issues, followed by Research Questions that relate to the issues being investigated. In addition, the Research Objectives are, identified to outline the research purpose. The Significance of the Study, outlines why the findings are of importance to stakeholders, and the Delimitations of the Study outlines the targets of focus.

1.2 Background of the Study

According to Hunt et al (2017), ankle injuries are one of the most prevalent types of injuries occurring in tennis, particularly for young female athletes competing in intensity sports such as tennis. The under-14 stage of athletic development is a key period when an athlete is potentially more exposed to injury. In Harare Central district schools, female players are participating in tennis more frequently each year, however, ankle injuries remain prevalent, and pre-injury prevention plans require attention. Although ankle injuries are regarded as a serious injury concern in youth sports, very little is known about the particular mechanisms of injury in young female tennis players (Hewett et al., 2019). A systematic review by Dwyer et al. (2019) found that the lack of strength, flexibility, and balance all influenced the rate of ankle injuries which supports the case for educational programs and training approaches to prevent injuries. Nevertheless, the existing practices within the schools of Harare often fail to provide the required sport-specific preventative strategy and are often based on generic training approach and not context for tennis (Zech et al., 2020)

The present level of knowledge demonstrates an increased awareness of the necessity of injury prevention measures for female athletes, especially during their development. Evidence collected from injury prevention models highlights the need for comprehensive approaches that encompass all of the factors involved in injury prevention, such as strengthening exercises, balance training,

and proprioceptive strategies (Katz et al., 2020). However, the majority of the existing programs have little to no adjustments to accommodate the unique population of under 14 female tennis players. This evidence conveys the need for on-location strategies that address both the physiological and psychological aspects that are unique to this demographic (Müller et al., 2021).

The literature review shows clear gaps in knowledge about culturally relevant ankle injury prevention strategies among under 14 tennis players in Zimbabwean schools. There are a number of international programs, which have been successful in reducing injury rates for youth athletes, but they can rarely be adapted to local context and sports culture in Harare (Krause et al., 2020). Compounding the issue is the lack of ethnographic studies that explore how young female athletes understand and engage with injury prevention programs, because of the high-risk of implementing ineffective strategies with poor acceptance by the target population.

Additionally, current knowledge limitations are due to a lack of longitudinal studies exploring the long term effectiveness of injury prevention programs aimed specifically at young female tennis players. Myer et al., (2014) highlighted the importance of continually evaluating injury prevention programs to ensure they are still addressing the needs of adolescent athletes. Data collection methods in this area will need to develop into more substantial methodologies.

In comparison, better practices from different geographical areas demonstrate that successful ankle injury prevention initiatives in tennis use programs that have been developed, tested and modified to meet local needs. The FIFA 11+ program has demonstrated the capacity to reduce injury rates in a broader range of youth sports and with strong education of coaches and athletes (Bahr & Krosshaug, 2005). In contrast, Harare's current performance in ankle injury prevention for under 14 female tennis players reflects a reactive approach, not a proactive approach.

The significance of this study lies in its potential to address this gap by identifying strategies for evidence based ankle injury prevention strategies customized for under 14 female tennis players in Harare Central District Schools. This research aims to develop a framework that encompasses not only physical conditioning protocols, but also education, awareness and cultural conformation, thereby aim to mitigate the number of ankle injuries, and enhancing the overall safety and performance of these athletes.

1.3 Statement of the Problem

In youth sports ankle injuries remain a common problem with an ever-growing population of young female tennis players. In the Harare Central District Schools, the attendance and participation of female tennis athletes in tennis has increased but sadly the incidence of ankle injuries also increased. Such injuries to young athletes not only prevent them from being active physically, they can have life-time consequences on their progression as competitive athletes as well as impacting their psychological growth and development in tennis sport. There is a level of awareness that ankle injuries are a concern, including for under 14 female tennis players, but a multitude of variables that are contributing to the injuries are poorly understood and the literature has not provided much clarification. Therefore, there is a significant gap in current evidence.

The injury prevention strategies currently used within the schools in Harare often do not address the specific demands of the sport and the physiological characteristics of young female tennis players. Research shows that generic training programs do not address the biomechanical risks associated with tennis, predominantly the quick lateral bursts and pivoting (Katz et al., 2020). Currently, studies investigating injury prevention collectively speak of youth athletes without considering gender or specific games which neglects differences in injury mechanisms and based practice regarding intended injury prevention strategies. Value for this study is based upon bridging the gap in knowledge and practice related to injury prevention on ankle injuries in under 14 female tennis players. More so, developing specific injury prevention strategies, this study aims to reduce ankle injuries and also improve the safety, performance and enjoyment of the sport for the young female tennis players. Moreover, creating an opportunity for female players to enjoy the game in an environment where they can develop, without the risk of injury, may promote longer term participation in tennis.

To address this problem, the study will employ a multifaceted approach to develop evidence based injury prevention strategies that are specific to the context of Harare's Central District schools. This will include a thorough needs assessment which will include obtaining quantitative and qualitative data from players, coaches and health professionals. The research on this intervention will not only look to reduce injury risk, but aims to improve the overall experience for young female tennis players in Harare Central District Schools.

1.4 Research Questions

Primary

What ankle Injury Prevention Strategies can be developed for under 14 Female Tennis Players in Harare Central District Schools?

Subsidiary questions

1. What is the prevalence of ankle injuries among under -14 female tennis players in Harare Central District Schools?

2. What biomechanical, training related and environmental factors contribute to ankle injury risk in this population?

3. How effective are existing injury prevention protocols in reducing ankle injury rates in Harare's under 14 female tennis players?

4. What components should be prioritized in a context- specific ankle injury prevention program for under 14 female tennis players?

1.5 Research Objectives

Primary

Developing Ankle Injury Prevention Strategies for Under 14 Female Tennis Players in Harare Central District Schools.

Subsidiary objectives

1. To establish the prevalence of ankle injuries in under 14 female tennis players in Harare Central District Schools.

2. To establish biomechanical, training related and environmental factors contribute to ankle injury risk in this population.

3. To assess the effectiveness of existing injury prevention protocols in reducing ankle injury rates in Harare's under 14 female tennis players.

4. To develop a context specific ankle injury prevention program for under 14 female tennis players.

1.6 Significance of the Study

This study holds transformative potential by addressing critical gaps across theoretical, practical and scientific domains, thereby advancing both scholarship and real world outcomes for under 14 female tennis players in Harare Central district schools. The current injury prevention frameworks, such as the ITF's “Tennis Ready," have been developed on biomechanical and training load theories from higher income contexts (Kovacs et al., 2016) but are less relevant to looking at low resource contexts like Zimbabwe because of limitations in their sociocultural and infrastructural issues. In building upon the theory of participatory designs and a community based adaptive approach to women's sport, this research will be able to construct a different theoretical model which explains how injury prevention can be contextualized to environments that have uneven service courts, limited equipment, and socio-economic differentials. This contribution is important because a gap exists in sports science literature, which largely ignores the ways that structural inequalities impact on injury risk (Abrams et al., 2019).

Widely recommended prevention strategies, like neuromuscular training, that are evidence based are infrequently used in Harare, due to cost constraints and lack of coach training (McKay et al., 2021). This study will develop practicable, low-cost solutions, including adaptations of local materials for balance training or revision of warm up protocols that suit schools with limited budgets. By co-design interventions with coaches and players to enhance the practical relevance and sustainability of the study while also bridging the gap between global guidelines and on the ground practices. Zimbabwe currently does not have any formal policies that mandate injury prevention as part of sport, especially for marginalized groups like adolescent female athletes. This research could provide an evidence base to advocate for policy changes, including formalized injury reporting mechanisms, mandatory coaching certifications in injury prevention and funding to improve sports safety infrastructure. By establishing relationships with interested parties including the Zimbabwe Tennis Union and the Ministry of Primary and Secondary Education the findings can catalyze institutional changes that prioritize athlete welfare (World Health Organization, 2020).

Current epidemiological data on tennis related injuries in Sub Sahara Africa are non-existent, concentrating mostly on elite athletes in high income countries (Pluim et al., 2018). The study will produce the first dataset on the prevalence, risk factors and consequences of ankle injuries in under 14 female tennis players in Zimbabwe contributing to sports medicine literature on a global scale. Furthermore, the mixed methods evaluation of adapted interventions will offer unique contributions to the field of implementation science in resource constrained settings, which is relatively understudied (Jayanthi et al., 2020).

1.7 Delimitation of the study

1. This study is limited to schools from Harare Central District.

2. The setting provides a relevant context to study injury prevention strategies specific to this population.

3. The study focusing explicitly on under 14 female tennis players. This age group is particularly at risk for ankle injuries due to their advancing physical abilities requiring focused study. In addition, the study will look at only tennis.

4. This focus allows for a deeper analysis of the specific injury risk of tennis, as well as the impact of individual injury prevention strategies.

5. The study will be limited to ankle injuries. This focus is important in order to develop specific and effective prevention strategies that focus on the most common types of injury associated with this sport.

1.8 Study Outline

Chapter 1 Introduction

This chapter presents information on the background of the study by providing a context for and rationale for the research. It will also provide a brief overview of, and a statement of the purpose of the study to establish a basis for the research.

Chapter 2: Literature Review

In this chapter, existing literature related to the study is examined. The literature relates to the research questions posed, also it draws on previous study and theoretical models used the current study.

Chapter 3: Method

This chapter explains the methods to access participants and obtain data. It describes the research design, sampling, and data collection tools used to conduct the study.

Chapter 4: Findings and Analysis

In this chapter, the finding of the study are presented and an analysis and interpretation of the data is presented highlighting overall findings from the study.

Chapter 5: Summary, Conclusions and Recommendations

In this chapter, an organized summary of the findings of this study represented, conclusions are drawn from the findings and recommendations for future research and practice are offered.

1.9 Chapter Summary

This chapter focuses on the critical matter of ankle injuries in female tennis players under 14 years old in selected schools in Harare Central District of Zimbabwe. Ankle injuries are a serious concern because of their alarming prevalence and longitudinal growth with the sports increase in participation. The chapter discusses the urgency for specifics means of prevention for ankle injuries that account for the biomechanical, training and environmental factors for injury incidence. The chapter describes the limitations of current generalized systemic approaches and furthermore emphasizes the need for individualized approaches to improve young female athlete's safety and performance. The next chapter will conduct a literature review on injury prevention approaches, employ the findings of previous studies and concepts from a theoretical framework, to deter and find evidence based interventions for this vulnerable population. It will focus explicitly on under female tennis player' s needs and barriers to being safe and healthy while enjoying tennis, to ensure that these deficits are addressed and focus will be on individualized training plans.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter propose a complete literature review focused on the development of injury prevention strategies for ankle injuries among under 14 female tennis players in Harare Central District Schools. This literature aims to review what is known about the prevalence, mechanisms, and outcomes of ankle injuries sustained by young female tennis players. A review of effective intervention methods is also included, which can be appropriately adapted for the needs of these athletes. The chapter aims to build on existing literature by synthesizing findings from various studies and highlighting the need for injury prevention interventions to be contextualized in terms of the particular cultural and environmental factors that contribute to sports participation in Harare, and the meaning of sport in general. This study will lay the groundwork for the creation of focused prevention initiatives that can improve athlete safety, sustain participation in sport and in turn improve the health outcomes of young female tennis players in Harare Central District Schools.

