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Time-trends and circumstances surrounding ankle injuries in men's professional football: an 11-year follow-up of the UEFA Champions League injury study

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ABSTRACT

Background: Ankle injury is common in football, but the circumstances surrounding them are not well characterised.

Aim: To investigate the rates, especially time-trends, and circumstances of ankle injuries in male professional football.

Methods: 27 European clubs with 1743 players were followed prospectively between 2001/02 and 2011/12. Time loss injuries and individual player exposure during training sessions and matches were recorded. Injury rate was defined as the number of injuries/1000 h.

Results: A total of 1080 ankle injuries were recorded (13% of all injuries) with lateral ligament ankle sprain being the most common injury sub-type (51% of all ankle injuries). The rates of ankle injury and ankle sprain were 1.0/1000 h and 0.7/1000 h, respectively. The ankle sprain rate declined slightly over time during the 11-year study period (on average 3.1% per season) with a statistically significant seasonal trend ($p=0.041$). Foul play according to the referee was involved in 40% of the match-related ankle sprains. Syndesmotic sprains and ankle impingement were uncommon causes of time loss (3% each of all ankle injuries).

Conclusions: Lateral ligament ankle sprain constituted half of all ankle injuries in male professional football, whereas ankle impingement syndromes were uncommon. The ankle sprain rate decreased slightly over time, but many ankle sprains were associated with foul play. Our data extend the body of literature that provides football policy makers with a foundation to review existing rules and their enforcement.

INTRODUCTION

Ankle injuries account for 10-18% of all injuries in high-level football.¹⁻⁸ Sprains constitute between 51 and 81% of all ankle injuries in these studies, and more than three-quarter of the ankle sprains affect the lateral ligaments.^{2,4} Many ankle sprains occur as a result of player contact,⁹⁻¹¹ often with tackling and foul play involved,⁹⁻¹⁰ and a common football-specific injury mechanism with direct impact on the medial aspect of the lower leg by an opponent tackling before or at foot strike resulting in a forced inversion of the ankle joint has been described.¹⁰

The epidemiology of ankle sprains in football is fairly well described, but knowledge about other ankle injuries, such as fractures and impingement, on the overall injury burden and player availability is scarce. Previous studies suggest that the ankle sprain rate is lower nowadays than during the 1980s and 1990s,^{5,6,12-16} but long-term prospective studies that have investigated the development of ankle injuries over time are lacking. We investigated the rates, especially time-trends, and circumstances of ankle injuries in male professional football in Europe over eleven consecutive seasons.

MATERIALS AND METHODS

The current survey is a sub-study of a prospective cohort study evaluating male professional football in Europe in collaboration with the Union of European Football Associations (UEFA).⁸ A total of 27 clubs from ten countries with 1743 players (mean squad size 28 players were followed over a varying number of seasons from 2001 to 2012 (160 club-seasons and 4375 player-seasons included for analysis).¹⁷ The studied seasons were divided into pre-season (July and August) and competitive season (September to May). The study design adheres to the consensus statement on injury definitions and data collection procedures in football,¹⁸ and the general methodology has been reported elsewhere.¹⁹

Inclusion criteria and definitions

All players belonging to the first team squads each season were eligible for inclusion. Players who were transferred to other clubs or finished their contracts due to other reasons before the end of a season were included for as long as they participated. Injury was defined according to time loss (table 1), and players were considered injured until the club medical staff allowed full participation in training and availability for match selection.^{18,19} For the purpose of this study, the ankle (talocrural) region included the tibiotalar and the inferior tibiofibular joints as well as the surrounding stabilizing connective soft tissue (i.e. joint capsules and ligaments) of these joints, and the overlying skin. Achilles tendon pathology was classified as lower leg injuries,¹⁸ and, similarly, pathology of other tendons passing from the lower leg to the foot was classified by the study group as lower leg or foot injuries depending on the injury location. Ankle sprains were classified as capsular, lateral (anterior talofibular, calcaneofibular, and posterior talofibular ligaments), medial (deltoid ligament), and high

(tibiofibular syndesmosis). Re-injuries were defined according to the concept of early recurrences.¹⁸

