



A cross-sectional retrospective survey of injury situation and prevalence in female recreational netball players with a focus on knee injuries

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ABSTRACT

Objectives: To examine situations of injury and injury prevalence in female adult recreational netball players with a focus on knee injuries.

Design: Cross sectional retrospective online survey.

Participants: 193 female adult recreational netball players.

Main outcome measures: Any injury sustained in the previous 12 months, situation of injury, any knee injuries sustained in the previous five years, the length of time unable to play netball, and knee injury management.

Results: In the previous 12 months, 61% of respondents sustained injury to the lower limb, and 27% to the upper limb. Lower limb injury situations were mostly landings (46%). Upper limb injury situations were mostly collisions with an opponent (27%). 46% reported sustaining a knee injury in the previous five years. Following knee injury, players were unable to play netball for 6.8 ± 7.0 months (training); and 8.2 ± 7.4 months (matches) respectively.

Conclusions: Lower limb injury is more common than upper limb injury in recreational adult female netball players. Landing was the most common situation of injury for the lower limb including knee injuries. In the previous five years, nearly half of the players had sustained a knee injury resulting in more than six months out of the game.

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1. Introduction

Netball is an intermittent sport requiring multiple jumps, changes of direction and running throughout the game (Thomas et al., 2017). It is played in 70 countries across the globe (World Netball, 2022) and continues to grow in popularity. Epidemiological studies in netball have reported injury prevalence of 15–40% (Langeveld et al., 2012; McManus et al., 2006; Smith et al., 2020) and injury incidence of 13.8–500.7 injuries/1000 player hours (Langeveld et al., 2012; McManus et al., 2006; Smith et al., 2020). Higher incidence occurs in multi-day tournaments (Langeveld

et al., 2012) while lower incidence occurs when reporting over one season or more (McManus et al., 2006; Smith et al., 2020). The ankle has consistently been identified as the most commonly injured region in netball players (26–84%) (Hopper et al., 1995; Pillay & Frantz, 2012; Smith et al., 2020), followed by the knee (8–29%) (Hopper et al., 1995; Pillay & Frantz, 2012; Smith et al., 2020). Whilst ankle injuries are more common, a recent review showed that knee injuries have increased over the previous ten years in all year groups sampled (Belcher, Whatman, Brughelli, & Borotkanics, 2020). Furthermore, knee injuries are considered to be more severe due to the associated time out of the sport (Flood & Harrison, 2009). Treatment of knee injuries, including ligament reconstruction and arthroscopy, accounted for 41% of all injury insurance claims (Otago & Peake, 2007), with knee or leg injury accounting for 37% of hospitalisations for female netball players (Flood & Harrison, 2009). The data suggests that knee injury is a problem in netball and that injury frequency has remained

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relatively consistent over the last 30 years (Mullally et al., 2021). To deal with the issue of knee injury occurrence and to design appropriate intervention programmes, an understanding of the situation and mechanism of knee injury in netball is required (Mullally & Clark, 2020).

The situation or mechanism of injuries in netball has been reported by several studies (Joseph et al., 2019; Smith et al., 2020; Stuelcken et al., 2016). Situation of injury is defined as the game situation (e.g. stage of the game, part of the court) and the player's behaviour (e.g. offensive or defensive manoeuvre before injury, type of landing) (Stuelcken et al., 2016). Mechanism of injury relates to the local joint kinematics when the injury occurs (e.g. knee at or close to full extension, apparent knee abduction collapse) (Stuelcken et al., 2016). When self-reporting injury, elite and recreational level players have cited landing as the most common situation of injury (Joseph et al., 2019; Pillay & Frantz, 2012; Smith et al., 2020). A video analysis of the situation and mechanism of anterior cruciate ligament (ACL) injury in elite netball also reported landing as the primary situation of injury (Stuelcken et al., 2016). Therefore, landing appears to be consistently the primary situation of lower limb injury.

