Injury epidemiology in the men's and women's Spanish roller-hockey league: a descriptive study

Bernat de Pablo[1,2,3], Guillem Trabal[4], Javier Yanguas[2], David Dominguez[5], Gil Rodas[2,5], Martí Casals[6,7]

[1]Hospital Universitari Mutua Terrassa. Terrassa. Barcelona. [2]Servicios Médicos F.C. Barcelona. Barcelona. [3]Escuela de Doctorado. Universitat de Vic – Universitat Central de Catalunya. Vic. Barcelona. [4]Facultat d'Educació, Traducció, Esports i Psicologia. Universitat de Vic. Universitat Central de Catalunya. Vic. Barcelona. [5]Unitat de Medicina de l'Esport. Hospital de Barcelona / Hospital Sant Joan de Déu. Barcelona / Hospital Clínic de Barcelona. [6]Centre d'Estudis de l'Esport i l'Activitat Física (CEEAF). Facultat de Medicina. Universitat de Vic. – Universitat Central de Catalunya. Vic. Barcelona. [7]Institut Nacional d'Educació Física de Catalunya (INEFC). Universitat de Barcelona. Barcelona.

doi: 10.18176/archmeddeporte.00112

Received: 26/04/2022
Accepted: 13/09/2022

Summary

The purpose of the present study is to describe the injury patterns among male and female athletes of the Spanish Rink hockey league.

A cross-sectional study was performed, concerning the time-loss injuries (the athlete is prevented to participate in a training session / game because of the injury registered by the medical staff of every team. 137 athletes were included (98 male, age 26.7 ± 5.9 years; 39 female, age 23.3 ± 4.6 years).

Ninety-four time-loss injuries were recorded, being the most frequent the muscle injury (38 episodes, 40.4%), especially the ones affecting the adductor longus muscle (23 episodes, 60,5% of the muscle injuries). The majority of the registered injuries were classified as mild (1-7 days of time-loss) but the and the median return-to-play was 19.4 ± 29.6 days. Eight episodes of reinjury were described (8.5% of total injuries) and 2 injuries required surgical treatment (2.1% of total injuries).

Concerning female athletes, we can highlight a increased number of ligament injuries in the lower limbs compared with male athletes and the absence of tendinopathies causing time-loss.

The knee injuries were the injuries with a higher return-to-play in goalkeepers.

The present study is the first to describe the injury patterns among rink hockey elite athletes and must set a starting point to study and prevent injuries in this sport.

Key words:
Time-loss injuries. Roller hockey. Epidemiology. Injury surveillance.

Epidemiología lesional en la liga española de hockey patines masculina y femenina: un estudio descriptivo

Resumen

El propósito del presente estudio es describir los patrones lesionales durante una temporada de los deportistas de la máxima competición masculina y femenina de Hockey Patines en España.

Se realizó un estudio descriptivo de las lesiones con baja deportiva (el/la deportista no puede participar como mínimo en un entrenamiento o partido debido a la lesión) recogidas por los equipos biomédicos de cada equipo. Se estudiaron 137 deportistas (98 hombres, con una media de edad de 26,7 ± 5,9 años y 39 mujeres con una media de edad de 23,3 ± 4,6 años) Se recogieron un total de 94 lesiones con baja deportiva, siendo las más frecuentes las lesiones musculares (38 episodios, 40,4% de las lesiones totales), en especial del músculo aductor largo (23 episodios, 60,5% de las lesiones musculares). La mayoría de lesiones registradas fueron leves (1-7 días de baja deportiva) aunque el tiempo medio de baja fue de 19,4 ± 29,6 días. Se recogieron 8 episodios de relesión (8,5% de las lesiones totales) y 2 lesiones que precisaron tratamiento quirúrgico (2,1% de las lesiones totales).

Al estudiar a las deportistas femeninas destaca que presentaron un mayor número de lesiones ligamentosas de extremidades inferiores en comparaciones con los varones y no se describió ningún episodio de tendinopatía.

Al estudiar las lesiones específicas de los porteros/as se evidenció que las lesiones que causaban más baja deportiva eran las lesiones de rodilla.

El presente estudio es el primero en describir las lesiones en jugadores/as de primer nivel de hockey patines y debe marcar un punto de partida para el estudio y prevención de las lesiones en este deporte.

Palabras clave:
Lesiones. Epidemiología. Vigilancia de lesiones.

Correspondence: Bernat de Pablo Marquez
E-mail: bernatdepablo@gmail.com

Introduction

Roller hockey (RH) is a sport with a long tradition in Spain, mainly in the regions of Catalonia, Galicia, Asturias and Madrid. The top national division (men's and women's OK Liga) is home to many of the world's best athletes, as Spanish roller hockey has won the most international prizes for the country, with 17 men's world championships and 7 women's world championships[1].

