UEFA Women’s Elite Club Injury Study: a prospective study on 1527 injuries over four consecutive seasons 2018/2019 to 2021/2022 reveals thigh muscle injuries to be most common and ACL injuries most burdensome

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ABSTRACT

Objective Injuries in women’s football (soccer) have scarcely been investigated, and no study has been conducted in the highest competitive level involving club teams from different countries. Our aim was to investigate the time-loss injury epidemiology and characteristics among women’s elite football players over four seasons.

Methods 596 players from 15 elite women’s teams in Europe were studied prospectively during the 2018/2019 to 2021/2022 seasons (44 team seasons). Medical staff recorded individual player exposure and time-loss injuries. Injury incidence was calculated as the number of injuries per 1000 playing hours and injury burden as the number of days lost per 1000 hours.

Results 1527 injuries were recorded in 463 players with an injury incidence of 6.7 (95% CI 6.4 to 7.0) injuries per 1000 hours and a nearly fourfold higher incidence during match play compared with training.

Conclusions An elite women's football team can expect approximately 35 time-loss injuries per season. Thigh muscle injury was the most common injury and ACL injury had the highest injury burden.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- Injuries in women’s football have scarcely been investigated, and no study has been carried out at the highest competitive level involving club teams from different countries followed across several seasons.

WHAT THIS STUDY ADDS

- An elite women’s football team can expect 35 time-loss injuries per season (1.5 injuries per player) with a nearly fourfold higher incidence during match play compared with training.
- Hamstring muscle injury was most frequent (12%), closely followed by quadriceps muscle injury (11%).
- Anterior cruciate ligament (ACL) injury was infrequent (2%) but had the highest injury burden.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- Our study increases the knowledge and understanding of injury epidemiology among women’s elite football players and opens opportunities for further substudies.
- This study underlines the importance of implementing and evaluating preventive measures for frequent injuries such as thigh muscle injuries, and injuries with high burden and potentially negative long-term consequences such as ACL injury and concussion.

INTRODUCTION

Nearly 1.4 million women were registered football players in Europe in 2017 according to the Union of European Football Associations (UEFA), with around 3,600 of them being professional or semiprofessional. As concluded in several recent reviews, women’s football injuries have been scarcely investigated. Two of these reported very similar injury incidences for women’s elite football as in men’s elite football; 5.6–5.7 injuries per 1000 hours in total, 3.2–3.3 in training, and 19.1–19.5 in matches. Additionally, most injuries were located at the knee, thigh and ankle, and the most frequent injury types were joint/ligament injuries, muscle injuries and contusions/haematoma.

Even if there are several studies on elite women’s club teams, no previous study has included teams from the highest competitive club level in different European countries, as has been a matter of routine for the past two decades in men’s football. In addition, most of the data collection in the previous studies on women’s elite football took place more than a decade ago when a majority of players were not fully professional. Therefore, the aim of this study was to investigate the time-loss...
injury epidemiology and characteristics among women professional football players in Europe during four consecutive seasons, 2018/2019 to 2021/2022.

**MATERIAL AND METHODS**

Using the same design as for the UEFA Elite Club Injury Study (ECIS), the UEFA Women’s Elite Club Injury Study (WECIS) was launched in July 2018. The methodology adheres to the guidelines of the original consensus statement for football, and mostly to the International Olympic Committee (IOC) consensus statement, and where applicable, its recently published football consensus extension.

**Study population**

This study is ongoing with findings reported for the 2018/2019 to 2021/2022 seasons, including the 2020 lockdown due to the COVID-19 pandemic. In most European countries, the football season starts with a pre-season in July and the first half of August, followed by a competitive season from approximately the middle of August, ending in May. During 2019/2020, all major European first leagues cancelled the remaining matches (between four and eight matches left) from March 2020 due to the COVID-19 pandemic except for the German Frauen-Bundesliga which was temporarily paused and restarted in June 2020. All 2020/2021 league matches started as planned in the middle of August 2020. Conversely, the Swedish first league, Damallsvenskan, which has a spring to autumn season was postponed from the planned start in April to June 2020 and ended in late November with the 2021 season starting as usual in April. No league or cup matches were cancelled due COVID-19 during the second half of 2020 nor throughout the 2021 season.

