

[Athletic Training]

Injury Profile in Swedish Elite Floorball: A Prospective Cohort Study of 12 Teams

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Background: Floorball is an indoor team sport with growing popularity worldwide characterized by rapid accelerations, decelerations, and cutting and pivoting movements. While injuries are common, there are few high-quality epidemiological investigations of floorball injuries. Therefore, the aim of this study was to determine the incidence and severity of injuries in male and female elite-level floorball players in Sweden.

Hypothesis: The incidence of injuries has not decreased; female players are more vulnerable to injury than male players.

Study Design: Prospective cohort study.

Level of Evidence: Level 3.

Methods: Twelve floorball teams (6 male, 6 female) in the Swedish premiere leagues were followed for 1 year (preseason, game season, and the entire year). The team medical staff reported injury incidence, location, type (traumatic or overuse), and severity. Differences between male and female players were analyzed using the Mann-Whitney *U* test.

Results: The injury incidence was greater in female players during preseason (22.9 vs 7.4, $P = 0.01$), game season (39.5 vs 28.3, $P = 0.002$), as well as the whole year combined (33.9 vs 20.8, $P = 0.02$). The thigh was the most common injury location in male players and the ankle in female players. Overuse injuries were more common among men and were primarily back problems. Traumatic injuries were more common in women—mainly knee and ankle injuries. Most injuries were of mild severity. A greater number of anterior cruciate ligament injuries occurred in women ($n = 11$) than in men ($n = 2$).

Conclusion: The injury incidence was significantly greater in female floorball players throughout the entire floorball year. Male players sustained mostly overuse injuries while female players suffered traumatic injuries. The majority of injuries in floorball were mild, irrespective of player sex.

Clinical Relevance: Knowledge of the incidence and severity of floorball injuries is an essential step in the sequence of injury prevention. Future research should focus on identifying injury mechanisms and risk factors for these injuries to develop injury prevention strategies.

Keywords: epidemiology; floorball; overuse injury; sex; traumatic injury

In Sweden, floorball is one of the largest indoor sports, and approximately 25% of players are women. The International Floorball Federation has more than 50 member countries and is a full member of the International Olympic Committee (IOC). A floorball year consists of preseason (May-August), game season (September-March), and playoffs (April). The game time is 3 periods, 20 minutes each, with two 10-minute intermissions. Floorball is played with 5 players and 1 goalkeeper per team, with substitutions allowed during the game. The players use

graphite compound sticks and a light ball made of hollow plastic (Figure 1). According to the rules, floorball is a noncontact sport.^{12,16}

Like other pivoting sports, characterized by accelerations, decelerations, rapid changes of direction, and sudden stops, injury risk is a common problem—especially in the lower extremity.^{7,10} Floorball injuries are often a physiological and psychological burden for the injured player and expensive for the club and society.^{2,19,20}

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Figure 1. The floorball equipment, a plastic ball and stick.

Two earlier studies on Swedish floorball reported an injury incidence of 2.4 per 1000 game hours⁹ and 2.6 in male players versus 2.5 in female players.²¹ A Finnish study suggested that the injury incidence of floorball was 23.7 and 15.9 per 1000 game hours in male and female players, respectively.¹⁶ Some years later, another group reported an injury incidence of 34.3 per 1000 game hours in elite female floorball players.¹²

Most previous publications of injuries in floorball occurred at least 10 years ago before the development of elite floorball technique and increased interest. It is likely that the injury profile has changed. To study the injury profile of floorball at the elite level, we prospectively recorded the injury incidence, injury location, type of injury, and injury severity in Swedish male and female elite floorball players during a complete floorball year: 2010-2011 (preseason and game season).

METHODS

The present investigation was approved by the regional ethical review board in Stockholm, Sweden (Dnr 2009/2001-31). A prospective cohort study of injuries in the Swedish Floorball Federation's premier leagues for male and female players was carried out during the 2010-2011 preseason and game season. All 28 teams in these 2 leagues were invited to participate in an injury prevention study, in which 23 teams volunteered. The players themselves made the final decision whether to participate and gave their written consent.¹⁹ Twelve teams (n = 238 players) not involved in the prevention intervention were included in this study. Players who joined the teams during the season were not included. The exposure to floorball was calculated separately for preseason (May to the first half of September) and until the last game (second half of September to March/April) (Table 1).

Data Collection

Baseline data for each player were collected at the start of the study. The players completed a questionnaire with background

Table 1. Sex-specific characteristics of the floorball players at baseline^a

	Men (n = 122)	Women (n = 116)
Age, y	25 ± 4.6	22 ± 4.2
Floorball experience, y	12.7 ± 4.6	10.9 ± 3.2
Exposure floorball preseason, h/wk	5.3 ± 0.9	5.0 ± 0.6
Exposure floorball game season, h/wk ^a	6.3 ± 0.9	6.0 ± 0.6

^aData presented as mean ± SD.

data including previous injuries.^{3,6} Injuries were consecutively recorded by team medical staff. Exposure data were reported in hours per week for each team including scheduled floorball training and games, while other sports and optional training were not included. All teams were allowed to use a web-based online registration system, the Swedish National Injury Register.

