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Autores / Autors Noya Salces, Javier ; Gómez Carmona, Pedro M. ; Gracia Marco, Luis ; Moliner Urdiales, Diego ; Sillero Quintana, Manuel

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Epidemiology of injuries in First Division Spanish football

JAVIER NOYA SALCES¹, PEDRO M. GÓMEZ CARMONA², LUIS GRACIA-MARCO³,
DIEGO MOLINER-URDIALES⁴ & MANUEL SILLERO-QUINTANA²

¹Russian Federation, Moscow, Russia, ²Universidad Politécnica de Madrid, Madrid, Spain, ³University of Exeter, Exeter, UK and ⁴University Jaume I, Castellón, Spain

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Abstract

The aim was to examine the injuries sustained by Spanish football players in the First Division and to compare injury-related variables in the context of both competition and training. The injury data were prospectively collected from 16 teams (427 players) using a specific web-based survey during the 2008/2009 season. A total of 1293 injuries were identified (145 were recurring injuries). The overall injury incidence was 5.65 injuries per 1000 h of exposure. Injuries were much more common during competition than during training (43.53 vs. 3.55 injuries per 1000 h of exposure, $P < 0.05$). Most of the injuries (89.6%) involved the lower extremities, and overuse (65.7%) was the main cause. Muscle and tendon injuries were the most common types of injury (53.8%) among the players. The incidence of training injuries was greater during the pre-season and tended to decrease throughout the season, while the incidence of competition injuries increased throughout the season (all $P < 0.05$). In conclusion, the results of this study suggest the need for injury prevention protocols in the First Division of the Spanish Football League to reduce the number of overuse injuries in the muscles and tendons in the lower extremities. In addition, special attention should be paid during the pre-season and the competitive phase II (the last four months of the season) in order to prevent training and competition injuries, respectively.

Keywords: professional football, men, injury incidence, injury exposure, football association

Introduction

The negative impacts that injuries have on the health, performance and finances of football players and clubs are well known. Recent European (Dauty & Collon, 2011; Ekstrand, Hagglund, & Walden, 2011b; Hagglund, Walden, & Ekstrand, 2005) and American (Morgan & Oberlander, 2001) epidemiological studies of professional male football players reported an overall incidence of approximately 6–8 injuries per 1000 h of exposure. Previous studies have shown that football injuries mainly affected the lower extremities (Wong & Hong, 2005), particularly the ankle, knee or thigh (Azubuike & Okojie, 2009; Ekstrand, Hagglund, & Walden, 2011a; Junge & Dvorak, 2004).

In 2011, the First Division of the Spanish Football League was recognised as the strongest national league in the world by the International Federation of Football History and Statistics (IFFHS), and 4 of its teams were ranked among the top 25 in the world. Nonetheless, there are no reference data on injury incidence in the professional Spanish football leagues, and this gap in the data requires urgent

attention. Therefore, this prospective study examines the incidence of injuries among male Spanish football players in the First Division during the 2008/2009 season and compares injury-related variables in the context of both competition and training.

Materials and methods

Participants and study period

All of the First Division Spanish football clubs ($n = 20$) competing in the 2008/2009 season were contacted and invited to participate in the study. Ultimately, 16 clubs and 427 players (26.6 ± 2.6 players/club) participated; four clubs refused to participate. Medical staff opposition, the time commitment and concerns about confidentiality were the main reasons for not participating. Injuries were recorded from early July 2008 to the end of May 2009. Previous injuries were not taken into consideration but players were included once the injury was healed. Those whose injuries continued to heal after the end of the study period were included, and the duration of the recovery period was discussed with

65 the respective medical staff. Injuries of those players who were hired by the teams after the study started were not included.

70 The season included the pre-season (from 6 July 2008 to 23 August 2008) and the competitive season (from 24 August 2008 to 31 May 2009). The competitive season included 2 rounds with 20 teams: competitive phase I (from 24 August 2008 to 18 January 2009) and competitive phase II (from 19 January 2009 to 31 May 2009). All of the matches and training sessions were performed on natural turf surfaces.