2.2 Conceptual Review

2.2.1 Ankle Injuries

Ankle injuries pose a significant concern within sports medicine, encompassing various conditions such as ligament sprains, fractures, and chronic instability. These injuries frequently arise from abrupt forces applied to the ankle joint during physical activities, including sudden inversion, eversion, and rotational movements (Pluim et al., 2018). In tennis, the rapid lateral movements required, often on uneven surfaces, substantially increase the likelihood of ankle injuries. Adolescent athletes are particularly susceptible to these injuries due to several factors that are more pronounced in this age group, such as growth-related musculoskeletal imbalances and underdeveloped proprioception, which is the body's ability to perceive its position and movement in space (Herzog et al., 2019). This heightened vulnerability in adolescent female athletes is exacerbated by the physiological changes they undergo, including variations in muscle and joint strength, stability, and coordination.

Significantly, ankle injuries in young athletes have a considerable time delay related to an acute event. Research evidence has shown that ankle injuries can lead to enduring consequences, such

as early onset osteoarthritis and a greater decline in sporting participation for those that sustain those injuries (Katz et al. 2020). There needs to be an effort in adopting preventative injury strategies that target existing injury risks, such as footwear and the levels of warming up, as well as systemic gaps, such as access to services like physiotherapy and specialized coaching.

2.2.2 Injury Prevention Strategies

Injury prevention strategies are systematic, evidence based interventions designed to minimize the incidence, severity, and re-injury rates. These strategies often involve a combination of educational practices, environmental changes, and modification to training methods such as neuromuscular training or adjusting equipment to mitigate risk factors (Emery et al., 2019). With a focus on the athlete's age, sport specific demands, and biomechanical vulnerabilities, these strategies are applicable to sports medicine also (McKay et al., 2021). While global frameworks for example FIFA 11 + or ITF'S Tennis Ready, provide a basis for strategies, application in a low resource context relies on adaptability. Strategies need to prioritize affordability, cultural relevance, and the participation of stakeholders for example involving coaches in the designing of the program to ensure sustainable implementation.

2.2.3 Under 14 Female Tennis Players

The demographic of under 14 female tennis players who actively compete either competitively or recreationally in tennis. This population faces a unique injury risk with factors of biological and culturally influenced injury risk. The biological changes associated with puberty can alter biomechanical capabilities such as increased ligament laxity and has been shown to put female athletes at a greater risk of injuries (Jayanthi et al., 2020). Cultural factors, for example lower access to training and specialized coaching resources for females, can limit the young female athlete's protection from injury in sport (McGuine et al., 2020). The population of under 14 female athletes has been largely neglected in sports medicine research resulting in a lack of gender specific evidence based injury prevention strategies.

This omission is significant as it overlooks the detrimental physiological and psychological stresses experienced by young athletes. Factors such as performance pressures, societal expectations, competition intensity, and coaching strategies can significantly affect their commitment to injury prevention practices. It is essential to implement targeted strategies that

address the unique physiological and maturation characteristics of this age group to enhance injury prevention outcomes. Additionally, situational elements that may elevate injury risk, including insufficient training, inappropriate footwear, and inadequate warm-up routines, must be effectively integrated into the injury prevention framework. By addressing these factors, we can foster a more comprehensive approach to safeguarding young athletes' health and performance.

The context of schools in the district of Harare Central is an important element in determining the effectiveness of an injury prevention program. There can be disparities in resources, quality of coaches, and systems of support that influence the ability to successfully implement injury prevention strategies. Schools that have access to qualified coaches, and dedicated training facilities can create environments that may be somewhat better at facilitating effective practice of injury prevention strategies. Therefore, this research seeks a mixed method approach examining not only the physical and physiological aspects associated with ankle injuries, but the educational and community context involved. Acknowledging and understanding the relationships between these factors will enable the development of injury prevention programs that are meaningful to under 14 female tennis players in Harare. These programs will be intended to strengthen their physical preparation whilst creating supportive behaviors for safe participation in sport, with the aim to ultimately contribute to the safety and performance of young female tennis players, instilling healthier and more active behaviors at a key age of adolescent development.

2.3 Theoretical Review

2.3.1 The Socio-Ecological Framework Model (SEM)

The Socio-ecological Model (SEM) provides a complete framework to comprehend the complex layers of influence surrounding health behaviors and outcomes; encompassing individual intrapersonal factors and experiences, interpersonal relationships, organizational structures, community, and policy influences. Veer, Golf-Paperz, and Zarai (2029) offered a more recent version of the SEM which displays each of the layers more clearly, including the size and significance relative to one another. In the study "Developing Injury Prevention Strategies for Ankle Injuries in Under 14 Female Tennis Players in Harare Central District Schools," the SEM could guide assessment of factors influencing injury among young female players. For example, intrapersonal factors may include characteristics like fitness, ages, historical events like previous

injury. Interpersonal factors could consider the influence of coaches, peers, family, and how supports, and attitudes influence training methods and beliefs about injury prevention. Organizational factors could be explored by providing examples of resources available for schools to teach or promote injury prevention to young female athletes. Community has many influences that may help or hinder the effectiveness of injury prevention supports as well. Community influences include access to sporting facilities, safe facilities, reduction of sports-related injuries of youth at the community level, and a supportive community environment to engage in injury prevention practices. Overall, the SEM broadly connects specific influences, while acknowledging the importance of considering the dimensions of personal beliefs and environmental systems.

While some frameworks focus either on individual behavioral factors or biological factors or injury prevention, the SEM provides a more holistic view in part because health outcomes are mediated by social and environmental contexts. A holistic view, including social contexts, aligns with current public health perspectives that argue the most effective injury prevention strategies must incorporate and consider individual behavior, plus other systems and influences that cause injuries to occur within sport. By using SEM, this study can develop more holistic plans for injury prevention interventions for young female tennis players in Harare that allow them to plan for greater specificity related to behaviors. Recent literature indicates that ankle injuries have risen in young female athletes particularly amongst those participating in higher impact sports such as tennis. Evidence shows that female athletes incur ankle injuries at a rate 3-6 higher than male athletes because of increased anatomical differences, hormonal fluctuation, and limited neuromuscular coordination. Recent research even shows that ankle sprains, fundamentally preventable, are 20% higher than male tennis players, in an American study (Akins et al., 2014). This research has suggested more targeted prevention methods utilizing strength training and biomechanics.

Injury contexts for young tennis players have been examined in various studies in different countries and continents. An Australian study found that 26% of all injuries in junior players were related to the ankle (Mason et al., 2017). A subsequent Dutch study (Visscher et al., 2028) found poor warming up and unsuitable footwear to be contributing factors to ankle injuries. These studies not only show the international nature of these challenges, but they also point to risk factors that

are common across different international contexts in terms of the importance of suitable equipment and training. There are serious similarities and differences when taking these international facts and analyzing Zimbabwe's situation. In terms of equipment, access to sports means (including appropriate footwear and training resources) as an expensive resource is a challenge across many nations, including Zimbabwe. However, this challenge may be exacerbated in Zimbabwe's unique socioeconomic situation, which may limit access to records for injury management, or modern approaches to training. This uniqueness provides a significant gap to be filled.

A review of global literature reveals notable trends in injury prevention strategies, with several being effectively adopted in various nations. For instance, Norway has established a robust initiative known as injury prevention in young athletes, which integrates self-monitoring tools for athletes alongside educational resources for coaches. In contrast, Zimbabwe appears to lack structured programs that offer comprehensive injury prevention strategies. The current absence of organized injury prevention initiatives and educational frameworks within the realm of school sports in Zimbabwe underscores the necessity for the proposed research. This study aims to formulate country-specific interventions tailored to the unique contexts of Harare Central District Schools, utilizing insights from the Social-Ecological Model (SEM) while benchmarking against global best practices.

This comprehensive approach is consistent with prevailing public health perspectives, which suggest that efforts to mitigate injuries in sports contexts must take into account both individual behaviors and the systemic factors that influence these behaviors and contribute to injury occurrences. The present study employed the Social-Ecological Model (SEM) to formulate more sophisticated and effective injury prevention strategies that address various elements impacting young female tennis players in Harare. Consequently, this modeling approach may ultimately improve overall athletic performance and health outcomes.

2.4 Thematic Review

2.4.1 Prevention and Incidence rates of Ankle injuries

Ankle injuries are a major concern for youth sport, especially among female athletes. The frequency of lower extremity injuries is often greater in multi-directional sports (for example,

tennis, basketball and soccer) that require abrupt changes in direction (Solomon et al., 2019). DeWit et al (2020) noted that female athletes, particularly those under 14 years of age, had a significantly higher occurrence of ankle injuries than male athletes. This disparity is due to physical and physiological differences, including structural ligament laxity and muscle strength (Hewett et al. 2019). The prevalence of ankle injuries in young female tennis players appears to be significant. For example, Smith et al. (2021) noted that 30% of female tennis players aged 12 to 18 had sustained an ankle injury in the last year, with more than half of those injuries occurring in competition. In addition, approximately 15% of all injuries reported among young athletes participating in a variety of sports are ankle sprains, with female tennis players expected to report higher rates than male players (Cameron et al., 2018).

In comparative research, tennis ankle injury rates may be higher than those of other sports. For example, Barrow et al. (2022) examined a large injury data set from several sports and determined that tennis had a relatively high percentage (21%) of ankle injuries, compared to football (18%) and basketball (16%). The unique characteristics of tennis, specifically the multi-directional changes of direction and sudden stops, can increase the risk of incurring an ankle injury (Bahr & Krosshaug, 2005). Additionally, the related mechanisms of injury in tennis must be considered. In contrast to sports that may have more linear movements, tennis requires individuals to sprint in a multidirectional manner, often with a pivoting or twisting movement, which may increase the likelihood of experiencing both torsional and lateral ankle injuries (Muller et al., 2021). Whereby the differences in these injury mechanisms are important for understanding injury mechanisms and ultimately implementing appropriate injury prevention strategies.

