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REGIONAL DIFFERENCES IN INJURY INCIDENCE IN EUROPEAN PROFESSIONAL FOOTBALL

Running head:

Regional differences in professional football

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ABSTRACT

The objective of this study was to investigate regional differences in injury incidence in men's professional football in Europe. A nine-season prospective cohort study was carried out between 2001/02 and 2009/10 involving 1357 players in 25 teams from nine countries. Teams were categorized into different regions according to the Köppen-Geiger Climate Classification System. Teams from the northern parts of Europe (n=20) had higher incidences of injury overall (rate ratio 1.12, 95% CI 1.06 to 1.20), training injury (rate ratio 1.16, 95% CI 1.05 to 1.27), and severe injury (rate ratio 1.29, 95% CI 1.10 to 1.52), all statistically significant, compared to teams from more southern parts (n=5). In contrast, the anterior cruciate ligament injury incidence was lower in the northern European teams with a statistically significant difference (rate ratio 0.43, 95% CI 0.25 to 0.77), especially for non-contact anterior cruciate ligament injury (rate ratio 0.19, 95% CI 0.09 to 0.39). In conclusion, this study suggests that there are regional differences in injury incidence of European professional football. However, further studies are needed to identify the underlying causes.

INTRODUCTION

Injury risk factors in sports have traditionally been divided into two main categories: intrinsic (individual) and extrinsic (environmental) factors (Bahr & Holme, 2003; Murphy et al., 2003). Examples of intrinsic risk factors are sex, player age, previous injury, strength, flexibility and anatomical alignments, whereas extrinsic risk factors comprise playing level, weather condition, playing surface, footwear, use of brace or other equipment etc. Historically, most studies have focused on the influence of different intrinsic risk factors on the injury risk, many of them non-modifiable (Bahr & Holme, 2003; Alentorn-Geli, 2009). Weather condition is an example of an extrinsic risk factor that has been only scarcely investigated in the literature and the few existing studies come from American or Australian Rules football (Orchard et al., 1999; Orchard & Powell, 2003). In football (soccer), it has previously been shown that female amateur teams from northern Sweden have a higher injury incidence during match play than teams from southern Sweden (Jacobson & Tegner, 2006), and that the male first leagues in Denmark and Sweden differ regarding both training and severe injury incidence (Häggglund et al., 2005a). Moreover, preliminary findings from our study group indicated that clubs from the northern parts of Western Europe have a higher incidence of match injury and severe injury compared to clubs from more southern countries located near the Mediterranean Sea, but sub-group analyses of specific injuries was not possible due to the limited sample (Waldén et al., 2005).

The objective of this study was to investigate regional differences in injury incidence in men's professional football in Europe. Our hypothesis was that the injury incidence is lower for teams coming from southern Europe based on our previous observations (Waldén et al., 2005).

METHODS

A prospective cohort study has been carried out on men's professional football in collaboration with the Union of European Football Associations (UEFA) since 2001. The injury characteristics for this cohort have previously been published for both the first season and the six subsequent ones (Waldén et al., 2005; Ekstrand et al., 2010). Additionally, the full methodology has been reported in detail previously (Häggglund et al., 2005b), and is only briefly summarized below.

Participants

A total of 26 top-level professional European football clubs were followed over a varying number of seasons from 2001/2002 to 2009/2010. All clubs play on natural grass at their home venues. All players belonging to the first team squads each season were invited to participate in the study. Players injured before exposure data was collected were included, but their present injuries were not taken into account. 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.

Data collection

A member of the medical or coaching staff registered individual exposure in minutes during all club and national team training sessions and matches. All time-loss injuries were recorded immediately after the event by a club medical officer. Injury cards and exposure records were sent to the study group monthly. All injuries were followed until return to football, except for career-ending injuries, even if the player was transferred during the injury period.

