

## Prevalence of musculoskeletal pain among the south African female senior national hockey players

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### Summary

*Background:* Field hockey is a team sport in which the competing teams attempt to score into the opposing team's goal. In the attempt to score goals, players' sprint (with possession of the ball) making sudden change in the direction of movement around their opponents which increases the risk of musculoskeletal injury and pain.

*Aim:* This study documented the prevalence of hockey related musculoskeletal pain among the South African female senior national hockey team (n=30).

*Methods:* Subjects completed a self-report questionnaire, which gathered their biographical, epidemiological and exercise history over the last 12 months. The following descriptive statistics (mode, mean, frequency, percentages) and inferential statistics (chi-square set at a probability of 0.05) were employed to analyse the data.

*Results:* Twenty-eight (93.33%) of the cohort sustained musculoskeletal pain within the last 12 months ( $p < 0.001$ ). The most prevalent anatomical sites that sustained hockey related musculoskeletal pain were; ankles (24.14%), lower back and hip (22.41%), lower leg (13.79%), knees (12.07%) and thighs (10.34%) ( $p < 0.01$ ). The predisposing mechanisms of producing these hockey related musculoskeletal pain were rapid, rotational movement (43.75%), collision with players (18.75%), and being struck with the ball (12.5%) ( $p < 0.01$ ).

*Conclusion:* The South African senior female hockey team experienced a high prevalence of hockey related ankle and lower back and hip musculoskeletal pain.

### Keywords:

Female hockey players, musculoskeletal pain

## Występowanie bólów mięśniowo szkieletowych wśród zawodniczek narodowej drużyny RPA w hokeju na trawie

### Streszczenie

*Wprowadzenie.* Hokej na trawie jest grą zespołową, w której rywalizujące drużyny próbują strzelić bramkę drużynie przeciwnej powiększając swój dorobek punktowy. Zdobywanie bramek odbywa się m.in. w wyniku szybkich ataków, nagłych zmian kierunków ruchu, w kontakcie z przeciwnikiem co naraża graczy na urazy w układzie mięśniowo-szkieletowym i w efekcie ból.

*Cel:* Badanie miało na celu udokumentowanie występowania bólu wśród zawodniczek drużyny narodowej RPA w hokeju na trawie

*Metody:* Zastosowano kwestionariusz, w którym zebrano informacje biograficzne, epidemiologiczne i dotyczące treningu sportowego w ostatnich 12 miesiącach. Zebrane dane zostały opracowane statystycznie i posłużyły do przeprowadzonych analiz.

*Wyniki:* 28 zawodniczek (93,33%) skarżyło się na bóle mięśniowo-szkieletowo w ostatnich 12 miesiącach ( $p < 0,001$ ). Najczęściej ból występował w stawach skokowych (24,14%), kręgosłupie i stawie biodrowym (22,41%), podudziu (13,79%), stawach kolanowych (12,07%) i udach (10,34%) ( $p < 0,01$ ). Głównymi czynnikami wywołującymi ból były gwałtowne ruchy obrotowe (43.75%), kolizja z przeciwnikiem (18.75%) i uderzenie piłką (12.5%) ( $p < 0.01$ ).

*Wniosek:* W narodowej drużynie kobiet RPA w hokeju na trawie występuje wysoki wskaźnik występowania bólu związany z urazami stawu skokowego, dolnej części płaców i bioder

### Słowa kluczowe

hokej na trawie, urazowość, ból

## Background

Field hockey is a team sport in which a team of eleven players attempt to score goals by hitting, pushing or flicking the ball with hockey sticks into the opposing team's goal (1). In the attempt to score goals, players' sprint (with possession of the ball) making sudden change in the direction of movement around their opponents which increases the risk of musculoskeletal injury and pain. This sudden change in direction places the ligaments and muscles around the joints at risk of musculoskeletal injury and/or pain (2). International field hockey injury surveillance reports indicate that players' injure their lower limb at a 60% prevalence rate in comparison to femoral, hip, back, shoulder and upper limb injuries (3,4). Further statistical interrogation of hockey related lower limb musculoskeletal injury studies revealed that ligamentous ankle injuries are most common. Epidemiological surveys indicate that inversion ankle sprains are the most prevalent lower limb injury, above eversion ankle sprains, syndesmotic sprains, fractures (tibia, fibula & talus) and muscle strains (5,6). Predisposing factors attributed to the mechanism of field hockey related injuries include frequency of hockey played, rapid, repetitive rotational movements of the ankle joint and direct physical trauma inflicted by players on each other during tackles and collisions (4,7,8,9,10). During the last 20 years, the game of hockey is being played at a faster pace, thereby increasing the potential risk of injury. The pace of the game has been increased due to the preferred synthetic Astroturf surface on which it is played (11).

