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SARA JÉSSICA RIBEIRO DA SILVA

Epidemiology of injuries in Portuguese senior female rugby union: a cohort prospective study

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Trabalho realizado sob orientação de:

ANTÓNIO CRUZ FERREIRA, MD, PHD

LUIZ MIGUEL SANTIAGO, MD, PHD

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Abstract

Introduction: Rugby union is a team sport known for its physical intensity, which naturally comes with the risk of injury. It is played worldwide by an ever large number of athletes, with female players significantly contributing to the sport's expansion, accounting for a quarter of all participants. However, there is limited evidence of injuries sustained during matches, especially at the amateur level.

Aims: To provide evidence about the incidence, severity, location, and type of injuries occurring in matches of the 15-s Portuguese national women's rugby union championship.

Methods: A prospective cohort study was conducted to record time-loss injuries that occurred during the 2023/24 championship in Portugal. An online form was used to report injury details including the date, location, type, event leading to the injury, period of the game, and return-to-play date. The definitions and methodology align with the international consensus for this type of study. Ethical approval was obtained.

Results: A total of 39 time-loss injuries were recorded, with an overall injury incidence rate of 36.2 injuries per 1000 match-hours. The mean injury severity was 43.4 days. Lower limb was the region with the highest incidence of injuries (48.7%), the majority were joint/ligament injuries (43.6%) followed by muscle/tendon injuries (28.2%). The majority of injuries (92.3%) resulted from contact-related activities, "being tackled" being the most frequent cause (35.9%).

Discussion: Incidence rate was similar to both amateur and elite women’s rugby, however, injury severity was lower when compared to previous studies on women’s elite and international levels. Injury prevention strategies centered on the tackle including skills training aimed at developing and improving tackling technique, could be beneficial. The majority of injuries occurred in the second half of the match, reinforcing the importance of strength and conditioning programs aimed at reducing fatigue-related injuries.

Conclusion: Present findings can contribute to future development of effective injury prevention strategies, enhanced training protocols to educate players on injury prevention, and potential modifications to game rules aimed at reducing injury occurrence and ensuring athlete’s safety.

Keywords

Rugby union; Athletic injuries; Epidemiology; Female; Portugal

Introduction

Rugby union is a team sport that is characterized by high-intensity activities such as running, sprinting, and contact events such as tackling, scrummaging, rucking, and mauling. (1)

Rugby Union is played by over 8.46 million players worldwide. Almost a quarter of the total participants are female, with females being the major drivers of the recent growth of the game. (2)

Despite the increasing popularity of the women's game, relatively little evidence is available regarding the risk of injury sustained by female players during match play. (3) To date, research into the epidemiology of injuries in rugby union has focused mainly on professional and international male rugby players, and there is a lack of data on injury surveillance in women, particularly at competitive levels other than the international and elite. (4) (5) (6)

The incidence rate of injuries in elite women's rugby union varied from 3.6 to 37.5 injuries per 1000 play-hours,(3) similar to what is described in the case of international competitions, namely the 2021 Women's Rugby World Cup. (7) Match injuries in female athletes are lower in comparison with the elite male athletes, in men's competition. (3) (4)

However, the severity of injuries is greater among female players compared to males at similar levels of rugby union play. (3) The mean severity at the international level in the Women's Rugby World Cup (RWC) is higher than in the men's RWC tournaments, and the same holds for elite tournaments. (4) Knee anterior cruciate ligament sprain/tear represented the most significant contributor to days lost and posed the highest injury burden for both male and female players. Among international players, females experienced a higher incidence of such injuries compared to their male counterparts. (4)

The most common types of injuries at international and elite level are sprain/ligament injuries and concussions. (3)(5)(7) The tackle is the game event responsible for most injuries, especially when the player is "being tackled". (3)