Insert table 1 near here

Data collection

A member of the medical or coaching staff registered individual player exposure in minutes during all club (first team, second team or youth team) and national team training sessions and matches. All injuries were recorded immediately after the event by a club medical officer. Injury cards and attendance records were sent to the study group once a month. The injury card was slightly modified during the study period in that all injuries had to be classified as contact or non-contact injuries starting from the 2004/05 season and the minute of injury was recorded for all match injuries from the 2005/06 season. Each injury was coded according to a modified version of the Orchard Sports Injury Classification System (OSICS) 2.0.²⁰

Statistical analyses

Continuous data for anthropometrics were presented as mean with corresponding standard deviation (SD), and lay-off times were presented as both mean $\pm$ SD and median with corresponding interquartile range (IQR). Injury rate (IR) was calculated as the number of injuries per 1000 h with corresponding 95% confidence interval (CI). Injury burden was calculated as the number of lay-off days per 1000 h. IRs were compared using a rate ratio (RR) and significance tested with z-statistics.²¹ Seasonal trend for ankle injuries in general and ankle sprains, expressed as average annual percentage of change, was analysed using linear regression with log-transformed injury rates as dependent variable. A two year moving average (MA) approach, by summarising two consecutive seasons, was also used to smooth out large seasonal variation. Due to a skewed distribution, differences in lay-off times were

analysed using the Mann-Whitney U test for re-injuries and the Kruskal-Wallis test for ankle sprain categories. Injury occurrence between the six 15-minute periods of a match was analysed using the one-sample proportional z-test. All analyses were two-sided and the significance level was set at $p < 0.05$.

RESULTS

A total of 8029 injuries were recorded during 1 057 201 exposure hours (888 249 training and 168 952 match). There were 1080 ankle injuries (427 training and 653 match), thus constituting 13% of all injuries. The overall ankle IR was 1.0/1000 h (table 2), which means that a professional football club with a 28-player squad will suffer around 7 ankle injuries each season. Ankle sprain was the single most common injury type (table 2), constituting 68% of all ankle injuries and 9% of all injuries. The overall ankle sprain rate was 0.7/1000 h (table 2), and a professional 28-player squad will thus suffer an average of 4 to 5 ankle sprains each season. The moving average approach indicated an average annual IR decrease of 1.7% for ankle injuries in general, but the seasonal trend in the regression model was not significant ($R^2=0.12$, $b=-0.011$, 95% CI -0.034 to 0.012, $p=0.30$). Similarly, an average annual IR decrease of 3.1% for ankle sprains was indicated in the moving average approach (figure 1), with a statistically significant seasonal trend in the regression model ($R^2=0.39$, $b=-0.030$, 95% CI -0.059 to -0.002, $p=0.041$).

When comparing pre-season and competitive season (figure 2), there were no statistically significant differences in ankle IRs during training (0.51/1000 h vs. 0.48/1000 h, RR 1.06, 95% CI 0.84 to 1.34, $p=0.60$) or match play (4.13/1000 h vs. 3.81/1000 h, RR 1.08, 95% CI 0.88 to 1.33, $p=0.45$), nor in ankle sprain rates during training (0.34/1000 h vs. 0.33/1000 h, RR 1.05, 95% CI 0.79 to 1.38, $p=0.76$) or match play (2.86/1000 h vs. 2.53/1000 h, RR 1.13, 95% CI 0.87 to 1.45, $p=0.32$).

Insert figures 1 and 2 near here

Three-quarter of the sprains affected the lateral ligaments, whereas only 5% were high syndesmotic injuries (table 2). More sprains occurred to the dominant leg (542/729) and the

difference in IRs between the dominant and non-dominant ankles were statistically significant (0.51/1000 h vs. 0.18/1000 h, RR 2.90, 95% CI 2.45 to 3.42, $p<0.0001$). The IRs for the different sprain categories were between 3 and 10 times higher during match play compared to training (table 3).

Insert tables 2 and 3 near here

Second to joint and ligament injuries, contusions were most common and constituted approximately every sixth ankle injury, whereas only 18 fractures were reported (table 2). Ankle impingement syndromes were uncommon causes of time loss (table 2). The rate of posterior impingement was more than three-fold higher than anterior impingement (0.024/1000 h vs. 0.007/1000 h, RR 3.57, 95% CI 1.54 to 8.26, $p=0.003$). Most of the impingement syndromes affected the dominant ankle (5/7 in anterior and 16/25 in posterior).