Before commencing the study, forms and the data collection procedures were tested in a pilot study from January to May 2017/2018. A convenient sample of 12 teams selected by UEFA based on the UEFA league coefficient with champions and runners-up from associations 1–8 and champions from associations 9–12 being directly qualified to the Women’s Champions League, and on the inclusion of their men’s counterparts in the ECIS. All data from these months are excluded from this report as decided a priori because of expected incomplete data collection. Two pilot study teams did not deliver complete data from July 2018 and were excluded. Following inception, another five teams based on the same inclusion criteria were added resulting in six teams delivering complete four-season data, four teams complete three-season data, three teams complete two-season data and two teams complete one-season data (online supplemental table 1). Except for one team, all teams were ranked among the top five in the highest national leagues of Europe.

All first team squad players (most being professionals, some being amateurs) were informed about the study by their team physician at the start of pre-season, or when joining the team later during the season, and provided written consent. Players who left during the season for a team outside the WECIS were included for their entire time of participation.

**Study procedure**

All teams were requested to appoint a contact person in the club medical staff at each season start, usually the team physician, to inform the players about the study and to be responsible for the data collection. To ensure that the study methodology was followed, each contact person was provided with a study manual containing all operational definitions and other relevant information of the data collection procedure with practical examples as well as the three study forms. All football exposure and injuries that occurred during team activities were recorded on standard forms which were sent to the study group each month. The first author reviewed the reported data and, if there were any missing non-optional or unclear data, immediate feedback was sent back to the contact person to enable corrections of the reports.

**Exposure and injury registration**

Baseline data regarding anthropometrics and leg dominance were collected at player inclusion. Training and match exposure (in minutes) with the club and the national team was registered for each player on an attendance record. All football-related injuries were noted on a one-page injury card with compulsory tick-box alternatives on type of training/match, injury type/location, injury mechanism, and so on, and an optional free text on diagnosis and further information such as specified muscle, tendon or ligament involvement. Injuries were classified into different severity categories (table 1), and tabulated according to the recommendations in the recent football-specific consensus extension.

**Patient involvement**

This research was done without patient (player) involvement. Patients were not invited to comment on the study design or to contribute to the writing of the article.

**Equity, diversity and inclusion**

This study was conducted on women’s elite football players exclusively. All teams included were from high-income countries with no representation from middle-income or low-income countries. There are four men and three women in the author list with varying nationalities, professions and fields of expertise.

**Statistical analysis**

Only full season data were included in the analyses meaning that teams who delivered incomplete data or data for part of a season were excluded for that season. Continuous data for anthropometrics and exposures are presented as mean with SD. Injury incidence was calculated as the number of injuries per 1000 hours, as described in table 1, with 95% CI. Injury incidences were compared as a rate ratio (RR) with 95% CI using Poisson regression with number of injuries as the dependent variable and including exposure hours as offset. Injuries were also expressed as the average number of injuries per a typical 23-player squad team per season. Days lost were presented as median with IQR. Injury burden was defined as the number of days lost per 1000 hours, as described in table 1, with IQR and expressed as median with IQR. Differences in injury proportions between training and match play was analysed using the $\chi^2$ test. All analyses were two-sided and the significance level was set at $p<0.05$. All analyses were carried out in line with the checklist for statistical assessment of medical papers (CHAMP) statement, using SPSS (IBM SPSS Statistics for Windows, V.27.0. Armonk, NY USA: IBM Corp). A statistical significance level of $p<0.05$ was applied.

**RESULTS**

There were 596 unique players with a mean team squad size of 23 (SD 3.2) players. Mean player age was 23 (SD 4.4) years, height 169 (SD 6.3) cm and body mass 62 (SD 6.5) kg.
which means that a typical 23-availability for match selection 85% (2.5). The mean training attendance was 77% (2.8) and the mean player exposure per match during 44 team seasons with 1129 player seasons. The overall exposure was 227,922 hours (195,945 training, 31,977 match). Injuries per 1000 player-hours with a fourfold higher incidence (4.8, 95% CI 4.5 to 5.1; RR 3.8, 95% CI 3.5 to 4.2, p<0.001). The training injury incidence during the 2018/2019 season was significantly lower than the 2020/2021 (RR 0.7, 95% CI 0.6 to 0.9, p<0.001) and 2021/2022 seasons (RR 0.7, 95% CI 0.6 to 0.8, p<0.001), whereas the 2019/2020 COVID-19 affected season had a significantly lower training injury incidence than only the 2021/2022 season (RR 0.8, 95% CI 0.7 to 1.0, p=0.029) (table 2). However, the 2019/2020 COVID-19 affected season had a significantly lower match injury incidence than all other seasons (2019/2020 vs 2018/2019, RR 0.7, 95% CI 0.6 to 1.0, during match play than training (18.4, 95% CI 16.9 to 19.9 vs 4.8, 95% CI 4.5 to 5.1; RR 3.8, 95% CI 3.5 to 4.2, p<0.001).

