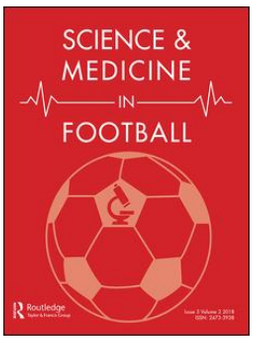

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Injury incidence and prevalence in Finnish top-level football – one-season prospective cohort study

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ABSTRACT

Ojective: To investigate the injury characteristics in Finnish male football players.
Design: One-season prospective epidemiological study. Data were collected via injury reports from the medical staff and directly from the players using the Olso Sports Trauma Research Center Health Questionnaire.
Participants: The first team squads of Finnish football league (n = 12 teams, 236 players).
Main outcome measurement: Injury incidence.
Results: A total of 541 injuries occurred during the exposure of 62 878 hours. Injury incidence per 1000 exposure hours was 8.6 (30.6 in matches and 3.4 in training). A player sustained on average 2.3 (median 2, range 0–13) injuries during the study. Thigh and ankle were the most commonly injured body parts for acute injuries and hip/groin were the most commonly injured body part for overuse injuries. The median absence time for all injuries was 12 (range 0–107) days, 12 (range 0–107) for acute, and 8 (range 0–61) for overuse injuries. Thigh injuries caused the greatest consequences in terms of absence from full participation (median 5 days, range 0–88).
Conclusion: Lower limb muscle injuries were the most prevalent injuries in the study. Collecting data directly from the players enabled to report more injuries compared to what was reported only by the medical staff.

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Accepted 10 April 2021

KEYWORDS
Football; soccer; epidemiology; muscle injury; injury incidence; injury prevention

Introduction

Football is the most popular sport in the world and the high injury rate in professional football players is well-known (Hawkins et al. 2001; Drawer and Fuller 2002; Jones et al. 2019). Epidemiological studies have been published from several football leagues around the world, with total injury incidence varying from 2.2 to 14.4 injuries/1000 exposure hours (Hägglund et al. 2005b; Ekstrand et al. 2011; Stubbe et al. 2015; Falese et al. 2016; Owoeye et al. 2017; Bayne et al. 2018). However, regional differences between football leagues exist and the number of severe injuries among different European elite football leagues vary (Orchard et al. 2013; Waldén et al. 2013)

Only one previous epidemiological study regarding injury incidence among Finnish football players has been published (Lüthje et al. 1996). This study was conducted during season 1993. During the past decades, major changes have occurred in high-level football in Finland. Athletes play the game faster and, depending the importance of the game, more aggressively than in the past (Andersen et al. 2004). The growing number of artificial turfs as primary playing surface, increasing professionalism, and increased number of total matches are factors that have influenced the development of Finnish football. Major improvements have occurred in the past 26 years also in terms of football medicine, injury diagnostics, and injury prevention (Naraghi and White 2016; Kaeding et al. 2017).

Data collection methods in recent epidemiological studies in different countries have followed the international consensus agreements on procedures for epidemiological studies in football (Hägglund et al. 2005a; Fuller et al. 2006) which was not utilized 26 years ago in the prospective study regarding Finnish football players (Lüthje et al. 1996). Also, the majority of the previous epidemiological studies (Hägglund et al. 2005b; Ekstrand et al. 2011; Falese et al. 2016; Jones et al. 2019) have used time-loss definition that consider only injuries that caused the player being unable to participate in sport and may therefore underestimate the total incidence of injuries (Clarsen et al. 2013). The main aim of the study was to prospectively investigate the incidence, location, and severity of injuries in elite male Finnish football players over one season.

Materials and methods

Study design

This investigation was a one-season prospective follow-up study. The study methods were selected according to the international guidelines for football injury research (Fuller

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et al. 2006) and prospective monitoring of injuries in elite athletes (Clarsen et al. 2014).

