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Sports injuries in the emergency department: an observational study with a gender perspective

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Abstract

Introduction Sports injuries are a significant concern in emergency departments and affect both amateur and professional athletes. With the increase in women's participation in sports, it is crucial to understand sex-specific injury characteristics, as patterns observed in men may not apply to women. This observational, descriptive and retrospective study aims to analyze sex differences in sports injuries to improve diagnosis, treatment, and prevention strategies. Our hypothesis is that sports injury patterns differ between sexes.

Methods Patients treated for sports injuries between 2020 and 2023 in the Emergency Department at our hospital were included in the study. Researchers collected data on demographics, sports practiced, types of injuries, and initial treatment, utilizing descriptive statistics, Student's t-test for continuous variables, Fisher's exact test for categorical variables, and variable correlation for data analysis.

Results A total of 977 patients were included in the study, 82% of whom were men. Significant differences were observed regarding the sport practiced ($p < 0.001$) and the type of injury ($p = 0.02$) between the groups. No differences were observed in injury location or the percentage of patients receiving each treatment modality. Specific correlations were also conducted between sports, type of injury, and location. Contusions, ligamentous injuries and dislocations were associated with specific sports and/or locations in men and women. Ligamentous injuries were observed in both sexes predominantly in the ankle and knee.

Conclusion Increasing sports participation offers health benefits but also increases the risk of injuries. Our study aimed to investigate whether sports injury patterns differ between sexes. The results support this hypothesis, highlighting significant sex differences in injury patterns.

Keywords Sports, Injury type, Injury location, Sex-difference, Emergency room

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Introduction

Sports injuries are a common reason for visits to the Emergency Department, and affect both amateur and professional athletes [1]. These injuries have significant personal and social relevance, as they are important causes of work absenteeism among young people [1, 2]. In addition, the potential long-term consequences of sports-related injuries —such as the development of osteoarthritis— should also be considered [2]. With the growing popularity of sports in our society, an increase in the incidence of these injuries has been observed [1, 2]. One aspect to consider is the rise in women's participation in sports activities [3]; as more women engage in sports, it becomes crucial to understand the specific characteristics of injuries affecting this group, as patterns of injuries observed in men cannot always be extrapolated to women [3–5].

The literature indicates differences in sports injuries between men and women in terms of incidence, injury mechanisms, and risk factors. For example, the increased risk of anterior cruciate ligament injuries in women is widely known to be attributable to anatomical and hormonal factors [4–6], as well as extrinsic factors (physical conditioning, preventive strategies, etc.) [7–9].

Understanding the differences between sexes regarding sports injuries is essential for several reasons, particularly the potential to improve our diagnoses, treatments, and preventive strategies.

In this context, the present study aims to analyze the data of patients treated in the Emergency Department of our center for sports injuries. We seek to provide information on sex differences in the sports practiced, types of injuries, and anatomical locations of these injuries. Our hypothesis is that injury patterns differ between women and men.

Materials and methods

An observational, descriptive, and retrospective study was conducted, including all patients treated in the Traumatology Emergency Department at Parc Taulí Hospital, specifically those who attended the triage as "Sports Accident". Parc Taulí Hospital is the reference public hospital for a catchment area of approximately 406,913 citizens. It is open to the entire population within this area. While some athletes—particularly those who are federated—may seek care through private insurance or mutual health organizations, it is common for them to first attend our emergency department after an injury. From there, if appropriate, they are referred to their respective private providers.

We obtained our initial database through the hospital's documentation team. Upon ED admission, patients are categorized by the type of incident (common illness, work-related accident, sports-related accident, or traffic accident). We filtered all reports classified as sports-related injuries. The study period spanned from January 2020 to January 2023.

An initial sample of 1,288 patients was obtained, from which those with incomplete clinical information or unavailable variables in the discharge report were excluded. Thus, the final population comprised 977 patients.

The medical discharge reports of the patients included in the study were reviewed independently by four researchers. The collected variables included demographic information (age and sex), type of sport practiced, type of injury, anatomical location of the injury, initial treatment measures, length of stay in the emergency department (as a surrogate variable for severity), and the need for hospital admission.