Whilst landing has been identified as the most common situation of ACL injury in elite netball players, key information about recreational level female netball players is needed. It has been highlighted that injuries at a recreational level are likely to differ from those in elite players (Stevenson et al., 2000); this may be explained by differences in training volume affecting the ability of musculotendinous structures to adapt to high workloads (Berardi et al., 2020). Some studies have used hospital or insurance data to determine injury prevalence (Flood & Harrison, 2009; Joseph et al., 2019); however, this only provides information on injuries where some form of treatment was sought. Injury prevalence in netball players across different levels of play was provided by Pillay and Frantz (Pillay & Frantz, 2012) but this was based around a multi-day tournament which is unlikely to reflect patterns across one or more seasons. Smith et al. (Smith et al., 2020), outlined injury rates and prevalence of situation of injury of community level players but the situation of injury was not linked specifically to the region of injury. Therefore, whilst there is some data available in recreational level netball players, it does not provide information about knee injury prevalence and knee injury situation which is important in injury prevention efforts (Finch, 2006).

Due to the potential severity of knee injury, it would be useful to examine the specific type of knee injuries sustained, how long the player was out of the game, and how the injury was managed amongst recreational players. These data can inform the future prevention and treatment of knee injuries in such players by determining if they remain a present-day burden. Therefore, the aims of this study were to: 1) examine injury prevalence and perceived situations of injury in recreational adult level netball players; and 2) identify the prevalence and management of knee injury in recreational netball players.

2. Methods

A three-part survey including 29 questions was administered worldwide to a convenience sample of female recreational netball players to identify demographics, training practices, and injury history. The questions pertaining to training practices are not considered in this paper. The survey was available online through Jisc online survey platform for a period of six months. Before the launch of the survey, institution level approval was granted by the appropriate Ethics Committee.

The survey was open to any female recreational netball player aged 18 years or over. The title page of the survey included

information on the purpose of the study and a statement of consent, by clicking on to the next page, respondents were thereby giving their consent to take part in the survey. Respondents were recruited through a variety of social media platforms and through direct emails to netball clubs through online searches. Anyone playing at the elite level was excluded from the analysis. Elite was defined as players who were competitive at the Olympic, International, National, or Professional level (Gupta et al., 2017).

The survey was designed in collaboration with a physiotherapist, a biomechanist, an exercise physiologist, and an academic who specializes in survey design.

The survey included three sections. Section one identified respondent demographics and characteristics including age, country of residence, playing level, playing position, and length of time playing netball. Section two identified current training practices, these questions are not considered in this paper. Section three (Appendix) required respondents to outline injuries they had sustained in the previous 12 months with more detailed questioning about knee injuries sustained in the previous five years. An injury was defined as "any injury that then stopped you from participating in one or more of the following training sessions or matches", as adapted from previous work (Fuller et al., 2006). The survey underwent pilot testing with contacts who participated in sports for feedback regarding the wording and understanding for respondents. As a result of the pilot testing, question types were amended such as changing multiple choice to free answer questions to ensure that respondents were able to transition through the survey quickly and efficiently and ensure they were able to provide the necessary information for each question. Questions were a mixture of fixed response questions generating categorical and ordinal data; and open-ended questions providing a broad range of responses that were grouped by themes identified in the analysis. A conventional content analysis (Hsieh and Shannon, 2005) was completed by the first author where the themes of injury situation for the upper limb and lower limb were derived from the data (Hsieh and Shannon, 2005).

The responses of the survey were exported to Microsoft Excel. Descriptive statistics were calculated including means and standard deviations for age, length of time playing netball, time playing at respective level of play, time unable to attend netball training or matches. The themes identified in the conventional content analysis were grouped and the number of responses for each theme was counted. Absolute (n) and relative (%) frequency of responses were calculated. The number of injuries per respondent was also calculated.

3. Results

One hundred and ninety-three respondents completed the survey. The mean age of respondents was 33.7 ± 11.2 years, and respondents reported that they had played netball for 19.1 ± 11.0 years. The majority (75%) of respondents were from England, followed by Australia (14%), Scotland (6%), and Wales (3%). Over half (52%, $n = 101$) of respondents played in a local league, followed by County (20%, $n = 38$), Regional (13%, $n = 26$), Social League (9%, $n = 17$), Premier (3%, $n = 6$), Other (2%, $n = 3$), and Back to Netball (1%, $n = 2$). Respondents had competed at their respective level for 8.8 ± 7.5 years. The first choice playing position of the respondents was evenly split across positions with Goal Defence (GD) and Goal Shooter (GS) the most common first choice playing position (19% and 18%, respectively).