Injury Definition

Players who refrained 1 day or more from ordinary training or a game were defined as injured according to the time-loss definition.⁸ The injuries were based on number of days absent from floorball: mild, 1 to 7 days; moderate, 8 to 30 days; and severe, >30 days.⁸ The injuries were classified as traumatic (sudden specific event as a contact or noncontact injury) or overuse (repeated microtrauma without any identifiable event).^{4,17}

Statistical Analysis

Mean values, standard deviations, and frequency were used to describe the data. The injury incidence was expressed as the number of injuries per 1000 hours of exposure to floorball. Because of nonnormal distribution of data, the Mann-Whitney *U* test was used to explore differences between men and women in terms of injury incidence, injury location, type of injury, and injury severity. The level of significance was set at $P < 0.05$. Statistical analyses were performed using Statistica 11 software (Stat soft).

RESULTS

Injury Incidence

The injury incidence was 2.6 per 1000 exposure hours in men and 3.9 in women (Table 2). Of 238 floorball players, 34 players (14%) sustained 38 injuries during the preseason and 101 players (42%) sustained 148 injuries during the game season. In total, floorball caused 0.8 injuries per player. A greater number of injuries occurred in women than men (57% and 43%, respectively; $P = 0.02$).

Table 2. Injury incidence (number of injuries) per 1000 floorball hours in male (n = 122) and female (n = 116) players during preseason, game season, and the entire floorball year

Injury Incidence	Preseason	Game Season	Entire Season
Men	1.4	3.0	2.6
Women	3.9	3.8	3.9

Table 3. Injury locations in male (n = 122) and female players (n = 116) during preseason, game season, and the entire floorball year^a

	Preseason			Game Season			Entire Season		
	Men	Women	P	Men	Women	P	Men	Women	P
Ankle	4 (2)	7 (4)	0.38	10 (10)	29 (15.5)	0.0004 ^b	14 (7.5)	36 (20)	0.0003 ^b
Calf	1 (0.5)	1 (0.5)	0.97	7 (4)	2 (1)	0.16	8 (4)	3 (1.5)	0.21
Knee	5 (3)	8 (4)	0.34	7 (4)	21 (11)	0.008 ^b	12 (7)	29 (15.5)	0.007 ^b
Thigh	0 (0)	3 (1.5)	0.12	16 (9)	15 (8)	0.96	16 (9)	18 (10)	0.59
Groin	1 (0.5)	3 (1.5)	0.37	4 (2)	1 (0.5)	0.27	5 (3)	4 (2)	0.82
Rib	0 (0)	0 (0)	—	1 (0.5)	0 (0)	>0.99	1 (0.5)	0 (0)	>0.99
Back	0 (0)	4 (2)	0.07	12 (7)	5 (3)	0.15	12 (7)	9 (4.5)	0.62
Shoulder	0 (0)	1 (0.5)	>0.99	8 (4)	1 (0.5)	0.04 ^b	8 (4)	2 (1)	0.10
Arm/hand	0 (0)	0 (0)	—	4 (2)	2 (1)	0.52	4 (2)	2 (1)	0.52
Face/head	0 (0)	0 (0)	—	0 (0)	3 (1.5)	0.12	0 (0)	3 (1.5)	0.12
Total	11 (6)	27 (14)		69 (37)	79 (42)		80 (43)	106 (57)	

^aData presented as n (%).

^bSignificant difference, $P < 0.05$.

Injury Location

During the preseason, the knee was the most commonly injured body part (7%) in both men and women. During the game season, the thigh (17%) was the most commonly injured body part in men and the ankle in women (Table 3). Men sustained 2 (1%) anterior cruciate ligament (ACL) injuries and women 11 (6%) ACL injuries during the year studied ($P = 0.02$).

Type of Injury

Male players sustained their greatest number of both traumatic and overuse injuries in the beginning of the game season (Figure 2), whereas female players sustained traumatic injuries at the start and the end of the game season, and most overuse injuries occurred in the middle of the game season (Figure 3).

Traumatic ankle injuries were the most common throughout the entire season for both sexes (n = 50, 27.5%), with a greater

rate among women ($P = 0.01$). The most common locations for overuse injuries were the back for men and the ankle for women (Table 4).

Injury Severity

The majority of injuries were of mild severity (Table 5). Female players had a greater rate of mild ankle injuries and severe knee injuries than male players.