### Exposure and injuries

Detailed data on exposure, injury incidence and injury burden (season-by-season and overall) are presented in table 2. The overall exposure was 227,922 hours (195,945 training, 31,977 match) during 44 team seasons with 1129 player seasons. The mean training attendance was 77% (2.8) and the mean player availability for match selection 85% (2.5).

In total, 463 (78%) of the players incurred 1527 injuries which means that a typical 23-player squad could expect 35 injuries per season. The overall injury incidence was 6.7 (95% CI 6.4 to 7.0) injuries per 1000 hours with a fourfold higher incidence during match play than training (18.4, 95% CI 16.9 to 19.9 vs 4.8, 95% CI 4.5 to 5.1; RR 3.8, 95% CI 3.5 to 4.2, p<0.001).

### Table 1 Operational definitions

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Training or match with the club’s first and reserve teams and any national team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Scheduled physical training activity under the guidance of the coaching team</td>
</tr>
<tr>
<td>Match</td>
<td>Competitive or friendly match against another team</td>
</tr>
<tr>
<td>Training attendance</td>
<td>Players’ active and full participation in scheduled team training</td>
</tr>
<tr>
<td>Match availability</td>
<td>Players’ availability for match play regardless of being picked by the coach</td>
</tr>
<tr>
<td>Injury</td>
<td>Any physical complaint sustained by a player that resulted from a football match or football training and led to the player being unable to take full part in future football training or match play (time-loss injury)</td>
</tr>
<tr>
<td>Traumatic onset injury</td>
<td>Injury with sudden onset and known cause</td>
</tr>
<tr>
<td>Gradual onset injury</td>
<td>Injury with insidious onset and no known trauma</td>
</tr>
<tr>
<td>Contact injury</td>
<td>Injuries due to contact with another player or an object</td>
</tr>
<tr>
<td>Injury incidence</td>
<td>Number of injuries per 1000 player hours (Σ injuries/Σ hours) x 1000</td>
</tr>
<tr>
<td>Injury burden</td>
<td>Number of days lost per 1000 player hours (Σ days lost/Σ hours) x 1000</td>
</tr>
<tr>
<td>Recurrent injury</td>
<td>Injury of the same type and at the same site as an index injury occurring previously during the same season</td>
</tr>
<tr>
<td>Early recurrence</td>
<td>Recurrent injury that occurs within 2 months after return to full participation from the index injury</td>
</tr>
<tr>
<td>Injury severity</td>
<td>Number of days from injury to medical clearance. A player was considered injured until the medical team allowed full participation in team training sessions and being available for match play</td>
</tr>
<tr>
<td>Slight</td>
<td>Injury that results in 0 days lost from training or match</td>
</tr>
<tr>
<td>Minimal</td>
<td>Injury that results in 1–3 days lost from training or match</td>
</tr>
<tr>
<td>Mild</td>
<td>Injury that results in 4–7 days lost from training or match</td>
</tr>
<tr>
<td>Moderate</td>
<td>Injury that results in 8–28 days lost from training or match</td>
</tr>
<tr>
<td>Severe</td>
<td>Injury that results in &gt;28 days lost from training or match</td>
</tr>
</tbody>
</table>