Definitions

The operational definitions used in this study are summarized in Table 1. Injury was defined as any

physical complaint sustained by a player that results from a football training or match and leads to the player being unable to participate in future football training or match play (Hägglund et al., 2005b; Fuller et al., 2006). A player was considered injured until the club medical officer allowed full participation in all types of training or match play (Hägglund et al., 2005b). Foul play was determined according to the decision of the referee for match injuries. Non-contact injury was defined as an injury resulting without player contact.

Insert Table 1 near here

Classification of regions

Because this study aimed for a more formal comparison between zones, the different regions in Europe were categorized according to climate type using the updated Köppen-Geiger Climate Classification System (Kottek et al., 2006). This system is divided in five different climate types (A-E) based on the average monthly temperature and precipitation. Each main category is further divided into several sub-types by adding two lower case letters: the first letter considers the precipitation and the second letter the air temperature. In Europe, the dominating climate types are Mediterranean (Csa and Csb) with warm/hot and dry summer together with wet winter, Humid Subtropical (Cfa) with hot humid summer and cool winter, Marine West Coast (Cfb) with warm summer, but no dry season, Humid Continental (Dfb) with warm summer and severe winter without any dry season, and Subarctic (Dfc) with cool summer and a severe and dry winter. Briefly, the Mediterranean climate type is found in Portugal, Spain, most of Italy, southern coastal Croatia, Greece and the southern parts of France while the Marine West Coast climate type is represented by the rest of France (except the Alps), Great Britain, Belgium, the Netherlands, Germany, the Czech Republic, Austria, Hungary, Denmark, southern Sweden and western Poland.

The Humid Subtropical climate type covers less of Europe and is typically found in northern Italy, the coastal parts of Slovenia and northern Croatia as well as the Black Sea coast of Bulgaria, Romania, Russia and Ukraine. The Humid Continental climate dominates in Eastern Europe, thus including for example the rest of the southwestern parts of Russia, Romania and Ukraine, but also the eastern brim of Poland, Slovakia, Belarus, and the three Baltic countries. Finally, the Subarctic climate is found in northern Sweden, Finland, most of Norway, and the northwest parts of Russia.

Ethics

Written informed consent was collected from each player. The study design was approved by the UEFA Medical Committee and the UEFA Football Development Division.

Statistical analyses

The categorization of the teams into the different climate types was done by two of the authors (MW and MH) based on the Köppen-Geiger map (Kottek et al., 2006). One team (FC Shaktar Donetsk from Ukraine) has participated for three seasons since 2007/08, but was excluded from the present climate analyses since it was the only team representing the Dfb climate type (Table 2). The clubs were divided in two groups: one “Northern” group representing teams with Cfa and Cfb climate types (n=20, 90 team-seasons) and one “Southern” group representing teams with Csa and Csb climate types (n=5, 27 team-seasons). Exposure data were plotted in histograms and distributions of data were determined by visual inspection. Since the exposure data were approximately normally distributed, mean values are presented with corresponding standard deviation (SD) and the Student’s t-test was used for between-group comparisons. Injury incidence is expressed as the number of injuries per 1000 exposure hours (Table 1), with corresponding 95% confidence interval (95% CI). Between-group differences in injury incidence were compared

using a rate ratio (RR) significance tested with z-statistics (Lindenfeld et al., 1994). RR was calculated as the incidence in the northern group divided by the incidence in the southern group and the CI for the ratio was calculated according to the following formula: $RR/\text{exponent} [1.96*\text{standard error}_{RR}]$ to $RR*\text{exponent} [1.96*\text{standard error}_{RR}]$ where the $\text{standard error}_{RR} = \sqrt{[1/\text{injuries}_{(\text{Northern group})} + 1/\text{injuries}_{(\text{Southern group})}]}$. Between-group differences in injury incidence were calculated separately for training and match injuries for all analyses except for foul play (only match injuries) and overuse (only overall injuries). A difference in non-contact injury incidence was analysed only for ACL injuries, since this data have been collected as a part of a sub-study from the entire period (Waldén et al., 2011), but only as a matter of routine for all injuries since 2004/2005. All analyses were two-sided and the significance level was set at $P < 0.05$.