The injury type was classified into six categories: contusion (bruises without clinical repercussions), ligamentous injury (diagnosed through physical examination), muscular and tendon injury (including muscle tears and strains, diagnosed through physical examination), fracture (open or closed, diagnosed through imaging techniques), dislocation (defined as loss of joint congruence, diagnosed through imaging), or wounding (defined as loss of skin integrity at the dermal level).

Initial treatment was divided into surgical (wound suturing or urgent surgical intervention within 24h; for example, in open fractures), orthopedic (immobilization with splint, cast, orthosis, bandaging, or others), and symptomatic (medical treatment) methods.

Descriptive statistics were used to summarize the demographic and clinical characteristics of the patients, as well as the distribution of injuries. For the comparisons between women and men, quantitative variables were analyzed via Student's t-test and categorical variables were analyzed via Fisher's exact test. Qualitative variables are presented as frequencies and percentages, whereas quantitative variables are expressed as measures of central tendency and dispersion. Correlation studies were also performed on significant variables from the descriptive analysis, and to examine correlations more specifically, linear regression was conducted for type of injury by sport, injury location by sport, and type of injury by location, specific to women and men. RStudio version 2023.03.0 with R version 4.2.2 was used for the analysis.

The study was conducted in accordance with the ethical principles established in the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee of our center prior to conducting the study (reference 2023/5069).

Table 1 Age [median (IQR)]) and length of stay [median (IQR)]) in men and women

	Women	Men
Age (years)	18 (15–24)	18 (15–25)
Length of stay (minutes)	119 (78–178)	119 (79–195)

Results

During the study period (2020–2023), a total of 977 sports-related injuries were recorded. Considering an average of 152,595 ED visits per year (according to hospital data), this corresponds to an incidence of 1.6 cases per 1,000 emergency department visits per year.

Among the 977 patients included in the study, 179 were women (18%) and 798 were men (82%). Most of the patients treated were amateur athletes. No significant differences were observed in the mean age of patients between men and women ($p = 0.5$), or in their length of stay ($p = 0.26$) Table 1.

Significant differences were observed in the sports practiced between the different groups, with a p-value < 0.001. The most commonly practiced sports among the patients were football (women 23% [$n = 42$]; and men 70% [$n = 558$]) and basketball (women 15% [$n = 26$]; and men 6% [$n = 45$]). The remaining sports were more evenly distributed among women, with 62% participating in disciplines such as volleyball, horseback riding, hockey and padel, among others. In contrast, only 24% of men engage in these sports, as shown in Fig. 1.

Significant differences were also observed regarding the type of injury ($p = 0.02$); 33% of injuries in men corresponded to contusions ($n = 264$), 26% were ligamentous injuries ($n = 209$), and 22% were fractures ($n = 178$). In women, 40% were contusions ($n = 71$), 31% were ligamentous injuries ($n = 56$), and 15% corresponded to fractures ($n = 27$). Women suffer a greater percentage of ligamentous injuries and contusions, whereas men have a greater percentage of fractures, wounds, or dislocations, as shown in Fig. 2.

The differences in injury location were not significant ($p = 0.19$), with the most common injury locations being the ankle (women 20% [$n = 35$]; and men 16% [$n = 127$]) and the knee (women 19% [$n = 34$]; and men 16% [$n = 132$]). Other common injury locations were the fingers, wrists, head, shoulders, or the face, as shown in Fig. 3.

Analysis of the treatment applied revealed no significant differences ($p = 0.26$), with the most frequently used treatments being orthopedic and symptomatic, as shown in Table 2. There were also no significant differences in terms of hospitalization ($p = 0.074$).

Specific correlations were also conducted between sports, type of injury, and location for both groups, as shown in Tables 3, 4 and 5. While in women, contusions were associated with sports such as cycling or horseback riding, in men they predominated in football or martial arts. Ligamentous injuries, concentrated in both sexes in the ankle and knee, were associated with sports such as football, athletics, and volleyball in women; whereas in men, they were particularly common in basketball. With respect to fractures, associated with martial arts in women and with football and cycling in men, the tibia, wrist, and clavicle were the most commonly affected. Finally, the most common dislocations in women were patellar dislocations in sports such as basketball or martial arts, whereas in men, the locations most commonly associated with dislocations were the shoulder, elbow, and fingers, which were not related to a specific sport.