In the 12 months prior to completing the questionnaire, a total of 73 injuries to the upper limb were reported equating to 0.38 injuries/respondent and 37.8 injuries per 100 players/year. However, 73% of respondents reported that they had not sustained any

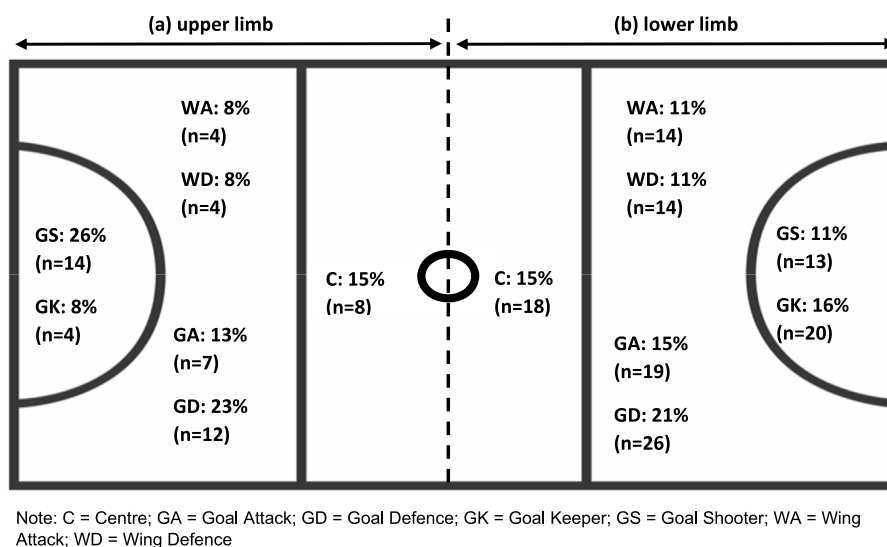


Fig. 1. Proportion (%) of upper limb injuries and lower limb injuries reported by recreational netball players by netball playing position in previous 12 months (number of injuries = 73, number of respondents sustaining an upper limb injury = 52). Note. Due to rounding of decimal places, upper limb injuries by playing position do not add up to 100%.

upper limb injury in the previous 12 months. Of those respondents who had sustained an upper limb injury ($n = 52$), most (52%) had only suffered from one injury. Two respondents reported sustaining five upper limb injuries each in the previous 12 months. Fig. 1 shows the most common playing position of respondents suffering an upper limb injury, with the majority experienced by the GS (26%, $n = 14$) and GD (23%, $n = 12$) positions. The Goal Keeper (GK), Wing Attack (WA) and Wing Defence (WD) positions sustained the fewest upper limb injuries across playing positions. Upper limb injuries occurred most in the second quarter (33%) followed by the third quarter (29%) (Table 1).

The self-reported situation of upper limb injury identified in the conventional content analysis when playing netball was mostly due to collision with an opponent (27%), and ball to hand (netball struck the players hand) (24%) (Table 1). Thirteen respondents reported sustaining an upper limb injury when not playing netball, the majority of which were sustained when playing another sport (54%).

In the 12 months prior to completing the questionnaire, a total of 182 injuries to the lower limb were reported equating to 0.94 injuries/respondent and 94.3 injuries per 100 players/year. Only 39% of respondents reported not sustaining a lower limb injury in

the previous 12 months. Of those who had sustained a lower limb injury in the previous 12 months ($n = 117$), 60% had suffered from one injury, and 30% had suffered from two injuries. Lower limb injuries were more evenly split across different playing positions than upper limb injuries (Fig. 1). Lower limb injuries primarily occurred during matches (98%) with training accounting for the remainder. Most injuries during a match occurred in the third quarter (33%) followed by the first quarter (26%) (Table 1).

The self-reported situation of lower limb injury identified in the conventional content analysis when playing netball was mostly due to landing (48%), followed by collision with an opponent (18%) (Table 1). Thirty-one lower limb injuries were reported when not playing netball, the majority of these were unspecified (39%); however, 29% occurred when engaging in other training, 23% occurred when running, and 10% occurred when playing other sports.