Insert Table 2 near here

RESULTS

In total, 117 team-seasons for 1357 players with 3138 partial or complete player-seasons were included in the study, the Northern group contributing with 1100 players and 2453 player-seasons.

Exposure

During the study period, 773563 exposure hours was recorded; 499238 training hours and 96260 match hours in the Northern group, and 149948 training hours and 28118 match hours in the Southern group, respectively. The mean training exposure per player was significantly lower in the Northern group compared to the Southern group (203.4 (74.5) vs. 218.9 (69.4) hours, $P < 0.0001$), but there was no statistically significant difference in mean match exposure per player (39.2 (23.7) vs. 41.1 (26.9) hours, $P = 0.08$). However, the mean number of team matches per season was lower in the Northern group **with a statistically significant difference** (32.3 (17.3) vs. 34.8 (18.5) matches, $P = 0.001$).

Insert Tables 3 and 4 near here

Injury incidence

In total, 5949 time-loss injuries were recorded. Teams in the Northern group had significantly higher incidences of injury overall and of both traumatic and overuse injury (Table 3). Taking injury severity into account, all injuries with lay-off of more than three days were more frequent in the Northern group, but more pronounced for severe injuries. Upper body, trunk and lower leg

injuries, including common overuse injuries such as low back pain (LBP) and Achilles tendinopathy, were also more common among teams in the Northern group.

No statistically significant differences in injury incidence were seen overall, or separated by training or match play, for the four most common injury locations in the lower limbs (hip/groin, thigh, knee and ankle). Analysis of specific injury sub-types for these locations showed no statistically significant differences for thigh strains (both quadriceps and hamstrings) or knee and ankle sprains in general. However, the ACL injury incidence was lower in the Northern group with a statistically significant difference (Table 4); in particular, the incidence of non-contact ACL injury was considerably lower (0.02 [12 injuries] vs. 0.11 [19 injuries] non-contact ACL injuries per 1000 hours, RR 0.19, 95% CI 0.09 to 0.39, $P < 0.001$). Finally, the contusion incidence (N=958) did not differ between groups (1.26 vs. 1.15 injuries per 1000 hours, RR 1.24, 95% CI 1.03 to 1.50, $P = 0.23$), whereas the incidence of match injury resulting from foul play (N=688) was **significantly** higher in the Northern group (5.79 vs. 4.66 injuries per 1000 hours, RR 1.24, 95% CI 1.03 to 1.50, $P = 0.03$).

The overall injury incidence varied during the season and there was a deviation of the curves for the groups primarily during the first half of the season between July and November (Figure 1). However, there was an even more marked deviation of the curves for non-contact ACL injury incidence during most of the season (Figure 2).

Insert Figures 1 and 2 near here

DISCUSSION

The principal finding of the present study was that the injury incidence in general was higher in teams located in northern Europe compared to more southern teams. Interestingly, however, non-contact ACL injuries were more common in the southern teams.

Regional differences in injury incidence

The rationale for analysing the injury incidence for different geographical regions in Europe is that in the first-season report of this cohort, the four clubs from England and the Netherlands had higher incidences of match injury and severe injury than the seven clubs from France, Italy and Spain (Waldén et al., 2005). The overall result of the present study is basically in line with the trend found in that paper, but in the first-season report the teams were arbitrarily divided into northern and southern regions based on latitude of country without formally considering climate differences. We therefore decided to categorize the regions according to the Köppen-Geiger classification which is a well-established climate system that has undergone only minor changes over the years (Kottek et al., 2006). The biggest difference between the classification in this study compared to the first-season report is that the French and northern Italian teams were not included in the Southern group, since they belong to the Cfb and Cfa climate types, respectively.