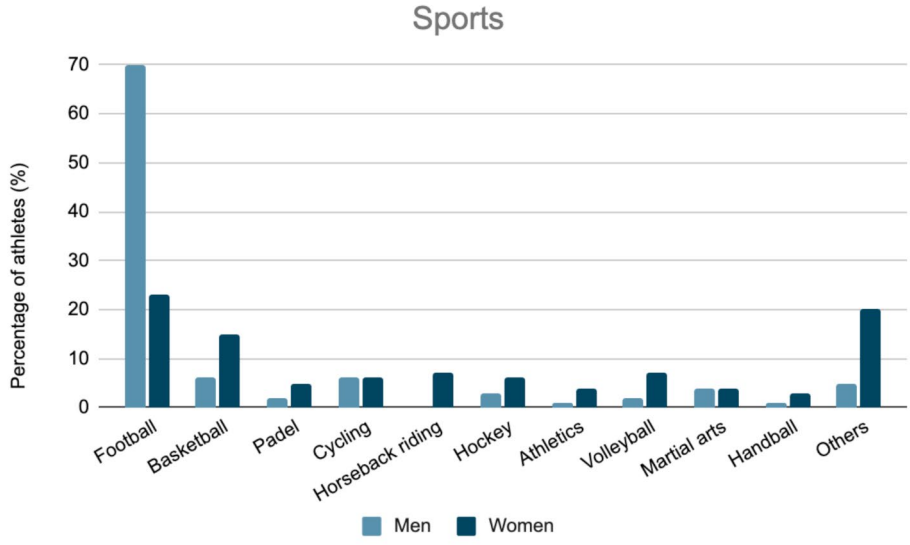

Fig. 1 Distribution of the most frequently practiced sports by sex

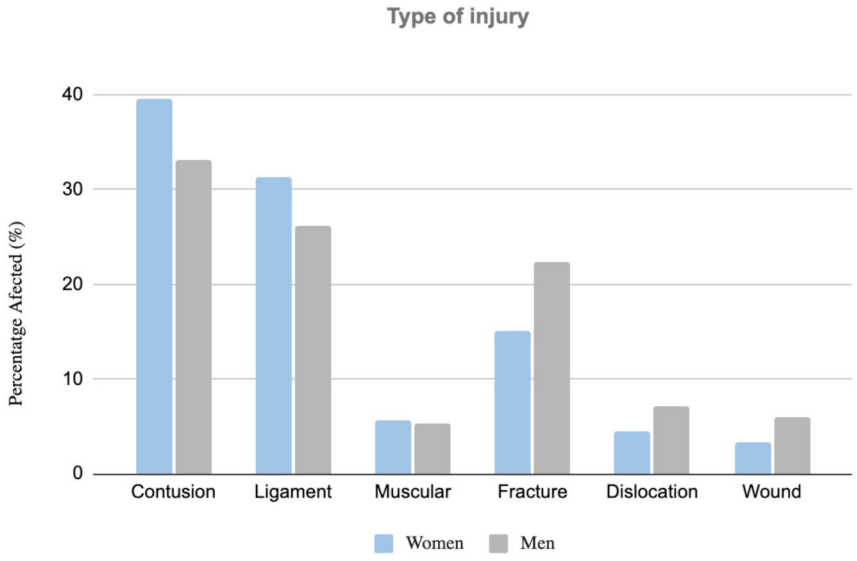

Fig. 2 Distribution of injury type by sex

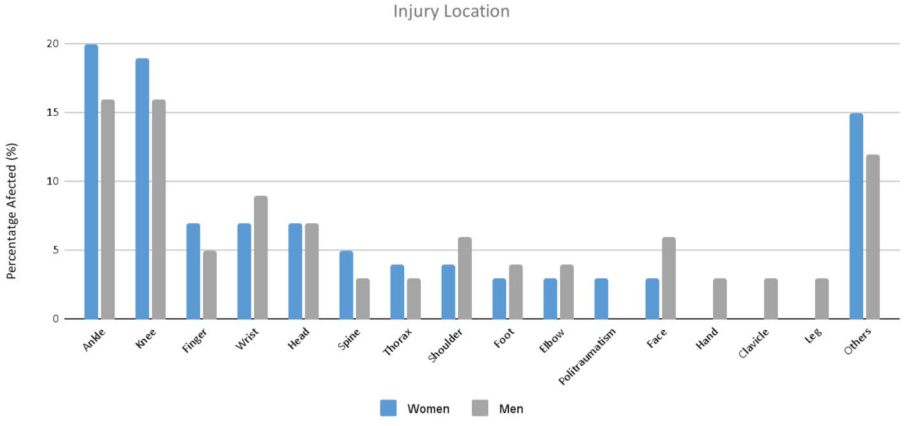

Fig. 3 Locations of injuries by sex

Table 2 Initial treatment applied and need for hospitalization by sex

	Women	Men
Orthopedic	73 (41%)	373 (47%)
Symptomatic	95 (53%)	370 (46%)
Surgical	11 (6%)	55 (7%)
Hospitalization	7 (4%)	14 (2%)

Discussion

Sports participation is currently increasing because of the multiple physical and mental health benefits it provides. However, this increase also comes with a greater incidence in sports injuries [2, 3]. Our hypothesis was that sports injuries differ between men and women.

Despite the increasing participation of women in sports, men continue to receive treatment for sports injuries in hospitals at a higher rate than women do. In our study, 82% of patients treated for these injuries were men, a finding that aligns with the literature. Chamorro et al. reported a male-to-female ratio of 7:3, Padegimas et al. found that 76.8% of treated patients were men, and Finch et al. estimated that 69.8% of those treated were male [1, 10–12].

The mean age of the athletes treated at our center was 22 years-old for both sexes, a figure similar to that reported by Chamorro [1] and Finch [11]. In terms of hospitalization, 2% of men and 4% of women required admission, a figure comparable to the 1.6% reported by Padegimas et al. [10]. This difference was not significant in our study.

