BMJ Open Sport & Exercise Medicine

Time-loss and recurrence rate of lateral ankle sprains in male professional football players depending on the severity grade: do we trivialise LAS?

Zacharias Flore ,[1,2] Karen Hambly,[1] Kyra De Coninck,[1] Götz Welsch[3,4]

To cite: Flore Z, Hambly K, De Coninck K, *et al*. Time-loss and recurrence rate of lateral ankle sprains in male professional football players depending on the severity grade: do we trivialise LAS? *BMJ Open Sport & Exercise Medicine* 2025;**11**:e002271. doi:10.1136/bmjsem-2024-002271

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjsem-2024-002271).

Accepted 6 January 2025

[1]School of Sport and Exercise Sciences, University of Kent, Canterbury, UK
[2]Hamburger SV Fußball AG, Hamburg, Germany
[3]UKE-Athleticum, University Medical Center Hamburg-Eppendorf, Hamburg, Germany
[4]Department of Trauma and Orthopaedic Surgery, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

Correspondence to
Zacharias Flore;
zf43@kent.ac.uk

ABSTRACT

Objectives Lateral ankle sprains (LAS) are among the most common injuries in professional football (soccer). Despite this, the severity and possible long-term consequences of LAS remain trivialised. This multicentre observational study in German elite football provides insights into time-loss and recurrence rates after LAS. Time-loss and recurrence rates are outcome measures vital for the future evaluation of rehabilitation protocols.

Methods 798 male football players representing 34 teams from 13 professional German football clubs participated in this study during the 2021–2022 season, followed by a 12-month follow-up period. Data collection and reporting were carried out in accordance with the UEFA recommendations for the standardised collection of data on football injuries. Time-loss, recurrence rate and standardised severity grades (I–III) after LAS were recorded for professionals, U23, U19 and U17, respectively.

Results A total of 187 ankle injuries were reported, with 115 out of the total being analysed. The overall time-loss was 29.89 days, with significant differences between youth elite players and professionals (32.96 vs 15.53 days lost; p<0.001). Professional players demonstrated the shortest time-loss in all LAS injury grades. Time-loss decreased with advancing age (R^2=0.03, F(1, 106)=3.16, p=0.078). Grade I LAS's time-loss differs significantly from grades II and III (p<0.001). A recurrent LAS was recorded in 34 players. The overall LAS recurrence rate was 25.6%.

Conclusion This study provides data on time-loss and recurrence, which serve as reference values for future evaluation of rehabilitation concepts after LAS in elite football players.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Lateral ankle sprain (LAS) is one of the most common injuries in professional football players, with short time-loss and a high recurrence rate.

WHAT THIS STUDY ADDS

⇒ There is a lack of homogeneous data reporting and availability of specific injury data after LAS in professional football. This is the first study to analyse the time-loss and recurrence rate of LAS in elite football across a range of age groups and to differentiate between different grades.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Data can serve to evaluate future rehabilitation concepts after LAS.

INTRODUCTION

Ankle injuries are prevalent in sports, particularly in football (soccer).[1–3] The ankle is the third most frequently injured area among professional football players, accounting for 10%–18% of all reported injuries, following knee and muscle injuries.[4–13] Among all forms of ankle injuries, ligament injuries account for the majority, ranging from 62% to 69%.[8 9 13] A small proportion of 5%–7% pertains to syndesmotic ligaments.[13–15] Notably, 75% (3 out of 4) of all ligament injuries affect the lateral ligament complex.[13] Despite their high prevalence (10%–18%) and incidence (0.7/1000 hour) in elite football, ligamentous ankle injuries continue to be trivialised.[13 16] Although a criteria-based approach to rehabilitation has been the gold standard for various types of injuries, such as anterior cruciate ligament (ACL) injuries, lateral ankle sprains (LAS) are still mainly treated based on time-based criteria and the clinician's experience.[17–19] There is a lack of criteria-based rehabilitation programmes for LAS patients up to the point of a completion test, despite the availability of some return-to-competition (RTC) criteria and completion test batteries.[19–21] To properly evaluate new rehabilitation concepts, it is crucial to establish standardised and clearly defined outcome measures. Objective parameters, such as time-loss and recurrence rate, can help objectively quantify and assess the effectiveness of these concepts. However, limited information on time-loss in different age groups and severity grades of ankle injuries in elite football players is available. This lack of specificity and differentiation among various severity grades

makes it difficult to compare studies. To improve the comparability of results, it is necessary to collect data in a standardised way, using clear definitions and consensus guidelines for epidemiological data collection.[22–25]