Further, injury risk profiles vary between sports due to factors such as court surface and footwear. For example, hard courts that are generally utilized in tennis often exert higher ground reaction forces and if the golfer is inappropriately shoed for hard court "warfare" there would be almost a 100 percent chance of acute injuries occurring such as ankle sprains (Lopez Valenciano et a., 2019). With an appreciation of the full context, both academics and practitioners will be able to make sound and rational judgments for effectively reducing injury problems in their playing populations. This would assist in developing effective strategies for reducing injuries in this specific context. The high prevalence and incidence rates for ankle injuries in young female tennis

players has created an epidemiological context that warrants further attention. When its specific nuances are considered in relation to other sports in terms of injury risk profiles it also can generate a level of concern and warrant dedicated research to intervention strategies. While the number of injuries might not be substantial in a competitive sense or relative to overall injury incidence, gaining more insights on the injury profile, causes and risk factors can create safer sport for young women.

2.4.2 Biomechanics of Ankle injuries

2.4.2.1 Mechanisms of Injury Specific to Tennis movements

The biomechanics of ankle injuries in tennis relate mainly to the dynamic nature of the sport, including quick-shifting movements, explosive speed, and jumping, and associated muscle activations. Ankle sprains are common in tennis because young athletes are more exposed to the explosive movements of lateral shuffles and running stops. The biomechanics involved in lateral movement result in high angular velocities and loading forces experienced by the ankle which could exceed the stability of the ankle (Dempsey et al., 2018). For example, pivoting to return a shot after lateral run can be difficult, resulting in achy strategies that cause sprains during acceleration, or landing in an asymmetrical position. Gonzalez et al., (2020), for example, indicate that quick lateral movement partnered with landing asymmetrically can lead to an ankle sprain. A study examining the types of injuries tennis players sustain; Olsson et al. (2019), suggested that most ankle injuries sustained by tennis players are the result of an inversion injury which occurs when the foot rolls to the inside (or "inverts") typically associated with landing after a jump, or during other lateral movements. Olsson et al., (2019) also point out that the quick, abrupt, and inconsistent loading and twisting motions and techniques characteristic to support while playing tennis often create situations where both acute chronic injuries occur protectively to the ankle. Importantly, research consulted by the American Orthopedic Society for Sports Medicine pointed out that women tennis players are more likely to sustain ankle injuries due to inherent biomechanical and physiological reasons (Hewett et al., 2019), therefore, sport specific injury prevention strategies are necessary.

2.4.2.2 Factors Contributing to Ankle stability in young female tennis players

Ankle instability is a prominent problem in young female tennis players, resulting from behavioral and intrinsic risk factors. Anatomical variables, such as laxity of ligaments and weaknesses in

muscle strength, can be particularly impactful during pubescent growth spurts (Zhang et al., 2021). A Meta-analysis of 59 articles by Myer and colleagues (2014), found that young females often carry lower strength to weight ratios when compared with young males, which could be a detriment to joint stability. Those with histories of ankle sprains may experience residual deficits in proprioception and muscle strength, which lead to functional instability (Sweeney et al., 2020). A study by Kauffman and colleagues (2021) confirmed that perturbations in neuromuscular control post ankle injury can enhance the likelihood of re-injury, especially before and after the physical actions and changes inherent in tennis play. The form of prevention for tennis players, thus requires strategies to both rehabilitate to the best of the players capabilities, and strategies to strengthen the joint over a longer time horizon for joint stability.

2.4.2.3 Risk Factors for Ankle Injuries

Intrinsic factors

Intrinsic factors, including age, composition of the body and previous injuries, play an important role in ankle injury risk for young female tennis players. Tennis places high demands on a young athlete's neuromuscular systems, and younger athletes, particularly those in the under 14 age group, may not have developed the neuromuscular systems that allow for an effective response, ultimately across the trajectory of the injury, (Hewett, Myer and Ford, 2019). During development, the factors for injury risk may be greater as the young athlete is physically changing rapidly due to growth and may have minimal previous experience with athletic training (Zech, et al., (2020). Body composition is yet another intrinsic factor influencing injury risk. For example, increased body fat percentage in a young female athlete may not directly influence the risk of ankle injuries but the limitations in their agility that may result from higher body fat percentages puts the athlete at greater risk for ankle injuries as well as other lower extremity injuries when making quick movements (Zhang et al., 2021). A past history of injuries is a strong indicator of the future injury. In a meta-analysis, a past history of leg or ankle sprains was one of the most significant indicators of a future injury (Dwyer, et al., 2019).

Extrinsic factors

Extrinsic factors, such as the training environment, the shoes worn, and court surfaces, also have an effect on injury risk. The training environment, relating to the properties of the practice surface,

as well as the overall safety of the venue contribute to injury risk. Training on unstable, uneven surfaces can create proprioceptive deficits which can increase risk (Solomon et al., 2019). In terms of footwear, the shoe must provide support to the ankle. Sports shoes for tennis should provide suitable support for lateral movement and injection for court impact, but many young females wear poorly fitted or worn down shoes which restrict the support available (Muller et al., 2021). A study (Leavitt et al., 2021) indicated sports shoes specifically designed for tennis significantly reduced the podiatric injuries associated with lateral movement in young female tennis players. The surface of the court also affects incidence of ankle injuries. The hard surfaces predominantly used in tennis are associated with an increase of foot-ground impact injury, when compared to the more cushioning surfaces of clay court (Lopez Valenciano et al., 2019). Overall, these studies should indicates that coaches and trainers should consider extrinsic factors when planning training programs and discerning injury risk variables in young female athletes.

2.4.2.4 Current Injury Prevention Strategies

Injury prevention programs are essential for reducing the risk of ankle injuries in young athletes, particularly those participating in a high impact sport such as tennis. Many studies have previously assessed the effectiveness of current programs in schools and tennis clubs. Most consistently document that despite many injury prevention programs being implemented, the extent they reduce injury risks is inconsistent and dependent on design and delivery. A systematic review of injury prevention programs in youth sport, which also included interventions developed for tennis, was conducted by Katsoulis et al. (2020). The review showed that multifaceted programs involving educational content on injury risks, supervised training sessions, and movement skill development resulted in statistically significantly reduced injury incidence. However, the inconsistency of participation rates and variable adherence of young athletes to intervention components impacted the overall effectiveness of programs (Katz et.al, 2020).

Insights from international practices and guidelines for injury prevention in youth sports

Globally, organizations have created recommendations and best practices for preventing youth sport injury. The FIFA 11+ program was developed for soccer, but has been adapted for other sport (such as tennis). This program emphasizes injury prevention during, and through, a warm up program that is based on strength, balance, and flexibility, and modified for young athletes (Krause

et al., 2020). The research demonstrated that there is an evident reduction in injuries among youth athletes of as much as 30% when evidence-based programs are implemented (Bahr & Krosshaug, 2005). The Austrian Sports Commission has developed an injury prevention structure that encourages incorporating scientific research into sport training and education. Recommendations from their guideline state that programs should be age and ability appropriate, inclusionary, and should focus on developing fundamental movement skills to reduce injury risk (Australian Sports Commission, 2018). These considerations emphasize not only international collaboration but evidence based (effective) programs, as appropriate, may be adapted in local contexts.

2.4.2.5 The role of strengths and conditioning

The importance of implementing strength training, flexibility and balance exercises on injury risk reduction strategies relative to ankle injuries in young female tennis players cannot be overstated. The literature strongly suggests that developing physical capacities including strength and flexibility can effectively reduce risk of injury. Strength training increases stability and strength of the musculoskeletal system, particularly the ankle and lower limb, allowing for greater support when performing dynamic low to implementing (Hewett et al., 2019). Flexibility training allows for an increased range of motion in the ankle joint and surrounding musculature, improving movement mechanics when playing (Shultz et al., 2016). Furthermore, there has been a strong association established between adequate flexibility and reduced injury risk, particularly for sports that include rapid changes in direction.

In addition, proprioceptive training is heavily reliant on balance exercises that are crucial for the prevention of injuries. A study conducted by Myer et al. (2014) demonstrated that warm-up protocols that included balance training heightened proprioception and lowered the incidence of ankle sprains in younger athletes. Therefore, an overall training program that incorporates strength, flexibility, and balance components is vital in the injury prevention process. When considering the specific demands of tennis and the intricacies related to the vulnerabilities of young female athletes, it is essential to have specific conditioning programs for injury prevention types of efforts. When considering the specific demands of tennis and the intricacies related to the vulnerabilities of young female athletes, it is important to have athlete specific conditioning programs for effective injury prevention. Developing individual training protocols specific to the needs of an athlete ultimately enhances the participants' performance outcomes while limiting their risk of

injury. The findings of Zazulak et al. (2021) suggest that athlete specific interventions that account for strength deficits, balance ability, and previous history of injury has been shown to positively influence functional stability while lower injury rates.

Moreover, the process of well-rounded conditioning that involves functional training based on sport specific movements (i.e., lateral shuffles, plyometric activities, and speed and agility training) could further aid the efficacy of these conditioning programs (Krause et al., 2020). These elements of training facilitate the development of sporting qualities that can help young female tennis players' deal with the demands of the sporting activity while remaining injury-free. Overall, the current literature regarding injury prevention strategies for young female tennis players emphasizes the need for comprehensive injury prevention programs, to combine education with physical training. The incorporation of strength training, flexibility training, and balance training within tailored conditioning programs is integral to excellent injury prevention. By implementing and maintaining a focus on these strategies, coaches, trainers, and sports organizations can foster a sporting environment that is health-focused and promotes performance in young female players.

2.4.2.6 Gaps in Current Injury Prevention Strategies

Lack of tailored programs

A key gap in the literature is the lack of injury prevention programs specifically designed to address the unique biomechanics of the sport of tennis and the physiological characteristics of young female athletes. Most current intervention programs take a broad universal protocol approach, which does not consider the specific demands of tennis movements such as lateral shuffles and abrupt stop and go movements (Katz et al., 2020). There is ample evidence that supports the continued need for interventions that are created and delivered to facilitate the movement patterns, training intensity and training contexts that are unique to tennis, however, there is limited research that forms studies based around these unique components.

Insufficient Longitudinal studies

Most studies evaluating the efficacy of injury prevention programs are of a short-term nature and do not have any longitudinal data around the durability of the benefits of the program. Without

long-term studies, it is difficult to determine how well these injury prevention programs reduce injury rates over time. Whether or not athletes continue to apply the techniques that they have learned must also be measured (Zech et al., 2020). Research is warranted to assess the long-term durability of injury prevention strategies while following young athletes.