The South African female hockey team is ranked 12th in the world standings (1). Field hockey is one of the more popular recreational sports enjoyed by many South Africans. Despite the popularity of this sport in South Africa, which is played at most schools and universities, there is limited information pertaining to the prevalence of musculoskeletal injury to hockey players. To date there is only two injury surveillance studies that have been conducted on South African hockey players. Both studies have focused their attention on the prevalence of ankle injuries (2,11). There is no evidence of any published literature pertaining to an injury profile on the South African national female hockey team. This presents a legitimate need for an injury surveillance study to be conducted among the South African national female hockey team. To address this need, the present study focused on the prevalence of musculoskeletal pain sustained by female national hockey players.

## Methods

Thirty female players participated in a retrospective epidemiological investigation by voluntary informed consent. Subjects belonged to the South African national senior team who participated in the Hockey World Cup 2010. The subjects' training history and epidemiology of hockey-related musculoskeletal pain were gathered by employing the use of a self-report musculoskeletal pain questionnaire adapted from Ellapen et al.(2). Subjects were requested to indicate only hockey-related musculoskeletal pain, but not musculoskeletal pain contracted from other sport and/or recreational activities. Subjects could not report on the prevalence of

musculoskeletal injuries due to the fact that these claims of musculoskeletal injuries could not be substantiated by medical records; however subjects' identification of symptoms of musculoskeletal injuries (such as pain, discomfort, numbness, pins and needles, radiating), intensity of pain (accessed severity of pain according to the Kee and Seo Pain Rating Scale and anatomical location was recorded to inferring musculoskeletal injury(12). The definition of musculoskeletal pain employed in this study was defined as any sensation of distress to the musculoskeletal system ranging from uncomfortable to severe, which inhibited the hockey player from engaging in hockey for a minimum duration of 24 hours.

The national female hockey team consisted of 30 players all of whom participated in the study, thereby indicating 100% compliance of this specific homogenous population. Although the sample size is smaller than other South African injury surveillance hockey studies (Naicker et al. -  $n=47$  & Ellapen et al. -  $n=53$ ), the calibre of the hockey proficiency of this cohort justifies the sample size and homogeneity. The inclusion criteria that allowed eligibility for subjects to participate in the study were; all subjects had to belong to South African National senior female hockey team and voluntarily consent. The study being retrospective in nature recorded the prevalence of musculoskeletal pain over the last 12 months. Descriptive statistics which included the mode, mean, frequency, percentages and inferential statistics comprising of chi-square tests (with the probability set at 0.05) were employed in the statistical analysis.

## Results

The cohort's mean age, body mass, stature and body mass index were 23.73 years ( $\pm 3.19$ ), 62.24 kg ( $\pm 8.4$ ), 1.64 m ( $\pm 0.05$ ) and 23.08 kg/m<sup>2</sup> ( $\pm 2.48$ ) respectively (Table 1). The majority of the participants were Whites (66.66%) followed by Coloureds (26.66%) and Blacks (6.66%). The average number of years playing in the South African national senior female hockey team is 4.4 ( $\pm 3.02$ ). Out of the 30 hockey players who answered the questionnaire, 93.33% ( $n=28$ ) experienced hockey related musculoskeletal pain ( $p<0.0001$ ). The prevalence of hockey related musculoskeletal pain were as follows; lower extremities (64.51%), upper extremities (9.67%) and neck (1.61%), ( $p<0.01$ ). Further statistical interrogation revealed the prevalence of hockey related musculoskeletal pain specific to anatomical sites were as; ankle (24.14%), hand (1.72%), foot (3.45%), knee (12.07%), lower leg (13.79%), lower back and hip (22.41%), thigh (10.34%), shoulder (5.17%), neck (1.72%), elbow (1.72%), forearm (1.72%) and ribs (1.72%) ( $p<0.01$ ) (Table 2.).