The main purpose of this observational study, conducted across multiple centres, is to gather data on the recovery time and recurrence rates after LAS in professional football players. The collected data could be used as a benchmark to evaluate future LAS treatment concepts. The second objective of this study is to differentiate the time-loss and recurrence rates based on the severity of the injury and the level of the player (elite youth vs licensed professionals). We have two hypotheses: First, professional players will experience shorter recovery periods, and second, injuries with lower severity grades will have higher recurrence rates due to being taken less seriously. In a future follow-up intervention study, a criteria-based rehabilitation algorithm will be evaluated using the reference values obtained from this study. The data from the intervention will be compared with the outcome parameters collected in this observational study to determine its effectiveness.

MATERIAL AND METHODS

Participants

Recruitment

The clubs were recruited through direct contact, written correspondence and email, with the medical team leaders presenting the study design in writing and personal visits. The observational study spanned one season (June 2021–June 2022) plus a subsequent 12-month follow-up period from June 2022 to June 2023.

Demographics

In total, 34 teams from 13 professional football clubs were included in this study, with 798 male professional players aged over 16 years (from U17 to professional level). The study incorporated teams from the first to the fourth division of the German Bundesliga. Additionally, the study includes one rehabilitation centre that serves as a medical partner to one of the professional football clubs (online supplemental SM 1). The diagnosis of ankle injuries was conducted by experienced team physicians using various diagnostic methods, including MRI, ultrasound and clinical evaluation.

Inclusion and exclusion criteria

Only participants with complete data sets of LAS injuries were included, which had information regarding time-loss, injury grade and recurrence. In addition, injuries were categorised as ‘recurrent’ even when the occurrence was before the commencement of this study. The inclusion and exclusion process is described in detail in a flow chart (online supplemental SM 2 and 7).

Patient and public involvement

Patients or the public were not involved in the research’s design, conduct or reporting.

Equity, diversity and inclusion statement

The author group is gender balanced and comprises mid-career and senior researchers from different disciplines (medicine, physiotherapy, sports science and research). Two members of the author group are from Germany and the UK, respectively. Two authors are medical staff members of German professional football clubs. Two authors are researchers at an English university. Our study population included German male elite football players aged over 16 years from different socioeconomic backgrounds. Participating in elite football academies ensures the best medical and rehabilitation settings comparable to those of adult professionals.

Study design

This is an observational cohort study. The findings of this study will inform a future larger multiphase, multicentre study that aims to evaluate a newly developed criteria-based rehabilitation approach after LAS in professional football players. The observational study presented here was designed to collect reference values to assess the efficacy of the concept in a future intervention study (online supplemental SM 3).

Data recording and reporting

Anonymous data concerning injury details (structure, diagnosis, setting, injury mechanism, protection, time-loss and recurrence) were transmitted monthly in an Excel file (Microsoft Excel, 2006: 16.0.4266.1001) by a designated individual responsible for data collection for the study. To ensure consistent data collection, we used presupplied manuals that included instructions, definitions and case examples (online supplemental SM 4).

Table 1 Anthropometric data

	Age (years)		Height (cm)		Weight (kg)	
Age category	Mean (SD)	MD	Mean (SD)	MD	Mean (SD)	MD
U17	16.03 (0.67)	16	176.86 (6.24)	177.5	66.88 (7.51)	66.4
U19	17.42 (0.71)	17	179.78 (6.9)	179.5	72.63 (6.0)	73
U23	21.58 (3.1)	21.5	183 (4.8)	182	75.71 (2.93)	75
Prof	23 (2.96)	22	179.89 (7.49)	181	75.59 (6.41)	76

MD, median.

Table 2 LAS injuries: number, time-loss and severity

Level	Grade I Time-loss (d) mean (SD)	I n	II Time-loss (d) mean (SD)	II n	III Time-loss (d) mean (SD)	III n	Time-loss weighted mean	Time-loss mean (SD)
Prof	5.25 (5.17)	12	22 (NA)	1	41.6 (26.24)	6	17.61	15.53 (21)
U23	19.6 (2.61)	5	32.5 (10.61)	2	77 (31.11)	3	39.4	33.80 (25.85)
U19	19.41 (14.06)	24	39 (23.5)	14	46.5 (19.67)	20	33.48	31.61 (22.01)
U17	13.13 (8.32)	8	43.25 (21.49)	10	57.5 (46.11)	10	39.73	35.11 (32.50)
Weighted mean	14.93		39.46		50.91		32.89	
Mean (SD)	14.74 (12.03)		39.18 (21.14)		50.52 (29.92)			Overall mean: 29.89
Total number	49		27		39			

For 16 cases: grade or age category not provided.
d, days; LAS, lateral ankle sprains; n, number.