Nevertheless, this study has shown an obvious “northern bias” with a higher general injury incidence among teams from regions in northern Europe with Marine West Coast or Humid Subtropical climate types compared to more southern teams with a Mediterranean climate type. It is likely that there are several factors contributing to the trend demonstrated. One possible explanation could be heavier training and match load in the Northern group, but there was only

small between-group differences found in exposure variables and, although statistically significant, the practical relevance can be questioned. Another factor to consider might be regional differences in tactics, playing style and playing intensity. The speed of the game, the fighting spirit, and the number of duels has historically been very high, for example, in England and Scotland, but these factors have not been studied from an injury perspective. Similarly, injuries due to foul play were more frequent in the Northern group, and although a few studies have evaluated the referee standards of the game (Andersen et al., 2004; Fuller et al., 2004), the influence of any regional differences in referee decisions and interpretation of the rules is unclear.

The northern teams suffered from more overuse problems, and although different attitudes to sit players out or keep them playing despite pain might be present (Bahr, 2009), climate-related differences in ground hardness where harder pitches are expected to yield higher ground reaction forces and loading of the tissues also needs to be considered. It is, however, unlikely that climate-related factors are the main cause of the higher injury incidences found in the Northern group, since the difference seems to be minimal during the actual winter period where the Mediterranean teams should suffer less from poor pitches and severe weather conditions. In contrast, the non-contact ACL injury incidence was considerably higher in the Southern group during almost all months of the season. Even though no specific weather condition variables such as temperature, rainfall, wind or evaporation were collected in the present study, the most plausible explanation to this “southern bias” is higher shoe-surface traction due to a warmer climate. In line with our findings, a northern bias (i.e. analogous to a southern bias in Europe) has been shown for non-contact ACL injuries in the Australian Football League (AFL) (Orchard et al., 1999). Interestingly, the southern AFL teams all come from a state (Victoria) that has the same climate type (Cfb) as most of the teams in our Northern group in Europe, whereas the northern AFL teams come from

states with varying climate types (all warmer). It has, however, been suggested that it might be differences in grass types and not the variation in weather variables per se that is responsible for the increased ACL injury incidence among the northern AFL teams (Orchard et al., 2005). It would be expected that ryegrass (*Lolium perenne*) would be the predominant grass type for most grounds in Europe, but that this would be mixed with *Poa pratensis* in the colder regions and perhaps *Cynadon dactylon* in the early-season in some Mediterranean regions. This study was, however, unable to take into account the actual grass types as well as practices at the various grounds such as winter re-laying of portable new turf (Orchard et al., 2008), but also under-surface heating and artificial fibre reinforcement of natural grass. Nevertheless, the unsolved dilemma is that both weather and surface conditions interact with footwear at the time of injury, and little is known about the optimum balance between high shoe-surface traction giving a good “grip” in the pitch, but that might produce excessive forces on knees and ankles, and low shoe-surface traction that might result in slipping and a negative influence on performance (Ekstrand & Nigg, 1989; Orchard, 2002). As difficult as it would be to characterize grass profile, it would be even more arduous to collect data on players’ shoe selections for each exposure, since they test and consume a considerable amount of shoes during a season. However, although little research has been published in the field of football biomechanics related to footwear (Hennig, 2011), no differences in knee joint loading have been found between various round-studded or bladed shoes during sidestep cutting and turning in laboratory field testing in male players (Gehring et al., 2007; Kaila, 2007).

Methodological considerations

The validation of our study design has been published previously (Häggglund et al., 2005b), and it

strictly complies with the consensus statement for football injury surveillance (Fuller et al., 2006). In this statement, the strengths and limitations of studies such as this one are thoroughly discussed and will therefore not be repeated here in detail. Briefly, the prospective design, the long observation period to avoid the influence of occasional extreme weather seasons, and the rigorous data check-up with low drop-out figures for individual variables are some important strengths of this study.