If the literature is scarce for elite women's rugby, then at the amateur level, there are even fewer studies. A study carried out in 2021 by Irish Amateur Rugby (6) showed that the incidence rate of injuries continues to be lower for women compared to men, and there is no difference when compared to the elite. The severity of injuries is mainly caused by anterior knee ligament injuries, and the incidence is higher in women's rugby, as it is in the elite. Tackle continues to be the event that causes the most injuries. Most of the injuries reported were concussions and ankle ligament injuries. It should also be noted that in female players, "83% of non-contact injuries occurred in the fourth quarter of match play" (6), which "points to the need for strength and conditioning training programmes to reduce fatigue-related injuries". (6)

Portuguese women's rugby become a reality in 2000. Before, only inconsistent teams and occasional matches would take place. Since then, the sporting seasons comprise two national championships in the predominant variants: the 15-s (fifteens) and 7s (sevens). However, due to logistical constraints and player's shortness, between 2013 and 2017, it only focused on rugby 7s. (8)

Between 2018 and 2021, the 15-s variant gradually reappeared, going through a phase of adaptation during which some teams adopted the rugby 10-s (tens) format.

In 2023, a year of enormous significance for women's rugby in Portugal, we saw the formation of the first national women's team in the 15-s variant, which took part in an official European competition, the Rugby Europe Trophy. Overcoming all their opponents, the young national team managed to qualify for the Rugby Europe Championship, the highest level of the sport within Europe, where they are to this day.

With this greater exposure to 15-s rugby, the sport has grown and become more visible, and the risk of injury is a common problem among players, which is why prevention is essential. According to the four-stage "sequence of prevention" suggested by *Van Mechelen* in 1992 (9) firstly, the extent of the sports injury problem must be identified and described. (9) In Portugal, *Cruz-Ferreira et al.*(10–12) have made an exemplary effort in conducting studies on male rugby, with several notable works emerging in both 15-s and 7s formats. Since there are no studies documenting injuries in the Portuguese senior female rugby union, it is pertinent to carry out epidemiological research to be able to work towards reducing the burden of injuries in Portuguese national and amateur women's rugby. So, this study aims to determine the injury incidence rate in matches, describe the type, location, severity, and game event responsible for injuries, and describe injuries in different positional groupings (forwards and backs) in Portuguese Women's XV Rugby Honour Division National Championship throughout the 2023/2024 season.

Methods

A prospective observational cohort design, incorporating data gathered throughout the 2023/24 season was made as an exploratory study. Portuguese Women's XV Rugby Honour Division National Championship, all teams competing against each other and the final stage to determine the championship winner were englobed.

The study period was of four months, from October 2023 to January 2024. The 2023/2024 season consisted of 7 amateur teams, with each team playing 9 matches in total.

A match consists of 80 minutes with 15 players from each team on the pitch. (13) Match exposure was calculated as the number of matches played multiplied by the number of exposed players (15) and the match exposure time (80 mins/60). For this study, compensation minutes and suspension minutes due to yellow or red cards were considered negligible.

At each game, both teams presented their respective medical staff, who had been requested beforehand to collaborate with the group of researchers in identifying and reporting injuries occurring during the match. All medical staff accepted except for one team, making a total of 6 teams taking part in the study. The medical staff was reduced to one physiotherapist and sometimes non-medical personnel were involved in recording injuries, which constituted a limitation.

An injury was considered to be '*Any physical complaint, which was caused by a transfer of energy that exceeded the body's ability to maintain its structural and/or functional integrity, that was sustained by a player during a rugby match, that results in a player being unable to take a full part in future rugby training or match play for more than 24 hours following the day of injury.'* (14)

The injuries were reported on a form adapted and translated from the original consensus drawn up by Fuller et al. (14) on which detailed information about each injury was entered: date of injury, player position (forward or back), period of the game (first half or second half), location of injury (head/neck, upper limb, trunk, or lower limb), side of body injured, type of injury (bone, joint/ligament, muscle/tendon, skin, brain/spine/peripheral nervous system, or other), (14) event leading to injury (collision, tackling, being tackled, ruck, maul, scrum, line-out, or other), and lastly, an injured player's return-to-play date.