This is a collective, dynamic and complex sport that pits two teams of five players against each other (four players on the rink and a goalkeeper). The players wear classic roller-skates (two pairs of parallel wheels) and use a stick to move a solid, round ball to score a goal[1]. RH is considered a contact sport due to the easy interaction between the dynamic (ball and stick) and static elements (fences and goalposts) in the game, that increases the risk of contact between participants[2-4]. Some factors differentiate RH from other indoor sports: (i) the athletes reach very high speeds (up to 30 km/h) compared to other sports,[2] (ii) the use of parallel wheels causes different turning and braking mechanisms to other skating sports such as Inline hockey and Ice hockey[3], (iii) the speed of the ball can reach 115 km/h[4,5]. It should also be considered that the goalkeeper figure has very different characteristics to a rink player, due to their posture, mobility or their intention to stop a ball moving at very high speeds[6,7]. With these factors in mind, RH can be considered a sport with a high risk of musculoskeletal injuries [8,9], which can influence athletes' performance and their recovery.

Although there are few studies on the injury epidemiology for roller hockey, the available scientific literature points to a high risk of injuries, mainly secondary to traumas[8,10,11]. In any case, studies so far are descriptive based on very small, heterogeneous samples.

Time-loss injuries (TLI) can influence sports performance and the athlete's health, as well as the teams' collective results[12]. The injury surveillance programmes make it possible to analyse injury patterns for a sport, determine the magnitude of the problem, define an initial step to set up injury prevention programmes and find out about new problems to understand the athletes' injury pattern better[12,13].

The aim of this study is to describe the injury patterns for time loss injuries among participants in the top Spanish men's and women's RH division (OK Liga) over an entire season.

Material and method

Study design

Descriptive study using an intentional non-probabilistic sample of 14 teams from the men's and women's OK Liga, the top Spanish senior category for RH (10 teams in the senior men's first division [SM] and four teams in the senior women's first division [SF]). The men's and women's OK Liga in the 2020/21 season comprised 16 teams each.

137 athletes were studied. 98 SM (71.5% of the sample), with an average age of 26.7 ± 5.9 years old (range: 18.1 – 45.2) and 39 SF (28.5%), with an average age of 23.3 ± 4.6 years old (range: 15.9– 35.2). Out of the total 98 SM, 78 (79.6%) were rink players and 20 (20.4%) were goalkeepers and out of the 39 SF, 32 (82%) were rink players and 7 (18%) goalkeepers.

For athletes to be included in the study, they had to meet the following criteria: the athlete should play in the senior team and form part of its original squad. Athletes from lower divisions who only participate occasionally in training/matches were excluded.

All the athletes gave their consent to collect injury data. The study was designed according to the Helsinki Declaration[14], and it was accepted by the Ethics Committee (code 014/CEICGC/2021).

Data

The athletes' data was recorded, and the injury characteristics reported by the medical team of each RH team throughout the 2020/21 season. Data collection began on the first day of the pre-season and ended with the last match in the season. The number of official matches in the season ranged between 35 and 45 depending on the sporting results.

Clinical information referring to the type of injury, injury mechanism and days of time loss was recorded on a previously designed common template.

Injuries that were not related to RH and time loss for medical diseases or other reasons were not recorded.

Definitions, categories and calculation of the injury incidence

The injuries were classified according to the *Orchard Sports Injury Classification System* (OSICS) version 10[15]. The type of injury, location and appearance were compiled according to the Consensus of the International Olympic Committee[13]. The concepts of time-loss injury (TLI) and return-to-play (RTP), were compiled according to the definitions suggested by the *Union of European Football Associations* (UEFA)[16,17].

The definitions used in the study are shown in Table 1.

Statistical analysis

A descriptive analysis was carried out on the time-loss injuries by calculating the absolute frequency and the relative frequency over the total number of injuries in each category of interest for the qualitative variables.

In the case of the quantitative variables, central trend summary measures (mean) and statistical dispersion (standard deviation and range) were calculated.

We calculated the summary measures for the time-loss incidences according to the formula i=n/e, where n is the number of injuries during the study period and e is the respective number of exposed athletes (EA) or participants) with incidence ratios presented as injuries per 100 players per season. Furthermore, the Cumulative incidence ratio (CIR) is calculated to compare the injury incidence ratios between the two genders. The incidences and CIR association measure were calculated using the function *pois.exact* from the *epitools* library and the function *'epi.2by2'* from the epiR library in R, respectively. These calculations estimate the incidence and confidence intervals at 95% using a Poisson distribution. All analyses were performed using SPSS v21 and the R statistics package (The R Foundation for Statistical Computing, Vienna, Austria), version 3.4.

