

## EPIDEMIOLOGY OF INJURIES IN ELITE SOUTH AFRICAN NETBALL PLAYERS

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### ABSTRACT

*Netball places physically strenuous demands on players, such as quick acceleration, changing of direction and high jumps. Epidemiological studies provide the proof of risks for sports injuries, as well as the effects of preventative and therapeutic intervention. The objective of this research was to assess the incidence and severity of injuries in a cohort of elite South African netball players. The subjects were players (N=1280) who participated in three elite netball tournaments during the 2009 season. Team or tournament medical staff collected the injury data. A high incidence of 500.7 injuries per 1000 playing hours was reported. Most injuries occurred to the ankle joint (34%), followed by the knee (18%), fingers, hand and wrist (15%). Ligaments were the most commonly injured structures. The majority of injuries were minor. Factors associated with injuries included tournament play, previous injury, lack of core stability, neuromuscular and proprioceptive training. In order to reduce the amount of injuries to the lower extremities, it is recommended that netball players follow a structured programme to enhance core stability, neuromuscular control, and proprioception and to optimise biomechanical execution of functional movement patterns.*

**Key words:** Netball; Epidemiology; Injury prevention; Sports injuries.

### INTRODUCTION

Despite the benefits of regular physical activity, each sporting activity has an inherent risk of injury. In some instances it can lead to permanent damage (Bahr & Holme, 2003). Managers and coaches are responsible for the optimal physical and psychological preparation of athletes. The demands placed on athletes are physically and mentally challenging, and injuries occur when the physical load breaches a threshold (Van Tiggelen, 2008).

Netball has high physical requirements, such as quick acceleration, changing of direction, high jumps to receive a pass or to intercept an opponent's ball, which are only some of the requirements (Hopper & Elliott, 1993). These tasks leave the players vulnerable to injury. Most sporting activities entail a certain amount of risk of injury, even if reasonable preventative measures are put in place to prevent these injury risks. Therefore, governing bodies should be aware of the risks in sport and that steps are taken to limit these injury risks (Fuller & Drawer, 2004).

Epidemiological studies provide the evidence of risks in sport, as well as the efficacy of therapeutic intervention programmes (Fuller & Drawer, 2004). Seeing that the contents of these studies are of critical importance, it is imperative that the data presented are produced from sound methodology. When this is the case, the true risks and injury of the sporting code are reflected (Brooks & Fuller, 2006).

Decreases in injury rates can be established through pro-active initiatives (Elphinston & Hardman, 2006). Even though improved techniques to rehabilitate sports injuries are consistently developed, it may be of greater importance to prevent injuries (Bahr & Holme, 2003). Sports injuries often have detrimental long-term effects. Former elite athletes (variety of sporting codes) show greater knee abnormality and dysfunction of the lower extremities when compared to a control group (Kettunen *et al.*, 2001). There is also an unacceptably high correlation between British professional soccer players who sustained acute injuries and osteoarthritis in the lower extremities (Drawer & Fuller, 2002). Therefore, monitoring, prevention and proper management of sports injuries are of great importance to athletes, the sport and the community (Bahr & Holme, 2003).

If an injury surveillance study can provide the evidence that a sport threatens the health of an athlete, the following step towards injury prevention would be to identify the risks. If the risks are identified, it is possible to implement prevention programmes to limit the risk and potential injuries to the athlete (Van Mechelen *et al.*, 1992). No literature could be found that indicate the injury rates and tendencies in South African netball players. Without this link in the chain, effective limitation of risks and prevention of injuries cannot be accomplished.

The purpose of this study was firstly, to determine the epidemiology of injuries at the University Sport South Africa's (USSA) tournament, as well as the national u/19, u/21 and senior championships in 2009. The second purpose was to identify injury trends and possible associated factors at these tournaments, to compare it with available literature; and finally to make suggestions for interventions to limit the amount of injuries sustained by netball players.

## **METHODOLOGY**

### **Subjects**

The study population included all participants in the 2009 USSA and national u/19, u/21, and senior championships (n=1280). At each tournament teams competed in a round robin format over four to six days. The top four teams in each section played semi-final and final knockout matches to determine the winner of each tournament. Each team played one or two games per day.

### **Questionnaire**

An injury questionnaire was used to collect data on all injuries. The questionnaire was based on one drafted by the Rugby Consensus group to monitor epidemiology of rugby injuries and was adapted for netball (Fuller *et al.*, 2007). Team managers, coaches and medical staff were

instructed on how to complete the questionnaire. Completed questionnaires were collected daily. Reasonable measures were put in place to ensure that all data on injuries sustained at these tournaments were collected, in keeping with the accepted method of data collection of Hopper and Elliot (1993) and Hopper *et al.* (1995a).