Injury severity was defined as the number of days the player was unable to train or match play without limitations. (14)

This study's definitions and methodologies are in accordance with the international consensus statement for rugby union injury studies. (14)

Ethical approval was secured from the Ethical Committee of the local Regional Health Administration and institutional collaboration was granted by the Portuguese Rugby Union.

Injury data are presented as count (n), proportion (%), and incidence. Injury incidence was calculated as the count of injuries per 1000 player match hours. Severity is reported as mean days. Significant differences in injury incidence values between different playing positions (comparing backs and forwards) were assumed if the 95% CIs (Confidence Intervals) did not overlap.

Normality of the data was checked using Kolmogorov-Smirnov and Shapiro-Wilk tests.

Statistical analysis was performed using IBM SPSS Statistics software (Version 29.0).

Results

During the study period, a minimum of 90 players participated in at least one match of the championship. In total, there were 1077 hours of match play and 39 injuries.

Out of the 7 participating teams, only 6 reported injury occurrences, resulting in a limited dataset (total of 39 injuries).

The medical staff sometimes didn't report injuries on the day of the game, so there could be minimal injuries that went unnoticed.

Table 1 shows the number of match injuries, exposures, injury incidence rate and severity for backs, forwards, and all players.

Table 1: Number (n), exposure, incidence rate (injuries per 1000 match-hours) and severity (mean days absence) of match injuries by position.

Position	Injuries (n)	Exposure (player match-hours)	Incidence rate (per 1000 match-hours)[a]	Severity (days)
Backs	18	502,7	35,8 (21.9-55.5)	25,94
Forwards	21	574,6	36,5 (23.2-54.9)	58,28
All	39	1077,3	36,2 (26.-49.0)	43,35

[a] Values are mean (95% confidence interval)

The overall injury incidence rate was 36.2 injuries per 1000 hours played. Forwards (36.5 injuries per 1000 hours) exhibited a slightly higher incidence of injuries compared to backs (35.8 injuries per 1000 hours).

The players were out of action due to injuries sustained in matches for a total of 1691 days during the study period. The mean injury severity during the study was 43.4 days.

Lower limb was the body region with the highest incidence of injuries (48.7%, 95% CI: 33.6-64.0).

Figure 1 summarises the anatomical locations of injuries sustained by all players during the championship. The most common injury locations were the shoulder/clavicle (17.9%) followed by the knee (15.4%), and foot/toe (12.8%).

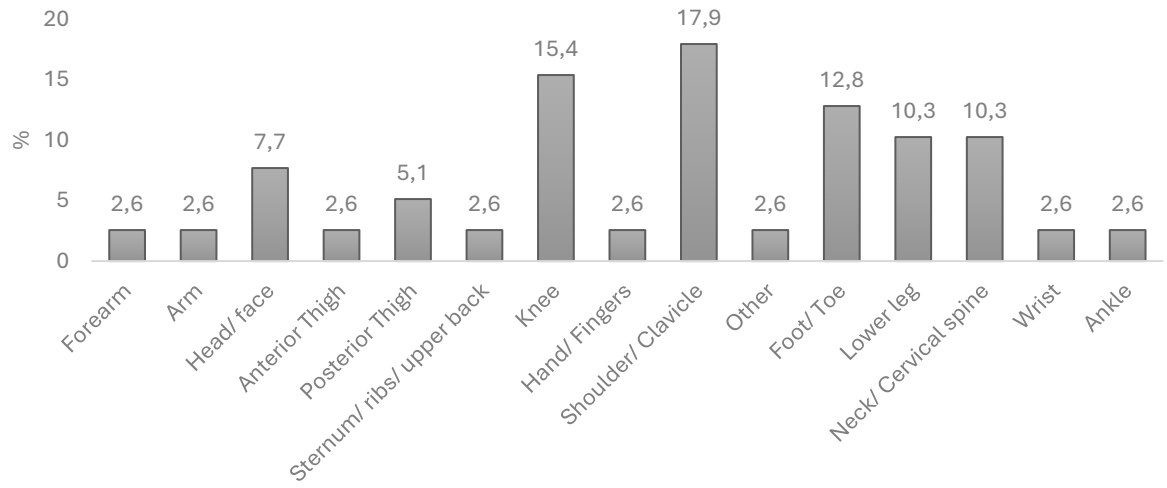

Figure 1: Percentage of match injuries by anatomical locations

Table 2 summarises the types of match injuries suffered by forwards, backs, and total players during the study period. The majority were joint/ligament injuries, making up 43.6% (95% CI: 28.9-59.1) of total injuries, followed by muscle/tendon injuries, with 28.2% (95%CI: 16.0-43.5).