Results

Total injuries (time-loss injuries)

A total of 94 time-loss injuries were recorded (TLI), 61 (64.9%) in SM and 33 (35.1%) in SF.

The TLI average per athlete and season was 0.7 ± 0.9 (0.6 ± 0.8 in SM and 0.9 ± 1 in SF). One SF suffered 4 TLI during the season, 6 athletes had 3 TLI (4 SM and 2 SF), 14 athletes had 2 TLI (9 SM and 5 SF), 44 athletes had 1 TLI (31 SM and 13 SF). 51 athletes (37.2% of the total) did not have any injuries during the 2020/21 season. Among rink players, the injury average was 0.7 ± 0.9 and among goalkeepers it was 0.4 ± 0.7.

There was an average of 6.7 ± 3.22 (range 3-13) TLI per team and season. The average in the male teams was 6.1 ± 3 (range 3-11) and in female teams 8.2 ± 3.6 (range 5-13).

Relative frequencies

The most frequent TLI were muscular injuries with 38 (40.4%) episodes. Muscular injuries mainly affected the thigh, with 30 (31.9%) episodes of muscular injury in this location, of which 23 affected the long adductor muscle, 4 the rectus femoris, 2 the gracile muscle and 1 the semitendinosus muscle. 11 (11.7%) tendon injuries were recorded, all diagnosed in males (Table 1).

The majority of the injuries affected the lower limbs (68.1%), followed by the upper limbs (15.9%), head and neck (11.7%) and trunk (6.4%). For lower limbs, the most frequent location was the thigh, with 34 injuries (36.2%), followed by the knee with 13 (13.8%) and the ankle with 8 (8.5%).

A total of 53 (56.4%) TLI were recorded during training and 41 (43.6%) during matches. Differentiated by gender, out of the 61 TLI recorded in the male league, 37 (60.6%) happened during training and 24 (39.4%) during matches. The female league saw more injuries during matches (n=17, 51.5%) than during training (n=16, 48.5%). Out of the non-contact injuries, the majority happened during training (n=40, 64.5%). Out of the contact injuries, on the other hand, the majority happened during matches (n=22 68.7%) (Table 2).

The location of the injuries classified by player position and gender is shown in Figure 1.

There were 8 episodes of re-injury, 2 of them on the same player. The re-injury rate was 9.3% of the injuries. Three re-injuries happened due to episodes of dynamic osteopathy of the pubis and 3 episodes due to the reappearance of muscular injuries in the long adductor muscle.

Incidence proportion

Table 3 shows the incidence ratio of the TLIs described in the study.

The total injury incidence ratio was 68.6 (CI 95% 61.2-76.8) injuries/100 athletes/season, greater in female rink players, 90.6 (CI 95% 81.1-101.3), than in male rink players 67.9 (CI 95% 58.3-79.1). The cumulative incidence ratio (CIR) between the rink players of both genders to sustain an injury for the whole study period was 1.33 (CI 95%, 1.10-1.61), which indicates that the female players were 1.33 times more likely to be injured than male rink players.

The incidence of muscular injury was 32.8 (CI 95% 25.2-42.5), namely 26.4 (CI 95% 27.1-48.9) in men and 25.6 (CI 95% 15-43.8) in women.

The incidence of tendon injury was 9.5 (CI 95% 5.4-16.6). Out of the 11 tendon injuries, 7 affected the thigh adductor muscles.

The injury incidence in goalkeepers was 44.4 (CI 95% 29.1-67.7). 40 in SM (CI 95% 23.4-68.4) 57.1 in SF (CI 95% 30.1-108.5). The injury incidence in rink players was 74.5 (CI 95% 66.8-83.1).

Return-to-play and severity

The RTP and the injuries described were 19.4 ± 29.6 (range 1-185, mode 2), namely 23.5 ± 34.6 (range 1-185, mode 2) in SM and 11.7 ±14.3 (range 1-60, mode 2) in SF.

Table 1. Definitions used in the study.