Recruitment of participants

All 12 teams of Veikkausliiga, top-level male football league in Finland, were invited to the study and all teams agreed to participate. Players (and their parent/guardian if the player was under 18-years-old) were informed of the initiation of the study in December 2018. Every player who was an official member of the participating team was eligible to be included in the study. Final participation was based on a written informed consent of each player. The study gained ethical approval from the Ethics Committee of Pirkanmaa Hospital District, Tampere, Finland in December 2018 (ETL-code R18187).

Data collection

Pre-season in Finnish football starts in January and the competitive season runs from April to November. Data collection was conducted between February and November 2019 (10-month follow-up). At the beginning of the study, each player was asked to complete a detailed questionnaire, which included basic demographic information as well as information on training and playing history and previous injuries (Pasanen et al. 2015).

The injury data were collected from two data sources. The primary source of data was standard injury reports from the team medical staff. In addition, the data was collected directly from the players using a weekly health questionnaire. All participating players were included in the standard reports, even if the player did not respond to the weekly questionnaire.

Registration of injuries using standard reports

A named member of the medical staff from each team was asked to report injuries using a standard injury report form. This report included information about the date of injury, whether the injury occurred during training or match play, the injury type, location, injury mechanism, diagnosis, and the date the player was able to return to play (Ekstrand et al. 2011). Reports were returned to the researchers via secured e-mail as soon as all the information was collected.

Registration of injuries using player reports

In addition to the standard injury reports, the data was also collected from the players by using an online survey software (QuestBack Oy, Espoo, Finland). Every Monday throughout the study, players received an automatic text message to their mobile phone containing a web link to the online survey, which led them to fill in a weekly questionnaire on injuries they had experienced during the previous week. The questionnaire included the updated version of the Oslo Sports Trauma Research Center Questionnaire on Health Problems (OSTRC-H2) (Clarsen et al. 2020), which was received directly from the OSTRC questionnaire developers. However, as the current study was conducted before the publication of the new improved reporting guidelines (Clarsen et al. 2020), the reporting in the current study follow the original OSTRC questionnaire protocol (Clarsen et al. 2014). Only injuries are reported in this article.

The weekly questionnaire included four key questions on the consequences of health problems on participation, modified training/competition, performance, and degree of perceived symptoms. If the player answered the minimum score for each of four questions, the questionnaire was finished for that week. If the player answered anything other than the minimum value for any question, the questionnaire continued by asking them to define whether the problem they referred to was an illness or an injury (Clarsen et al. 2014). If the player reported an injury, the body part affected, injury type, injury mechanism (non-contact or contact), mode of onset (acute or overuse), and if the injury occurred during a training or match were reported. Injuries that lead to moderate of major modifications in training or competition and/or reduced or complete inability to participate in sport were regarded as time-loss injuries (Clarsen et al. 2020). Injuries (n = 2) that were not related to participation in football were excluded. Finnish players filled the questionnaire in Finnish and foreign players in English. The Finnish questionnaire was a forward-backward translation of the OSTRC-H2 questionnaire. A reminder was sent to non-responders three days later. Every week, the project assistant compiled a report based on the questionnaire responses from the previous week and sent it to the named member of team medical staff.

Classification and severity of injuries

An injury was defined as any physical complaint sustained by a player during football training or match play, irrespective of the need for medical attention or time loss from soccer activities. (Fuller et al. 2006) Acute injury was defined as a result from a single, specific, and identifiable event, whereas overuse injury was defined as being caused by repeated micro trauma without a single, identifiable event responsible for the injury. Recurrent injury was defined as injury of the same type and at the same location as the index injury, which occurs after a player's return to full participation from the index injury (Fuller et al. 2006). Recurrent overuse injuries (of the same location and of the same nature) were reported as a single case despite periods of symptom remission.

The severity of injuries was based on medical staff reports. The severity of an injury was defined as the number of days missed from full participation in team training and playing: *slight* (0 day), *minimal* (1–3 days), *mild* (4–7 days), *moderate* (8–28 days), *severe* (>28 days) and *career-ending injury* (an injury causing the player to stop football playing totally or forcing player to play at a lower playing level) (Fuller et al. 2006). In addition, the consequences of injuries were reported by the players based on their responses to the OSTRC-H2 questions regarding modified training/competition and performance each week (Clarsen et al. 2014). *A substantial injury* was defined as any player-reported injury that lead to moderate or major modifications in training or competition and/or performance and/or complete inability to participate in sport.