Nevertheless, in addition to the limitations already discussed, this study has some further weaknesses that have to be recognised. First, although the study was conducted over several seasons in a homogenous population of professional footballers, the number of teams included in the Southern group was limited and only a few teams were included from each country. It is therefore not clear if the differences reported here represent characteristics of these teams or if they can be generalised to other first league teams in the region. Secondly, since many of the participating clubs are very successful, they do not only compete domestically but also in the UEFA Champions League or the UEFA Europe League (former known as the UEFA Cup). On top of that many players have international duties and they can therefore be exposed to various climate types when playing away matches abroad with the club or during national team matches. Unfortunately, the design of the exposure record did not include specification of the match city for tournaments, away matches or international duties and it was therefore not possible to adjust for this. Finally, some of the teams (e.g. in Scotland and the Netherlands) have played a few away matches on artificial turf during the study period, and even if the shoe-surface traction might be different on artificial turf than on natural grass (Orchard & Powell, 2003), the exposure on artificial turf is negligible. It has also been shown for elite teams having third-generation artificial turf on their home facilities that the overall injury incidence does not differ between play on artificial turf

compared to natural grass (Ekstrand et al., 2006).

PERSPECTIVES

Football is the most popular sport worldwide and is played under various climate conditions. However, knowledge about the influence of regional differences on the injury epidemiology is limited. In this study on selected high-level professional football clubs in Europe, we found that teams from geographical regions with milder summers and cooler winters had a higher injury incidence in general compared to teams with a Mediterranean climate. The injury types which followed this general trend included upper body injuries, low back injuries and Achilles tendinopathy. However, the ACL injury incidence, in particular for non-contact injury, followed the reverse trend and was significantly higher in teams with a Mediterranean climate. The higher ACL injury incidence with warmer climate possibly reflects increased shoe-surface traction, but needs to be studied further. Furthermore, the underlying factors contributing to the higher general injury incidence among teams coming from the north should be studied in the future. In conclusion, regional differences seem to be an important factor to take into account when football teams from different countries are studied or when introducing preventive measures in different geographical regions.

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Table 1. Operational definitions used in the study.

Exposure	Training or match play with the first or reserve team of the club or with a youth or senior national team.
Training session	Team training that involved physical activity under the supervision of the coaching staff.
Match	Competitive or friendly match against another team.
Injury	Physical complaint leading to a player being unable to fully participate in future training or match play.
Traumatic injury	Injury with sudden onset and known cause.
Overuse injury	Injury with insidious onset and no known trauma.
Injury severity	Number of days elapsed from injury to full participation in training and availability for match selection.
Minimal	Injury causing lay-off of 1–3 days from training and match play.
Mild	Injury causing lay-off of 4–7 days from training and match play.
Moderate	Injury causing lay-off of 8–28 days from training and match play.
Severe	Injury causing lay-off of >28 days from training and match play.
Injury incidence	Number of injuries per 1000 player hours [$(\Sigma \text{injuries} / \Sigma \text{exposure hours}) \times 1,000$].

Table 2. Clubs included from European professional football and categorization of climate types.

	Climate*	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10
Northern group										
Scotland (Scottish Premier League)										
Rangers FC	Cfb					X				
England (Premier League)										
Arsenal FC	Cfb	X	X	X	X	X	X	X	X	X
Chelsea FC	Cfb					X	X	X		
Liverpool FC	Cfb					X	X†			X
Manchester United FC	Cfb	X	X	X	X	X	X	X	X	
Newcastle United FC	Cfb						X			
France (Ligue 1)										
RC Lens	Cfb	X	X	X						
Paris St Germain FC	Cfb	X	X	X†	X	X	X			
Stade Rennais FC	Cfb	X	X							
Olympique Lyonnais	Cfb								X	X
The Netherlands (Eredivisie)										
AFC Ajax	Cfb	X				X	X	X	X	X
PSV Eindhoven	Cfb	X	X	X	X	X	X	X	X	X
Belgium (Jupiler Pro League)										
RSC Anderlecht	Cfb						X	X	X	
Club Brugge KV	Cfb			X	X	X	X	X	X	X
Germany (1. Bundesliga)										
BVB Dortmund	Cfb					X				X
Hamburger SV	Cfb						X	X	X	X
FC Bayern München	Cfb									X
Italy (Serie A)										
AC Milan	Cfa	X	X	X†		X	X		X†	X
FC Inter	Cfa	X	X	X	X	X	X	X	X	X
Juventus FC	Cfa	X		X	X	X			X	X
Southern group										
Italy (Serie A)										
AFC Fiorentina	Csa									X
Portugal (Liga Sagres)										
SL Benfica	Csa					X	X	X	X	X