Before the study began, the individuals responsible for data collection received training. The data collection process followed the UEFA guidelines for prospective data collection in planned injury studies in professional football.[23 24]

Definitions

Time-loss

Time-loss was determined as the period from the first day after injury until, and including, the last day of rehabilitation before the commencement of unrestricted team training.[23]

Recurrence

Recurrence was an injury occurring on the same side and involving the same structure. Injuries within the first 2 months after the initial injury were categorised as 'early recurrence', those between 2 and 12 months as 'late recurrence', and those occurring more than 12 months later as 'delayed recurrence'.[23]

Exacerbation

Exacerbation was defined as a delayed return to team training due to a subsequent ankle injury suffered during the rehabilitation phase, occurring immediately before the RTC or at the end of the absence from play. This new injury extended the rehabilitation duration and, given its timing (before the official RTC and during the rehabilitation phase), was categorised as an 'exacerbation' of the initial injury rather than a recurrence.[26]

Grading

We determined the severity of the injury using the grading system established by Rammelt *et al*.[27] Ligament sprains without macrostructural damage were defined as grade I, partial ruptures as grade II and complete ruptures as grade III injuries (online supplemental SM 5).

Statistical analysis

Time-loss

Time-loss, depending on the occurrence of recurrence, was calculated using the Wilcoxon signed rank test. The mean difference for time-loss depending on age category and time-loss depending on grade was globally tested with the Kruskal-Wallis test. Age category and grade (severity) dependent time-loss were analysed using pairwise Wilcoxon signed rank-sum tests with Bonferroni correction. Age-related time-loss trend analysis was calculated by performing linear regression.

Recurrence rate

The total number of ankle injuries and recurrence rates for specific age categories were calculated by division (%) and presented descriptively. Statistical correlation between grade (severity) or age category and recurrence rate was determined using χ^2 tests.

RESULTS

Number of clubs and teams

Clubs

In total, 13 professional football clubs and 1 rehabilitation centre participated in the observational study during the 2021–2022 season. Among these, 6 out of the 13 clubs were in the first division, and 5 clubs were in the second division of the German Bundesliga. One club played in the third and competed in the fourth league, respectively (online supplemental SM 1).

Teams

A total of 34 teams took part in the study. 11 of the 34 teams were under 17 and 19, respectively. Seven teams were under 23, while five were professional (online supplemental SM 1).

Demographic data (teams)

Anthropometric data of the 798 players included in this investigation are presented in table 1.

Injury data response rate

We collected 153 out of 156 monthly injury reports. Only two injury reports were incomplete, resulting in an overall response rate of 98%.

Table 3 Results (summary)

	Time-loss mean	SD	Range	95% CI	P value
Age category					
U17	35.11	32.5	(3, 130)	29.54 to 40.68	
U19	31.61	22.01	(0, 91)	27.84 to 35.38	
U23	33.8	25.85	(18, 99)	29.37 to 38.23	
Prof	15.53	21	(0, 81)	11.93 to 19.13	
Prof	15.53	21	(0, 81)	11.45 to 17.11	<0.001
Youth	32.96	25.89	(0, 130)	29.04 to 37.09	
Grade					
Grade 1	14.74	12.03	(0, 55)	12.68 to 16.80	*
Grade 2	39.18	21.14	(18, 91)	35.56 to 42.80	†
Grade 3	50.52	29.92	(5, 130)	45.40 to 55.64	‡
Rehabilitation (d)					
No recurrence	30.64	26.58	(0, 130)	26.09 to 35.19	<0.001
Recurrence	26.11	22.38	(0, 65)	22.28 to 29.94	
	Initial (n)	Recurrence (n)		Recurrence (%)	
Age category					
U17	34	7		20.59	
U19	64	21		32.81	
U23	13	2		15.38	
Prof	20	4		20.0	
Total	131	34		25.95	

*Grade I–II p<0.001.
†Grade I–III p<0.001.
‡Grade II–III n.s.
n.s, not significant.

Injuries (statistical analysis)

Data description

During the 2021–2022 season, 187 ankle injuries in 34 teams were reported. Detailed information is shown in tables 2 and 3.