The most common injuries in our study were contusions, which occurred in 40% of women and 33% of men, followed by ligamentous injuries, which affected 31% of women and 26% of men. Notably, women experienced

Table 3 Specific correlations in men and women: type of injury by sport

	WOMEN	MEN
Injury type	**Sports (*p*-value)**	**Sports (*p*-value)**
Contusion	Cycling (0,02) Horseback riding (< 0,01) Climbing (0,03)	Football, Judo (0,02) Ski (0,04)
Ligamentous	Football (0,03) Basketball, Athletics, Volleyball (< 0,01) Handball (0,01)	Basketball (0,01)
Fracture	Karate (< 0,01)	Football, Rugby (0,04) Cycling (< 0,01) Ski (0,02) Parkour, Paragliding (0,03)
Dislocation	Basketball (0,01) Baile (0,03) Rugby, Martial arts, Waterpolo (< 0,01)	

Table 4 Specific correlations in men and women: injury location by sport

	WOMEN	MEN
Injury location	**Sports (*p*-value)**	**Sports (*p*-value)**
Ankle	Artistic Gymnastics (< 0,01) Athletics (0,03) Volleyball (0,01)	Basketball (0,04)
Knee	Dancing (< 0,01)	Karate (0,03)
Shoulder	Martial Arts (< 0,01)	Volleyball, Judo (< 0,01)
Wrist	Skating, Martial Arts (0,01)	Skating (0,03)
Hand Finger	Volleyball, Waterpolo (< 0,01)	Skating, Waterpolo (< 0,01)
Clavicle	Rugby (< 0,01)	Cycling (< 0,01)
Head	Swimming (0,01)	Paragliding, Snowboarding, Motocross, Boxing (< 0,01) Rugby, Football (0,01) Handball (0,3)