### **Definitions**

An injury was defined as any physical complaint that a player sustained during a netball match or netball training that forced the player to receive medical attention. A recurrent injury was defined as an injury of the same type and at the same site as an index injury and that occurred after a player's return to full participation from the index injury. Injury severity was determined as the number of matches the player had missed due to injury. Exposure was defined as the amount of game time (minutes) a player participated before the injury occurred. The full quarter (15 minutes) is counted in which the player's injury was sustained. These definitions are similar, but not identical to the definition of an injury, recurrent injury, injury severity and exposure time as presented in the consensus statements for epidemiological studies in rugby and football injuries (Fuller *et al.*, 2006; Fuller *et al.*, 2007).

### **Statistical analysis and interpretation of data**

All data were captured in Microsoft Excel 2007. The SAS version 9.1.3 statistical software was used for the further analysis. Means and standard deviations or medians and percentiles were used for numeric data. Frequencies and percentages were calculated for categorical data. The statistical significance and/or confidence intervals were calculated to compare data with that found in the literature ( $\alpha=0.05$ ). The Research Ethics Committee of the University of the Free State approved the study.

## **RESULTS AND DISCUSSION**

### **Incidence of injury**

A total of 1280 players that participated in 447 games at the three netball tournaments were included in the study. One hundred and ninety-two (192) players sustained 205 injuries. This is equal to 15% of players that sustained one or more injuries. The injury rate was calculated at 500.7 injuries per 1000 playing hours. The direct probability that a player could sustain an injury was calculated at 0.15 per player. Ninety-one per cent (91%) of the injuries were acute and 8.8% of the injuries were recurrent or chronic in nature. Ninety-five per cent (95%) of the injuries were sustained during matches played at these tournaments. Three per cent (3%) of injuries were sustained during warm up and 2% during a practice session. In 60.8% of the cases there was contact with another player that lead to the injury.

In a study of netball players 10 years and older (Victoria, Australia), the incidence of injuries were calculated at 9.49 injuries per 1000 players (0.0095 injuries per player), which is 17 times lower than the current results (Otago & Peak, 2007). In this study, data were collected by means of claims that were made to a medical insurance company. If data is collected in this manner, there is the potential of only serious injuries being identified and of

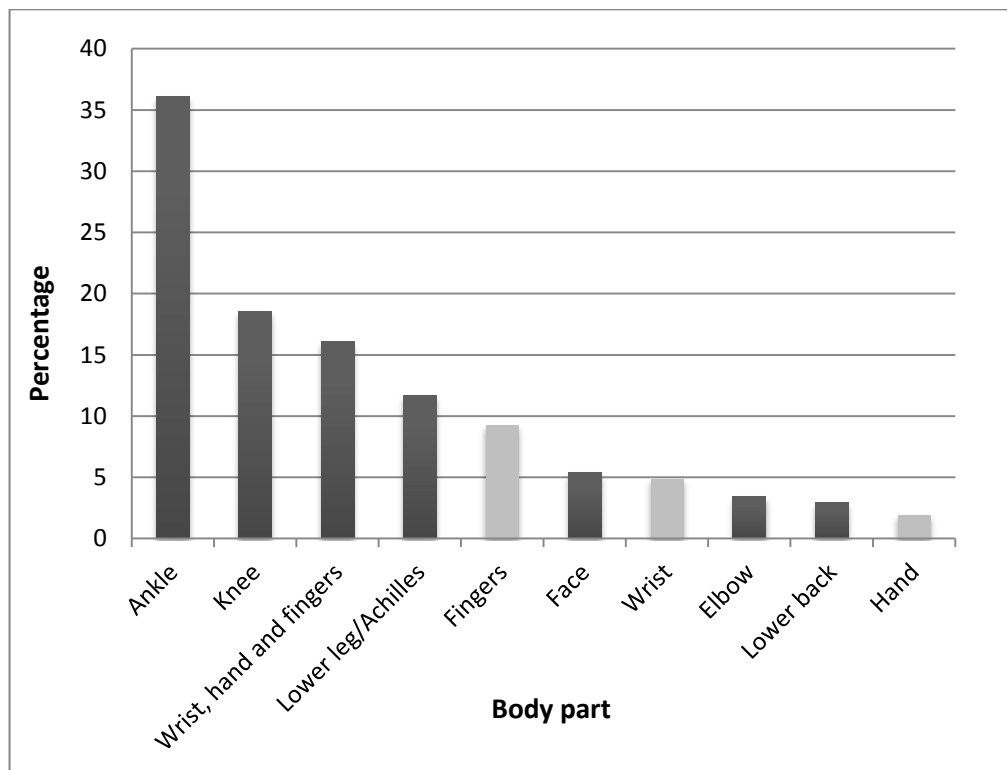
underreporting causing collection bias. Other studies also reported much lower injury rates of 11.3 to 14 injuries per 1000 playing hours among non-elite players over one to two seasons (Stevenson *et al.*, 2000; Finch *et al.*, 2002; McManus *et al.*, 2006).