Time-loss

The average overall time-loss for LAS in elite football players was 29.9 days. Significant variations were among different age groups and levels (table 2). Except for U23 players, who experienced an average time-loss of 33.8 days, time-loss tended to decrease with increasing age, as indicated by linear regression analysis, showing a decreasing trend (figures 1a and 2). Among the different age groups, professionals had the shortest overall time-loss, averaging 15.5 days. U17 players experienced 35.1 days of time-loss, and U19 players faced 31.6 days of time-loss due to LAS (table 2).

See table 2 for the average time-loss and time-loss for each LAS injury grade. The time-loss for grade I (14.7 days) differed significantly from grade II and III, with 39.2 and 50.5 days, respectively (p=0.001). The time-loss for grade II and grade III differed descriptively but not significantly (p=0.11) (figure 1b). The difference in time-loss between elite youth players (U17–U23) and professional players is highly significant (ANOVA (t(109)=–3,1; p=0.02; 95 CI –32,08, –7,04). The overall mean time-loss was 15.5 days (SD=21) for professionals and 32.9 days (SD=25.9) for youth elite players (figure 1c). Specifically, the time-loss of professionals differed significantly from that of U17 players (p=0.0138) and U19 players (p=0.007). Both the time-loss difference in professionals and U23 players (15.5 vs 33.8; p=0.06) and in between elite youth teams was not significant (figure 1a). LAS recurrence development was associated with significantly shorter time-loss compared with non-recurrence development with 26.1 (SD=22.38) and 30.6 (SD=26.6) days, respectively (W=13 578; p≤0.001) (figure 1d). There was a decreasing age-related trend for time-loss even if age did not significantly predict time-loss (R^2=0.3, F(1, 106)=3.16, p=0.078) (figures 1a and 2).

Recurrence rate

The overall recurrence rate of all ankle injuries was 23.52% (44 out of 187 ankle injuries). Out of 131 investigated for LAS, 34 recurrent LAS were included in the statistical analysis (online supplemental SM 2). The LAS recurrence rate was 25.95%.

Out of 39 recurring LAS cases, 19 of the initial injuries occurred before the start of the study in June 2021.

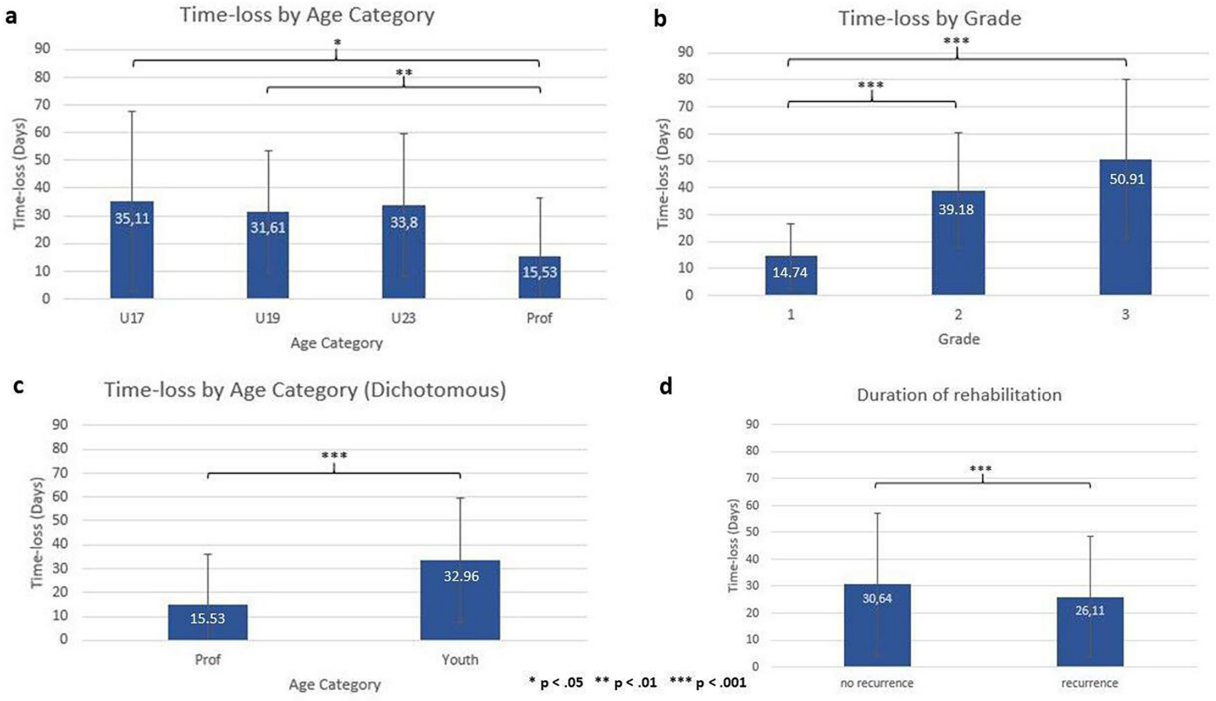

Figure 1 Results.