Injury circumstances

From season 2004/05 and forward, 566 ankle sprains were classified according to contact or non-contact (6 cases missing), with more than half of them being the result of player contact (58%). Foul play (own or opponent) was involved in 40% of the match-related ankle sprains, but few of these fouls were sanctioned with a yellow or red card (5.8%). Additionally, the minute of injury was reported for 285 ankle sprains occurring during match play from season 2005/06 and forward (35 cases missing). Significantly fewer ankle sprains than expected occurred during the first 15 minutes of the first half (11.2% vs. 16.7%, $p=0.014$), whereas no significant differences were detected for the rest of the 15-minute periods (figure 3).

Insert figure 3 near here

Injury severity

In total, 13% of the ankle injuries were severe (table 4). Average lay-off per ankle injury was 16 ± 27 (median 8, IQR 15) days with the injury burden completely dominated by lateral ligament sprain (table 4). High ankle sprains had an average lay-off of 43 ± 33 (median 34, IQR 37) days and this was significantly longer than the other three ankle sprain categories ($p < 0.0001$). Finally, there were 3 avulsion fractures of the lateral malleolus causing lay-off between 6 and 15 days, whereas all other ankle fractures were severe with an average lay-off of 103 ± 45 (median 93, IQR 50) days.

Insert table 4 near here

Re-injuries

In total, 11% of all ankle injuries, and 10% of ankle sprains, were classified as re-injuries (table 2). No significant difference in average lay-off was seen between recurrent sprains and other sprains (15 ± 19 [median 9, IQR 13] vs. 15 ± 21 [median 8, IQR 15 days], $p = 0.87$).

DISCUSSION

The principal finding of this study was that 40% of the match-related ankle sprains occurred as a result of foul play. Other important findings were that almost every tenth football injury was an ankle sprain and that the ankle sprain rate showed a statistically significant decreasing trend over the 11-season study period. Finally, ankle impingement was an uncommon cause of time loss during the seasons studied, especially the anterior impingement.

Ankle injury epidemiology

In a large-scale review of 227 studies on 70 different sports (Fong et al., 2007),²² football was a high-risk sport for ankle injury, particularly ankle sprain. We found that 68% of all ankle injuries were sprains and this finding extends previous literature.¹⁻⁸ Historically, ankle sprain used to be the most common football injury and studies from male high-level football conducted during the 1980's and 1990's reported overall ankle sprain rates as 1.8/1000 h and 1.3/1000 h, respectively.^{12,13} In more recent studies conducted from 1999 and later, however, the ankle sprain rates has been considerably lower (0.5-0.8/1000 h).^{5,6,14-16} The overall ankle sprain rate in the current study was 0.7/1000 h, and it thus seems that the current ankle sprain rate is lower than historically attributed. Interestingly, there was a trend of a further decline over time with an average annual decrease in the ankle sprain rate of three per-cent.

The most plausible explanation to the lower ankle sprain rate nowadays and declining trend is successful implementation of strategies in the clubs such as balance board training and taping/bracing for preventing recurrent ankle sprains,²³⁻²⁶ although no such player data was collected in this study. Another contributing factor could be that more training now than

before is devoted to “low-risk” activities such as recovery sessions, resistance training and physical conditioning making overall ankle sprain rates lower.

Foul play was involved in 40% of the match play ankle sprains. This finding is in line with the results in a previous systematic video analysis study of Norwegian and Icelandic elite football where many ankle sprains were shown to result from late tackles, sometimes even intentional fouls, without penalty to the offending player.¹⁰ We therefore call for stricter enforcement of the existing rules or introduction of new rules such as timed suspensions to be able to prevent these frequent contact-related injuries that theoretically would be very difficult to prevent with balance training or ankle support.

Ankle sprain frequency at different stages of matches

In two studies on male professional and amateur football, ankle sprains were more frequent in the last thirds of both halves,^{4,11} without formal statistics, whereas no such trend was detected in the current study.

No worries for footballer’s ankle?

Although given increasing attention in recent years,^{27,28} anterior and posterior ankle impingement syndromes were quite infrequent in this study and constituted only 3% of all ankle injuries. Considering that anterior ankle impingement historically was called “footballer’s ankle”,^{29,30} the posterior impingement rate was, somewhat surprisingly, more than three-fold higher in the current study. The problem with ankle impingement is, however, most probably underestimated due to the use of a time loss injury definition,³¹ and players might be able to play despite their symptoms and are perhaps not referred to definitive treatment until the season is over. As only 4 of the 32 impingement injuries in the current

study were categorised as severe, most of them were obviously managed non-surgically in this setting.