Data collection

80 The head of the medical staff of every club was initially contacted. Contact information was obtained from the clubs' official websites or the Spanish Football Federation (RFEF). After a brief explanation over the telephone, a letter describing the project was sent to the participants. Written informed consent was obtained from the clubs and players that agreed to participate in the study. The study was performed in accordance with the ethical guidelines of the 1961 Declaration of Helsinki (revision of Edinburgh, 2000). The survey instrument and the research design were approved by the Ethics Committee of the Technical University of Madrid (UPM), Madrid, Spain.

Survey

95 A web survey based on the Fédération Internationale de Football Association (FIFA) Consensus Statement (2006) was used to record the type, location and severity of injuries. The medical staff from the clubs reported each injury through the web survey. The database was checked weekly by the researchers, and the medical staff members were contacted when necessary.

Location of injuries

105 This study used the following 12 categories of injuries, which have been used in previous studies (Fuller et al., 2006; Hawkins, Hulse, Wilkinson, Hodson, & Gibson, 2001; Woods, Hawkins, Hulse, & Hodson, 2002): foot, ankle, lower leg, knee, thigh, hip/groin, upper extremities, shoulder/clavicle, lumbar/sacrum/pelvis, head/face/neck/cervical, abdomen and sternum/rib/dorsal.

Types of injury

Injuries were classified into seven categories in accordance with the Consensus Statement for football (Fuller et al., 2006): fractures and bone stress,

115 joints (non-bone) and ligaments, muscles and tendons, contusions, lacerations and skin lesions, central/peripheral nervous system and other injuries. In addition, injuries were also classified as traumatic (those with an acute onset) or overuse injuries (those without any known trauma).

Severity of injury

120 The severity of each injury was defined according to the number of days elapsed from the date of injury to the date of the player's return to full participation in team training or availability for competition. The injury severity was classified into four categories that have been used in previous studies (Fuller et al., 2006; Woods et al., 2002): minimal (≤ 3 days), mild (4–7 days), moderate (8–28 days) and severe (> 28 days). In addition, recurrent injuries were recorded. Recurrent injuries were defined as injuries of the same type and location that occurred after the player recovered and returned to full participation. Recurrent injuries were classified as less severe, equally severe or more severe in comparison to the original injury.

Player exposure and injury incidence

140 Three teams were individually followed to obtain mean values to estimate the competition and training exposure of the other teams. Using these values, weekly exposure was estimated on a team basis. Weekly competition exposure, including national (League) and international matches, was calculated by summing the number of competition matches per week for each team and multiplying by 90 min (the official duration of a match) and 11 players. Players' participation with national teams was not recorded. Weekly training exposure was calculated by multiplying the duration (in minutes) of every training session by the mean number of players (per team). Moreover, the warm-up period before competition matches (25 min \times 11 players) and friendly matches (90 min \times 11 players), which were mainly played within the own team, were also considered as training exposure as in previous studies (Walden, Hagglund, & Ekstrand, 2005b). Cool down periods after competition matches were not usual among Spanish teams and were not taken into account for exposure calculation. Finally, the results were divided by 60 to obtain competition and training exposure in hours. The injury incidence is expressed as the number of injuries per 1000 h of training or competition.

Statistical analysis

Descriptive statistics are presented as frequencies, proportions (%), incidence rates (per 1000 h of

165 exposure) and 95% confidence intervals (non-overlapping confidence intervals indicate a significant difference between competition and training) (Kirkwood & Sterne, 2003). Lost days due to an injury are presented as mean and standard deviation (minimum and maximum values are indicated when standard deviation is greater than mean). All of the analyses were performed using the PASW statistical package, version 18.0 (SPSS Inc., Chicago, IL), with $P < 0.05$ considered statistically significant.

175 **Results**

The mean age of the players was 26.8 ± 4.1 years, their height was 181 ± 6 cm and their weight was 75.8 ± 5.7 kg. A total of 1293 injuries were reported by the 427 players (524 competition injuries and 769 training injuries). The top 3 injuries were 1) thigh muscle injuries; 31.4%, 11.5 days of time loss (min: 1, max: 190); 2) ankle sprain; 12.5%, 9.7 days of time loss (min: 1, max: 94); and 3) hip muscle injuries; 10.9%, 8.6 days of time loss (min: 1, max: 82).