Five recurrences were excluded because they occurred more than 12 months ago ('delayed') and were treated as initial injuries for assessment. 17 recurring LAS cases occurred during the 12-month follow-up phase (online supplemental SM 2 and 6). Two of the data sets did not specify the time of occurrence. Grade information was provided for initial and recurrent LAS injuries in 26 LAS cases.

Severity of initial and recurrent injuries

Among 34 recurrent LAS injuries, 26 individuals (76.5%) reported their initial injury severity (grade). Since five

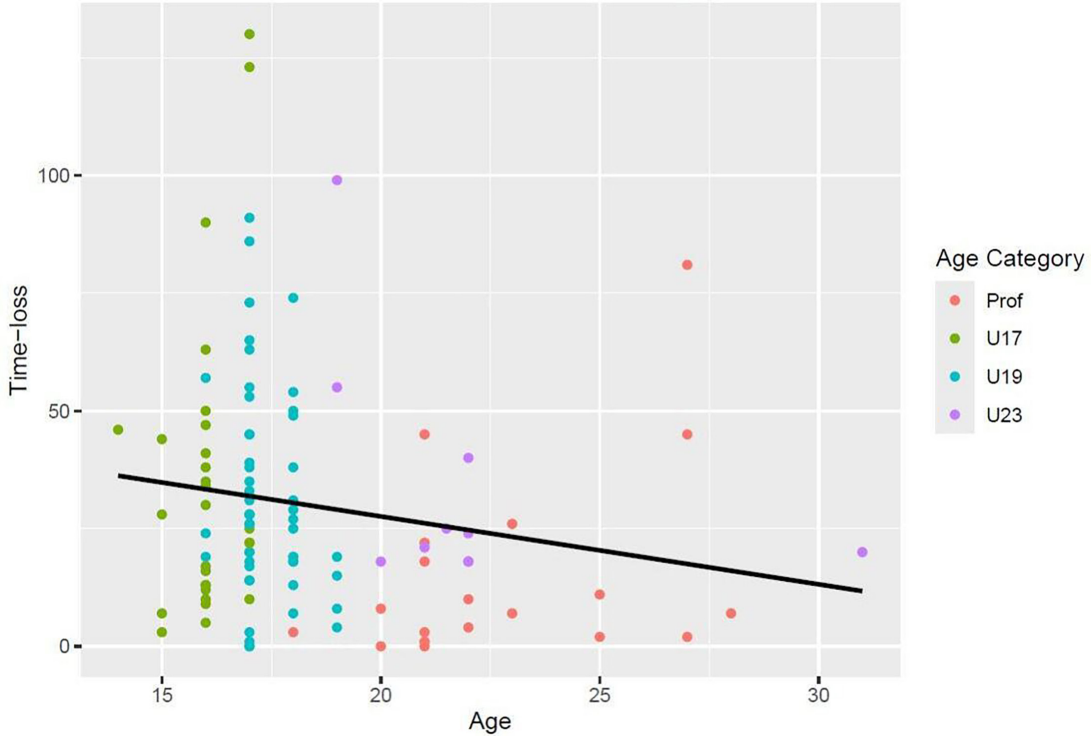

Figure 2 Linear regression.