Interestingly, almost two-thirds of the impingements occurred to the preferred kicking leg (dominant ankle) in the current study. It has previously been shown that a typical ankle injury mechanism in football is a forced plantar flexion where the injured player hit an opponent's foot when attempting to shoot or clear the ball, and this anterior capsular traction mechanism was suggested to contribute to the development of "footballer's ankle".¹⁰ However, since the anterior joint capsule attachments are more proximal and distal to the sites where the talotibial spurs originate, this theory has been questioned.³⁰ Noteworthy, a forced plantar flexion not only leads to an anterior traction force, but also to a forceful compression of the bony and soft tissues on the posterior part of the ankle.²⁷ Thus, the previously described injury mechanism for "footballer's ankle" could therefore be a more common cause of posterior ankle impingement. This notion is supported by the fact that posterior impingement was significantly more common in the current study than anterior impingement.

Injury severity

In total, 87% of the ankle sprains had a lay-off of less than 4 weeks, which is in line with a recent study from Swedish elite football where this figure was 83%.⁷ The mean lay-off per ankle sprain was, however, 15 days in the current study compared to only 8 days in that study. This apparent discrepancy could possibly reflect a "better safe than quick" treatment algorithm that is supported by the fact that the ankle sprain re-injury rate was low (10%).

Interestingly, almost two-thirds of the high ankle sprains were severe and these injuries were associated with a substantially longer lay-off than both lateral and medial ligament sprains.

The athletic literature in this field is scarce, but in a review of 1344 ankle sprains occurring in

West Point cadets only 10 high ankle sprains were identified, but, in line with the current study, these injuries required a considerably longer time to return to full activity compared to grade III lateral ligament sprains (mean 55 vs. 28 days).³²

Methodological considerations

The prospective design with rigorous data check-up and the 11-season study period to avoid the influence of occasional extreme seasons are some important strengths of the present study together with the large and homogenous sample of professional footballers. However, this study also has some important limitations. First, no treatment details were requested on the general injury card and, additionally, no sub-study specific injury card was sent to the clubs as for some of our previous sub-studies.^{33,34} It would have been interesting to collect surgical data for the ankle fractures and impingement syndromes, but it would probably be of minor value for ankle sprains since the need for ligament surgery in professional football has been shown to be minimal.⁴ Second, no information about the use of any preventive training such as balance board training and coach-directed limitation of player-contact during training sessions or the use of any protective equipment such as bracing and taping was recorded, and these aspects therefore need to be addressed in future studies. Third, only one diagnosis was recorded for each injury case in the database (the main diagnosis). In cases with multiple injuries sustained in the same event (e.g. a severe ankle ligament sprain with concomitant mild cartilage abnormalities on imaging), only the most significant injury is captured in the injury surveillance. Fourth, all tendon injuries were excluded from the definition of ankle injury, and it could be argued that for example posterior tibial and peroneal tendon injuries located posterior to the malleoli should be included among the ankle injuries. The exact location of the tendon pathology was, however, not requested on the injury card and tendon injuries were therefore excluded from the ankle injury definition. Fifth, the participating clubs

were not provided with any specific diagnostic or return to play criteria in our study manual and it is therefore possible that reported sub-classifications, lay-off times and re-injury rates varied between clubs due to different diagnostics and treatment algorithms. Sixth, no reliable history of previous injury was collected at player inclusion and it was therefore not possible to compare the ankle sprain rates between uninjured players and players with prior ankle sprain. It is, however, well-known that players with previous ankle sprain during the career or the preceding season have approximately 2-3 times higher rate of future ankle sprain.¹²⁻¹⁵ Finally, the design of the injury card during the first seasons of the study did not include information about the match minute of the injury and whether it resulted from contact or not.

Clinical and policy implications – call for action

In conclusion, lateral ligament ankle sprains constituted half of all ankle injuries in male professional football, whereas anterior and posterior ankle impingement syndromes were infrequent. The ankle sprain rate showed a statistically significant decreasing trend over the 11-season study period and although reasons for this cannot be ascertained from our study design, it is consistent with a decreasing trend for ligament injuries in general.¹⁷ Many match-related ankle sprains were, however, associated with foul play and this finding might warrant a discussion in the international governing bodies about stricter rule enforcement.