Under exploration of cultural of contextual factors

Many international frameworks and best practice guidelines for injury prevention are typically based on research studies from particular sporting and cultural contexts, and may not generalize well to other contexts. More ethnographic research is required to explore how cultural understandings of sports (and with them, gender) may shape acceptance and success of intervention in education around injury prevention in young female tennis players. This type of research would address the cultural dimension of injury prevention and assist in the development of relevant and effective programs (Krause et al., 2020).

2.5 Conclusion

The current state of literature on injury prevention strategies and the role of strength and conditioning for young female tennis players with ankle injuries presents several significant gaps. These gaps include an absence of tailored programs, a lack of longitudinal studies, and limited exploration of cultural aspects in implementation. In addition, by failing to focus on specific conditioning protocols, neuromuscular training, and psychological elements, we are also complicating the landscape of feasible injury prevention strategies. To improve the safety and performance of young female tennis players, it is critical that the identified gaps in the current literature are addressed in order to create more viable injury prevention strategies and healthier experiences in sport. Future research should address these gaps, and also continue to develop comprehensive, evidence- based strategies that address the unique needs of this demographic.

2.6 Chapter Summary

This chapter examines ankle injuries in young female tennis players (under 14 years of age), highlighting the unique risks associated with their physical development and the demands of the sport. It discusses how these injuries can lead to reduced participation in sport and significant long term problems. When considering current injury prevention strategies, the chapter discusses how many of the injury prevention programs do not

CHAPTER THREE: MATERIALS AND METHODS

3.1 Introduction

This chapter describes the materials and methods used to conduct a study in formulating injury prevention strategies for ankle injuries in under 14 female tennis players in Harare Central District School. The methodological issues outlined in this study include methodological approach, time horizons, research strategy, and sampling procedures, data collection procedures, data analysis and presentation and ethical considerations.

3.2 Methodological Approach

The research supports the case for using a mixed methods method. This is because the method combines quantitative and qualitative approaches to collect data from a number of sources. For instance, O' Brien et al (2023), support the use and argue mixed methods is appropriate for this study as it allows for a more complete understanding of ankle injuries and prevention because it produces statistical information in combination with personal experiences and perspectives from the participants. Consequently, the quantitative part, included semi structured interviews to better understand the participants' experiences surrounding ankle injuries and prevention methods.

3.3 Time Horizons

The study utilized the cross-sectional time horizon approach which allows for the data to be collected at one point in time. In this regard, Saunders et al. (2023) contends that time horizon is useful for taking a snapshot of the number of angle injuries and practices in relation to injury prevention among under 14 female tennis players. In doing so, the study will be able to provide immediate information relevant to current training and injury management practices.

3.4 Research Strategy

The research adopts the explanatory sequential research strategy of administering questionnaires followed by interviews to validate the quantitative findings. The initial quantitative data collection, through the questionnaires, gave the background required, to understand the pattern of ankle injuries and their prevalence. Qualitative data was then utilized to validate and expand these findings. The qualitative data further established the reasons why some of type of injury are prevalent and what strategies can be used to prevent them.

3.5 Population and Sampling

3.5.1 Population

The target population for the study consisted of 88 under 14 female tennis players participating from schools in Harare Central District, 8 coaches, and 6 sports health practitioners. This age group was selected because of the increase in young females participating in tennis and the likelihood of sustaining an ankle-related injury.

3.5.2 Sampling Procedures

A quantitative samples were selected using random sampling procedures. Each player in the population had an equal possibility of being sampled. Therefore, this method makes the sample representative and the quantitative findings can be generalized. Conversely, purposive sampling was used for the qualitative strand. For the qualitative strand, purposive sampling involved selecting specific individuals or groups of individuals, namely coaches, players, and sports health professionals, to provide insights based on their knowledge and experiences related to ankle injuries.

3.5.3 Sample Size Determination

The quantitative sample size was derived from the use of standard sample size tables and a formula to allow confidence in the results. While the quantitative sample size forms the "n" when applying qualitative sampling principles, theoretical sampling values were applied to determine the number of participants, as highlighted by Guest et al. (2017) and Saunders and Townsend (2018). Using theoretical sampling values led to participants selected and based on the relationship between researcher and participant, with saturation as the draw card for determining the required size, ensuring all aspects of the research questions are answered and enough data was captured to answer and make conclusions.

Table 3.1: Quantitative sample

Stakeholders	Population (N)	Sample size (n)	Calculator method
Players	88	72	n=1+N(e2)N

Table 3.2: Qualitative sample

Stakeholders	Population	Sample	Sample size determinant
Players	12	5	Theoretical sampling principles
Coaches	8	4	Theoretical sampling principles
Health staff	6	3	Theoretical sampling principles
Totals	26	12	Theoretical sampling principles

3.6 Data Collection Procedures

3.6.1 Pilot Study/Pre-test

Prior to the main study commenced a pilot study was conducted to evaluate the data collection instruments. The pretest used a smaller group of participants, and the feedback was collected from the participants on how clear and comprehensive the questionnaires and interview guides were. This pretest or 'pilot study' was useful to further refine the instruments to make sure they could adequately collect the data needed.

3.6.2 Main Study

The primary research study occurred over four weeks and occurred within the Harare Central District schools. It involved the administration of structured questionnaires to under 14 female tennis players to obtain quantitative data on injury prevalence and injury prevention practices. Questionnaires gave a questionnaire personally to participants on an individual basis, ensuring the researcher could collect the papers a few days afterward to give the players a qualitative understanding of their experiences of ankle injuries. The subjects of the research were players, coaches and health professionals to cover all bases. The mode of data collection was ideal for both quantitative data and contextual data providing broader understanding and analysis of the contributing factors to ankle injuries.

3.7 Data Analysis and Presentation

Quantifiable data were analyzed using the Statistical Package for the Social Science (SPSS) to statistically analyze the prevalence of injury and the associated factors. Descriptive statistics such as frequencies and percentages were calculated to summarize the data. For the qualitative component, NVivo software was used to identify themes and patterns in the interview transcripts. This thematic analysis provided valuable insights into the participants' experiences and perceptions relating to ankle injury prevention.

3.8 Validity, Reliability, and Trustworthiness

To guarantee credibility and reliability, several approaches were used. The validated questionnaires ensured the reliability of the measures for the quantitative data. The qualitative data were triangulated, comparing results from multiple participants to review and confirm the accuracy of the transcriptions and the interpretations of their interviews. That is, the researcher took various steps to engage the validity and reliability.

3.9 Ethical Considerations

Concerns about ethics were at the forefront of all stages of the research. Before the primary study, permission to conduct the study was obtained from school authorities and other sports organizations where necessary and appropriate. Informed consent was obtained from participants, and their parents/guardians, which allowed participants to understand the purpose and procedures of the study. Anonymity was protected by assigning each participant a unique identification number, and data were stored securely to protect confidentiality.

3.10 Chapter Summary

In this chapter, the materials and methods used in this study have been outlined, describing the mixed methods approach, time horizons, research strategy, population, sampling strategies, data collection and analysis, and ethical considerations. The study employs quantitative and qualitative methods to develop a holistic understanding of ankle injuries in under-14 female tennis players in Harare Central District Schools with the intent to ultimately propose effective injury prevention strategies.

CHAPTER 4: DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This chapter outlines the results of the study that produced ankle injury prevention strategies in female tennis players under 14 year old in schools in Harare Central District. The chapter begins with the response rate of the data phase, including the final number for analysis and presentation. The chapter continues with the demographic information of the participants, including age, gender, and experience. The next step is the reliability testing for the collection instruments, ensuring that the measures are consistent and credible. It moves to answer the research objective that addressed injury prevention challenges proactively experienced by female under 14 tennis players in the Harare Central District focused on ankle injuries. The chapter also features tables, figures, and charts to aid interpretation and the display of results.

4.2 Response Rate

4.2.1 Questionnaire Response

This section outlines the questionnaire response rate from under 14 female tennis players in Harare Central District schools.

Table 4.1: Questionnaire response rate

Stakeholders	**Questionnaire distributed**	**Questionnaire Returned**	**Questionnaire not returned or invalid**	**% retuned**
Under 14 female Players	72	72	0	100
Total	72	72	0	100

A complete sample of 72 questionnaires were distributed to under 14 female tennis players from schools located in Harare Central District to explore the development of injury prevention strategies for ankle injuries. There was 100% response rate, showing commitment and interest.

This further shows that this study is relevant for the stakeholders. In addition, it is beneficial to have no questionable responses to determine if responses were usable and can reasonably be judged on how reliable and trustworthy data to use to draw conclusions or recommendations from. This is of value because the study is specific to under 14 females and can be extrapolated to other potential studies, programs, or pathways that consider this stage of athletic development. Given the response rate in this study, it is possible that this approach could be useful for transferring this study into future studies across other populations, or sport, to solicit the experiences across several players.

Table 3.2: Interview response rate

Stakeholders	**Target**	**No Interviewed**	**% returned**
Players	5	3	60
Coaches	4	2	50
Health staff	3	3	100
TOTAL	12	8	66.67

The response rates of the interview participants were 100% for the health staff, 50% for the coaches, and 60% for the players. The high response rate for the health staff could potentially be the result of a professional expectation since being part of a research study is a part of their employment, especially in regard to injury prevention. The players had a medium response rate and this highlighted the players' willingness to offer an insight into their ankle Injury experiences. The low response rate for the coaches indicated that they were fully engaged with their coaching commitments and were unable to commit to the study. Overall, the study would argue that the data that was used was of sufficient quality to support the findings.

4.3 Demographic Data

This section analyses the demographics of the key participants, primarily focusing on gender, age and experience. The demographic was important to understand the profiles of the respondents which in turn supported the validity of their insights.

Table 4.3: Age of questionnaire respondents

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	13 years	40	55.6	55.6	55.6
	14 years	32	44.4	44.4	100.0
	Total	72	100.0	100.0	

In the research, 55.6% of the population was 13 years of age, while 44.4% were 14 years. In this way, the data provided indicate that any preventative measures for injury risk in female tennis players need to be aimed at the younger age group, as it makes up the majority of the sample. Therefore as part of the plans that focus on their souls, what needs to be included in injury prevention delivery are workshops on strength and conditioning injury prevention, and coaching methods. The weighting of the age group also reinforces the need to intervene early and hit the ground running with best practice in sports for athletes. Introducing such initiatives into the Harare Central District Schools would help reduce the incidence of injury and create an excellent environment for the development of young female athletes.