Concept	Definition
Time-loss injury	Any physical ailment felt by the athlete that might appear during training or a match that means that the athlete has to miss the next training session or match.[16,17]
Return-to-play	Absence time (in days) from the day of the injury until the athlete can play in a match again or complete a training session.[16,17].
Re-injury	Any injury of the same type and in the same anatomical place as an injury on the same individual in the two months following the RTP.[17]
Injury incidence	Calculated according to the formula i=n/ where n is the number of injuries during the study period and e is the respective number of Exposed Athletes (EA) with an incidence ratio presented in injuries per 100 players per season.[18]
Severity	The severity of the injuries was classified according to the RTP as mild (1 to 7 days), moderate (8 to 28 days) or severe (>28 days) following the classification by Van Mechelen *et al*.[12]
Appearance	Classified as Acute or Progressive appearance.[15]
Causal mechanism	Classified as overuse or a direct trauma (with an opponent or an object in the game).[15]

Adapted from Tuominen **et al.** 2015. [19]

Figure 1. Most frequent locations of TLI in rink players (left) and goalkeepers (right).

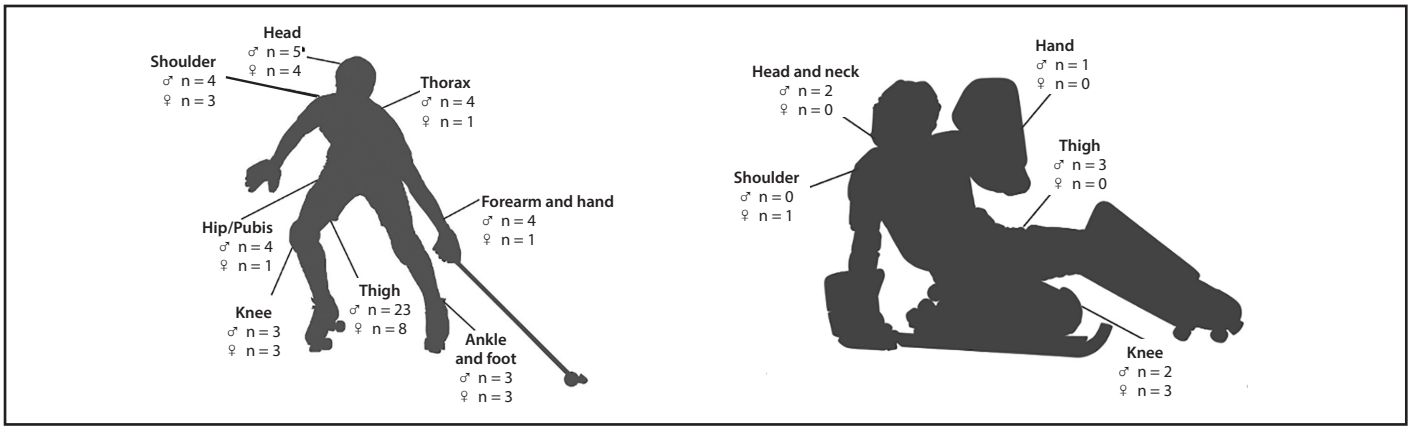

Table 2. Injury characteristics.

	Total N (%)	SM N (%)	SF N (%)
Total injuries	94	61	33
Moment			
Training	53 (56.4%)	37 (60.6%)	16 (48.5%)
Match	41 (43.6%)	24 (39.3%)	17 (51.5%)
Type of injury			
Muscular	38 (40.4%)	28 (45.9%)	10 (30.3%)
Bruising/wound	16 (17%)	7 (11.5%)	9 (27.3%)
Ligament	12 (12.8%)	5 (8.2%)	7 (21.2%)
Tendon	15 (15.9%)	11 (18%)	-
Fracture	7 (7.4%)	5 (8.2%)	2 (6%)
Arthritis	6 (6.4%)	2 (3.3%)	4 (12.1%)
Dislocation	4 (4.2%)	4 (6.5%)	-
Onset			
Acute appearance overuse	28 (29.7%)	16 (26.3%)	12 (35.2%)
Progressive app. overuse	34 (36.2%)	26 (42.6%)	8 (23.5%)
Trauma	32 (34.1%)	19 (31.1%)	13 (38.3%)
Mechanism			
No contact	62 (66%)	43 (70.5%)	19 (57.6%)
Contact with athlete	10 (10.6%)	5 (8.2%)	5 (15.1%)
Contact with object	22 (23.4%)	13 (21.3%)	9 (27.3%)
Severity			
Mild (1-7 days)	46 (48.9%)	25 (41%)	21 (63.6%)
Moderate (8 to 28 days)	28 (29.8%)	20 (32.8%)	8 (24.2%)
Severe (>28 days)	20 (21.3%)	16 (26.2%)	4 (12.1%)

Classifying by severity, 46 injuries were considered mild (1-7 days of RTP), 28 were considered moderate (7-28 days of RTP) and 20 were considered severe (>28 days of RTP) (Table 2).