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Contributor statement

MW, MH and JE were responsible for the conception and design of the study. All authors have been involved in the data collection over the study period. MW and the statistical advisor conducted the analyses which were planned and checked with the co-authors. All authors contributed to the interpretation of findings and had full access to all data. MW wrote the first draft of the paper which was critically revised by MH and JE. The final manuscript has been approved by all authors. MW is the study guarantor.

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Competing interests

JE is the first vice chairman of the UEFA Medical Committee.

Ethics approval

The study design was approved by the UEFA Medical Committee and the UEFA Football Development Division.

Provenance and peer review

Not commissioned; externally reviewed.

WHAT ARE THE NEW FINDINGS?

- The ankle sprain rate in male professional football has decreased significantly over the past decade.
- Foul play was involved in more than half of the ankle sprains associated with player contact.
- Ankle impingement syndromes, especially the anterior “footballer’s ankle”, were uncommon causes of time loss.

HOW MIGHT IT IMPACT ON CLINICAL PRACTICE?

- Ankle sprains are common and constitute more than half of all ankle injuries in professional football. The decreasing trend in the ankle sprain rate since 2001/02 as shown in this study gives indirect evidence that injury prevention strategies have been successful. These findings might therefore serve as a motivator among players, coaches, medical practitioners and stakeholders for continuous preventive efforts in the sport.

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Table 1 Operational definitions used in study

Training session	Team training that involved physical activity under the supervision of the coaching staff
Match	Competitive or friendly match against another team
Injury	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 a full part in future football training or match play
Ankle injury	Injury to the tibiotalar and the inferior tibiofibular joints as well as the surrounding stabilizing connective soft tissue (i.e. joint capsules and ligaments) of these joints and the overlying skin
Slight/minimal injury	Injury causing 0–3 days lay-off
Mild injury	Injury causing 4–7 days lay-off
Moderate injury	Injury causing 8–28 days lay-off
Severe injury	Injury causing >28 days lay-off
Traumatic injury	Injury with sudden onset and known cause
Overuse injury	Injury with insidious onset and no known trauma
Re-injury	Injury of the same type and at the same site as an index injury occurring within two months after return to full participation from the index injury
Non-contact injury	Injury occurring without contact with another player or object.
Dominant leg	Preferred kicking leg
Foul play	Violation of the laws of the game according to the match referee
Injury rate	Number of injuries per 1000 player hours $[(\Sigma \text{injuries} / \Sigma \text{exposure hours}) \times 1000]$
Injury burden	Number of lay-off days per 1000 player hours $[(\Sigma \text{lay-off days} / \Sigma \text{exposure hours}) \times 1000]$

Table 2 Frequency, injury rate and injury recurrence of all ankle injury types in male professional football

	No. of injuries (%)	IR*	95% CI	No. of re-injuries (%)
Fracture and bone stress	22 (2.0)	0.021	0.014 to 0.032	1 (4.5)
Fractures	18 (1.7)	0.017	0.011 to 0.0027	1 (5.6)
Other bone stress	4 (0.4)	0.004	0.001 to 0.010	0
Joint and ligament	744 (68.9)	0.704	0.655 to 0.756	78 (10.5)
Dislocation/subluxation	3 (0.3)	0.003	0.001 to 0.009	0
Sprain/ligament injury	729 (67.5)	0.690	0.641 to 0.742	75 (10.3)
Capsular	67 (9.2)	0.063	0.050 to 0.081	5 (7.5)
Lateral	552 (75.7)	0.522	0.480 to 0.568	58 (10.5)
Medial	72 (9.9)	0.068	0.054 to 0.086	8 (11.1)
High	38 (5.2)	0.036	0.026 to 0.049	4 (10.5)
Cartilage lesion	12 (1.1)	0.011	0.006 to 0.020	3 (25.0)
Contusion	182 (16.9)	0.172	0.149 to 0.199	0
Laceration and skin lesion	10 (0.9)	0.010	0.005 to 0.018	1 (10.0)
Peripheral nervous system	2 (0.2)	0.002	0.001 to 0.008	0
Other	120 (11.1)	0.114	0.095 to 0.136	41 (34.2)
Synovitis	65 (6.0)	0.062	0.048 to 0.078	26 (40.0)
Impingement	32 (3.0)	0.030	0.021 to 0.043	4 (12.5)
Anterior	7 (0.6)	0.007	0.003 to 0.014	2 (28.6)
Posterior	25 (2.3)	0.024	0.016 to 0.035	2 (8.0)
Instability	7 (0.6)	0.007	0.003 to 0.014	3 (42.9)
Unspecified pain	12 (1.1)	0.011	0.006 to 0.020	3 (25.0)
Osteoarthritis	2 (0.2)	0.002	0.001 to 0.008	0
Sinus tarsi syndrome	2 (0.2)	0.002	0.001 to 0.008	1 (50.0)
Total	1080 (100)	1.022	0.962 to 1.084	121 (11.2)

CI, confidence interval; IR, Injury rate.