### Table 2 Team and player exposure data, injury incidence and injury burden during the 2018/2019 to 2021/2022 seasons

<table>
<thead>
<tr>
<th>Table 2 Team and player exposure data, injury incidence and injury burden during the 2018/2019 to 2021/2022 seasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training sessions</td>
</tr>
<tr>
<td>2018/2019 Mean (SD)</td>
</tr>
<tr>
<td>No/team</td>
</tr>
<tr>
<td>No/player</td>
</tr>
<tr>
<td>Matches</td>
</tr>
<tr>
<td>No/team</td>
</tr>
<tr>
<td>No/player</td>
</tr>
<tr>
<td>Player exposure (hours)</td>
</tr>
<tr>
<td>Matches</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Injury incidence</td>
</tr>
<tr>
<td>Matches</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Injury burden</td>
</tr>
<tr>
<td>Training</td>
</tr>
<tr>
<td>Matches</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Injury incidence is defined as the number of injuries per 1000 hours and injury burden is defined as the number of days lost per 1000 hours.

of all injuries (21%, 321/1527) which means that the typical 23-player squad could expect seven severe injuries per season. Anterior cruciate ligament (ACL) injury 10% (33/321), quadriceps muscle injury 9% (28/321), and hamstring muscle injury 8% (25/321) were the three most common severe injury diagnoses. The severe injury incidence was fourfold higher during match play than training (4.1, 95% CI 3.4 to 4.8 vs 1.0, 95% CI 0.8 to 1.1; RR 4.2, 95% CI 3.3 to 5.2 p<0.001).

**Thigh muscle injuries**

Hamstring muscle injury was the most frequent injury representing 12% (188/1527) of all injuries. The typical 23-player squad could thus expect four hamstring muscle injuries per season. The total hamstring muscle injury incidence was 0.8 (95% CI 0.7 to 1.0) injuries per 1000 hours and being fivefold higher during match play compared with training (table 3). The median days lost was 8 (IQR 4–16) days and the median injury burden was 8.3 (IQR 5.9–16.1) days lost per 1000 hours, being 12-fold higher during match play compared with training (table 4). The most frequent injury mechanism was running/sprinting (56%, 104/187, injury mechanism missing for one injury). In all, 125 injuries had optional free-text diagnoses to distinguish between biceps femoris and semimembranosus/semitendinosus; a majority of these (66%, 82/125) were located to the biceps femoris. Every sixth hamstring muscle injury was a recurrence (17%, 32/188) with 26 (81%) being early recurrences.

Quadriceps muscle injury was almost as frequent as hamstring muscle injury representing 11% (171/1527) of all injuries. The typical 23-player squad could thus expect approximately four quadriceps muscle injuries per season. The total quadriceps muscle injury incidence was 0.8 (95% CI 0.6 to 0.9) injuries per 1000 hours and being almost threefold higher during match play compared with training (table 3). The median days lost was 9 (IQR 4–22) days and the median injury burden was 10.1 (IQR 4.8–18.6) days lost per 1000 hours, being fourfold higher during match play compared with training (table 4). The most frequent injury mechanism was running/sprinting with 30% (52/171) of injuries, followed by shooting 23% (40/171). In all, 114 injuries (67%) had optional free-text diagnosis specific to the rectus femoris and the rest were unspecified. Every tenth quadriceps muscle injury was a recurrence (11%, 18/171) with 12 (67%) being early recurrences.

**Ankle knee ligament injuries**

Lateral ankle ligament injury was the most frequent ligament injury representing 7% (111/1527) of all injuries. The typical 23-player squad could thus expect 2.5 lateral ankle sprains per season. The total lateral ankle ligament injury incidence was 0.5 (95% CI 0.4 to 0.6) injuries per 1000 hours and being fourfold higher during match play compared with training (table 3). The median days lost was 9 (IQR 5–21) days and the median injury burden was 7.9 (IQR 4.1–13.1) days lost per 1000 hours, being threefold higher during match play compared with training (table 4). More than half of the lateral ankle ligament injuries had a contact mechanism (52%, 58/111). The main mechanisms of contact-related lateral ankle ligament injuries were being tackled (29%, 17/58) and jumping/landing (17%, 10/58). For non-contact lateral ankle ligament injuries, twisting/turning (32%, 17/53) and jumping/landing (26%, 14/53) were the two dominating mechanisms. Every tenth lateral ankle ligament injury was a recurrence (11%, 12/111) with seven being early recurrences.