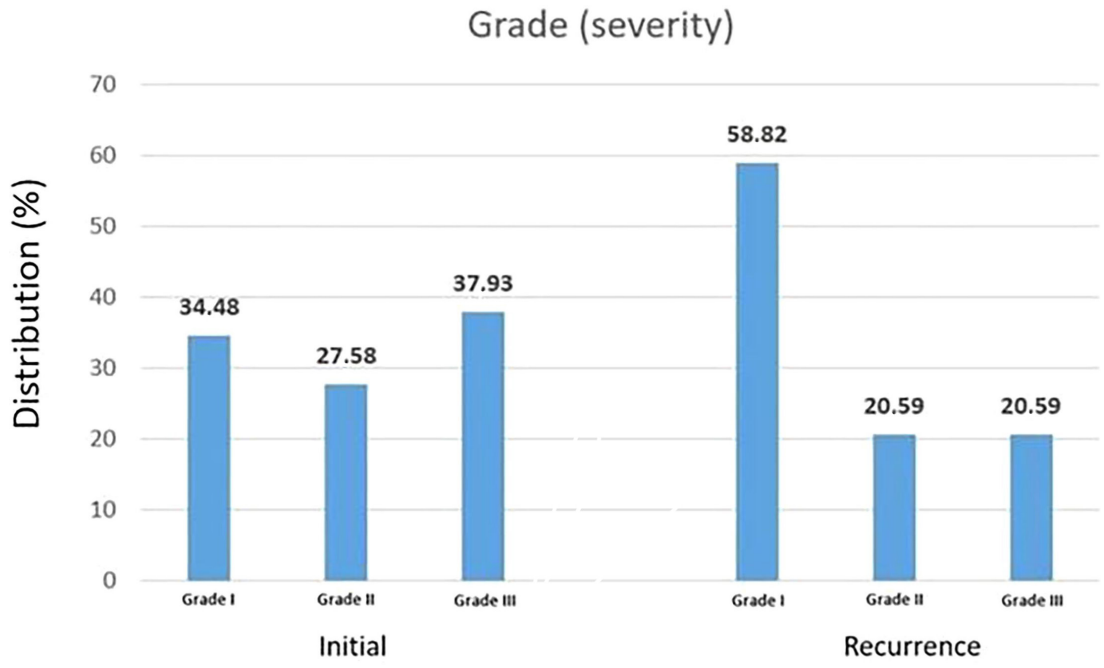

Figure 3 Distribution severity. Initial and recurrence.

recurrent 'delayed' injuries became 'initial' (online supplemental SM 7), only three out of these five reported their severity (online supplemental SM 4). In total, 29 initial injuries were analysed. Among these, 11 severity reports (37.9%) were classified as grade III, 8 as grade II (27.6%) and 10 as grade I (34.5%) (figure 3). The severity (in grades) was reported in all recurrent LAS injuries. Of the 34 LAS recurrent injuries, 7 (20.6%) were classified as grades II and III. In comparison, 20 out of 34 injuries (58.8%) were classified as grade I (figure 3). Of the total 44 recurrent ankle injuries, the grading of both the initial and recurrent injury was reported for 30 injuries (online supplemental SM 6).

Timing of recurrent injuries

Most recurrent LAS injuries occurred during the late stage of the follow-up phase (between 2 and 12 months) following the initial injury, with 21 out of 39 cases (53.8%). Six out of 39 cases (15.4%) were classified as delayed recurrences, and 7 out of 39 cases (17.9%) were early recurrences. In 5 out of 39 cases (12.8%), the timing of the recurrence was not reported.

Recurrence: occurrence by level of play

U19 players and professionals demonstrated the highest recurrence rate with 21 (32.8%) and 4 (20%) recurrent LAS, respectively. Lower recurrence rates were reported for U23 and U17 players, with 2 (15.4%) and 7 (20.6%), respectively.

Relationship between grade and recurrence

The grade of severity of both the initial and its recurrent LAS was reported in 26 out of 34 LAS. There is no relationship between grade and recurrence rate (χ^2 test=0.819, df=2, p=0.664).

Relationship between age category and recurrence

30 out of 34 recurrent LAS reported data of player age. 4 out of 20 professionals (20%); 2 out of 13 U23 players (15.4%); 21 out of 64 U19 (32.8%) and 7 out of 34 U17 players (17.6%) suffered from recurrence. There is no relationship between age category and recurrence (χ^2 test=2.687, df=3, p=0.443).

DISCUSSION

This is the first study to analyse LAS in elite football players across a range of age groups and levels and to differentiate between different grades (severity).

Reference to time-loss

The results of our study demonstrate an age-dependent correlation with time-loss, except for U23 players. The time-loss tends to decrease with increasing player level (age). While the overall time-loss for elite youth players is 33.47 days, it is notably shorter for adult professional players at 15.5 days. Professionals exhibit the shortest time-loss across all injury severity grades, with a mere 5.25 days for grade I injuries. This trend may be attributed, in part, to the higher external pressures experienced by professionals, both for athletes and the medical staff.[28 29]