Muscular injuries presented an average RTP of 18.6 ± 25.2 (range 1-90, mode 2), namely 15 moderate, 14 mild and 9 severe.

Within the injury severity, we can specifically differentiate any that required surgery. These represented 2.1% of the injuries recorded (n=2), with an incidence of 1.72 (CI 95% 4.4-68.1). The two surgical injuries recorded in our study were two glenohumeral dislocations, with an RTP time of 105 and 185 days respectively.

Figure 2. Initial position used by the goalkeeper. On the left, knee on the ground, on the right, in half screen position (author's own work).

Among goalkeepers, the injuries with a longer RTP affected the knee, with an average RTP of 28.6 days± 37.8 (range 4-95).

Discussion

The aim of this study is to describe the injury patterns among participants in the top Spanish men's and women's RH division (OK Liga) throughout an entire season.

Firstly, we should highlight that there are prior studies on injury epidemiology among male RH athletes although there is no prior study involving female athletes. So, the results obtained in male athletes will be compared with the results published to date and the results obtained in female athletes will be used to define a starting point to study injuries in this athlete population. Secondly, none of the studies published previously on RH injuries included athletes from different teams in the same league, thereby broadening the sample and avoiding bias.

Regarding the number of TLI per season, the only two studies published to date in the field of the top Spanish league (in men's teams) demonstrated a higher average number of injuries per player and season (two TLI per player and season in the Reverter study[8] and 1.1 TLI per player and season in the Egocheaga study[10].

The two teams that were crowned league champions were the teams that suffered the most injuries (11 in the male league and 13 in the female league). This could be explained by the higher number

Table 3. Incidence ratios for TLI according to the injury characteristics and the athlete's characteristics

		Total	Senior male				Senior female			
			Male Rink players		Male Goalkeepers		Female Rink players		Female Goalkeepers	
		N	N	Incidence (95% IC)	N	Incidence (95% IC)	N	Incidence (95% IC)	N	Incidence (95% IC)
Total injuries		94	53	67.9 (58.3- 79.1)	8	40 (23,4-68,4)	29	90.6 (81.1- 101.3)	4	57.1 (30.1- 108.5)
Moment	Training	54	36	46.1 (36.3- 58.7)	3	15 (5,2-42,6)	12	37.5 (23.9- 58.6)	3	42.8 (18.2- 100.8)
	Match	40	18	23.1 (15.4- 34.6)	5	25 (11,7-53,4)	16	50 (35.4- 70.7)	1	14.2 (2.3- 87.6)
Appea-rance	Acute overuse	29	14	17.9 (11.2- 28.8)	3	15 (5,3-42,6)	10	31.2 (18.7- 52.2)	2	28.6 (8.8- 92.2)
	Progressive overuse	34	25	32 (23.2- 44.3)	1	5 (0,7-33,8)	7	21.8 (11.4- 42.1)	1	14.3 (2.3- 87.6)
	Trauma	31	13	16.7 (10.1- 27.4)	4	2 (0,8-48)	12	37.5 (23.9- 58.6)	2	28.6 (8.8- 92.2)
Mechanism	No contact	62	40	51.2 (41.3- 63.7)	3	15 (5,3-42,6)	16	50 (35.3- 70.7)	3	42.8 (18.2- 100)
	Contact with athlete	14	6	7.7 (3.5- 16.7)	0	-	8	25 (13.7- 45.6)	0	-
	Contact with object	18	8	10.2 (5.3- 19.7)	4	20 (8,3-48)	5	15.6 (7- 34.9)	1	14.3 (2.3- 87.7)
Severity	Mild	47	21	26.9 (18.7- 38.8)	4	20 (8,3-48)	19	59.4 (44.6- 79.1)	3	42.8 (12.82- 100.8)
	Moderate	28	19	24.3 (16.5- 36)	1	5 (0,7-33,8)	7	21.9 (11.4- 42.1)	1	14.2 (2.3- 87.6)
	Severe	20	13	16.7 (10.1- 27.3)	3	15 (5,3-42,6)	4	12.5 (4.9- 31.3)	0	-
Type of injury	Muscular *Aductor longus* *Rectus femoris*	38 23 4	25 17 1	32 (23.2- 44.3) 21.8 (14.3- 33.2) 1.2 (0.1- 8.9)	2 0 0	10 (2,7-37,2) - -	10 5 3	31-2 (18.7-52.2) 15.6 (7- 34.9) 9.8 (3.2- 27.5	0 0 0	-
	Bruising/wound	16	3	3.8 (1.3- 11.6)	3	15 (5,2-42,6)	9	28.1 (16.1- 48.9)	1	-
	Sprain	13	3	3.8 (1.3- 11.6)	2	10 (2,7-37,2)	6	18.7 (9.1- 38.5)	2	-
	Tendinopathy	11	11	14.1 (8.1- 24.4)	0	-	0	-	0	14.3 (2.3- 87.7)
	Fracture	6	4	5.1 (1.9- 13.3)	1	5 (0,7-33,8)	1	3.1 (0.5- 21.5)	0	28.6 (8.8- 92.2)
	Arthritis	5	2	2.6 (0.6- 10)	0	-	2	6.2 (1.6- 23.9)	1	-
	Dislocation	5	4	5.1 (1.9- 13.3)	0	-	1	3.1 (0.5- 21.5)	0	-