**Injury severity**

Injury severity data are displayed in table 5 and in online supplemental table 2. Severe injuries constituted more than one-fifth of all injuries (21%, 321/1527) which means that the typical 23-player squad could expect seven severe injuries per season. Anterior cruciate ligament (ACL) injury 10% (33/321), quadriceps muscle injury 9% (28/321), and hamstring muscle injury 8% (25/321) were the three most common severe injury diagnoses. The severe injury incidence was fourfold higher during match play than training (4.1, 95% CI 3.4 to 4.8 vs 1.0, 95% CI 0.8 to 1.1; RR 4.2, 95% CI 3.3 to 5.2 p<0.001).
Medial collateral ligament (MCL) injury of the knee was the second most frequent ligament injury representing 3% (43/1527) of all injuries. The typical 23-player squad could thus expect one MCL injury per season. The total MCL injury incidence was 0.2 (95% CI 0.1 to 0.3) injuries per 1000 hours and being sevenfold higher during match play compared with training (table 3). The median days lost was 14 (IQR 7–34) days and the median injury burden was 4.1 (IQR 2.4–334) days and the median injury burden was 38.0 (IQR 29.2–52.1) days lost per 1000 hours, being sixfold higher during match play compared with training (table 4). One player with a total ACL injury ended their career, otherwise one player returned to full team training within 6 months (3%), 13 (41%) within 9 months, and 30 (94%) within 12 months. Most ACL injuries had a non-contact mechanism (64%, 21/33). The two dominating injury mechanisms for non-contact ACL injuries were twisting/turning (48%, 10/21) and jumping/landing (24%, 5/21). Being tackled (42%, 5/12) was the main injury mechanism for contact-related ACL injuries.

### Concussions
Concussion was the most frequent head injury representing 3% (47/1527) of all injuries. The typical 23-player squad could thus expect one concussion per season. The total concussion incidence was 0.2 (95% CI 0.2 to 0.3) injuries per 1000 hours and being fourfold higher during match play compared with training (table 3). The median days lost was 9 (IQR 6–19) days and the median injury burden was 0.8 (IQR 0–3.9) days lost per 1000 hours, being sevenfold higher during match play compared with training (table 4). In more than one-quarter of cases (28%, 13/47), the player returned to full team training within 6 days. The two main mechanisms of concussion were being hit by a ball (34%, 16/47) and heading the ball (21%, 10/47). Half of all match-related concussions (50%, 9/18) occurred due to heading the ball, while being hit by the ball was the most frequent injury.
mechanism during training (48%, 14/29). Every sixth concussion was a recurrence (15%, 7/47) with four being early recurrences.

DISCUSSION
The most important findings were that a typical 23-player squad could expect 35 time-loss injuries per season with a nearly fourfold higher incidence and a fivefold higher burden during match play compared with training. Muscle injuries dominated the injury landscape with hamstring and quadriceps muscle injuries being almost as frequent; however, ACL injury had the highest injury burden.

Match injuries dominate the landscape
The match injury incidence and burden were significantly higher compared with training in general and for relevant injury subtypes such as hamstring muscle injuries, quadriceps muscle injuries, ACL injuries and concussions. We found, however, no difference in injury incidence between national team matches and club team matches which stands in contrast to findings in one systematic review that reported higher incidence in national team matches (55.7 vs 19.5 injuries per 1000 hours). One possible explanation could be that we only included national team events from July to May, while off-season tournaments such as the Women’s World Cup, Women’s European Championship or the Olympic Games were not included.

Hamstring muscle injury is most frequent
We found hamstring muscle injury to be the most frequent, representing 12% of all injuries. Similar results have been reported in women’s football from Scandinavia, but a Spanish one-club study reported quadriceps muscle injuries to be more frequent. Interestingly, the number of quadriceps muscle injuries was only marginally lower in our dataset representing 11% of all injuries. Both these numbers contradict results in recent systematic reviews showing that ankle and knee injuries historically have been most frequent. It is, therefore, likely that there is a similar trend as seen in men’s professional football with a higher playing intensity over time, and an accompanying shift from ligament injuries to muscle injuries.