Time-loss: physiological considerations of time-loss

From a purely physiological perspective, an average time-loss of 15.5 days after LAS falls below the necessary healing duration for ligament recovery.[30] In this context, time plays a crucial role in the healing and turnover

process for formative collagen synthesis.[31] Therefore, the time factor should not be disregarded, even when considering the meaningfulness of criteria-based rehabilitation concepts. Time-loss below the necessary duration for biological wound healing raises questions regarding the potential trivialisation of LAS injuries in elite football players, possibly due to external pressures from the manager, sports directors or the press. Physiologically, it would be reasonable to anticipate better healing capacities in younger players, resulting in shorter time-loss for youth players compared with adult professionals. An average time-loss of 15.5 days, even when considering immobilisation during the acute phase, raises doubts about the complete restoration of all the essential athletic skills required for competitive football during a structured and progressively designed end-stage rehabilitation (on-field). This may cause athletes to prematurely return to play or RTC. A premature return increases the risk of recurrence and the development of chronic ankle impairments. It may also increase the likelihood of another potential subsequent injury occurrence, as has already been described in ACL rehabilitation research.[32 33]

Recurrence

In this study, we also aimed to explore the potential relationship between the severity of LAS and their recurrence rate. Our initial hypothesis suggested that lower-grade LAS (grade I) might be associated with a higher recurrence rate due to its trivialisation and premature RTC without sufficient healing and restoration. We could not confirm this hypothesis, depending on the grade. However, we demonstrated that a shorter time-loss (recovery period) is associated with a significantly increased risk of recurrence (30.6 vs 26.1 days). This is one of our most important findings since this is the strongest argument against head coaches to premature return athletes to competition. Furthermore, we could demonstrate that low-grade LAS injuries also carry an increased risk of recurrence. Consequently, it is imperative to reconsider the perception of grade I LAS injuries and avoid trivialising them. A shorter time-loss (rehabilitation period) seems to increase the risk of a subsequent reinjury.

We found significant differences in time-loss between grade I and grade II/III LAS, whereas differences between grade II/III were not significant. This may be because grade I LAS are non-structural injuries, whereas grades II and III are partial or complete ruptures, each with structural damage.

There is a similar distribution regarding the severity of initial LAS occurrence. The distribution of severity for recurrent LAS varies, with grade I recurrent LAS being the most common type (58.8%). Players may use external protection or engage in specialised preventive training programmes after an initial LAS, which may help protect the player from sustaining a more severe injury. Using external protection and improving the understanding and implementation of secondary prevention training could explain the decreasing trend in recurrent LAS occurrences reported in the literature.[13]

We detected an interesting age-related difference in the occurrence of recurrent LAS: U19 players demonstrated the highest recurrence rate (32.8%), followed by professionals with 20%. Higher individual training intensity in professionals and U19 players may be reasonable for a higher LAS recurrence rate. Professionals compete in each training session for squad nomination, while U19 players compete for a professional player contract during their final academy year. In general, U23 players may train with lower intensity due to reduced motivation. Most of the U17 players are considered to be still 'youth' players, and their training focuses more on tactical and technical development. This is in line with previously reported English elite academy injury data. Read *et al* reported an increase in injury during growth/maturation phases both in U12 and U15 players and an increase in older players (U18), while U17 players suffered relatively less from injuries.[34 35]

A recently published systematic review with meta-analysis investigated the time-loss and recurrence rate after LAS in elite football players.[36] As an additional finding, the authors could not identify in this review whether the recurrences occurred early or late. However, most recurrent LAS in this study occurred during the late phase (2–12 months) after initial LAS in 53.8%. We found significantly different time-loss of LAS in individuals who developed a recurrent injury compared with their non-recurrent counterparts, with 26.1 and 30.6 days, respectively. This finding highlights the need for sufficient rehabilitation and recovery time. Similar results were previously reported for ankle sprain injuries in football players and track and field athletes.[13 37] However, Ekstrand *et al* found significantly longer absences in recurrent injuries compared with non-recurrent overall injuries.[38]

Comparison to systematic review findings on time-loss and recurrence

The results regarding the overall time-loss in professional football players after LAS are consistent with the findings of a recently published systematic review with meta-analysis.[36] Due to a lack of specificity in the existing literature, the review could not provide data on time-loss in different age categories and severity grades. For the first time, this study differentiates between various age categories and different severity grades after LAS in professional football players. The overall average time-loss after LAS in this study is 29.9 days, which, at first glance, appears to deviate from the findings of the systematic review (15.9 days). However, a large proportion of the LAS injuries in our current study relate to youth players with a significantly longer time-loss than professionals. Due to the limited publication of studies on time-loss after LAS in elite youth players, only a small number (47 out of 3346 participants) were included in the meta-analysis. As a result, the review primarily reports time-loss for adult

professional players. Considering this detailed analysis, this study's data (professionals 15.5 days) closely aligns with the literature's time-loss data (15.9 days). A similar level of proximity can be observed for the recurrence rate. The literature reports a recurrence rate of 17.1% after LAS in elite football players,[36] whereas this study found a recurrence rate of 25.6% after LAS in German professional football.