Exposure calculation

Individual player exposure in training and matches was collected each week using the weekly questionnaire (QuestBack). In case of missing information, the data was supplemented with reports from medical staff or team websites.

Statistical methods

Descriptive statistics of baseline characteristics of the participants were reported by using mean, standard deviation and 95% CIs. Injury characteristics and injury incidence were analyzed by combining the data reported by the medical staff and self-reported data reported by the players. The injury incidence was expressed as the number of injuries per 1000 hours of training and playing and presented with 95% confidence intervals (CIs).

Average weekly injury prevalence was based on player reports and was calculated separately for acute and overuse injuries for each week that the project was conducted. This was done by dividing the number of players reporting the problem by the number of questionnaire respondents. Similarly, the prevalence of substantial injuries (those that lead to moderate or major modification in training or competition and/or sport performance and/or complete inability to participate in sport) was calculated for each week. All prevalence measures were reported as mean and 95% CIs. All statistical procedures were conducted using SPSS (version 24.; IBM Corp, Armonk, NY).

Results

Player characteristics

Altogether 236 players from 12 teams participated in the study. Of these, 33 players (14%) did not participate in the data collection using the weekly questionnaire. Hence, the injury and exposure data from these players was solely based on the reports of team medical staff. The mean age of the players was 24 (range 16–36) years, mean height was 182 (range 163–201) cm, and mean body mass was 78 (range 58–100) kg. Majority (81%) of participating players were born in Finland. During the follow-up, 22 players (9%) dropped out from the study due to expired contract or transfer to another club. Data from these players was included for the time they participated. The total exposure was 62 878 hours (56 251 hours of training and 6 627 hours of match play). Each team had 38 matches on average during the season (range 34–44) (Table 1).

Table 1. Match distribution between competitions (n).

Team	Finnish League	Finnish Cup	Europa League	Champions League	Friendly match	Relegation	Total
1	29	4	2	4	5	0	44
2	27	7	0	0	2	0	36
3	27	3	4	0	5	0	39
4	27	6	2	0	1	0	36
5	27	7	0	0	3	2	39
6	27	6	2	0	2	0	37
7	28	4	0	0	3	0	35
8	28	5	0	0	4	0	37
9	29	6	0	0	2	0	37
10	31	8	0	0	2	0	41
11	27	4	0	0	4	0	35
12	27	6	0	0	1	0	34
Total	**334**	**66**	**10**	**4**	**34**	**2**	**450**

Injury incidence

A total of 541 injuries occurred during the follow-up (median 2 injuries per player, range 0–13). Of all injuries, 178 (33%) were reported by the medical staff and 97 (18%) by the players and the medical staff. The rest of the injuries (n = 266, 49%) were reported only by the players using the weekly questionnaire. Majority of overuse injuries were reported by the players (only players n = 98; only medical staff n = 34; the players and the medical staff = 12), whereas acute injuries were reported more evenly between the players and the medical staff (only players n = 168; only medical staff n = 144; the players and the medical staff n = 85).

The combined injury incidence reported by the medical staff and players was 8.6 (95% CI 7.9–9.3) per 1 000 exposure hours. Majority (73%, n = 397) of all reported injuries were classified as acute injuries, whereas 27% (n = 144) were overuse injuries.

Of all reported injuries, 71% (n = 384) caused at least one-day absence from full participation, whereas 26% (n = 142) caused no time-loss. Time-loss injuries accounted for 91% (n = 249) in medical staff reports, whereas only 61% (n = 223) of player reported injuries caused time-loss. The combined incidence for time-loss injuries was 6.1 (95% CI 5.5–6.7) per 1000 exposure hours, 5.0 (95% CI 4.4–5.5) for acute and 1.1 (95% CI 0.9–1.4) for overuse injuries. Based on injuries reported by the medical staff only, time-loss injury incidence was 4.0 (95% CI 3.5–4.5), 2.9 (95% CI 2.5–3.4) for acute and 1.2 (95% CI 1.0–1.5) for overuse injuries. Of all acute injuries, medical staff reported time-loss injury incidence of 1.4 (95% CI 1.1–1.7) in training and 16.1 (95% CI 13.3–19.5) in matches. The information on time-loss was missing in 2% (n = 6) of acute, and in 6% (n = 9) of overuse injuries.