DISCUSSION

This study documents the injury profile in elite Swedish floorball and highlights differences in the injury rate between male and female players. In particular, female players had a greater incidence of severe acute knee injuries than male players, as well as a substantially greater injury incidence during the preseason.

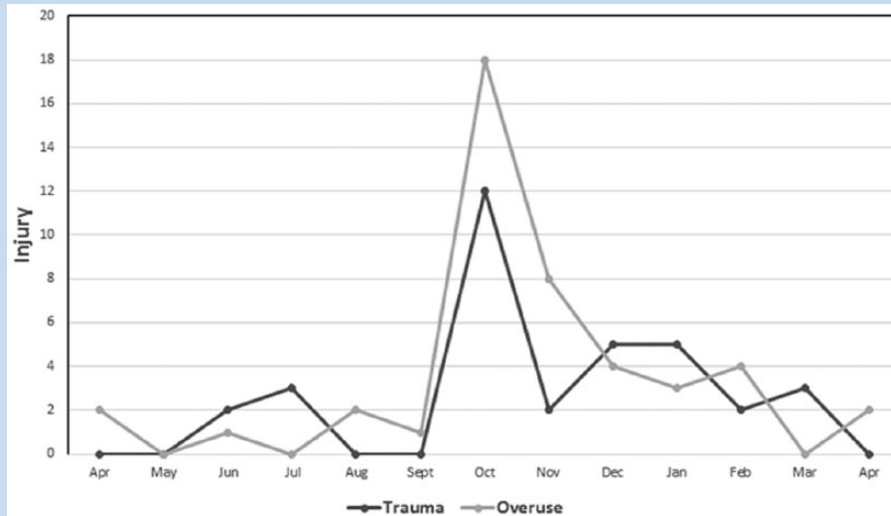


Figure 2. Distribution of overuse and traumatic injuries among male players (n = 122) during the entire floorball year.

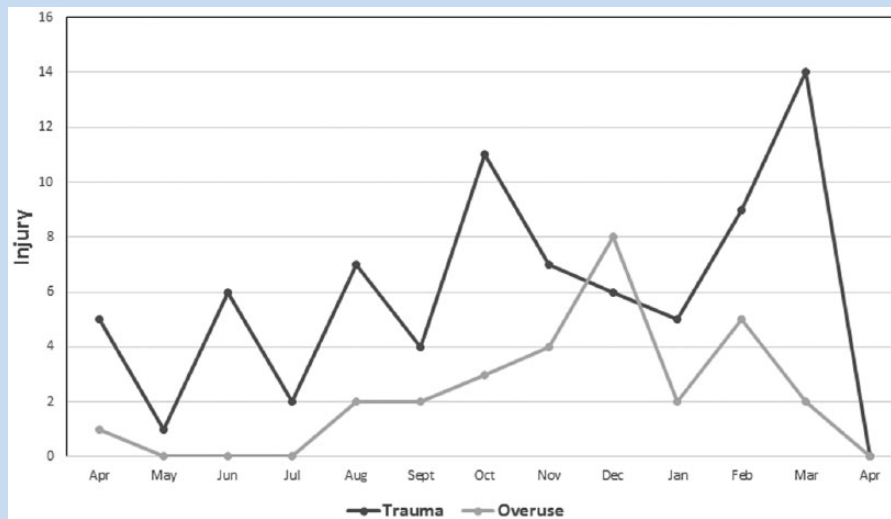


Figure 3. Distribution of overuse and traumatic injuries among female players (n = 116) during the entire floorball year.

Previous floorball studies report an injury incidence between 2.4 and 23.7.^{9,16,21} However, it is not possible to do a direct comparison between the results of the present study and those of previous studies as previous studies report incidence for training and games separately. In the present study, the exposure hours were not divided into practices and games but into preseason and game season. However, based on the preseason and game season, it may be possible to implement proper injury prevention strategies when needed.

The majority of injuries occurred in the lower extremity, which is in line with previous studies.^{9,12,16,21} In contrast with earlier publications,^{9,16,21} ankle injuries were more common in female players than in male players. Floorball has developed over time leading to changes in physical demands and new injury patterns. In the present study, thigh injuries, such as hamstring

ruptures, have increased in both men and women, in contrast with earlier publications.^{9,12,16,21} This highlights the need for adequate training as well as rehabilitation and return-to-sport measures.¹

Knee injuries—ACL injuries in particular—are common in female athletes.^{5,7,14} Female floorball players sustain a significantly greater number of ACL injuries than their male counterparts.^{12,16} A number of intrinsic risk factors for ACL injuries in women have been suggested¹⁵ and have led to suggestions of different ACL injury prevention programs.^{11,13}

Male players suffered from significantly more shoulder injuries than female players during the game season. Even though floorball is a noncontact sport, the speed and intensity during games appears to lead to contact with opponents and objects close to the rink.