4.3.1 Age of interview respondents

Table 4.4: Age of interview respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	13-14years	3	37.5	37.5	37.5
	21-40years	2	25.0	25.0	62.5
	31-40years	3	37.5	37.5	100.0
	Total	8	100.0	100.0	

The qualitative data for the ages of people involved in developing a strategy for injury prevention associated with ankle injuries for female tennis players in Harare Central District schools indicates a healthy representation of both younger adolescent and older adolescent youth. The largest grouping of people was from the age level of 13-14 years (37.5%) and then another group at the age level of 31-40 years (37.5%). This indicates representation from youth as well as adult coaching staff. The representation from the age level 21-40 years (25%) may represent health professionals or coaches who are implementing the prevention strategies. The age presentation shows evidence of a partnership that benefits from the experiences and opinions of the players and the knowledge and experience of adults. However, it should be recognized that there need to be plans for prevention for the stages of physical development and patterns of training represented in the 21-40-year-old group to prevent ankle injuries and to implement age-appropriate injury strategies. The data highlight that a broad spectrum of opinions is needed to improve safety and performance for young female tennis players.

Table 4.5: Gender of questionnaire respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	72	100.0	100.0	100.0

The data is indicative of an all-female sample of 72 respondents; thus for this study, as a function of intervention strategies for injury prevention pertaining to ankle injuries in female tennis players under the age of 14 residing in Harare Central District Schools, this represents absolute priority.

Because of the nature of tennis, ankle injuries are quite common due to the importance of agility, and the demands of fast-agility as well as lateral movement that is occurring during play. The data also supports the need for injury-preventative programs such as education meant to develop more awareness around the importance of proper footwear in respect to ankle injuries. Proper use of footwear may help reduce the risk of injury and keep young female players in the game.

Table 4.6: Gender of interview respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	5	62.5	62.5	62.5
	Female	3	37.5	37.5	100.0
	Total	8	100.0	100.0	

The data in Table 4.6 indicates a population of (62.5%) male and (37.5%) female out of 8 participants (n=8), it is anticipated that the demographic data will be beneficial regarding developing ankle injury prevention strategies for under 14 female tennis players in schools in Harare Central District. Because of the smaller proportion of females, it indicates possible gaps in terms of their specific needs with injury prevention strategies. Tennis is a physically demanding activity and young athletes may present with higher risks of sustaining ankle injuries; this means creating focused ankle injury prevention strategies that consider the biomechanics, training regiments, and social situations associated with female tennis players will be important. Identifying injury prevention initiatives will allow stakeholders to make decisions that help improve the safety and performance of young female tennis players, and in the end, provide a better opportunity for their athletic development.

Table 4.7: Experience of questionnaire respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4-5 years	43	59.7	59.7	59.7
	6-7 years	29	40.3	40.3	100.0
	Total	72	100.0	100.0	

Table 4.7 displays high frequency (59.7%) of participants with 4-5 years of experience, whereas the remainder had 6-7 years of experience (40.3%). The working population related to preventing ankle injuries with female tennis players under 14 of age in Harare Central District Schools would be considered a relatively experienced working population, therefore a substantial implication of this data has indicated a perception of implementing strategies to prevent injuries valid as the responses with 4-7 years' experience could and/or will be concerned about the regularity of injuries relating to their activities, exercises that they could create and/or adopt to target developing the muscular strength to implement a plan of action regarding the risk of ankle injuries. This could include one or more of the following factors, inappropriate shoes, warm-up, and/or lack of agility training. If all the experience is directed towards providing a safe environment for these young players to play games of tennis, chances are they would not be open to suffering a significant ankle injury and therefore sustain playing tennis and health in the long term.

Table 4.8: Experience of interview respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5 years	3	37.5	37.5	37.5
	6-10 years	2	25.0	25.0	62.5
	11-15 years	3	37.5	37.5	100.0
	Total	8	100.0	100.0	

The experience data in Table 4.8 of interview respondents indicates there is broad variation in the backgrounds of respondents involved in developing ankle injury prevention strategies to under 14

female tennis players in Harare Central District Schools. With (37.5%) of respondents indicating they had 1 to 5 years of experience, and another (37.5%) indicated they had 11 to 15 years of experience. The data suggest a mixture of new energy and experienced staff. The (25%) of respondents indicating 6 to 10 years of experience indicates stability, as it can be a bridge from initial ideas to full practice (intervention), and that they had had the opportunity to think about and develop the issue over time. Each individual will have unique but combined experiences to look at injury prevention from many different angles, as each of the groups will have an idiosyncratic experience as it pertains to young female tennis players. Players will have lived experience of an ankle injury and recovery, while coaches might bring an experienced perspective on their training advice that may increase the risk of injury. Health staff might integrate their medical experience with the development of prevention strategies. This qualitative data speaks to a collaborative process, as each of the groups can come together in practice to contribute their perspectives to create tailored strategies.

4.4 Presentation and analysis of data linked to the research objectives

This section illustrates the data in relation to the research aims of defining the prevalence of ankle injuries among females under 14 tennis players in Harare Central District schools. The presentation commences with quantitative data recorded in questionnaires, followed up with qualitative data from in-depth interviews, offering a holistic picture of the results.

4.4.1 To establish the prevalence of ankle injuries among under 14 female tennis players in Harare Central District Schools.

The results present the SPSS and NVivo analysis of the prevalence of ankle injuries among under 14 female tennis players in Harare Central District Schools.

Table 4.9: The descriptive analysis of the prevalence of ankle injuries among under 14 female tennis players in Harare Central District Schools.

	N	Minimum	Maximum	Mean	Std. Deviation

I have experienced ankle injuries while playing tennis in the past year	72	1	5	3.28	1.078
My coach emphasizes the importance of injury prevention during training sessions.	72	2	5	3.46	.749
I feel confident in my ability to prevent ankle injuries through proper techniques.	72	1	5	2.90	1.077
I receive adequate information on how to prevent ankle injuries from my coaches.	72	1	5	3.42	1.172
The training environment (e.g., court surface, space) contributes to my risk of ankle injuries.	72	1	5	3.24	1.449

Analysis of the SPSS results presented in Table 4.9 above shows a significantly high prevalence of injuries to the ankle for under 14 female tennis players in High Schools in Harare Central District. A mean score of 3.28 for players reporting that they experienced ankle injuries shows that several players have sustained ankle injuries, which reflects the status of this injury type among this demographic. Although coaches have placed emphasis on injury prevention during training with a mean score of 3.46 and had some confidence in their ability to prevent injury with a mean score of 2.90, these variables may indicate a potential critical area of improvement in training practices. Additionally, the players believed they received sufficient information on injury prevention; however, the training environment reported a mean score of 3.24, and risk related to an injury occurring continues to be a component of their training.

Table 4.10: The NVivo analysis of the prevalence of ankle injuries among under 14 female tennis players in Harare Central District Schools.

Theme	*Theme Description or definition*	*Matching mentions from the interviews*	*Number of mentions*
High prevalent	The prevalence of ankle injuries is high	*"Many players in my team have suffered ankle injuries". "Ankle injuries are a common occurrence during our matches"*	*7*
Moderate	The number of injured athletes is moderate	*"I know a couple of players who have ankle issues."*	*5*
Never observed	The injuries are rarely observed	*"I have never had an ankle injury"*	*3*

The findings in the NVivo Table 4.10 highlights systematic analysis of the evidence on ankle injuries in under 14 female tennis player in Harare Central District Schools suggest that it seems clear all players are having ankle injuries (7 references high prevalence) but even with 5 references suggesting moderate prevalence meaning that the players likely would still incur injuries and that there were some fortunately able to play without injury are concerning. With 3 references suggesting they were possibly "never observed" may be indicative that is may occur infrequently perhaps for some in certain conditions. The mixed feedback indicates that whilst some players are incurring injuries, others may not be impacted, possibly due to different levels of on training conditions. It seems to suggest targeted injury prevention initiatives, training improvements and coaching improvements seem warranted. It is recommended action is needed on these matters. Having those actions would unless reduce these ankle injuries and the overall safety and performance young players.

Overall, the analysis of ankle injuries among under-14 female tennis players in Harare Central District Schools reveals a concerning prevalence when comparing quantitative and qualitative

findings. Table 4.9 shows that a significant number of players reported experiencing ankle injuries, with a mean score of 3.28, indicating that many have suffered injuries in the past year. Although coaches emphasize injury prevention (mean score of 3.46), players expressed only moderate confidence in their ability to prevent injuries (mean score of 2.90). Table 4.10 supports these findings, where the qualitative data indicates that 7 mentions highlight the high prevalence of ankle injuries, with quotes like, “Many players in my team have suffered ankle injuries.” This qualitative feedback corresponds with the quantitative data, showing that while some players experience injuries, others report a moderate prevalence (5 mentions). However, 3 players noted they "have never had an ankle injury," suggesting that not all players are equally affected. Together, these results indicate that the prevalence of ankle injuries is significant, and there is a need for improved training and injury prevention measures. Both quantitative and qualitative data converge to underline the urgent need for targeted initiatives to enhance the safety and performance of young players.

4.4.2 To establish biomechanical, training-related, and environmental factors that contribute to ankle injury risk in this population

The SPSS and NVivo analysis is being used to examine the biomechanical, training related and environmental factors that may increase the risk of ankle injuries. This involves collecting data to understand how these factors affect under 14 female tennis players.

Table 4.11: The Pearson Correlation analysis of biomechanical training related, and environmental factors contribute to ankle injury risk in this population.

	I believe that warm-up exercises are important for preventing ankle injuries.	I regularly perform ankle strengthening exercises as part of my training.	The footwear I use while playing tennis is suitable for preventing ankle injuries.	I have seen improvements in my performance after following injury prevention protocols.	I have received training on how to fall safely to avoid ankle injuries

I believe that warm-up exercises are important for preventing ankle injuries.	Pearson Correlation	1	-.268*	.240*	-.137	.209
	Sig. (2-tailed)		.023	.042	.252	.078
	N	72	72	72	72	72
I regularly perform ankle strengthening exercises as part of my training.	Pearson Correlation	-.268*	1	-.607**	.308**	-.621**
	Sig. (2-tailed)	.023		.000	.008	.000
	N	72	72	72	72	72
The footwear I use while playing tennis is suitable for preventing ankle injuries.	Pearson Correlation	.240*	-.607**	1	-.031	.739**
	Sig. (2-tailed)	.042	.000		.793	.000
	N	72	72	72	72	72
I have seen improvements in my performance after following injury prevention protocols.	Pearson Correlation	-.137	.308**	-.031	1	-.207
	Sig. (2-tailed)	.252	.008	.793		.082
	N	72	72	72	72	72
I have received training on how to fall safely to avoid ankle injuries	Pearson Correlation	.209	-.621**	.739**	-.207	1
	Sig. (2-tailed)	.078	.000	.000	.082	
	N	72	72	72	72	72

The SPSS results in Table 4.11 reveal analysis of correlation shows there were several significant relationships among participant beliefs and practices concerning ankle injury prevention in tennis. There is a negative correlation of beliefs in the importance of warm up exercises and actual regular performance of ankle strengthening exercises (r = -0.268), suggesting that those individuals who value warm ups do not satisfactorily engage in strengthening exercises and wearing suitable footwear (r = -0.607), indicating that players who regularly strengthen their ankles may not see their footwear as sufficient. There was also a strong and positive correlation (r = -0.739) regarding the amount of training received in safe falling techniques and believing shoes are suitable, which

indicates proper training may foster beliefs in the effectiveness of shoes. Overall, these results suggest that while athletes can present appropriate expectations of various injury prevention techniques, the execution may take place inconsistently. Ultimately, these results suggest there is a need to foster a holistic approach to injury prevention, integrating the continual impact of exercise habits, equipment choices, and utilize proper biomechanical practices to reduce the risk of injury in this population.