Table 2: Types of match injuries sustained during Portuguese Women's National Championship

Type of injury	Forwards		Backs		All	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Bone	3	14,3 (4,2 - 33,4)	1	5,6 (0,6-23,2)	4	10,3 (3,6-22,6)
Joint/ligament	7	33,3 (16,3 - 54,6)	10	55,6 (33,2-76,3)	17	43,6 (28,9-59,1)
Muscle/tendon	7	33,3 (16,3 - 54,6)	4	22,2 (8,0-44,6)	11	28,2 (16,0-43,5)
Skin	1	4,8 (0,5 - 20,2)	1	5,6 (0,6-23,2)	2	5,1 (1,1-15,4)
Brain/ C/PNS	2	9,5 (2,0 - 27,2)	1	5,6 (0,6-23,2)	3	7,7 (2,2-19,1)
Other	1	4,8 (0,5 - 20,2)	1	5,6 (0,6-23,2)	2	5,1 (1,1-15,4)

n: injuries count; CI: confidence interval; C/PNS: central or peripheral nervous system.

The most common diagnosis sustained by backs was sprain/ligament injury (38.9%, 95%CI: 19.4-61.7), with a significantly higher incidence of injury than all other specific types of injury. For forwards, the most common diagnosis was sprains/ligaments (23,8%, 95%CI: 9.7-44.6), closely followed by fractures (14.3%, 95%CI: 4.2-33.4). For all players, sprain/ligament injuries were the most common specific type of injury (38.8%, 95% CI: 18.0-46.2), followed by dislocation/subluxation (12.8%, 95% CI: 5.1-25.8).

Table 3 shows that the majority of injuries resulted from contact-related activities (92.3%, 95% CI: 80.9-97.8), especially during tackle, with the situation of "being tackled" being the most frequent (35.9%, 95% CI: 22.3-51.5).

Table 3: Event and contact-related activities leading to injury during Portuguese Women's National Championship

		Forwards		Backs		All	
		n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Event	No contact	1	4,8 (0,5-20,2)	2	11,1 (2,4-31,1)	3	7,7 (2,2-19,1)
	Contact	20	95,2 (79,8-99,5)	16	88,9 (68,8-97,6)	36	92,3 (80,9-97,8)
Contact	Line-out	1	4,8 (0,5-20,2)	0	0,0	1	2,6 (0,3-11,4)
	Collision	3	14,3 (4,2-33,4)	1	5,6 (0,6-23,2)	4	10,3 (3,6-22,6)
	Scrum	4	19,0 (6,8-39,2)	0	0,0	4	10,3 (3,6-22,6)
	Tackling	4	19,0 (6,8-39,2)	3	16,7 (4,9-38,1)	7	17,9 (8,4-32,0)
	Being tackled	5	23,8 (9,7-44,6)	9	50,0 (28,4-71,6)	14	35,9 (22,3-51,5)
	Ruck	3	14,3 (4,2-33,4)	2	11,1 (2,4-31,1)	5	12,8 (5,1-25,8)
	Other	0	0,0	1	5,6 (0,6-23,2)	1	2,6 (0,3-11,4)

n: count of injuries; CI: confidence interval.

For backs, being tackled (50.0%), tackling (16.7%), running (11.1%), and ruck (11.1%) were the events responsible for most injuries. For forwards, being tackled (23.8%), tackling (19.0%), and scrum (19.0%) were the events responsible for most injuries. Therefore, the tackle continues to be the most common match event resulting in injury.