A total of 79% of the injuries were localized in the lower extremity. The most commonly injured body parts were thigh (20%), hip/groin (16%), and knee (13%) (Table 2). Of all thigh injuries, most of the injuries affected the hamstrings (65% of thigh injuries). Thirty-seven percent of acute injuries were caused by a direct contact whereas 47% of acute injuries were non-contact injuries. In 16% of the injuries, data for injury mechanism were missing. Recurrent injuries accounted for 14% of all injuries, 11% for acute and 23% for overuse injuries.

Injury severity reported by the medical staff

Based on the medical staff reports, the median absence time from full participation was 12 days, 12 (range 0–107) for acute and 8 (range 0–61) for overuse injuries. Thigh injuries caused the greatest absence time from full participation, 1 251 days altogether (mean 14 days, median 5, range 0–88) (Table 3). The single most severe injuries were gastrocnemius tendon tear (107 days), rectus femoris tendon tear (100 days), meniscus rupture (100 days) and 5th metatarsal fracture (99 days). No career-ending injuries were observed during the study.

Table 2. Injury incidence/1000 exposure hours (match, training, overuse, and total).

Body part	Reported: *	Acute injuries, incidence (n)		Overuse injuries, incidence (n)	All injuries, incidence (n)
		Match	Training		
Head and neck	**Medical staff**	**1.2 (8)**	**0.1 (6)**	-	**0.2 (14)**
	Players	**2.0 (13)**	**0.1 (3)**	**<0.1 (1)**	**0.3 (17)**
	Combined	**2.6 (17)**	**0.1 (7)**	**<0.1 (1)**	**0.4 (25)**
Head/face	Medical staff	1.2 (8)	0.1 (6)	-	0.2 (14)
	Players	1.8 (12)	0.1 (3)	-	0.2 (15)
	Combined	2.4 (16)	0.1 (7)	-	0.4 (23)
Neck/cervical spine	Medical staff	-	-	-	-
	Players	0.2 (1)	-	<0.1 (1)	<0.1 (2)
	Combined	0.2 (1)	-	<0.1 (1)	<0.1 (2)
Upper limb	**Medical staff**	**1.1 (7)**	**0.1 (5)**	-	**0.2 (12)**
	Players	**1.5 (10)**	**0.1 (7)**	**<0.1 (2)**	**0.3 (19)**
	Combined	**1.7 (11)**	**0.2 (10)**	**<0.1 (2)**	**0.4 (23)**
Shoulder/clavicle	Medical staff	0.2 (1)	<0.1 (1)	-	<0.1 (2)
	Players	0.5 (3)	0.1 (3)	<0.1 (1)	0.1 (7)
	Combined	0.5 (3)	0.1 (4)	<0.1 (1)	0.1 (8)
Upper arm	Medical staff	0.2 (1)	-	-	<0.1 (1)
	Players	0.2 (1)	-	-	<0.1 (1)
	Combined	0.2 (1)	-	-	<0.1 (1)
Elbow	Medical staff	0.2 (1)	-	-	<0.1 (1)
	Players	0.3 (2)	-	-	<0.1 (2)
	Combined	0.3 (2)	-	-	<0.1 (2)
Wrist	Medical staff	-	<0.1 (1)	-	<0.1 (1)