The Kee and Seo Pain Rating Scale<sup>12</sup> which ranged from 1-5, (1 being uncomfortable and 5 being severe) was used to determine the intensity of musculoskeletal pain experienced by the players. A score of 3 (moderate pain intensity) was rated the most prevalent (37.93%) followed by a rating score of 4 (high pain intensity) (31.03%) among the injured cohort ( $p<0.01$ ). The most common symptoms of musculoskeletal pain reported by the injured cohort was dull aching (79.41%), followed by sharp (5.88%), pins and needles (5.88%), radiating (5.88%) and numbness (2.94%) ( $p<0.01$ ). The predispo-

sing mechanism producing hockey related musculoskeletal pain reported by the injured cohort was; rapid rotational movement (43.75%), direct physical trauma - collision (18.75%), struck by a ball (12.5%), and others (25%) which include medically certified vertebral disorders (spondylosis – 6.25%) and muscle imbalances (18.75%) (as determined by biokineticist). According to the cohort the preferred paramedical/medical professional is a physiotherapist (65.52%) followed general practioners (10.34%), biokineticists (10.34%), orthopaedists (10.34%) and chiropractic practioners (3.45%). The position of hockey played in relation to the prevalence of ankle injury was found to be as follows; forward players (33.3%) mid-fielders (30%) defenders (23.33%) and goal keepers (13.33%).

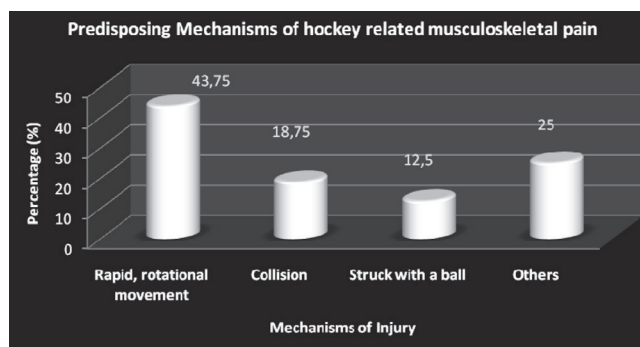
The subjects' practised hockey an average of 10.73 months per year ( $\pm 1.33$ ) and 4.93 days per week ( $\pm 0.82$ ). Each training session lasted an average of 112 minutes ( $\pm 20.74$ ). The total number of minutes in which hockey was practised within the last 12 months by the cohort was 5924.67 with a total of number of 62 injuries sustained, thereby yielding an injury rate of 0.01 injuries/minute of hockey practised. Subjects ( $n=30$ ) participated in the following cross-training activities; resistance strength training (86.66%), agility (3.33%), flexibility (66.66%), core stability (86.66%) and running (16.66%). Most hockey players completed multiple cross-training exercises.

**Table 1.** Demographics of South African Senior Female Hockey players ( $n=30$ )

Parameters	Mean	Standard deviation
Age (years)	23.73	3.19
Body mass (kg)	62.24	8.4
Stature (m)	1.64	0.05
Body mass index ( $\text{kg/m}^2$ )	23.08	2.48

**Table 2.** Prevalence of hockey related musculoskeletal pain at specific anatomical sites of the injured hockey players ( $n=30$ )

Anatomical sites	Percentage (%)	Significance ( $p<0.01$ )
Neck	1.72	( $p<0.01$ )
Shoulder	5.17	( $p<0.01$ )
Elbow	1.72	( $p<0.01$ )
Hand	1.72	( $p<0.01$ )
Forearm	1.72	( $p<0.01$ )
Ribs	1.72	( $p<0.01$ )
Lower back & hip	22.41	( $p<0.01$ )
Lower leg	13.79	( $p<0.01$ )
Thigh	10.34	( $p<0.01$ )
Knees	12.07	( $p<0.01$ )
Ankle	24.14	( $p<0.01$ )
Foot	3.45	( $p<0.01$ )



**Figure 1.** Predisposing mechanism of hockey related musculoskeletal pain

## Discussion

Among the 30 hockey players surveyed, 28 (93.33%) experienced hockey related musculoskeletal pain within the last 12 months ( $p<0.0001$ ). These findings correspond with other international injury surveys which recorded the prevalence of hockey related musculoskeletal pain (13,14,15). The highest prevalence of hockey related musculoskeletal pain was found in the lower extremities (86.2%), followed by the upper extremities (10.33%) and the neck was 1.72% ( $p<0.01$ ). The lower extremities included foot, ankle, lower limb, knee, thigh and lower back and hip, whilst upper extremities included shoulder, elbow, forearm and hand. The findings of this study confer with previous reports that documented the higher prevalence of lower limb musculoskeletal pain (3,4). The prevalence of hockey related musculoskeletal pain specific to anatomical sites were; ankle (24.14%), lower back and hip (22.41%), lower leg (13.79%), knee (12.07%), thigh (10.34%), shoulder (5.17%), foot (3.45%), hand (1.72%), neck (1.72%), elbow (1.72%), forearm (1.72%) and ribs (1.72%) ( $p<0.01$ ) (Table 2). The prevalence of lower extremity musculoskeletal pain indicates the high vulnerability of musculoskeletal injury when playing hockey. The findings of this study confer with previous reports that the ankle is the most frequently injured joint among elite hockey player yielding greater prevalence of musculoskeletal pain (2,11). The anatomy of the talocrural joint (commonly referred to as the ankle joint by the hockey players) is a hinge joint which is not highly stable 16. The talocrural joint receives its stability by the medial and lateral ligaments. The medial ligament restraints have proven to be more effective than the lateral ligaments, yielding fewer reports of eversion ankle sprains in comparison to inversion sprains (3,5,17). The predisposing mechanism of talocrural joint sprains cited by this cohort is rapid, rotational movements. Naicker et al. (11) has postulated that rapid rotational movements, when playing hockey moves the ankle into plantar flexion and inversion, which exceeds the plastic properties of the lateral ligaments producing tearing.