In the last five years, 46% ($n = 89$) of players reported that they had sustained a knee injury. Of these, 70% had only sustained one injury in the five-year period. Of the knee injuries reported, 54% occurred to the right knee compared to 46% to the left knee. Twenty-seven players (14%) had injured both knees during the five-year period. Fifty-six players reported the situation of knee injury. Landing was identified as the most common situation of knee injury (45%), followed by other e.g. wear and tear (20%), change of direction (13%), a combination of landing and change of direction (11%), slip/trip (7%), and collision with opponent (5%). For those suffering from knee injuries, the most common playing positions were GD (21%) and Goal Attack (GA) (19%).

Following knee injury, the mean time that players were unable to attend netball training was 6.8 ± 7.0 months; and the mean time that players were unable to play netball matches was 8.2 ± 7.4 months. In those players who suffered a knee injury, 4% reported receiving a knee injection e.g., steroid injection and 22% underwent knee surgery (44% ACL reconstruction, 23% meniscus repair, 16% repair to ACL and meniscus).

4. Discussion

The aims of this study were to examine injury prevalence and situations of injury, and to identify knee injury occurrence and management in adult female recreational netball players. In the

Table 1
Time and situation of injury reported by recreational level netball players ($n = 193$).

	Upper Limb	Lower Limb
Time During Match		
First Quarter	24% ($n = 11$)	26% ($n = 27$)
Second Quarter	33% ($n = 15$)	18% ($n = 19$)
Third Quarter	29% ($n = 13$)	33% ($n = 35$)
Fourth Quarter	11% ($n = 5$)	21% ($n = 22$)
Training	2% ($n = 1$)	2% ($n = 2$)
Situation of Injury		
Collision with opponent	27% ($n = 16$)	18% ($n = 24$)
Ball to hand	24% ($n = 14$)	0% ($n = 0$)
Landing	0% ($n = 0$)	48% ($n = 63$)
Slip/fall	5% ($n = 3$)	12% ($n = 15$)
Intercepting	19% ($n = 11$)	0% ($n = 0$)
Change of Direction	0% ($n = 0$)	12% ($n = 15$)
Other	25% ($n = 15$)	11% ($n = 14$)

Note. Due to rounding of decimal places, upper limb injuries by quarter and lower limb injury situation does not add up to 100%.

previous 12 months, injuries to the upper limb occurred predominantly due to a collision with an opponent; injuries to the lower limb occurred predominantly during landing. Nearly half of the respondents reported sustaining a knee injury in the previous five years with the majority sustaining one injury. Knee injuries accounted for an extended time period away from playing netball and nearly a quarter of players sustaining a knee injury needed surgery.

The injury data reflected that injury to the lower limb was more common than the upper limb; such findings are consistent with other team court sports such as basketball (Andreoli et al., 2018) and volleyball (Kilic et al., 2017). Epidemiological data in netball consistently indicates that injuries to the lower limb are the most common (Langeveld et al., 2012; McManus et al., 2006; Smith et al., 2020). Whilst this may appear counterintuitive given the involvement of the upper limb in throwing, lower limb injuries are more common due to the fact that players land multiple times in a game (Lavipour, 2009) and the situation of injury has commonly been cited as landing (Pillay & Frantz, 2012; Smith et al., 2020; Stuelcken et al., 2016); which was found in the current study. In netball, players need to land and stop abruptly due to the footwork rule (International Netball Federation, 2020), where players are only permitted to take one step on landing after catching the ball, resulting in high vertical and horizontal forces (Otago, 2004). Such high-risk biomechanical features predispose netball players to noncontact knee injury (Mullally & Clark, 2020). The proportion of players sustaining a knee injury in this study was high compared to previous literature reporting prevalence of 8–29% (Hopper et al., 1995; Pillay & Frantz, 2012). It is not clear why there is such a difference, it may be that as this study was retrospective in nature, more players who had sustained a knee injury were motivated to complete the survey. In contrast, the previous studies (Hopper et al., 1995; Pillay & Frantz, 2012) collected injury data prospectively so players were just reporting injuries as they occurred. A final consideration is the age of respondents in this study which is higher than those in previous studies (Hopper et al., 1995; Pillay & Frantz, 2012). Older players tend to sustain more injuries so this may have influenced the results of the current study (Downs et al., 2021). Nevertheless, the proportion of players reporting a knee injury in the previous five years is concerning and further supports the need to find appropriate injury prevention interventions for this population. The injury rates calculated are lower than the 1.9 injuries (all body regions) per player for one season previously reported (Pillay & Frantz, 2012); however, there are differences in reporting methods and the mode of competition that may have contributed to the different rates between studies. A recent systematic review (Downs et al., 2021) identified that injury rates in netball have used different metrics with different types of injury so it is difficult to appropriately compare findings. Therefore, future studies should use consistent and standardised methods (Downs et al., 2021).