of matches, as the two teams which reached the final had played the most matches. Even so, as data on the training hours is not available, it is not possible to determine a causality involving greater exposure.

Regarding the most frequent anatomical location, the results obtained confirm the trend in prior studies, where lower limbs were the most frequently affected zone, followed by the upper limbs and the head and neck[8,10].

Muscular injury was the most frequently described in the study, which matched findings in the two prior publications on Spanish athletes[8,10]. Neither of these studies defined the affected muscles or the severity of the injuries. The results presented allow us to conclude that the most affected muscle among RH players is the long adductor, accounting for 23 out of the 38 muscular injuries described with an incidence of 19.8 (CI 95% 13.7-28-6). They also describe 11 tendon injuries, for an incidence of 9.5 (CI 95% 5.4-16.6) and the most frequently affected muscle were the thigh adductors. In the study by Florit[26], looking at the incidence of tendinopathy in a professional RH team over 8 seasons, the incidence of tendinopathies that led to time-loss was 10.7 (CI 95% 9.5-12), so the results were similar. In this study, the most frequently affected zone was also the thigh adductor area.

With all these results, we can conclude that the pubis region is the most susceptible to muscular and tendon injuries in RH. These results match the studies published on ice hockey, a skating sport that has been extensively studied, where this zone concentrates most of the overuse injuries[19].

Mechanism

Most of the recorded injuries took place with no contact. These results match the Reverter study[8], carried out on just one team in the OK Liga, with a similar ratio. Studies published in biomechanically similar sports such as inline hockey[20] or ice hockey[19] show that the majority of the injuries described occur in direct contact. RH rules, that severely punish contact compared to other skating disciplines, might favour these differences.

By analysing the causal mechanism of the injuries, we can see that the non-contact injuries take place more often in training, while

the opposite happens in competition, where contact injuries are more common. This is explained by the actual nature of the activity, as competition implies greater contact and demands than training. This trend has been seen in other sports such as football[21], but it has not been studied previously in RH and allows us to draw the conclusion that players train differently from how they play.

Head injuries

There has been growing concern in recent years in RH about head injuries and their consequences for athletes. This concern has led to some national federations promoting the use of a protective helmet in lower divisions[22]. Prior studies[9,23] have demonstrated that craniofacial injuries are frequent in RH, although they do not specify whether studies took place among top level athletes. The Reverter study[8] recorded two episodes of concussion and 14 of bruising and injuries in the craniofacial region over two seasons in 23 athletes, with an incidence of 39.1 (CI 95% 31.5-48.5).

The results detected nine TLI affecting the head, with an incidence of 7.7 (CI 4.1-14.5), lower than in the Reverter study, with one single episode of concussion. The differences from the Pelaez study[9], which includes amateur and lower-division athletes and presented a high rate of concussion, can be explained by the greater skill among professional athletes both in terms of skating and when handling the ball and the stick: in other sports such as inline skating, it has been demonstrated that less skating experience increases the risk of injuries[20, 25].

Despite increased awareness-raising on head injuries in the world of sport, there is a risk of infra-diagnosis, both from the athletes and the medical teams[24]. It is important for the federations to provide information to the athletes, technical bodies, medical teams and even families, to remain alert to head injuries and their potential consequences in the long term[25].

Injuries among female athletes

The trends mentioned above, the most frequent location and the causal mechanism, are similar to male athletes. Nonetheless, female rink players are 1.33 times more likely to sustain an injury than their male counterparts.

From the results obtained, it should be highlighted that female athletes were injured more in matches than in training. This may be because, despite women's teams playing at the top level, they are not professionals and do not train for as many hours as the professional men's teams. This statement should be confirmed with a study on the exposure hours looking at both training and match time for men's and women's teams.

It is also worth mentioning that there is a higher proportion of ligament injuries in the lower limbs, mainly knees and ankles, compared to the men.

Finally, there was no evidence of tendinopathies due to overuse. This finding has not been seen in other skating sports and should be studied in greater depth.