The second most prevalent site of anatomical musculoskeletal pain was the lower back and hip. There has been no studies conducted which proposed the pathomechanics propagating pain in this anatomical site. It is postulated that the prolonged hip flexion when playing hockey changes the normal resting length tension relationship of the agonists



(hip flexors) and the antagonists (gluteal muscles) thereby producing asymmetrical force couple between the hip flexors and the gluteal muscle. This abnormal force couple between the hip flexors and the gluteal muscles produced an asymmetrical muscle imbalance. Prolonged hip flexion shortens the hip flexors while stretching the gluteal muscles, which impinges the sciatic nerve, located in this area. Compression of the sciatic nerve will produce radiating, pins and needles pain. All the subjects who reported lower back and hip pain ( $n=13$ ) described the sensation as having radiating and pins and needles. In addition, prolonged shortening of the hip flexors produces muscle spasms whilst prolonged stretching of the gluteal muscles increases their vulnerability to muscle spasms. Bahr and Maehlum (18) and Brukner and Khan (17) documents that symptoms of muscle spasms are dull pain, whilst muscle strains are sharp and dull pain.

The type of pain commonly experienced by the injured cohort was described as dull aching (79.41%) followed by sharp (5.88%), pins and needles (5.88%), radiating (5.88%) and numbness (2.94%) ( $p<0.001$ ). Prentice<sup>19</sup> and Brukner and Khan (17) identify dull aching, sharp pain sensations as muscle pain. It is plausible, that when an individual was struck with a ball and/or collided with other players, the force of the blow penetrated the skin and was absorbed into the various muscle layers, thereby yielding symptoms of muscle pain such as dull aching, discomfort, sharp sensations. Other descriptions of the pain experienced was pins and needles (5.27%) numbness (5.24%) and radiating (1.57%) which are indicative of nerve pain (18). It is hypothesized that the force of blow penetrates the skin and muscles thereby compressing the fragile nerve traversing the muscle, between muscles or between the muscle and the bone, producing nerve pain symptoms of pins and needles, numbness and radiating sensations.

The position played had a significant effect on the percentage of injuries reported. Forward players experienced the most musculoskeletal pain (33.33%) followed by mid-fielders (30%) defenders (23.33%) and goal-keepers (13.33%) (Figure 1) confirming the previous reports of (2,11,20). It is hypothesized that forwards experience a high prevalence of musculoskeletal pain due to the maximal effort they exert when in possession of the ball. Forwards are required to sprint while simultaneously changing directions which put the talocrural joint under increased risk of ligamentous injury (20,21). Often forwards and midfielders engage in rapid rotational movement in an attempt to maneuver around their opponent in order to gain the advantage. Although this is good sport strategy, it places the player at an increased risk of injury around joint, particularly the ankle. Field hockey is a very competitive game, where players often collide with each other in an attempt to gain possession of the ball. These collisions among players lead to musculoskeletal pain and/or injury.

The data revealed that hockey players who performed sport specific hockey practise in an excess of 4.93 days per week experienced higher prevalence of musculoskeletal pain ( $p<0.001$ ). Similar epidemiological findings reported by Dick et al. /4/ and Ellapen et al. /2/ illustrates the greater the frequency of sport specific practise per week, the higher the

prevalence of musculoskeletal pain and/or injury. It is postulated that the more often the hockey players' practised hockey per week the greater the opportunity to incur symptoms of musculoskeletal injuries, namely pain and discomfort. In addition, the more often hockey is practised, the greater the prevalence of micro-tearing of muscles, ligaments and other soft tissue. The greater number of hours of hockey practised per week minimised the healing time needed to recover from micro-tears of muscles, ligaments and other soft tissue. More often, injured athletes continue to train, transforming a mild injury to a more severe injury, thereby yielding more excruciating musculoskeletal pain (2). Many of the hockey players who experienced musculoskeletal pain described as uncomfortable (1 on the Kee & Seo Pain Rating Scale) (12) continued practise, until the pain intensity progressed to moderate (3 on the Kee & Seo Pain Rating Scale) (12), thereby yielding a more severe musculoskeletal injury, inhibiting them further practise for a minimum of 24 hours.