	Players	-	<0.1 (1)	-	<0.1 (1)
	Combined	-	<0.1 (1)	-	<0.1 (1)
Hand/finger/thumb	Medical staff	0.6 (4)	0.1 (3)	-	0.1 (7)
	Players	0.6 (4)	0.1 (3)	<0.1 (1)	0.1 (8)
	Combined	0.8 (5)	0.1 (5)	<0.1 (1)	0.2 (11)
Trunk	**Medical staff**	**2.0 (13)**	**0.2 (10)**	**0.1 (9)**	**0.5 (32)**
	Players	**0.8 (5)**	**0.3 (18)**	**0.3 (20)**	**0.7 (43)**
	Combined	**2.1 (14)**	**0.4 (25)**	**0.4 (26)**	**1.0 (65)**
Sternum/ribs/upper back	Medical staff	0.6 (4)	<0.1 (1)	<0.1 (1)	0.1 (6)
	Players	0.3 (2)	0.1 (3)	<0.1 (1)	0.1 (6)
	Combined	0.8 (5)	0.1 (4)	<0.1 (2)	0.2 (11)
Abdomen	Medical staff	0.5 (3)	<0.1 (1)	-	0.1 (4)
	Players	0.2 (1)	<0.1 (2)	<0.1 (2)	0.1 (5)
	Combined	0.5 (3)	<0.1 (2)	<0.1 (2)	0.1 (7)
Lower back/pelvis/sacrum	Medical staff	0.9 (6)	0.1 (8)	0.1 (8)	0.3 (22)
	Players	0.3 (2)	0.2 (13)	0.3 (17)	0.5 (32)
	Combined	1.2 (8)	0.3 (17)	0.3 (22)	0.7 (47)
Lower limb	**Medical staff**	**14.9 (99)**	**1.4 (81)**	**0.6 (37)**	**3.5 (217)**
	Players	**14.6 (97)**	**1.8 (100)**	**1.4 (87)**	**4.5 (284)**
	Combined	**24.3 (161)**	**2.7 (152)**	**1.8 (115)**	**6.8 (428)**
Hip/groin	Medical staff	2.4 (16)	0.3 (16)	0.1 (6)	0.6 (38)
	Players	2.3 (15)	0.4 (20)	0.5 (30)	1.0 (65)
	Combined	3.8 (25)	0.5 (30)	0.5 (34)	1.4 (89)
Thigh	Medical staff	5.6 (37)	0.3 (18)	0.1 (7)	1.0 (62)
	Players	4.1 (27)	0.5 (28)	0.3 (16)	1.1 (71)
	Combined	7.8 (52)	0.7 (37)	0.3 (21)	1.7 (110)
Knee	Medical staff	1.8 (12)	0.2 (13)	0.2 (10)	0.6 (35)
	Players	2.0 (13)	0.3 (15)	0.2 (15)	0.7 (43)
	Combined	3.2 (21)	0.4 (25)	0.4 (23)	1.1 (69)
Lower leg/Achilles tendon	Medical staff	1.7 (11)	0.2 (10)	0.1 (8)	0.5 (29)
	Players	2.0 (13)	0.2 (9)	0.3 (17)	0.6 (39)
	Combined	3.2 (21)	0.3 (16)	0.4 (23)	1.0 (60)
Ankle	Medical staff	2.7 (18)	0.2 (12)	<0.1 (1)	0.5 (31)
	Players	3.3 (22)	0.3 (17)	0.1 (4)	0.7 (43)
	Combined	4.8 (32)	0.5 (26)	0.1 (4)	1.0 (62)
Foot/toe	Medical staff	0.8 (5)	0.2 (12)	0.1 (5)	0.3 (22)
	Players	1.1 (7)	0.2 (11)	0.1 (5)	0.4 (23)
	Combined	1.5 (10)	0.3 (18)	0.2 (10)	0.6 (38)
Total	**Medical staff**	**19.2 (127)**	**1.8 (102)**	**0.7 (46)**	**4.4 (275)**
	Players	**18.9 (125)**	**2.3 (128)**	**1.7 (110)**	**5.8 (363)**
	Combined	**30.6 (203)**	**3.4 (194)**	**2.3 (144)**	**8.6 (541)**

*_Medical staff_ reported injuries using a standard report form and _players_ reported injuries using the OSTRC-H questionnaire. _Combined_ injuries include all injuries excluding duplicates.