Injuries in goalkeepers

The position of the goalkeeper in RH is not only key for the sport,[26] but it has a series of specific features which mean it has to be studied differentially to the field players. The position taken by the goalkeepers, alternating a position lying on the floor with a position kneeling on the floor (Figure 2) causes greater stress on the knee area, so injuries are more frequent in this location compared to rink players.

Given that the goalkeepers use protection, direct bruising injuries were less frequent than for rink players. This breaks the stereotype presented by Trabal[6] that the goalkeeper role is more dangerous than the rink player position.

Consequently, prevention strategies should be devised to avoid knee injuries among RH goalkeepers. There is also a need to improve tools to protect the cervical region among these athletes.

Limitations

The study was performed during the 2020/21 season which was marked by the worldwide Covid-19 pandemic. The Covid-19 cases and the preventive lockdowns during the season might have interrupted training and matches for the teams, which might potentially affect their performance.

The possible effects of the SARS-COV2 infection on athletes remains unknown for now. The results obtained do not correlate with SARS-COV2 infections.

The variability in the configuration of the medical teams for each club might vary the processes to diagnose and treat the injuries.

The hours of exposure in training and matches are not available so it is not possible to make an optimum calculation of the injury incidence (injury incidence rate). Although the aim of our study is only descriptive (not comparative), and the sample is small, this work has assessed a CIR association measure to calculate the incidence proportion among male and female rink players. The injury risk between male and female players seems to be relevant. Even so, in future studies, it would be advisable for information on incidence rates to include exposure hours and to be able to calculate both frequency and association measures and so make these findings more rigorous.

Practical applications

In the top division roller hockey teams in Spain, muscular injuries are the most frequent, particularly long adductor muscle injuries. These injuries affect the athletes' availability for training/playing, so it would be appropriate to design prevention protocols for this type of injury.

Trauma injuries are particularly frequent in the sport, due to its very nature. Traumatic head injuries are a cause for concern and it is important to monitor the prevention strategies (protective helmet) which are still pending implementation from the roller hockey regulatory bodies.

For the first time, the most frequent injuries are defined for female roller hockey players. The results should be a starting point to extend the studies on this population of athletes.

Thanks

To Marc Bosqué, Marc Godayol, Vicenç Rizo, Jordi Boada, Pedro Abal, Aleix Rovira, Roger Sotelino, Marc Pi, Adrià Gimenez, Pol Parareda, Ramón Fernández for their help collecting data.

Conflict of interests

The authors do not declare any conflict of interests.