The current subjects were elite players who were competing in a tournament, which could have contributed to the higher injury rate. There is evidence to suggest that players in A-sections and in higher age groups, who by implication have higher levels of skill, are more susceptible to injury (Hopper & Elliot, 1993; Hopper *et al.*, 1995a; Hopper *et al.*, 1995b). Evidence exists that injury rates in sport are higher in tournaments than compared to games played during the course of a season (Hawkins & Fuller, 1999; Hägglund *et al.*, 2003; Arnason *et al.*, 2004; Junge *et al.*, 2004a; Junge *et al.*, 2004b; Yoon *et al.*, 2004). This, as well as the exclusion of minor injuries, can explain the low injury rate of 0.054 injuries per player found in players who were competing during the course of a 14-week season (Hopper *et al.*, 1995a).

Inclusion criteria for earlier studies were that the players had to be free from any sport injuries for the past three months (Stevenson *et al.*, 2000; Finch *et al.*, 2002; McManus *et al.*, 2006). Previous injuries could leave an athlete vulnerable to recurrent injuries (Thacker *et al.*, 1999; Murphy *et al.*, 2003). The participants in the current study probably did not have sufficient time to heal from or rehabilitate previous injuries before the start of each tournament.

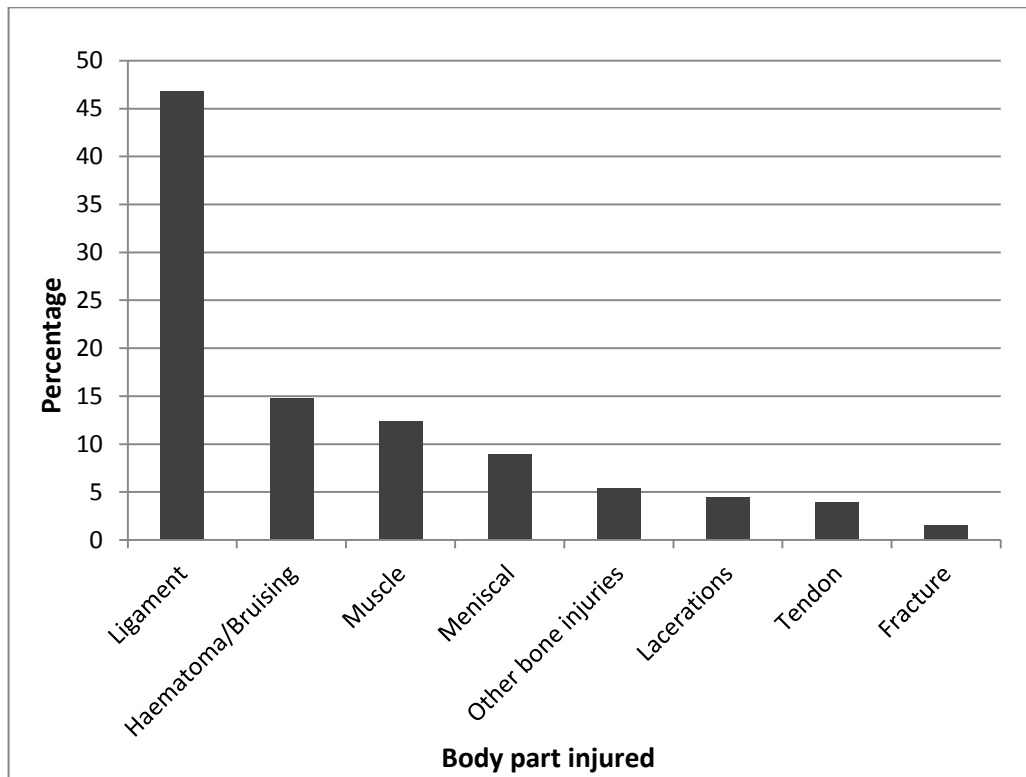
Two studies were found in the literature that revealed similar or higher rates of injury when compared to the current results. The probability of injury was 0.23 per player participating in the Australian netball championships, while the risk of injury was calculated at 0.14 injuries per player during the New South Wales netball championships (Hopper & Elliot, 1993; Hume & Steele, 2000). Both these studies were conducted at netball tournaments of similar age categories. The current results (0.15 injuries per player) supports the premise that higher injury rates occur at netball tournaments when compared to games played during the course of the season. It is clear that methodological differences between these studies, especially the method of collection of injury data and the definition of injury have a significant influence on the outcomes and make studies difficult to compare. Epidemiological data on sports injuries should be interpreted with this in mind.