## Conclusion

The study concluded that the South African senior female hockey team experienced a high prevalence of hockey related musculoskeletal pain, especially their ankles, lower back and hip.

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## References

1. Gallagher D. Top women hockey teams visit South Africa. {serial online} 2010 {cited 2010 August 10} Available from [www.hockeysouthafrica.com](http://www.hockeysouthafrica.com)
2. Ellapen, TJ, Demartinis R, Hansen C, Hughes, T. & Van Heerden, H.J. Incidence of hockey ankle injuries in Kwa-Zulu Natal, South Africa. *Africa Journal of Physical Health Education Recreation & Dance*, 2009; 15: 3: 417-423
3. Murtaugh K. Injury patterns among female hockey players. *Journal of Medicine and Science in Sports and Exercise*, 2001; 33(2): 201-7
4. Dick R, Hootman JM, Agel MA, Vela L, Marshall SW, Messina R. Descriptive epidemiology of collegiate women's field hockey injuries. *Journal of Athletic Training*, 2007; 42(2): 211-20
5. Pollard H, Sim P, McHardy A. Lateral ankle injuries. *ACO*, 2002; 10
6. Wright RW, Barile RJ, Suprenant DA, Matava MJ. Ankle syndesmosis sprains in national hockey league players. *American Journal of Sports Medicine*, 2004; 32(8): 1941-5
7. Beynnon BD, Renstrom PA, Alosa DM, Baumhauer JF, Vacek PM. Ankle ligament injury risk factors: a prospective study of college athletes. *Journal of Orthopedic Research*, 2001; 19(2): 213-20
8. Demartinis R. Duki Y. A comparison between agility testing on synthetic surfaces and grass in male hockey players. Unpublished thesis. University of Kwa-Zulu Natal, 2007
9. Yeung MS, Kai-Chan CH, Yuan WY. An epidemiological survey on ankle sprains. *British Journal of Sports Medicine*, 1994; 28(2): 112-16

10. Schick DM, Meeuwisse WH. Injury rates and profiles in female ice hockey players. *American Journal of Sports Medicine*, 2003; 31(1): 47-52
11. Naicker M, McLean M, Esterhuizen TM, Peters-Futre EM. Poor peak dorsiflexor torque associated with incidence of ankle injury in elite field female hockey players. *Journal of Science, Medicine and Sport*, 2007; 10(6): 363-71
12. Kee D, Seo SR. Musculoskeletal disorders among nursing personnel in Korea. *International Journal of Industrial Ergonomics*, 2007; 37: 207-212
13. Zoch, C, Fialka-Moser V, Quittan M. Rehabilitation of ligamentous ankle injuries. *British Journal of Sports*, 2003; 37: 29
14. Yard EE, Comstok RD. Injuries sustained by Pediatric Ice hockey, lacrosse, field hockey athletes presenting to the United States Emergency Departments 1990-2003. *Journal of Athletic Training*, 2006; 41(4): 441-449
15. Fong DT, Hong Y, Chan L, Yung PS, Chan K. A Systematic Review on Ankle Injury and Ankle Sprain. *Sports Medicine*; 2007; 37(1): 73-94
16. Marieb E. *Human Anatomy and Physiology* (7th edition). Benjamin-Cummings Publishing Company; 2004
17. Brukner P, Khan K. *Clinical Sports Medicine* (3rd edition). New York: The McGraw Hill Company; 2006
18. Bahr R, Maehlum S. *Clinical guide to sport injuries*. Champaign, IL: Human Kinetics; 2004
19. Prentice WE. *Rehabilitation techniques for Sports Medicine and Athletic Training*. Champaign, IL: Human Kinetics; 2004
20. Kuzuhara, K, Shimamoto, H, Masa Y. Ice hockey injuries in a Japanese elite team: a 3-year prospective study. *Journal of Athletic Training*, 2009; 44(2): 208-14
21. Flik K, Lyman S, Marx RG. American collegiate men's ice hockey: an analysis of injuries. *American Journal of Sports Medicine*, 2005; 33(2): 183-7