Bibliography

1. Moreno D. *Anàlisi dels gols en hoquei patins a les lligues espanyola, italiana i portuguesa.* Tesis doctoral. Universitat de Barcelona, Barcelona, 2019.
2. Fernández D, Varo F, Carmona G, Reche X. Quantification of external load of elite rink hockey players in official matches. *J Sports Med Phys Fitness.* 2020;60:1520-5.
3. Vitale JA, Castellini G, Gianola S, Stucovitz E, Banfi G. Analysis of the christiania stop in professional roller hockey players with and without previous groin pain: a prospective case series study. *Sport Sci Health.* 2019;15:641–6.
4. Vaz M, Ramos N, Abrantes J, Queiros de Melo F, Conceiçao F. Biomechanics of the penalty stroke in roller hockey. *Rev Port Cienc Desporto.* 2011;2:129–32.
5. Ballestero E. *El hockey sobre Patines: Variables del rendimiento en el disparo a portería.* Tesis doctoral. Universitat de Lleida, Lleida. 2017.
6. Trabal Tañá G. Estudi etnogràfic del porter d'hoquei sobre patins: una vida entre paradoxes. *Apunts Sport Med.* 2016;126:23–9.
7. Trabal G, Riera J. Goalkeeper effectiveness in the direct free hit of rink Hockey. *Apunts Sport Med.* 2020;139:56–64.
8. Reverter J, de Vega M, Hernandez V. Occupational injury in spanish professional roller hockey during two seasons: a comparative study. *J Phys Educ Sport.* 2018;18:1767–72.
9. Pelaez EG, Dascenzi PF, Savastano LE, Cremaschi FE. Lesiones craneofaciales producidas en hockey sobre patines. *Rev Arget Neurocir.* 2008;22:181–5.
10. Egocheaga J, Yague P, Mones L. Características de la patología lesiva en dos deportes de patinaje. *Med Rehab.* 2004;17:12–6.
11. Husen M, Burgsmüller L, Burggraf M, Jäger M, Dudda M, Kauther M. Injuries and overuse syndromes in rink hockey players. *Int J Sports Med.* 2021;42:132-7.
12. Van Mechelen W, Hlobil H, Kemper HCG. Incidence, severity, aetiology and prevention of sports injuries. *Sports Med.* 1992;14:82-99.
13. Bahr R, Clarsen B, Derman W, Dvorak J, Emery CA, Finch CF, *et al.* International olympic committee consensus statement: Methods for recording and reporting of epidemiological data on injury and illness in sports 2020 (Including the STROBE extension for sports injury and illness surveillance (STROBE-SIIS)). *Orthop J Sports Med.* 2020;8:2325967120902908.
14. World medical association declaration of Helsinki. *JAMA.* 2013;310:2191-4.
15. Orchard J. Revision, uptake and coding issues related to the open access Orchard Sports Injury Classification System (OSICS) versions 8, 9 and 10.1. *Open Access J Sports Med.* 2010;1:207-14.
16. Hagglund M. Methods for epidemiological study of injuries to professional football players: developing the UEFA model. *Br J Sports Med.* 2005;39:340-6.
17. Ekstrand J, Hagglund M, Walden M. Injury incidence and injury patterns in professional football: the UEFA injury study. *Br J Sports Med.* 2011;45:553-8.
18. Florit D, Pedret D, Casals M, Malliaras P, Sugimoto D, Rodas G. Incidence of tendinopathy in team sports in a multidisciplinary sports club over 8 seasons. *J Sports Sci Med.* 2019;18:780–8.
19. Tuominen M, Stuart MJ, Aubry M, Kannus P, Parkkari J. Injuries in men's international ice hockey: a 7-year study of the international ice hockey federation adult world championship tournaments and olympic winter games. *Br J Sports Med.* 2015;49:30-6.
20. Moreno-Alcaraz VJ, Cejudo A, Sainz de Baranda P. Injury types and frequency in spanish inline hockey players. *Phys Ther Sport.* 2020;42:91-9.
21. Noya J, Sillero M. Epidemiología de las lesiones en el fútbol profesional español en la temporada 2008-2009. *Arch Med Deporte.* 2012;29:750–66.
22. Real Federación Española de Patinaje. www.fep.es. Consultado 1 de febrero 2022.
23. Lopes L, Santos M. Mouthguard and orofacial traumatismo in young roller hockey practicers. *Global J Med Res.* 2013;19:5-11.
24. Meehan WP, Mannix RC, O'Brien MJ, Collins MW. The prevalence of undiagnosed concussions in athletes. *Clin J Sport Med.* 2013;23:339–42.
25. Schmidt JD, Welch D, ML Weber, Bierema L, Miller LS, Courson R, *et al.* Coach, sports medicine, and parent influence on concussion care seeking intentions and behaviors in collegiate student-athletes. *J Clin Transl Res.* 2020;5:215–26.
26. Trabal G, Daza G, Arboix J. Influencia de las variables contextuales en la intervención del portero de hockey patines en la falta directa. *Cuad Psicol Deporte.* 2020;20:139–51.

POSTGRADOS OFICIALES:
SALUD Y DEPORTE

UCAM
UNIVERSIDAD
CATÓLICA DE MURCIA

- **Actividad Física Terapéutica** *(2)*
- **Alto Rendimiento Deportivo: Fuerza y Acondicionamiento Físico** *(2)*
- **Performance Sport: Strength and Conditioning** *(1)*
- **Audiología** *(2)*
- **Balneoterapia e Hidroterapia** *(1)*
- **Desarrollos Avanzados de Oncología Personalizada Multidisciplinar** *(1)*
- **Enfermería de Salud Laboral** *(2)*
- **Enfermería de Urgencias, Emergencias y Cuidados Especiales** *(1)*
- **Fisioterapia en el Deporte** *(1)*
- **Geriatría y Gerontología: Atención a la dependencia** *(2)*
- **Gestión y Planificación de Servicios Sanitarios** *(2)*
- **Gestión Integral del Riesgo Cardiovascular** *(2)*
- **Ingeniería Biomédica** *(1)*
- **Investigación en Ciencias Sociosanitarias** *(2)*
- **Investigación en Educación Física y Salud** *(2)*
- **Neuro-Rehabilitación** *(1)*
- **Nutrición Clínica** *(1)*
- **Nutrición y Seguridad Alimentaria** *(2)*
- **Nutrición en la Actividad Física y Deporte** *(1)*
- **Osteopatía y Terapia Manual** *(2)*
- **Patología Molecular Humana** *(2)*
- **Psicología General Sanitaria** *(1)*

(1) Presencial *(2) Semipresencial*

MÁS INFORMACIÓN: **968 27 88 01** · **ucam.edu**