Table 4.12: The NVivo analysis of biomechanical training related, and environmental factors contribute to ankle injury risk in this population.

Theme	*Theme Description or definition*	*Matching mentions from the interviews*	*Number of mentions*
Abnormal foot mechanics	The running mechanics of athletes have shown some inaccuracies that are observable	*"Many athletes run with poor form sometimes over striding"* *"Their feet turn inwards when they run"*	*15*
Playing surface area	The playing surfaces are rocky and rough	*"The court we use is full of rocks and is uneven"*	*11*
Inappropriate footwear	Players use inappropriate footwear	*"Most players can't afford proper footwear"*	*16*
Training load and fatigue	The training load is randomly organized	*"There's no plan one day we train for 4 hours, and on another, we don't so the schedule"*	*10*

Table 4.12 outlines how biomechanical training and environmental factors are to the reducing ankle injuries of athletes. Many of the participants mentioned abnormal foot mechanics, describing how "many athletes run with poor form sometimes over striding", leading to instability and injury

risk. The playing surfaces in which the athletes train was often referenced as being “rocky and rough”, pointing to a serious environmental issue in itself. The most prevalent environmental issue was that of incorrect footwear, whereby one athlete stated “most players can't afford proper footwear” that would lead to durability and support. Lastly, the random nature of the training loads where athletes reported “one day we will train 4 hours, and on another we will not training” leads to inconsistency and fatigue, which also increases the risk of an injury. In summary, it is evident that improving training techniques, ensuring suitability of playing surfaces, and access to appropriate footwear are vital the reduction of ankle injuries within this population.

The assessment of both qualitative and quantitative data in Table 4.10 and Table 4.12 highlights meaningful advances in ankle injury prevention for under 14 female tennis players. Correlation analysis indicates that while players understand the importance of warm-up exercises, they may not be engaged in ankle strengthening practices. This discrepancy in their training habits indicates a disconnection. We noted that their perceptions of footwear suitability were influenced by training in safe falling techniques, suggesting that proper training may improve their perceptions of their gear. The qualitative findings reinforce the potential role of abnormal foot mechanics, inappropriate footwear, training loads and other training issues for their injury rates. Together, this suggests the relationship between beliefs, practice, and environmental risks are complex and holistic in nature. To meaningfully reduce ankle injuries, it takes a complete approach; addressing training practices, appropriate footwear, and safest playing conditions. Systematically considering how to address these overlaps, was seen as a way to better support our young players, providing them opportunities within their sport with reduced risk to safety and performance.

4.4.3 To assess the effectiveness of existing prevention protocols in reducing ankle injury rates in Harare’s under 14 female tennis players.

The SPSS and NVivo analysis is being used evaluate how effective the current injury prevention protocols are in lowering ankle injury rates among under 14 female tennis players in Harare Central District Schools. This involves analyzing data to see if these protocols are making a positive difference in preventing injuries.

Table 4.13: The effectiveness of existing prevention protocols in reducing ankle injury rates in Harare's under 14 female tennis players.

		Paired Differences					t
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
					Lower	Upper	
Pair 1	I believe that existing injury prevention programs are effective for players my age. - I feel that my training schedule allows enough time for recovery and injury prevention.	.500	1.986	.234	.033	.967	2.136
Pair 2	I often play on surfaces that increase my risk of ankle injuries (e.g., uneven courts). - I believe that existing injury prevention programs are effective for players my age.	-.375	1.524	.180	-.733	-.017	-2.088
Pair 3	I feel that my training schedule allows enough time for recovery and injury prevention. - I often play on surfaces that increase my risk of ankle injuries (e.g., uneven courts).	-.125	.855	.101	-.326	.076	-1.241

The results of the paired samples test, which are presented in Table 4.13 suggest that there are significant differences in perceptions about injury prevention and training schedules with respect to one another by participants. The first pair demonstrates a significant positive difference (mean = 0.500, p = 0.036) which indicates that the participants believe established injury prevention

programs are more beneficial than the time for recovery in their training schedules. The second pair shows a significant negative difference (mean = -0.375, p = 0.040) which suggests that participants believe playing on surfaces that carry a risk diminishes the perceived benefit of the injury prevention programs. The third pair does not show a significant difference (mean = -0.125, p = 0.219), which suggests a neutral viewpoint about a relationship between the training schedule of participants and risk of ankle injuries based on perceptions about the training schedule. This indicates that there is a significant opportunity to improve training programs by offering recovery strategies while attending to the level of risk involved with the training surface.

Table 4.14: The NVivo analysis of the effectiveness of existing prevention protocols in reducing ankle injury rates in Harare's under-14 female tennis players.

Theme	*Theme Description or definition*	*Matching mentions from the interviews*	*Number of mentions*
Effective	*Existing injury prevention protocols are reducing injuries*	*"The ankle taping protocol cut our sprains most of the time"*	*7*
Ineffective	*Existing injury prevention protocols are ineffectively used to reduce injuries*	*"The prehab exercises are demonstrated one then forgotten".* *"Recovery sessions exist on paper but never happen"*	*17*

Table 4.14 illustrates the inconsistently successful implementation of the injury prevention protocols observed for ankle injury prevention for under-14 female tennis players in Harare. Some of the participants acknowledged that a protocol such as ankle taping has been beneficial, as one noted, "The ankle taping protocol cut our sprains most of the time." However, the implementation of a successful injury prevention protocol does appear to be problematic. Many athletes expressed

their concerns regarding injury prevention methods not being used effectively. One commented that "The prehab exercises were shown once and then nothing." Another athlete stated, "The recovery sessions were on paper but never occurred." This illustrates that injury prevention methods exist however it demonstrates that they are not being consistently performed or prioritized which corresponds to the limited effectiveness of current injury prevention in these scenarios. This renders injury prevention ineffective. Hence, the ramifications of this study suggest that commitment to practice and adherence must be made to effective protocols, if they are to succeed. If all training and awareness with regard to injury prevention strategies were enhanced, then it would be very possible to reduce the number of ankle injuries sustained in female athletes of this age cohort.

Overall, results of the paired samples tests reveal the importance of perceived injury preventions and time for recovery during training schedules showed that participants show significant differences in their perceptions for injury prevention and time for recovery among the under 14 female tennis players in Harare. Results in Table 4.14, indicated that, most participants reported that current injury prevention programs seemed more effective than the capacity for recovery through a training schedule; this illustrates an opportunity redesign and/or implement injury prevention programs which encapsulate recovery. Furthermore, it was observed that concerns about exposure to risky surfaces also hindered respondents' perceptions of program amount of effectiveness. There were no significant variables related to risk of ankle injury in training schedules. The significant value demonstrated possible challenges and demonstrated a strong indication of a significant gap between injury prevention protocols and injury prevention, which were considered mainly ineffective. The analysis and participants' experiences provided an insight into a need for a systematic reassessment of training schedules to encompass recovery and address environmental risks. By better managing those two aspects, Coaches and trainers can help protect young athletes to reduce injury and improve performance and well-being in sport.

4.4.4 To develop a context specific ankle injury prevention program for under 14 female tennis players.

The SPSS and NVivo analysis of context specific ankle injury prevention program for under 14 female tennis players.

Table 4.15: Develop a context specific ankle injury prevention program for under 14 female tennis players

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
I would like more guidance on injury prevention strategies specific to my sport	72	1	5	4.19	.944
My peers are aware of the importance of ankle injury prevention in tennis.	72	1	5	3.38	1.238
I feel that a specific ankle injury prevention program would benefit my training and performance	72	3	54	5.06	5.893
Valid N (listwise)	72				

The outcomes in Table 4.15 indicate significant indications of the need for a context specific ankle injury prevention program for under 14 female tennis players in Harare Central District schools. (Table 4.15). The mean score of 4.19 (SD=0.944) for the item “l would like more guidance on injury prevention strategies specific to my sport” indicates that under 14 female tennis players have a strong motivation for tailored advice and resources, indicating that current forms of injury prevention education are not meeting their needs. In comparison, the mean score of 3.38 (SD=1.238) for peers' awareness of the importance of ankle injury prevention signifies a moderate level of peer awareness, suggesting that not all players may possess adequate knowledge of the injury risks for ankle injuries, which may influence their attitude collectively towards the importance of injury prevention. The mean score of 5.06 (SD=5.893) for the belief that a specific ankle injury prevention program would improve training and performance is noticeably high, which demonstrates that players are acknowledging that such a program could improve training and performance. This also demonstrates a significant gap between current resources and what players need in terms of effective injury prevention related to their individual sport.

Overall, the means suggest that it is important to design a sport specific ankle injury prevention program to enhance player safety and performance. This sport specific ankle injury prevention

program would, or could, inform or enhance awareness, education and activities that focus on an individual and a collective basis, providing safer and awareness for the playing environment for these under 14 female tennis players.

Table 4.16: The NVivo analysis to develop a context-specific ankle injury prevention program for under 14 female tennis players.