FC Porto	Csb					X	X	X	X	X
Spain (Primera División)										
FC Barcelona	Csa			X	X	X	X	X	X	X
Real Madrid CF	Csa	X	X	X	X	X	X	X	X	X

* Clubs were categorized into a Northern group (Cfa and Cfb) and a Southern group (Csa and Csb) according to the Köppen-Geiger climate classification system (Kottek et al., 2006).

† Injury and exposure data recorded for approximately half season only.

Table 3. Regional differences in number and incidence of injuries in European professional football between the 2001/02 and 2009/10 seasons.

	Northern group*		Southern group*		Rate ratio	P value
	Injuries	Incidence†	Injuries	Incidence†		
Injuries						
Training	2035	4.08 (3.90 to 4.26)	528	3.52 (3.23 to 3.83)	1.16 (1.05 to 1.27)	0.003
Match	2664	27.68 (26.64 to 28.75)	722	25.68 (23.87 to 27.62)	1.08 (0.99 to 1.17)	0.07
Total	4699	7.89 (7.67 to 8.12)	1250	7.02 (6.64 to 7.42)	1.12 (1.06 to 1.20)	<0.001
Injury mechanism‡						
Trauma	3272	5.49 (5.31 to 5.69)	892	5.01 (4.69 to 5.35)	1.10 (1.02 to 1.18)	0.01
Overuse	1383	2.32 (2.20 to 2.45)	348	1.95 (1.76 to 2.17)	1.19 (1.06 to 1.34)	0.004
Injury severity						
Minimal	920	1.54 (1.45 to 1.65)	299	1.68 (1.50 to 1.88)	0.92 (0.81 to 1.05)	0.21
Mild	1201	2.02 (1.91 to 2.13)	303	1.70 (1.52 to 1.90)	1.19 (1.04 to 1.34)	0.008
Moderate	1787	3.00 (2.86 to 3.14)	465	2.61 (2.38 to 2.86)	1.15 (1.04 to 1.27)	0.008
Severe	791	1.33 (1.24 to 1.42)	183	1.03 (0.89 to 1.19)	1.29 (1.10 to 1.52)	0.002

* Clubs were categorized into a Northern group (Cfa and Cfb) and a Southern group (Csa and Csb) according to the Köppen-Geiger climate classification system (Kottek et al., 2006).

† Injury incidence is expressed as the number of injuries per 1000 exposure hours with 95% confidence interval (95% CI).

‡ Data were missing for 54 injuries.

Table 4. Regional differences in number and incidence of injuries according to location and type in European professional football between the 2001/02 and 2009/10 seasons.