ACL injury has the highest injury burden
We observed that 3% of all injuries affected the MCL of the knee with 72% being contact related. There are no previous data reported for MCL injury mechanisms in women’s football, but this finding is in line with a study on male professional players, which reported the same percentage of MCL injury (3%) and almost the same percentage of contact-related injury mechanisms (73%). Noteworthy, ACL injury was almost as frequent as MCL injury representing 2% of all injuries. This percentage, and the average rate of 0.7 ACL injuries per team and season, is identical to that previously reported for Swedish elite women players during the first decade of the 2000s. Although the injury frequency was identical, the current study showed an average

<table>
<thead>
<tr>
<th>Injury</th>
<th>Total Burden (IQR)</th>
<th>Training Burden (IQR)</th>
<th>Match play Burden (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head/face</td>
<td>0.9 (0.8 to 3.9)</td>
<td>1.0 (0.0 to 3.2)</td>
<td>5.0 (0.0 to 16.9)</td>
</tr>
<tr>
<td>Concussion</td>
<td>0.8 (0.0 to 3.9)</td>
<td>0.5 (0.0 to 3.2)</td>
<td>3.6 (0.0 to 16.9)</td>
</tr>
<tr>
<td>Neck/cervical spine</td>
<td>0.0 (0.0 to 0.3)</td>
<td>0.0 (0.0 to 0.4)</td>
<td>0.0 (0.0 to 0.0)</td>
</tr>
<tr>
<td>Shoulder/clavicle</td>
<td>1.7 (0.5 to 4.6)</td>
<td>0.8 (0.0 to 2.7)</td>
<td>0.0 (0.0 to 17.1)</td>
</tr>
<tr>
<td>Arm/hand</td>
<td>7.5 (2.1 to 11.3)</td>
<td>4.4 (1.4 to 6.6)</td>
<td>24.2 (5.0 to 49.0)</td>
</tr>
<tr>
<td>Sternum/upper back</td>
<td>0.0 (0.0 to 0.1)</td>
<td>0.0 (0.0 to 0.0)</td>
<td>0.0 (0.0 to 0.6)</td>
</tr>
<tr>
<td>Abdomen</td>
<td>0.0 (0.0 to 0.3)</td>
<td>0.0 (0.0 to 0.3)</td>
<td>–</td>
</tr>
<tr>
<td>Lower back/pelvis/sacrum</td>
<td>2.3 (1.7 to 4.9)</td>
<td>1.9 (0.2 to 4.2)</td>
<td>2.2 (0.0 to 10.9)</td>
</tr>
<tr>
<td>Hip/groin</td>
<td>7.3 (2.5 to 14.0)</td>
<td>5.2 (1.7 to 11.1)</td>
<td>21.0 (0.0 to 26.2)</td>
</tr>
<tr>
<td>Muscle injuries</td>
<td>4.2 (1.5 to 4.8)</td>
<td>2.7 (0.6 to 5.5)</td>
<td>11.4 (0.0 to 14.6)</td>
</tr>
<tr>
<td>Adductor</td>
<td>3.0 (1.2 to 4.2)</td>
<td>1.8 (0.4 to 4.0)</td>
<td>4.2 (0.0 to 14.3)</td>
</tr>
<tr>
<td>Thigh</td>
<td>25.3 (14.3 to 29.0)</td>
<td>15.6 (7.5 to 23.9)</td>
<td>93.1 (45.9 to 118.9)</td>
</tr>
<tr>
<td>Muscle injuries</td>
<td>23.4 (12.8 to 27.2)</td>
<td>14.8 (6.9 to 16.8)</td>
<td>76.4 (45.9 to 110.3)</td>
</tr>
<tr>
<td>Quadriceps</td>
<td>10.1 (4.8 to 18.7)</td>
<td>6.0 (3.7 to 12.1)</td>
<td>25.2 (3.0 to 54.0)</td>
</tr>
<tr>
<td>Hamstrings</td>
<td>8.3 (5.9 to 16.1)</td>
<td>4.1 (1.7 to 7.2)</td>
<td>47.6 (26.8 to 59.5)</td>
</tr>
<tr>
<td>Knee</td>
<td>84.5 (53.6 to 101.5)</td>
<td>44.3 (24.6 to 71.2)</td>
<td>266.9 (160.9 to 329.9)</td>
</tr>
<tr>
<td>Ligament injuries</td>
<td>41.7 (39.2 to 68.9)</td>
<td>19.1 (1.4 to 37.0)</td>
<td>199.7 (103.5 to 297.6)</td>
</tr>
<tr>
<td>Medial collateral</td>
<td>4.1 (0.7 to 8.6)</td>
<td>0.9 (0.0 to 3.3)</td>
<td>10.6 (4.5 to 64.6)</td>
</tr>
<tr>
<td>Anterior cruciate</td>
<td>38.0 (29.2 to 52.1)</td>
<td>18.5 (0.0 to 34.0)</td>
<td>117.0 (0.0 to 281.4)</td>
</tr>
<tr>
<td>Meniscus/cartilage injuries</td>
<td>15.6 (1.8 to 27.4)</td>
<td>15.0 (0.5 to 30.9)</td>
<td>3.6 (0.0 to 21.2)</td>
</tr>
<tr>
<td>Lower leg/Achilles tendon</td>
<td>15.2 (5.7 to 21.7)</td>
<td>13.6 (6.0 to 23.6)</td>
<td>30.2 (9.1 to 41.9)</td>
</tr>
<tr>
<td>Muscle injuries</td>
<td>7.7 (3.2 to 10.4)</td>
<td>4.7 (0.0 to 9.5)</td>
<td>8.9 (0.0 to 23.7)</td>
</tr>
<tr>
<td>Achilles tendon injuries</td>
<td>1.5 (0.0 to 4.0)</td>
<td>0.6 (0.0 to 3.6)</td>
<td>0.0 (0.0 to 15.8)</td>
</tr>
<tr>
<td>Ankle</td>
<td>16.2 (11.2 to 29.2)</td>
<td>9.5 (6.8 to 12.0)</td>
<td>46.9 (26.5 to 130.0)</td>
</tr>
<tr>
<td>Ligament injuries</td>
<td>11.0 (8.9 to 20.1)</td>
<td>9.0 (4.3 to 11.5)</td>
<td>38.1 (22.6 to 63.8)</td>
</tr>
<tr>
<td>Lateral ligaments</td>
<td>7.9 (4.3 to 13.1)</td>
<td>3.8 (2.2 to 6.9)</td>
<td>12.6 (4.5 to 52.3)</td>
</tr>
<tr>
<td>Foot/toe</td>
<td>9.0 (1.2 to 11.3)</td>
<td>7.2 (0.8 to 10.5)</td>
<td>3.2 (0.0 to 43.1)</td>
</tr>
</tbody>
</table>