The findings of this study along with others, show inconsistencies about the influence of playing position on injury prevalence. The current study found that upper limb injuries were most common in GS followed by GD, whereas lower limb injuries were most common in GD and GK. Defensive circle players were identified as the most commonly injured in one study (Hopper et al., 1995), compared to Centre (C) followed by GA in a different study (Pillay & Frantz, 2012). Whilst the findings add to the data that is already available regarding playing position and injury, as this is a relatively small sample size, it is unclear if there is an association between playing position and injury. Consequently, injury prevention is likely to be equally important across all playing positions.

There are some inconsistencies about the quarter in which most

injuries occur when comparing the findings of this study to previous research. Langeveld et al. (Langeveld et al., 2012) identified that the third quarter was the most common quarter in which injuries occur followed by the second quarter, whereas Hopper et al. (Hopper & Elliott, 1993) found injuries occurred most commonly in the second quarter followed equally by the first and third quarters. In the current study, more lower limb injuries occurred in the third quarter followed by the first quarter. Whilst there are differences between the studies, the third quarter appears to be a common time for injury to occur. However, care must be taken with the interpretation of these findings without a more detailed analysis. The break between the first and second quarter is normally 3 min with the half-time break longer at 5 min (International Netball Federation, 2020). A possible explanation for the increased number of injuries in the third quarter in the present study may be due to the slightly longer half-time break. Players may not take part in a sufficient warm-up or have reduced concentration after the half-time break (Bathgate et al., 2002). Knowledge of the most common quarter for an injury to occur is useful as it may help inform coaches regarding appropriate strategies prior to players returning to the court after a break as part of an injury prevention strategy.

Landing was identified as the primary situation for lower limb injury and was also cited as a situation of upper limb injury supporting previous research (Joseph et al., 2019; Pillay & Frantz, 2012; Smith et al., 2020). Given the proportion of instances where a player sustains an injury as a result of landing, it is pertinent to address landing technique in an injury prevention programme (IPP) for netball players (Mullally & Clark, 2020). Landing technique can be positively modified by strength, balance, power, and neuromuscular control exercises (Noyes et al., 2005), so in addition to specific training of landing technique, exercises addressing these characteristics should also be included in an appropriate IPP (Mullally & Clark, 2020; Thomas et al., 2017).

It is acknowledged that relative to global participation rates, the sample size of the present study is small, and most respondents were based in the northern hemisphere. Some respondents did not indicate the situation of injury so there is some data that was not available. Furthermore, there is a risk of recall bias (Althubaiti, 2016) from respondents, particularly when considering knee injuries over a five-year time period. Nevertheless, the findings provide useful data for female adult recreational netball players.

5. Conclusion

In female adult recreational netball players, lower limb injuries are more prevalent than upper limb injuries with landing being the most common situation of injury. Nearly half of the players reported sustaining a knee injury in the previous five years. Further analysis is needed regarding playing position and injury risk along with the quarter when most injuries occur. Knee injuries continue to be a burden in recreational level female netball players. Therefore, a review of the current training and injury prevention practices is needed to help inform how to successfully implement an appropriate IPP.

6. Practical implications

- Lower limb injuries remain an issue of concern in female adult recreational level netball players
- Landing is the most common situation of injury so coaches should consider the landing technique of female adult recreational netball players
- There is a need to understand current training and injury prevention practices in female adult recreational netball players so that appropriate IPPs can then be designed and implemented

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None declared.

Ethical statement

This research was approved by St Mary's University Ethics Committee.

Ethical approval

This work was approved by the appropriate Ethics Committee related to the institution in which it was performed and subjects gave informed consent to the work.

Declaration of competing interest

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ptsp.2023.01.003>.

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