Most injuries occur in the second half of matches (53.8%, 95% CI:38.4-68.7), and both the attacking and defending midfield were the places on the pitch where most injuries occurred (28.2%, 95% CI: 16.0-43.0).

Table 4: Event leading to injury in each period of the match

		First half % (95% CI)	Second half % (95% CI)
No contact		0,00	14,30 (4,2-33,4)
Contact:	Line-out	5,60 (0,6-23,2)	0,00
	Collision	11,10 (2,4-31,10)	9,50 (2,0-27,2)
	Scrum	5,60 (0,6-23,2)	14,30 (4,2-33,4)
	Tackling	33,30 (15,3-56,3)	4,80 (0,5-20,2)
	Being tackled	33,30 (15,3-56,3)	38,10 (19,9-59,3)
	Ruck	5,60 (0,6-23,2)	19,00 (6,8-39,2)
	Other	5,60 (0,6-23,2)	0,00

CI: confidence interval

Discussion

The data obtained regarding the time-loss match injury incidence rate in Portuguese women's rugby (36.2 injuries per 1000 match-hours) aligns with previously published data. In elite women's rugby union, the injury incidence rate ranged from 3.6 to 37.5 injuries per 1000 match-hours. (3) At the international level, the injury incidence rate was reported at 44.2 per 1000 match-hours. (7) The present study correlates closely to the values reported in the Irish study for amateur rugby union (6), the incidence rate reported being 35.6 per 1000 match-hours for female players, reflecting the reality observed in Portuguese amateur women's rugby union. This probably reflects the notable difference in competitiveness between Portuguese amateur competition and the high standards of international rugby. The correlation between increased professionalism and an increased incidence of injuries has previously been established by Garraway, W et al. (15), in men's rugby union. Such a relationship may also hold strong evidence in the context of women's rugby.

Concerning the severity aspect, the mean injury duration was 43.3 days. To our knowledge, there are no studies on women's amateur rugby that we can relate to our study. Therefore, we can attempt to compare with the reality of amateur men's rugby. In a study conducted on Portuguese amateur men's rugby(10) the mean severity was 28.16 days, which aligns with most comparative studies between genders indicating that the severity of injuries is greater among female players compared to males at similar levels of rugby union play. (3) Our study also reveals a lower mean severity compared to that documented at the women’s elite (48 days) (3) and international level (71.9 days). (7)

Regarding the most frequent type of injury, sprain/ligament injuries come first, followed by muscle/tendon injuries. In most of the studies analysed, (3,7) these tend to be the two most common types of injuries, although their order may vary.

The most frequent diagnoses were sprain/ligament injuries (38.8%), consistent with findings at the amateur level (6) and also at the international level. (7)

In this study, the majority of injuries occurred in the lower limbs (48.7%), with the knee joint being the most affected within this region, which is in line with what is commonly observed in studies across all competitive levels, from amateur to international. (3,6,7)

As anticipated, in line with the collective evidence from various published studies (3–7) across all competitive levels, this study observed that the majority of injuries occurred during contact (Table 3). The physical demands of a rugby player differ from position to position, with forwards experiencing more involvement in contact situations. (16) In this study, forwards exhibited a higher incidence of injuries compared to backs. This positional demand may be an influential

factor in injury occurrence; however, no significant difference was found in the association between the player's position and the mechanism of injury. Nevertheless, we believe that an effective strategy would be to develop specific training programs designed to each positional group, focusing on contact situations.