Injury burden is defined as the number of days lost per 1000 hours.
days loss of approximately 9 months, which is higher than in the aforementioned study from Sweden (almost 7 months) and in a study from the same period of German women elite players (6 months).11 29 Given the high frequency of subsequent ACL injuries in women football players,29 30 ACL-reconstructed players would benefit from the currently recommended approach ‘better safe than quick’ with a minimum time of 9 months before medical clearance has been suggested to decrease subsequent knee injuries following ACL reconstruction.31 32

### Do concussions need particular attention?

Our study showed that a women’s elite team can expect one concussion every season on average. With a paucity of similar data on women football players, this finding is more than double the 0.4 concussions per team and season reported for male professional players.33 This comparison should, however, be interpreted with caution due to possible between-sex differences in reporting thresholds and the possibility of increased awareness of concussive symptoms. Nevertheless, more than one-quarter of concussed players returned to play within 6 days after injury, which is similar to the aforementioned study of male players,33 and also higher than the 2% found in a recent systematic review.9 The occurrence of gradual onset injuries (47%) was almost twice that reported in the recent study of the Irish Women’s National League (24%),34 and also higher than older studies which defined these injuries as overuse or chronic (16%–28%).8 11–14 The most plausible explanation is the aforementioned shift from, for example, contusions and ligament injuries to muscle injuries at the very top level. This shift in the injury landscape also likely explains that as many as 72% of all injuries were non-contact related, which is similar to the aforementioned study.

#### Perspectives on gradual onset and slight injuries

Importantly, slight injuries might be under-reported with a time-loss injury definition in youth or amateur football but should be negligible with the almost daily scheduled activities in women’s professional football at this level although some between-club differences in reporting seem to exist.

#### Research/policy implications

Previous literature on women’s football is scarce. Our study extends the knowledge and understanding of injury epidemiology among women’s elite football players and opens opportunities for further research. Our findings underline the importance of further research and implementation of preventive measures at all stakeholder levels for frequent injuries such as thigh muscle injuries, but also for injuries with high injury burden and possible negative long-term consequences such as ACL injury and concussion.
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CONCLUSION
This study shows that an elite women’s team squad can expect approximately 35 time-loss injuries per season with thigh muscle injury being most common and ACL injury most burdensome.

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