Table 4. Traumatic and overuse injury locations in male (n = 122) and female players (n = 116) during the entire floorball year^a

	Traumatic Injuries			Overuse Injuries		
	Men	Women	<i>P</i>	Men	Women	<i>P</i>
Ankle	10 (5.5)	27 (15)	0.001 ^b	4 (2)	9 (5)	0.19
Calf	1 (0.5)	2 (1)	0.60	7 (4)	1 (0.5)	0.07
Knee	5 (3)	21 (11)	0.001 ^b	7 (4)	8 (4)	0.75
Thigh	8 (4)	13 (7)	0.27	8 (4)	5 (3)	0.51
Groin	1 (0.5)	3 (1.5)	0.37	4 (2)	1 (0.5)	0.27
Rib	1 (0.5)	0 (0)	>0.99	0 (0)	0 (0)	—
Back	2 (1)	5 (3)	0.29	10 (6)	4 (2)	0.18
Shoulder	4 (2)	2 (1)	0.52	4 (2)	0 (0)	0.09
Arm/hand	2 (1)	2 (1)	0.96	2 (1)	0 (0)	0.26
Face/head	0 (0)	3 (1.5)	0.12	0 (0)	0 (0)	—
Total	34 (18)	78 (42)		46 (25)	28 (15)	

^aResults are given in number of injuries (percentage of total number of injuries) for injury location as well as traumatic and overuse injuries.

^bSignificant difference at $P < 0.05$.

Table 5. Distribution of injury locations and injury severity in male (n = 122) and female players (n = 116) during the entire floorball year^a

	Men			Women			Total		
	Mild	Moderate	Severe	Mild	Moderate	Severe	Mild	Moderate	Severe
Ankle	2 (1)	6 (3.5)	6 (3)	25 (13.5)	8 (4.5)	3 (1.5)	27 (14.5)	14 (7.5)	9 (5)
Calf	4 (2)	3 (1.5)	1 (0.5)	3 (1.5)	0 (0)	0 (0)	7 (4)	3 (1.5)	1 (0.5)
Knee	3 (1.5)	4 (2)	5 (3)	8 (4.5)	5 (3)	16 (9)	11 (6)	9 (4.5)	21 (12)
Thigh	5 (3)	9 (5)	2 (1)	11 (6)	6 (3)	1 (0.5)	16 (9)	15 (8)	3 (1.5)
Groin	3 (1.5)	1 (0.5)	1 (0.5)	3 (1.5)	1 (0.5)	0 (0)	3 (3)	2 (2)	1 (0.5)
Rib	0 (0)	1 (0.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.5)	0 (0)
Back	7 (4)	2 (1)	3 (2)	4 (2)	3 (1.5)	2 (1)	11 (6)	5 (2.5)	5 (2.5)
Shoulder	5 (3)	3 (1.5)	0 (0)	1 (0.5)	1 (0.5)	0 (0)	6 (3)	4 (2)	0 (0)
Arm/hand	2 (1)	1 (0.5)	0 (0)	2 (1)	0 (0)	0 (0)	4 (2)	1 (0.5)	0 (0)
Face/head	0 (0)	0 (0)	0 (0)	3 (1.5)	0 (0)	0 (0)	3 (1.5)	0 (0)	0 (0)
Total	32 (17)	30 (16)	18 (10)	60 (32)	24 (13)	22 (12)	92 (49)	54 (29)	40 (22)

^aResults are given in number of injuries (percentage of total number of injuries) for injury location and injury severity.

The distributions of traumatic and overuse injuries were 60% and 40%, respectively. Male and female players showed some seasonal differences in injury sequence. At the start of the game season (September and October), both male and female players sustained mostly traumatic injuries. Female players sustained another peak of traumatic injuries at the end of the season in connection with playoffs. With overuse injuries, male players were more often injured in October and November, while female players gradually suffered overuse injuries at the start of the game season, with a peak in December. These results demonstrate a need for a better preparation of the players in the transition from preseason to game season. The intensity of games likely increases toward the end of the season. However, fatigue from long periods of training could also contribute to injuries at the end of the season.¹⁸

Mild injuries were the most common during the game season, which also corresponds with earlier investigations.^{12,16,21} Sixty percent of injuries in men and 44% in women were moderate or severe, requiring a rest from floorball for more than 1 week. Unfortunately, the present study did not distinguish between index injuries and reinjuries.³

Limitations

There might be diagnostic inaccuracies when it comes to noncontact injuries. In particular, it can be difficult to discern whether a sudden complaint or acute pain is caused by trauma or overuse. We did not separate time of exposure in practices and games.

CONCLUSION

The majority of injuries were categorized as mild. Overuse injuries were the most common in male players while traumatic injuries were the most common in female players. Traumatic injuries occurred mostly in the lower extremity, and significantly more ACL and ankle injuries occurred in women.

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