Theme	*Theme Description or definition*	*Matching mentions from the interviews*	*Number of mentions*
Coaching strategies	The coaches were employed to use coaching strategies	*"Why should coaches employ individualized training…"*	*10*
Environmental considerations	Improve playing surfaces	*"It's important to revamp the tennis courts and make them modern"*	*9*
Physical conditioning	Regular physical conditioning	*"Players should be exposed to conditioning training programs"*	*12*
Player education and awareness	Educate players about warm-ups and wearing appropriate clothing.	*"It is important for players to learn how to take care of themselves"*	*11*

Table 4.16 presents key considerations for creating a context-specific ankle injury prevention program for female tennis players under the age of 14. First, coaching strategies are paramount; a participant mentioned the program should include individualized programming (or as the athlete said: "why would coaches do this through everything being individualized"). This was interpreted to signify that the current program was not able to specifically address the needs of each player. Improving playing surfaces is another component, as described by an athlete when she explained "we need to update/change the tennis courts and make them modern", which indicates a more

insight safe environment to provide those injuries may help reduce injuries. Regular physical conditioning, as an active component, was also deemed important; an athlete noted "players should be involved in conditioning programs" that can help with strength and flexibility. Education and awareness were another point; an athlete noted "it is important for players to learn how to look after themselves", and highlighting the important of warm-ups, and proper clothing. Overall, the information derived from this study suggests that a multi-faceted prevention program including coaching, facility improvement, physical training, and player education could decrease ankle injuries for these young athletes.

Overall, the results of SPSS in Table 4.15 and NVivo analysis in Table 4.16 support the need for a specific ankle injury prevention program with under-14 female tennis players in the Harare Central District schools. The high mean score of 4.19 indicates that the female tennis players strongly want more instruction on ankle injury prevention related to the sport they play. The mean score suggests current resources may not adequately fulfils their needs. In addition, the females' understanding of the importance of ankle injury prevention through their peers was rated at a moderate level of 3.38. The moderate rating suggests that many players may lack adequate knowledge not only individually but also collectively and, similarly, may not understand ankle injury prevention. The high score of 5.06 related to whether a designated ankle injury prevention program would improve their training and performance illustrates that players recognized the potential add value. There is clear evidence in the differences of the mean scores in current injury prevention education versus players' specific needs. A comprehensive program focusing on awareness, education, and practical solutions related to ankle injury prevention must be developed to improve player safety and performance and improve a safer environment for under-14 female tennis players

4.5 Discussion

To establish the prevalence of ankle injuries among under 14 female tennis players in Harare Central District Schools.

Analyzing ankle injuries sustained among under-14 female tennis players from randomly selected schools in Harare Central District shows a substantial worrying trend consistent with a wider body

of research conducted with youth in sports. Females tend to have a much higher prevalence of ankle injuries that is found in studies of youth sports injury where female athletes experience a higher rate of injuries than male athletes. This difference between male and female injury rates, which is greater in ankle injuries than other sports injuries, is often attributed to anatomical and physiological differences (for example, differences in ligament laxity and strength) (Hewtt et al., 2019), which make young females more susceptible to injuries from high-intensity activities involving rapid lateral movements. The findings in the Harare study indicate many players who suffered injuries and coaches who were concerned about their capacity to prevent these injuries. Players reported being less confident in their ability to prevent injuries. This lack of confidence aligns with the more general view in other research that there is a need to provide fundamental education and training for coaches and teachers in sports where the risk of injury is high (DeWit et al., 2020).

Interestingly, although players believe they receive enough information about avoiding injuries, the constant risk in their training environment suggests a gap from knowledge to practice. This tells us that it is not just important to educate athletes but there is a need to have safe and healthy training conditions. The training environment includes the winter conditions such as the type of court surface along with the appropriate footwear. There is documentation that hard courts which are generally prevalent in tennis can potentially increase the risk of acute injuries due to a higher ground reaction force (Lopez Valenciano et al., 2019). Furthermore, the multi-directional demands of tennis involving swiftly sprinting in multiple directions and jumping could certainly increase if not duplicate the ankle injury risk (Muller et al., 2021).

To establish biomechanical, training-related, and environmental factors contribute to ankle injury risk in this population

When assessing ankle injuries amongst under-14 female tennis players, the investigation reveals valuable implications for preventing such injuries. The variety of dynamic movements involved in tennis, along with direction changes and the ability to illustrate explosive movement, subjects' young players to increased risk of ankle injury. Studies show that when performing lateral movements, the ankle can produce dynamic forces that can exceed its limits of stability (Dempsey et al., 2018). For example, when young players accelerate to reach a ball or pivot to take a shot,

they frequently land obtusely; this is part of the mechanic for rolling their ankle (Gonzalez et al., 2020). The study by Olsson et al. (2019) estimates that the number one reason of ankle injuries are due to inversion, which occurs when the foot rolls inward, especially during the landing phase or when making a quick movement.

The results of this analysis indicate that players understand the value of warming up, but often do not perform ankle strengthening exercises, indicating a gap in their training habits. Additionally players' perceptions on the appropriateness of their footwear is confounded by their level of learning the safety technique of falling. This suggests that enhanced training could elevate their perception of equipment usage. The qualitative data shows other factors that increase injury risk, such as aberrant foot mechanics and inappropriate footwear to use. Furthermore, these issues alongside training load that is potentially too high culminate in a multifaceted situation that impacts injury rates. In order to effectively seek a reduction in ankle injuries, a holistic approach is required, including training practice improvement, appropriate footwear provision, and ultimately products that facilitate safe space to play. By targeting the interrelated aspects of training, safe space and safely reducing ankle injuries, coaches and trainers of female tennis players may be able to support young female tennis players holistically, improving player safety and performance in tennis as a sport. That in turn has consequences for improving the safety of adolescent females in the sport of tennis through supporting multifactorial issues impacting training practices and running in under-14 female tennis players.

To assess the effectiveness of existing injury prevention protocols in reducing ankle injury rates in Harare's under 14 female tennis players.

The analysis of the ankle injury rate among under-14 female tennis players does provide relevant risk factors for injury rates. Both intrinsic and extrinsic factors are important in the ankle injury rate. Intrinsic factors including age, body composition, and previous injury history may have significant impacts in young athletes. For example, younger players have not completely developed a mature neuromuscular system and possible lack neural control over the dynamic movement patterns of tennis; this can lead to injury (Hewett et al., 2019). A high body fat percentage can affect agility or decrease/limit agility causing lateral and anterior-posterior rapid movement changes which may also lead to ankle injury (Zhang et al., 2021). Finally, the

occurrence of previous injury is a strong predictor of future injury, emphasizing the importance of proper rehabilitation and injury prevention protocols prior to returning to play (Dwyer et al., 2019)

Extrinsic factors such as the training environment, footwear, and court surfaces all have serious implications for risk of injury. Training on uneven/unstable surfaces can also produce deficits in proprioception which is also a risk factor (Solomon et al., 2019). Footwear is important for ankle stability but many young players do not wear proper fitting or fail to wear shoes suitable for the sport, which can risk ankle injuries (Muller et al., 2021). Research has demonstrated that tennis-specific shoes can lower the chances of ankle injuries when lateral movements are completion (Leavitt et al., 2021). Court surface is also an important factor to remember as injuries have been shown to be higher while playing with hard courts compared to softer surfaces like clay (Lopez Valenciano et al., 2019). The results of the paired samples test indicate under-14 female tennis players were concerned about the current injury prevention program and access to opportunities for recovery. They felt existing prevention techniques were better than incorporating recovery into their training schedules. This highlights that training schedules need to be better coordinated with recovery strategies. Player above voiced their concerns about the safety of the surfaces they were using which could have affected the perceived effectiveness of injury prevention programs.

Even though there is an objective view concerning the link of training schedules and risk of ankle injury, the general conclusions highlight a major gap in current injury prevention strategies; an issue many players are finding to be substandard. This suggests a re-evaluation of training schedules is required to facilitate the recovery process and deal with the environmental risks. In doing so, coaches and trainers will be better able to protect young athletes, which will reduce the number of injuries, and improve the performance and well-being of the sport.

To develop a context specific -ankle injury prevention program for under 14 female tennis players.

The results of the study show a definitive need for an ankle injury prevention program tailored specifically for Under 14 female tennis players in the Harare Central District schools. The observed high mean score of 4.19, which reflects players' levels of desire for more education related to tennis specific injury prevention, indicates that young female tennis players strongly desire more advice

and information about an injury prevention program related to their sport of tennis. This suggests that the various resources available for tennis injury prevention education are not sufficiently tailored to address the needs of the female under 14 players. The moderate level of means reported for players' peers (3.38) noted relatively some of the pandemic period's players' peers may not have enough knowledge that affects their ability to collectively maintain their safety. The players' score of 5.06 noted to be very high indicated their belief there could be benefits of encouraging player training and performance with a specific injury prevention program. The results provide evidence of the large gap between injury prevention education opportunities and what the players actually need.

In order to tackle these issues, an all-encompassing program is needed that will enhance awareness, provide specific education, and develop an implementation plan. Elements of the program should include a strength training component, a flexibility training component, and a balance training component because they are essential components of prevention of ankle injuries. Studies have shown that strength training can enhance joint stability and promote support about the ankle, whereas flexibility training will improve movement mechanics (Hewett et al., 2019; Shultz et al., 2016). Likewise, balance exercises are fundamental to enhancing proprioception and injury prevention. It has been shown that including balance training as part of the warm-up routine will significantly decrease the chances of an ankle injury (Myer et al., 2014). With the aforementioned, it is also valuable to implement a conditioning program that every participant in the intervention receives a program that is specific their needs ultimately improving performance and minimizing the risk of injury (Zazulak et al., 2021).

Athletes can prepare for the demands of tennis using sport-specific movements, such as lateral shuffles and agility drills. (Krause et al., 2020). Overall, stressing these strategies will assist coaches and trainers in providing a safer environment that fosters a health-promoting and performance-enhancing context for young tennis players. Maintaining a holistic approach to player safety through injury prevention is critical to having fun and complying with a non-injured and healthy active lifestyle.

4.6 Chapter Summary

The chapter has laid out the results obtained from the research. Next chapter looks at discussing the key issues from the scholarly point of view.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section discusses the results of the research and offers conclusions and recommendations relating to the study's four research questions. The study examined the frequency of ankle injuries in female tennis players' under-14 in the Harare Central District Schools. It also investigated biomechanical, training-based and environmental risk factors particularly associated with ankle injuries. It evaluated the current practices for injury prevention for ankle injuries and offered a specific prevention injury mechanism for female tennis players under 14 years old. Finally, it provided performance recommendations for coaches, trainers and policy makers and suggestions for future research.

5.2 Summary of major findings

The findings of this study brought to the forefront a significant concern regarding ankle injuries in young female tennis players. A large proportion of the participants expressed that they have sustained infections, underreported ankle injuries over the last few years, meaning that there may be more serious but unreported factors that affect their participation. Moreover, the players accept the importance of some injury prevention which suggests they probably accept a risk to the game.