Figure 1 illustrates the anatomical site of injuries. The ankle sustained the majority (36.1%) of injuries. This was followed by injuries to the knee joint (18.5%), wrist, hand, and fingers (16.1%), and lower leg/Achilles tendon (11.7%). Other studies also reported the highest incidence of netball injuries to the lower extremities (Hopper & Elliot, 1993; Hopper *et al.*, 1995a; Hopper *et al.*, 1995b; McManus *et al.*, 2006; Fong *et al.*, 2007; Otago & Peak, 2007). If the injuries to the hand area are separated from each other, the fingers sustained 9.3% of the total amount of injuries, 4.9% to the wrist and 1.9% to the hand. Five per cent (5%) of all injuries were sustained to the face, 3.4% to the elbow and 2.9% to the lower back. The rest of the injuries that were sustained to the neck, ribs, shoulder, hip, groin, anterior and posterior thigh, feet and toes accounted for 0.9 to 2.4% of the total amount of injuries.



**FIGURE 1: ANATOMICAL SITE OF INJURIES IN ELITE NETBALL PLAYERS IN SOUTH AFRICA**

Figure 2 indicates the most frequently injured structures. As reported in earlier studies, ligaments were the most commonly injured structures in netball players (Hopper & Elliot, 1993; Hopper *et al.*, 1995a; Hume & Steel, 2000; Finch *et al.*, 2002; McManus *et al.*, 2006). Ligaments were involved in 46.8% of the total injuries in this study. Bruising/haematomas were found to be the second most common injuries that were sustained (14.8%), followed by muscle (12.3%), meniscus (8.9%) and other bone injuries (5.4%). Eighty-nine per cent (89%) of ankle injuries involved the ligaments, of which 38% were to the lateral ligament complex and 4.9% to the deltoid ligament. The majority of injuries at the knee were sustained to the menisci (36.1%). Haematomas/bruising (19.4%) and lacerations (11.1%) also occurred at the knee joint. Injuries to the medial collateral ligament (2.5%), lateral collateral ligament (1.2%), anterior cruciate ligament (0.6%) and patellofemoral pain were uncommon.



**FIGURE 2: STRUCTURES MOST FREQUENTLY INJURED DURING THE ELITE NETBALL TOURNAMENTS IN SOUTH AFRICA**

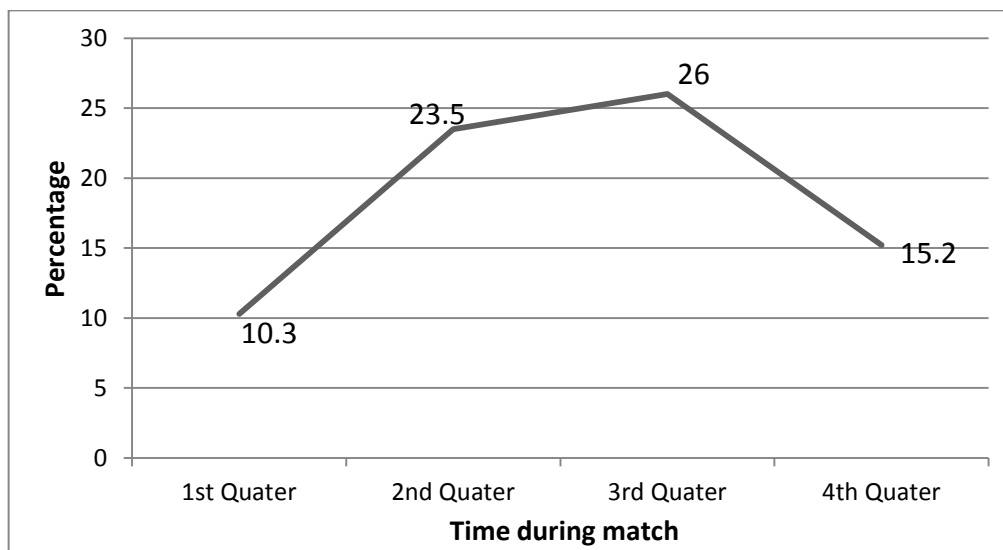
### Recurrent injuries

Of the 205 injuries that occurred, 148 (72.2%) were new injuries and 57 (27.8%) were recurrent. The results show that 36 (48.7%) of the 74 ankle injuries were recurrent in nature. Recurrent injuries at the knee were only responsible for 21.1% of the knee injuries. At the lower leg/Achilles, 29% of injuries were recurrent in nature and 10.5% at the fingers.