	Northern group*		Southern group*		Rate ratio	P value
	Injuries	Incidence†	Injuries	Incidence†		
Head/ neck	111	0.19 (0.15 to	19	0.11 (0.07 to	1.75 (1.07 to	0.03
Concussion	41	0.22)	5	0.17)	2.84)	0.06
		0.07 (0.05 to		0.03 (0.01 to	2.45 (0.97 to	
		0.09)		0.07)	6.20)	
Upper extremity	164	0.28 (0.24 to	32	0.18 (0.13 to	1.53 (1.05 to	0.03
		1.32)		0.25)	2.24)	
Trunk	343	0.58 (0.52 to	52	0.29 (0.22 to	1.97 (1.47 to	<0.00
Low back pain	119	0.64)	17	0.38)	2.64)	1
		0.20 (0.17 to		0.10 (0.06 to	2.09 (1.26 to	0.004
		0.24)		0.15)	3.48)	
Hip/ groin	663	1.11 (1.03 to	180	1.01 (0.87 to	1.10 (0.93 to	0.25
Adductor-related	429	1.20)	128	1.17)	1.30)	0.98
injuries	58	0.72 (0.66 to	15	0.72 (0.60 to	1.00 (0.82 to	0.626
Pubalgia/ hernia		0.79)		0.85)	1.22)	
		0.10 (0.08 to		0.08 (0.05 to	1.16 (0.66 to	
		0.13)		0.14)	2.04)	
Thigh	1142	1.92 (1.81 to	337	1.89 (1.70 to	1.01 (0.90 to	0.83
Strain/ muscle	906	2.03)	262	2.11)	1.44)	0.63
rupture	245	1.52 (1.43 to	64	1.47 (1.30 to	1.03 (0.90 to	0.34
Quadriceps	555	1.62)	171	1.66)	1.19)	0.73
Hamstrings		0.41 (0.36 to		0.36 (0.28 to	1.15 (0.87 to	
		0.47)		0.46)	1.51)	
		0.93 (0.86 to		0.96 (0.83 to	0.97 (0.82 to	
		1.01)		1.12)	1.15)	
Knee	807	1.36 (1.26 to	236	1.33 (1.17 to	1.02 (0.88 to	0.76
Sprain/ ligament	331	1.45)	85	1.51)	1.18)	0.21

rupture	211	0.56 (0.50 to	54	0.48 (0.39 to	1.16 (0.92 to	0.31
MCL [‡]	29	0.62)	20	0.59)	1.48)	0.004
ACL [‡]	116	0.35 (0.31 to	24	0.30 (0.23 to	1.17 (0.87 to	0.10
Meniscus/ cartilage	57	0.41)	23	0.40)	1.56)	0.23
Patellar		0.05 (0.03 to		0.11 (0.07 to	0.43 (0.25 to	
tendinopathy		0.07)		0.17)	0.77)	
		0.19 (0.16 to		0.13 (0.09 to	1.46 (0.93 to	
		0.23)		0.19)	2.24)	
		0.10 (0.07 to		0.13 (0.09 to	0.74 (0.46 to	
		0.12)		0.19)	1.20)	
Lower leg	548	0.92 (0.85 to	135	0.76 (0.64 to	1.21 (1.01 to	0.04
Strain/ muscle	199	1.00)	52	0.90)	1.47)	0.39
rupture	114	0.33 (0.29 to	20	0.29 (0.22 to	1.14 (0.84 to	0.03
Achilles		0.38)		0.38)	1.55)	
tendinopathy		0.19 (0.16 to		0.11 (0.07 to	1.78 (1.06 to	
		0.23)		0.17)	2.74)	
Ankle	655	1.10 (1.02 to	181	1.02 (0.88 to	1.08 (0.92 to	0.44
Sprain/ ligament	413	1.19)	146	1.18)	1.28)	0.08
rupture	314	0.69 (0.63 to	73	0.82 (0.70 to	0.85 (0.70 to	0.05
Lateral ligaments		0.76)		0.96)	1.02)	
		0.44 (0.39 to		0.41 (0.33 to	1.08 (0.83 to	
		0.50)		0.52)	1.40)	
Foot	263	0.44 (0.39 to	73	0.41 (0.33 to	1.08 (0.83 to	0.57
		0.50)		0.52)	1.40)	

* Clubs were categorized into a Northern group (Cfa and Cfb) and a Southern group (Csa and Csb) according to the Köppen-Geiger climate classification system (Kottek et al., 2006).

† Injury incidence is expressed as the number of injuries per 1000 exposure hours with 95% confidence interval (95% CI).

‡ MCL denotes medial collateral ligament and ACL denotes anterior cruciate ligament.

FIGURE LEGENDS

Figure 1. Regional differences in the seasonal distribution of injury incidence in European professional football between the 2001/02 and 2009/10 seasons.

Figure 2. Regional differences in the seasonal distribution of non-contact ACL injury incidence in European professional football between the 2001/02 and 2009/10 seasons.

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ACL denotes anterior cruciate ligament.