Data collection (for future studies included)

We collected the data for this study prospectively using a standardised recording procedure. The study design and data collection represent significant strengths of this research, as they follow the consensus guidelines for standardised data collection in prospective epidemiological injury studies in football.[23 24] A strength of this study is its specific focus on LAS and its differentiation between various severity grades of LAS in different age categories. In the literature, time-loss and recurrence rates of ankle injuries tend to be reported without including grades or the specific anatomical structures affected. We propose that grades and the affected anatomical structures should be included in future ankle injury epidemiological studies since these are relevant to clinicians and other stakeholders.

In addition to specifying the timing of recurrence (early, late and delayed), we also differentiated between recurrence and exacerbation, as recommended by Fuller *et al*.[26] A recurrence involves a repeated injury to the same structure after a clearly defined completion of a rehabilitation phase (eg, the end of medical leave) and after the resumption of full team training and competitive activities. Whereas an exacerbation occurs as a reinjury during an ongoing rehabilitation phase. These distinct categories can help explain prolonged rehabilitation durations due to a recurrent injury suffered during rehabilitation. These categories should be included in future epidemiological injury studies on recurrent injuries and time-loss.

The mechanisms of injury (contact, non-contact and indirect contact) were omitted from this study, as the focus was on time-loss and recurrence rates. Similarly, mechanisms of injury do not tend to be included in ankle injury epidemiological studies.

However, we recognise the importance of the mechanisms of injury in deciding whether an injury can be classified as a recurrent injury. Multiple direct contact injuries are unlikely due to intrinsic factors and should not be classified as recurrent. For example, improvements in proprioception are unlikely to prevent direct contact injuries such as direct impact and foul play. Whereas multiple indirect injuries should be classified as recurrent. Here, a focus on injury prevention may protect players from indirect injuries due to improvements in proprioception.

This does not necessarily mean that perfect motor control could prevent all indirect recurrent LAS. Nevertheless, it may indicate the importance of implementing prevention programmes.

This study on time-loss and recurrence rates of LAS in elite football players accomplished one of the key research aims by collecting vital reference data. These data are imperative for future evaluations of the effectiveness of new rehabilitation concepts.

Limitations of the study

The data were collected and reported by designated data collectors within the clubs. Despite intensive individual training and additional data collection guidance (manual), the possibility of bias in data collection cannot be entirely ruled out. When recording recurrent injuries, we deviated slightly from the original study protocol and included LAS that occurred before the start of the study. These data were thus retrospectively collected based on documentation in the medical databases of the clubs. Even though they were considered initial injuries from the study's perspective, they are viewed as recurrent injuries from the individual player's point of view. Consequently, we decided to classify them as recurrent LAS, even if the initial injury occurred before the official start of the study (online supplemental SM 6). In this case, we asked the data collectors to retrospectively assess the initial prestudy injury date and severity grade based on our definitions.

Clinical implications

The data from this investigation provide meaningful reference values to evaluate current and future (club internal applied) rehabilitation protocols after LAS in professional football players.

CONCLUSION

This study provides data on time-loss and recurrence rates after LAS in elite football players. The overall time-loss after LAS in elite football players was 29.9 days. There is a decreasing age-related trend. Adult professional players only demonstrated a time-loss of 15.5 days, similar to recent systematic review findings that raise the question of trivialisation. Time-loss between adult professionals (15.5 days) and elite youth players (33.4 days) differed significantly. The recurrence was significantly associated with the duration of rehabilitation (26.1 vs 30.6 days). The recurrence rate was 25.6%, with grade I (58.4%) as the most common type of recurrent LAS. The findings from this study on time-loss and recurrence rates after LAS in elite football players can serve as valuable outcome measures for evaluating rehabilitation protocols.

Acknowledgements The assistance of the participating clubs, players, and contact persons is greatly acknowledged.

Contributors ZF designed the study and wrote the manuscript. KH and KD reviewed and revised the draft. GW reviewed the manuscript. ZF is the study guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The study design was reviewed and approved by the Hamburg Medical Association ethics committee and was designed to collect reference values. The Ethics Board confirmed that no further ethics committee consultation was required since the authors would not collect primary data, and only secondary data provided by medical teams would be analysed.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

ORCID iD

Zacharias Flore http://orcid.org/0000-0001-9453-6516

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