*Injury rate is expressed as the no. of injuries per 1000 h.

Table 3 Match and training injury rates for the most common ankle injury types in male professional football with corresponding rate ratios

	Match IR*	95% CI	Training IR*	95% CI	RR†	95% CI
All ankle injuries	3.865	3.580 to 4.173	0.481	0.437 to 0.529	8.04	7.12 to 9.08
Fractures	0.065	0.036 to 0.112	0.008	0.004 to 0.118	8.26	3.20 to 21.31
Sprain/ligament injury	2.581	2.350 to 2.835	0.330	0.294 to 0.370	7.82	6.75 to 9.07
Capsular	0.160	0.110 to 0.233	0.045	0.033 to 0.061	3.46	2.13 to 5.63
Lateral	2.024	1.821 to 2.251	0.236	0.207 to 0.271	8.56	7.21 to 10.17
Medial	0.249	0.184 to 0.336	0.034	0.024 to 0.048	7.36	4.61 to 11.58
High	0.148	0.100 to 0.219	0.015	0.009 to 0.025	10.11	5.17 to 19.73
Contusion	0.817	0.691 to 0.965	0.050	0.037 to 0.067	16.49	11.74 to 23.15
Synovitis	0.142	0.095 to 0.212	0.046	0.034 to 0.063	3.08	1.86 to 5.09
Impingement	0.095	0.058 to 0.155	0.018	0.011 to 0.029	5.26	2.63 to 10.51
Anterior	0.024	0.009 to 0.063	0.003	0.001 to 0.011	7.01	1.57 to 31.32
Posterior	0.071	0.040 to 0.125	0.015	0.009 to 0.025	4.85	2.21 to 10.64

CI, confidence interval; IR, injury rate.

*Injury rate is expressed as the no. of injuries per 1000 h.

†Rate ratio is expressed as the match injury rate divided by the training injury rate.

Table 4 Severity, lay-off and injury burden for the most common ankle injury types in male professional football

	0-3 days*	4-7 days*	8-28 days*	>28 days*	Mean lay-off†	SD	Median lay-off†	IQR	Injury burden‡
All ankle injuries	270	311	360	139	15.9	27.1	7	13	16.3
Fractures	0	0	3	15	89.6	52.0	87	70	1.5
Sprain/ligament injury	141	212	279	97	15.4	20.5	8	15	10.6
Capsular	29	27	9	2	7.3	13.3	4	3	0.5
Lateral	100	157	233	62	14.7	19.2	8	14	7.7
Medial	11	26	26	9	13.6	15.4	7	12	0.9
High	1	2	11	24	43.2	33.0	34	37	1.6
Contusion	84	61	33	4	6.2	10.3	4	5	1.1
Synovitis	22	17	20	6	16.0	39.6	7	11	1.0
Impingement	11	8	9	4	12.1	16.4	6.5	8	0.4
Anterior	1	1	3	2	24.0	24.7	11	41	0.2
Posterior	10	7	6	2	8.8	11.9	5	7	0.2

CI, confidence interval; IQR, interquartile range; SD, standard deviation.

*Injury severity is categorised according to lay-off days as slight/minimal (0-3), mild (4-7), moderate (8-28) and severe (>28).

†Lay-off is expressed in days.

‡Injury burden expressed as the number of lay-off days per 1000 h.

Figure 1 Injury rates for ankle sprain per season in male professional football. Injury rate is expressed as the number of injuries per 1000 h. The dark gray line shows the two-year moving average injury rate calculated as the sum of two consecutive seasons

Figure 2 Seasonal distribution of injury rates in male professional football. Injury rate is expressed as the number of injuries per 1000 h

Figure 3 Proportion of ankle sprains during the 15-minute periods of match play in male professional football