Table 5 Specific correlations in men and women: type of injury by location

	WOMEN	MEN
Injury type	**Localization of the injury (*p*-value)**	**Localization of the injury (*p*-value)**
Contusion	Foot, Knee, Thorax, Shoulder, Wrist, Elbow, Finger, Polytraumatism, Skull (< 0,01) Foot Finger (0,04) Spine, Pelvis, Face (0,01)	Toe, Foot, Thorax, Hand, Polytraumatism, Skull (< 0,01) Hip (0,03) Abdomen (0,02)
Ligamentous	Ankle, Knee (< 0,01)	Ankle, Knee (< 0,01) Pelvis (0,3)
Fracture	Wrist, Clavicle (0,04) Tibia (< 0,01)	Tibia, Spine, Elbow, Wrist, Hand Finger, Nose, Fibula, Clavicle, Radius, Scapula, Humerus (< 0,01) Toe (0,04)
Dislocation	Clavicle (0,02) Patella (< 0,01)	Shoulder, Elbow, Finger, Clavicle, Patella (< 0,01)

a greater percentage of ligamentous injuries and contusions, whereas fractures and dislocations were more prevalent among men. This disparity may be attributed to men's greater participation in contact sports and high-energy activities [4, 13]. Additionally, injuries are predominantly caused by football, accounting for 70% of injuries in men and 23% in women. However, this statistic may be influenced by the fact that football is the most popular sport in our country, particularly among young men [1].

Regarding the correlations found, football was associated with a higher frequency of lower extremity injuries, particularly affecting the ankles and knees. In our sample, no significant sex differences were observed in this pattern, as both male and female athletes presented similar injury distributions. However, previous studies have described a higher risk of ankle ligament injuries and anterior cruciate ligament (ACL) injuries among football players [14–17], especially in women. This increased susceptibility in female athletes has been attributed to both intrinsic factors (such as ligamentous laxity, limb alignment, and hormonal influences) [4–6, 18], and extrinsic factors (including the type of sport, contact versus non-contact mechanisms, and athlete biomechanics) [8, 9, 12].

While the overall number of fractures is greater in men (22% compared to 15% in women in our study), it is important to highlight that women, particularly runners, more frequently experience bone stress injuries in the lower extremities [19–21]. These injuries can be early indicators of a Relative Energy Deficiency in Sport (RED-S), previously known as 'the female athlete triad", which comprises three clinical components: menstrual dysfunction, disordered eating, and low bone mineral density [22–24]. This triad is relatively common among teenage athletes, and its recognition is crucial because of the serious short- and long-term consequences it can have [24]. Therefore, it is essential to consider the possibility of RED-S in any adolescent athlete presenting to the emergency department with a bone stress injury.

Understanding the different injury patterns by sex allows us to optimize the diagnosis and management of our patients, as well as address modifiable risk factors to prevent these injuries. For example, considering the increased risk of ACL injuries in women, preventive strategies at the neuromuscular training level can be designed to reduce them [7–9].

One of the main limitations of this study is its retrospective design, which inherently limits the ability to establish causal relationships and may be subject to recall

biases. Additionally, the reliance on hospital-based data introduces the potential for reporting biases depending on the quality and completeness of medical reports. There is also a risk of confounding bias—particularly by age and sex—which may influence both the type of sport practiced and the injury pattern. While we stratified by sex, we did not stratify by age. Further multivariate analysis would be needed to fully account for these potential confounders.

On the other hand, this study presents several strengths that enhance the reliability and relevance of its findings. The inclusion of 977 patients over a four-year period provides a large and robust sample, allowing for meaningful analysis of injury patterns. The diversity of sports and the representation of both sexes offer a comprehensive view of sports-related injuries in the emergency department setting. Moreover, the use of real-world clinical data can increase the external validity of the results.

Conclusion

In conclusion, our hypothesis is supported by the results, as they demonstrate distinct differences in injury patterns between women and men, with men experiencing a greater frequency of dislocations and fractures, while women are more prone to contusions and ligamentous injuries.

Abbreviations

ACL Anterior cruciate ligament

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Author contributions

SM wrote the main manuscript text and participated in data collection. LMS, MGR and MMPS participated in data collection and analysis. MVN helped with the data analysis and prepared the tables and figures. XPL helped with the review process.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Approval was obtained from the Institutional Ethics Committee of our center (*Comité de Ética de la Investigación con Medicamentos del Parc Taulí de Sabadell*) prior to conducting the study (reference 2023/5069). As this was a retrospective study, the need for informed consent was waived by our Institutional Review Board (*Comité de Ética de la Investigación con Medicamentos del Parc Taulí de Sabadell*), both in adults and minor participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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