Self-reported injury prevalence

Altogether 203 players participated in the weekly questionnaire. The average response rate for the weekly questionnaire was 48%. Based on the players reports, the average weekly prevalence for all injuries was 21% (6% for overuse injuries and 16% for acute injuries). The average weekly prevalence of substantial acute and overuse injuries was 10% and 2%, respectively.

Table 3. Injury severity/1000 exposure hours (reported by the medical staff).

Injury severity	Acute injuries, n (%)	Overuse injuries, n (%)
Slight (0 days)	7 (3%)	4 (9%)
Minimal (1–3 days)	22 (10%)	6 (13%)
Mild (4–7 days)	47 (21%)	7 (15%)
Moderate (8–28 days)	91 (40%)	16 (35%)
Severe (>28 days)	54 (24%)	4 (9%)

* In 3% (n = 8) of acute injuries and in 20% (n = 9) of overuse injuries the absence time was not reported.

Discussion

This was the first study in 26 years to report the incidence and prevalence of injuries in Finnish top-level male football players. The principal finding of this study was that the injury risk remains high in Finnish elite football players. Thigh and hip/groin injuries accounted together more than one-third (37%) of all injuries. Furthermore, this study showed that overuse injury incidence is higher than what has been previously reported in Finnish football players.

The overall injury incidence in the current study was relatively high compared to what has been reported in recent studies (2.2 to 9.1/1 000 exposure hours) (Ekstrand et al. 2011; Stubbe et al. 2015; Bayne et al. 2018; Jones et al. 2019). However, considerably higher injury incidence has been reported earlier in Danish football players (14.4/1 000 exposure hours) (Hägglund et al. 2005b). The incidence of acute injuries was nearly ninefold higher in matches than in training. High injury risk during matches has been recognized in earlier studies (Hägglund et al. 2005b; Ekstrand et al. 2011; Stubbe et al. 2015; Jones et al. 2019). Wide variety of the match injury incidences may be explained by the match periodization and the total duration of the season in different countries. Muscle injury rates, for example, seem to increase with fewer days between matches (Bengtsson et al., 2018; Bengtsson et al. 2013). However, in the current study, teams that participated in UEFA Champions League or Europa League qualifications and therefore had more games in total did not have more muscle injuries compared to those who only competed in the Finnish football league.

The most injured body parts in our study were thigh (1.7/1000 h), hip/groin (1.6/1000 h) and knee (1.1/1000 h). The UEFA injury study (Ekstrand et al. 2011) followed the same elite football teams for seven consecutive seasons in 2001 to 2008. They reported the highest incidence for thigh (1.9/1000 h), knee (1.4/1000 h), ankle (1.1/1000 h) and hip/groin (1.1/1000 h) injuries. The current study found similarities in injury distribution within these body parts. However, the incidence for hip and groin injuries in our study was higher (1.4 vs 0.1–1.1) to what has been reported in previous epidemiological studies (Werner et al. 2009; Ekstrand et al. 2011; Stubbe et al. 2015; Bayne et al. 2018; Jones et al. 2019). According to our results, a squad of 25 players can expect approximately 9 hip/groin injuries per season. Groin injuries are a major problem in football as they often cause prolonged symptoms and have high recurrence (Werner et al. 2009; Waldén et al. 2015; Harøy et al. 2019). Copenhagen adductor exercise has shown to have significant reduction in groin injury rates (Harøy et al. 2019) and the implementation of this exercise is recommended as a part of preventive strategies for Finnish elite football teams.