The tackle, especially being tackled, was the game event that most frequently resulted in injury, consistent with findings from previously published studies across all levels of rugby competition. (3,6,7)

This raises the natural question of how to use this data to enhance athlete safety during the game. Possible approaches could include refining the definition of a well-executed tackle within the rules and increasing penalties for inadequately executed tackles. Furthermore, better educating players on injury prevention strategies, including skills training aimed at developing and improving tackling technique, could be beneficial. (3)

In our study, the second half of the game saw the highest incidence of injuries (53.8%), a trend also observed at the amateur and international levels. (6,7)

Although most injuries occurred following contact, it is noteworthy that all non-contact injuries took place in the second half, accounting for 14.3% of injuries during this game period (Table 4). This observation is consistent with findings from other studies conducted on amateur teams. (6) Additionally, 42.9% of injuries occurring in the second half were related to tackling (Table 4). This phenomenon may be explained by the association between fatigue towards the end of games and a decline in proper tackling technique, leading to an increased risk of injuries. Research investigating the influence of fatigue on games by analysing the chronology of injuries, revealed that the relative risk of tackle-related injuries is higher towards the end of matches, potentially due to incorrect technique. (17) To mitigate these occurrences, there is a need for strength and conditioning training programs aimed at reducing fatigue-related injuries.(6) Particularly, the development of lower-body strength should be prioritized to support the acquisition of robust tackling skills that can be maintained under fatigue. (18) Additionally, practicing tackling skills during repeated-effort exercises may facilitate better skill transfer under game-specific fatigue conditions. (18)

Limitations

Some limitations are recognized in this, exploratory study, particularly its short duration of only one championship. A broader extension of the investigation will provide greater consistency to the obtained results.

Due to the amateur nature of the teams under study, the limited level of medical support available for players to properly recover from injuries can indeed be viewed as a constraint. This limitation can prolong the duration of the injuries and, consequently, the severity outcome, making it challenging to compare injury surveillance between amateur and professional sports.

While this manuscript aims to describe injuries occurring at matches, it is essential to note that training exposure and associated injuries could have affected players and match injury data. Despite the amateur level of Portuguese female rugby, some athletes have represented the Portuguese national team in European events that coincided with the championship during the 4 months of this study, this has contributed to a certain degree of heterogeneity in this cohort in terms of players' international experience, and not accounting for cumulative wear and tear of the athletes.

The present study used, a 24-hour time-loss injury definition which has been recommended at all levels of the game, therefore, all injuries requiring medical attention were not included in the study, excluding this way minor but very common injuries in this sport such as strains/sprains and lacerations/contusions.

Lastly, the exclusion of chronic injuries from the study restricts the comprehension of the sport's influence on athletes' health solely to acute injuries and their subsequent effects.

Conclusion

The injury incidence rate in the Portuguese Women's XV Rugby Honour Division National Championship for the 2023/2024 season remained consistent with findings from studies on both amateur and elite women's rugby. Notably, it was lower than reported internationally, highlighting the variance in competitiveness between international competition and the Portuguese context. This exploratory study brings about specific training skills to be thought of.

The severity of injuries observed in the present study was lower than that documented at the elite and international levels of women's rugby. However, it surpassed the values observed in men's rugby, aligning with findings in the comparative literature between genders at the same level of competition.

The most frequent injuries in terms of location and type were lower limb and joint/ligament and muscle/tendon injuries, with tackling, particularly being tackled, being the event most often associated with injuries. This pattern is consistent across all levels of women's competition.

We emphasize the significance of training focused on contact scenarios for each position to minimise contact-related injuries. Special attention should be given to developing and refining tackling techniques, as well as incorporating repeated-effort exercises to enhance skill transfer under conditions of game-specific fatigue. Notably, a majority of injuries occurred in the second half of the game, aligning with trends observed across all levels of women's competition, thereby reinforcing the importance of strength and conditioning programs aimed at reducing fatigue-related injuries.

We believe that it will be crucial to conduct more epidemiological studies in Portuguese women's rugby to gain a broader and deeper understanding of the extent of the sports injury problem.

Through this study, we aim to provide insights into the most common injuries and their underlying mechanisms. We hope that our findings can contribute to future development of effective injury prevention strategies, enhanced training protocols to educate players on injury prevention, and potential modifications to game rules aimed at reducing injury occurrence and ensuring athlete safety.

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Annex 1: Exposure and incidence rate calculations

Match exposure (hours) = Number of matches x Number of players (15) x Match duration in minutes (80) / 60 min

Incidence rate (injuries/1000 match-hours) = (Number of injuries / Match exposure) x 1000