Across participants, there were evident differences in their confidence regarding injury prevention, indicating a need for further training and education. This study identified player-related factors that help explain the injury risk of ankle injuries (biomechanical, training-related and environmental). The athletes acknowledged the quality of training and any elements related to training positively or negatively impacted their injury risk. Many expressed concerns regarding the playing surfaces in addition to expressing concerns regarding playing surfaces and any concerns which may have resulted in additional ways to negatively impacted injury risk. Both the player condition and the surfaces reduced or exacerbated the playing condition needed to be considered when developing ways to minimize injury risk.

The evaluation of current injury prevention programs revealed opposing views from players. Many felt the existing programs were sufficient, however training did not allow enough time for recovery time required for injury prevention. Additionally, some players indicated that training on uneven

surfaces decreased their ability to condition and the quality of their training. Such contradictory information shows support a value placed on integrating injury prevention effectively as part of their training schedules. Players articulated needing action plans for injury prevention programs for specific ankle injuries. The findings also suggest education on risks of injury, how to train and appropriate footwear, would be basic content included in injury prevention plans. There is a need to create awareness with peers about injury prevention. By addressing these aspects of injury prevention it will allow for participants to create a supportive environment, where young players can feel empowered to engage in injury prevention behaviors.

The qualitative data collected as part of the study indicates that players have significant awareness of the role of injury prevention, yet the quantitative data indicated players are uncertain and are lacking knowledge. Many participants expressed an interest in learning more about specific injury prevention approaches for their sport, and it could be argued that this is an educational opportunity. The findings suggested that players acknowledge the risk of injuries to their ankles, but there was less engagement with injury prevention or injury risk reduction strategies. Overall, ankle injuries pose a considerable risk to under 14 female tennis players playing in Harare Central District Schools. The research provides insight into how injury prevention can be approached through evidence based measures which include education and the knowledge of the sport, environment, types of training practices, and management of players' knowledge. Thus, through implementation of a sport context specific program, all stakeholders will be able to minimize risks to young players, enhance performance outcomes, and feel proud of developing a culture of healthy sport in their community.

5.3 Conclusions

5.3.1 Prevention of ankle injuries

The results show that ankle injuries are very common for female tennis players under 14 years within Harare Central District Schools. The qualitative results showed that a high proportion of participants - 7 out of 8 - had previously sustained injuries due to ankle injuries. The quantitative results reveal this with an average score of 3.28 which indicates that many players had previously had ankle injuries in the previous year. The evidence provides clear evidence that ankle injuries

are a serious problem for this age group demonstrating that ankle injuries is a problem that needs further investigation.

5.3.2 Factors leading to injury at risk

This study highlighted several factors that relate to the risk of ankle injury in this population. The analysis showed that the two main categories of aspects that contribute to ankle injury are biomechanical (abnormal foot positioning), training (insufficient warm-up), and environmental factors (unsafe playing surfaces, inappropriate footwear), that increase the risk of injury. These results support our recommendation for complete training, with particular emphasis on both a player's technique and footwear.

5.3.3 Effectiveness of existing injury prevention protocols

The study looked at existing injury prevention protocols, and they are more or less ineffective. Players indicated that the existing policies do not offer good protection with respect to ankle injuries - more specifically, while the players believed that the coaches were promoting injury prevention through the existing protocols, they felt low in the belief that those coaching techniques would assist them in skill agility and therefore injury prevention. This suggests an urgency to improve on training regime to integrate the recovery and injury prevention needs of players.

5.3.4 Components for a context-specific prevention program

It is evident that players wanted more of a specific ankle injury prevention program, players wanted coaching suitable for their context (and of 4.39 average), but players awareness of peers about any injury prevention activities was considered moderate (3.38), which suggested education was an area of need. Additional factors included coaching parameters, environmental conditions and players physical preparedness all being an influencing factors, and whatever the approach, it was clear it suggested a multifactorial approach would be the best means to injury prevention as it could involve specificity as a coaching factor, modifiable environmental conditions and a specific education factor.

Overall Conclusion

In conclusion, the findings highlight the importance of developing effective strategies to prevent ankle injuries in young female tennis players. Now that we have established the prevalence of

ankle injuries, defined the causes of the injuries, and outlined the shortcomings of many injury prevention methods, we hope this program helps create an opportunity to provide young female athletes a safer environment. These issues can be addressed at reasonable levels to assure young athletes are safe and healthy, we can help support their continued development as athletes and performers in tennis.

5.4 Limitation of the study

The research sought to provide an injury prevention protocol for ankle injuries to under 14 female tennis players participating in Harare Central District Schools. Nevertheless, there were many limitations that impacted the data and the research process.

5.4.1 Methodological limitations

This study employed a mixed methods design using both quantitative and qualitative data. This strong design can provide a holistic view but has limitations. Self-reported surveys may be subject to response bias, meaning that some participants may not provide the actual answer, but rather a socially acceptable answer. The researcher only engaged a limited proportion of coaches participating to do qualitative interviews. The more diverse sample of coaches would have likely provided more rich insight into this critical population. A more even distribution of participants would have allowed us to explore their varying perspectives.

5.4.2 Sample size and representation

The study considered 72 female tennis players, an appropriate size of sample for quantitative research. However, the impact and insights from the small number of interviewed stakeholders (8), such as coaches and health staff, would be limited overall. A larger sample size would allow researchers to understand a more robust account of the perspectives regarding injury prevention strategies.

5.4.3 Access and participation challenges

Obtaining access to participants earlier, such as coaches and health staff, proved difficult. Many coaches did not respond to my requests, even though they were busy working, informing the lower response rate during this phase of the research. Similarly, for some players to discuss their injuries, players or their parents may have yielded reticent responses, limiting data from participants. There

may be more consideration of players' perspectives and the unintentional impact of time playing a role.

5.4.4 Mitigation strategies

In order to ameliorate the limitations identified, the study aimed to communicate with participants clearly about the importance of their responses and contributions. Efforts were made to schedule interviews at the most convenient time and available time for coaches and health staff, in order to improve participation rates. Additionally, creating a supportive environment by emphasizing the anonymity and confidentiality of the responses encouraged participants to provide more candid and honest contributions. I believe that overall the study provided great insight into ankle injuries sustained by under 14 female tennis players, and participants should have increased confidence in the knowledge gained from this study; however, these limitations need to be taken into account when interpreting the results of this study. Future research should aim to obtain a larger sample size and participation from a more diverse sample of the population.

5.5 Implications/Recommendations

5.5.1 Implications for practice

To enhance injury prevention, schools should develop customized programs to meet young female players' specific needs. This would include providing education on injury risk, training methods, and safe footwear. Coaches should focus on safer training settings (where possible) as well as monitoring recovery as part of their planned schedule. It may also be beneficial to run workshops on injury prevention regularly, in order to raise awareness with players and their friends.

5.5.2 Implications for theory

The results of this study contribute important information to the body of knowledge on injury prevention in youth sports as it pertains to female tennis players. This study sheds light on the challenges faced by these athletes and provides evidence to the gaps in the research. By acknowledging the challenges that female youth tennis players experience, the study emphasizes additional specifics for potential interventions. This information will contribute to future research and inform practice, ultimately safeguarding youth athletes.

5.5.3 Implication for Future Research

Future research should further investigate larger sample sizes and the broader context of different participant views, such as male participants. The future should also consider the longitudinal investigation in which the long-term effectiveness of these strategies could be considered. Studying impact is essential, as it helps to develop more effective approaches grounded in evidence to reduce injury in young athletes, and create a safer sports culture.

5.6 Chapter Summary

This chapter undertakes discussion of the results, conclusions and recommendations of the study with respect to ankle injuries in under-14 female tennis players in Harare Central District Schools. It notes that ankle injuries are a serious problem, with many participants reporting ankle injuries while actively understanding the importance of prevention; however there is a lack of confidence and knowledge around prevention strategies. The study identified lower confidence levels, biomechanical issues, poor training methods, and environmental issues as key contributors to injury risk behaviors amongst participants. The current injury prevention protocols are overall assessed moderately ineffective, with the need for improved integration of recovery strategies. Moreover the participants expressed a strong desire to understand a specifically designed prevention program which includes education on proper techniques and suitable footwear. The limitations of the study were articulated, including reliance on participant self-reported data and the limited number of coaches interviewed; thus future research should include larger samples of player and coaches across different and geographic sources. Finally, practical considerations were provided for schools and coaches to implement targeted injury prevention programs in higher performance contexts, as well as highlighting research directions to support athlete safety practices.

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Questionnaire for Players

Instructions:

Please indicate your level of agreement with the following statements or your frequency of experiences related to ankle injuries by circling the appropriate number.

Scale:

1 - Strongly Disagree

2 - Disagree

3 - Neutral

4 - Agree

5 - Strongly Agree

1.

Item	SD	D	N	A	SA
I have experienced ankle injuries while playing tennis in the past year					
My coach emphasizes the importance of injury prevention during training sessions.					
I feel confident in my ability to prevent ankle injuries through proper techniques.					
I receive adequate information on how to prevent ankle injuries from my coaches.					
The training environment (e.g., court surface, space) contributes to my risk of ankle injuries.					

2.

Item	SD	D	N	A	SA

I believe that warm-up exercises are important for preventing ankle injuries.					
I regularly perform ankle strengthening exercises as part of my training.					
The footwear I use while playing tennis is suitable for preventing ankle injuries.					
I have seen improvements in my performance after following injury prevention protocols.					
I have received training on how to fall safely to avoid ankle injuries					

3.

Item	SD	D	N	A	SA
I believe that existing injury prevention programs are effective for players my age.					
I feel that my training schedule allows enough time for recovery and injury prevention.					
I often play on surfaces that increase my risk of ankle injuries (e.g., uneven courts).					

4.

Item	SD	D	N	A	SA
I would like more guidance on injury prevention strategies specific to my sport					
My peers are aware of the importance of ankle injury prevention in tennis.					
I feel that a specific ankle injury prevention program would benefit my training and performance					

Interview Questions

Interview Questions Targeting Players, coaches, and Health staff

1. Based on your experience, how common are ankle injuries among under-14 female tennis players in your program? Can you provide any statistics or observations?
2. What biomechanical, training-related, or environmental factors do you believe contribute most significantly to the risk of ankle injuries in this age group?
3. How effective do you find the existing injury prevention protocols in your training regimen? Have you seen a noticeable impact on reducing ankle injuries?
4. How do you educate players about the importance of ankle injury prevention? What resources or methods do you use to convey this information?
5. What specific injury prevention strategies have you implemented or observed that you believe are effective for preventing ankle injuries in young female tennis players?
6. In your opinion, what components should be prioritized in a context-specific ankle injury prevention program for under-14 female tennis players? Why do you think these components are essential?
7. What feedback have you received from players regarding injury prevention practices? How do you incorporate this feedback into your training programs to improve safety and performance?