### Severity of injury

The ankle suffered the majority (41.7%) of the serious injuries, where a player was not able to compete for longer than 7 days. This is in contrast to the results of Hopper *et al.* (1995a), where a higher number of serious knee injuries were found. The majority of injuries in the current study were, however, minor in nature with 70.7% of all injured players being available for the next game. Another 11.4% missed 1 to 2 games because of injury. Two per cent (2%) of injured players missed 3 to 5 games, while 3.5% of injuries were severe enough

to keep the player out of action for 7 days. In 12.4% of cases the player could not return to play for more than 7 days.



**FIGURE 3: TIME OF INJURY DURING GAMES**

Figure 3 indicates there was a tendency for injuries to increase in each quarter of the game, with the majority of injuries occurring in the middle 30 minutes, reaching a peak in the third quarter (26%). The final quarter showed a decrease in the amount of injuries that occurred. Players in goal defence also sustained the majority (22%) of injuries, which corresponds with findings in the limited literature, followed by injuries in players playing in the centre position (17.6%) (Hopper *et al.*, 1995a). There was no significant association between the position of the player and the time of injury ( $r=0.1131$ ;  $p\text{-value}=0.1073$ ), which is also in accordance with the literature (Hopper *et al.*, 1995a).

### **Exercise habits of netball players**

The literature suggests that improvements in core stability can limit sports injuries, specifically knee injuries (Kibler *et al.*, 2006; Zazulak *et al.*, 2007a; Zazulak *et al.*, 2007b). An incorrect landing technique is one of the main contributing factors in ankle and knee injuries (Hopper & Elliot, 1993; Hopper *et al.*, 1995a; Hopper *et al.*, 1995b; Hume & Steele, 2000). There is growing evidence that improvements in neuromuscular control (NMC) and biomechanics (improved landing technique) contribute to injury prevention (McLean *et al.*, 2004; McLean *et al.*, 2005; Hu *et al.*, 2006; Powers, 2007).

Various authors emphasised the value of proprioceptive exercise as part of the training programme, as it has been proven to limit injuries to the lower extremities, especially to the ankle (Bahr *et al.*, 1997; Wedderkopp *et al.*, 1999; Stasinopoulos, 2004; Verhagen *et al.*,

2004; Emery *et al.*, 2005). These are all modalities that should be incorporated in netball players' training programmes for the prevention of injuries.

## CONCLUSIONS

The probability of a player being injured was 0.15 injuries per player. This is similar to other epidemiological studies that were conducted at tournaments, but higher than studies reporting on injuries sustained during the season. This is an indicator that injury rates are higher at tournaments than games played though the year. This could be due to the decrease in recovery time as teams played two games per day.

There were discrepancies in the rate of injury found in the literature, due to different methods of data collection, different netball populations, as well as different definitions of an injury and the interpretation thereof. It is recommended that the international netball governing body draft a consensus statement that standardises the methodology and definitions for future epidemiological studies, as were done for other sport codes (Orchard *et al.*, 2005; Fuller *et al.*, 2006; Fuller *et al.*, 2007; Pluim *et al.*, 2009).

A substantial amount of injuries (60.8%) occur because of contact with another player. As in soccer, colour cards can be used to warn a player against unnecessary contact. Previous injury is a known predisposing factor to injuries (McKay *et al.*, 2001). Netball injuries should be properly rehabilitated before returning to play in order to reduce the high incidence of recurrent injuries. Ankle braces has been shown to be successful in limiting ankle inversion, but the ability of the braces to limit inversion cannot be equated to the prevention of ankle sprains (Masharawi *et al.*, 2003). Because the players in goal defence seem to be more susceptible to injury, their defensive techniques should be investigated to determine whether it is a contributing factor to injuries.

This study reported a high incidence of injuries among elite netball players in South Africa and revealed clear factors associated with injuries. If these factors are addressed and its effects monitored, a great contribution can be made to the prevention of netball injuries.

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