Overuse injury incidence has varied in previous studies and in different football leagues. In our study we found an overuse injury incidence of 2.3 per 1000 exposure hours, which is similar to what the UEFA Injury Study (Ekstrand et al. 2011) reported (2.2/1000 hours). In the Netherlands, the overuse injury incidence was only 0.5 injuries per 1000 exposure hours (Stubbe et al. 2015), whereas higher incidences have been reported in Sweden (3.1/1000 hours), Denmark (5.6/1000 hours), and England (3.4/1000 hours) (Hägglund et al. 2005b; Jones et al. 2019). Groin, knee and lower leg were the most frequently affected body parts in Sweden and Denmark (Hägglund et al. 2005b) and also in the current study. The injury definition as well as data collection methods in our study are different from the aforementioned studies, as all of them used time-loss injury definition and collected data from the medical staff only. We used injury definition based on all physical complaints and utilized self-reporting from the players, which presumably detects more overuse injuries than traditional methods (Clarsen et al. 2013). Hence, the differences in data collection does not explain the relatively low incidence of overuse injuries in Finnish players compared with investigations from Sweden, Denmark and England. These findings suggest that there are regional differences in football leagues such as level of professionality, duration of season, amount of training and matches, which are related to injury risk. It is noteworthy, that in our study, we would have missed altogether 98 overuse injuries leading to overuse injury incidence of only 0.7/1000 exposure hours if the data collection would have been solely based on standard reports from the medical staff.

Average response rate to the weekly questionnaire (48%) was less that what has been reported in previous studies using OSTRC questionnaires (Clarsen et al. 2014; Harøy et al. 2019; Leppänen et al. 2019; Wörner et al. 2019). However, to our knowledge, no previous studies have used this method in professional football players. The response rate during the first 10 weeks was 73% and during the last 10 weeks 26%. Fourteen percent of players refused using the weekly questionnaire and many players gave up reporting after the beginning of the season which negatively affected the response rate. Four out of twelve participating teams had their own injury surveillance questionnaires and motivating players to fill in two overlapping questionnaires might have been a barrier. At the time of our data collection, new guidelines for improved reporting of the OSTRC questionnaires were not published and hence, we used the original guidelines. The improved reporting has suggested to reduce unnecessary responder burden by ensuring athletes only receive questions relevant to their current health state (Clarsen et al. 2020), which might positively affect the response rate in the future studies.

Despite the relatively low response rate, the weekly player reports revealed more injuries compared to standard injury report form filled by team physiotherapists, which may indicate that the medical team was not aware of all health problems affecting the player performance. However, altogether 18 completed player reports claimed no injury in the past week, while the medical-staff report claimed that the player was actually injured. Majority of these injuries that players did not report were acute injuries (n = 16) and caused at least one day time-loss from full participation (n = 15). This demonstrates that the

reliability of completed player reports was not flawless. Medical staff reports may be suitable for data collection in highly elite level where the players are followed closely in their everyday practice, while the player reports may provide more complete injury data in semi-elite or amateur setting where teams often do not have full-time medical staff.

When comparing the current study to the previous prospective study conducted in Finnish football players nearly three decades ago (Lüthje et al. 1996), several potential changes in injury profile can be seen. Majority (52%) of injuries in the previous investigation (Lüthje et al. 1996) were caused by collision or tackling whereas in the current study only 37% of acute injuries were caused by a direct contact. In 1993 (Lüthje et al. 1996), 72% of injuries occurred during match, when in our study only half (51%) of acute injuries were sustained during a match. In addition, total injury incidence in the current study was higher (3.5 vs 1.5 in training, 30.8 vs 16.6 in matches, respectively) to what was reported in Lüthje et al. (Lüthje et al. 1996). However, differences can partly be explained by the differences in data collection methods and hence the results are not directly comparable.

The obvious strength of this study is the data collection from two different sources. In addition to standard report from medical staff, we collected injuries also directly from the players. Also, the exposure data collected from the player, was confirmed from the medical staff as well as official reports found on websites. A limitation of this study is a poor response rate to the weekly questionnaire. Although we believe that the injury data is fairly well covered due to reports received from the medical staff, it is possible that we still failed to register all injuries, especially overuse injuries. However, previous epidemiological studies (Hägglund et al. 2005b; Ekstrand et al. 2011; Stubbe et al. 2015; Bayne et al. 2018; Jones et al. 2019) have all collected data from medical staff only which was also primarily used in the current study.

In conclusion, this was the first study in nearly three decades to report incidence and prevalence of injury in Finnish top-level male football players. Our findings suggest that lower limb muscle injuries remain as a major concern for top-level football players.

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