185 The total exposure was 228,743 h (12,038 h of competition exposure and 216,705 h of training exposure). Overall injury incidence was 5.65 (CI 5.35–5.96) injuries per 1000 h of exposure. The overall incidence of injuries was greater in competition (43.53; CI 39.96–47.42) than in training (3.55; CI 3.31–3.81). Incidences were also greater in competition independently of location, type and/or nature. In addition, the incidence of recurrent injuries was also greater in competition (4.7; CI 3.65–6.14) than in training (0.4; CI 0.33–0.5) ($P < 0.05$).

Injury location

200 Of all injuries, 89.6% involved the lower extremities (injury incidence = 5.1). The highest incidence of injuries affected the thigh, followed by the ankle, hip/groin, knee and lower leg (Table I).

Injury type

205 Muscle and tendon injuries had the highest incidence rate (3.04), followed by injuries of the joints and ligaments (1.38) and contusions (0.8). More than 50% of the injuries were related to muscles and tendons (both competition- and training-related injuries) (Table II).

Injury nature

210 Two out of three injuries were due to overuse (59.5% during competition and 70.0% during training), and one out of three injuries was due to trauma (40.5% during competition and 30.0% during

Table I. Incidence of injuries (by location) in the First Division Spanish Football League.

Location of injury	All injuries					Competition injuries					Training injuries					
	N	%	Inc.	95% CI	N	%	Inc.	95% CI	P	N	%	Inc.	95% CI			
Thigh	473	36.6	2.068	1.89	2.263	203	38.7	16.863	14.696	19.35	*	270	35.1	1.246	1.106	1.404
Ankle	185	14.3	0.809	0.7	0.934	64	12.2	5.316	4.161	6.792	*	121	15.7	0.558	0.467	0.667
Hip/groin	175	13.5	0.765	0.66	0.887	73	13.9	6.064	4.821	7.628	*	102	13.3	0.471	0.388	0.571
Knee	147	11.4	0.643	0.547	0.755	59	11.3	4.901	3.797	6.326	*	88	11.4	0.406	0.33	0.5
Lower leg	126	9.7	0.551	0.463	0.656	42	8	3.489	2.578	4.721	*	84	10.9	0.388	0.313	0.48
Foot	53	4.1	0.232	0.177	0.303	25	4.8	2.077	1.403	3.073	*	28	3.6	0.129	0.089	0.187
Lumbar/sacrum/pelvis	39	3	0.17	0.125	0.233	14	2.7	1.163	0.689	1.964	*	25	3.3	0.115	0.078	0.171
Head/face/neck/cervical	35	2.7	0.153	0.11	0.213	21	4	1.744	1.137	2.676	*	14	1.8	0.065	0.038	0.109
Sternum/rib/dorsal	19	1.5	0.083	0.053	0.13	7	1.3	0.581	0.277	1.22	*	12	1.6	0.055	0.031	0.098
Shoulder/clavicle	16	1.2	0.07	0.043	0.114	6	1.1	0.498	0.224	1.109	*	10	1.3	0.046	0.025	0.086
Upper extremities	14	1.1	0.061	0.036	0.103	5	1	0.415	0.173	0.998	*	9	1.2	0.042	0.022	0.08
Abdomen	11	0.9	0.048	0.027	0.087	5	1	0.415	0.173	0.998	*	6	0.8	0.028	0.012	0.062
Total	1293	100	5.653	5.353	5.969	524	100	43.529	39.957	47.42	*	769	100	3.549	3.306	3.808

Notes: Results are shown as frequency (N), proportion (%), incidence (Inc., per 1000 h of exposure), CI, Confidence Intervals.
 * $P < 0.05$ between competition and training.

Table II. Incidence of injuries (by type) in the First Division Spanish Football League.

Type of injury	All injuries				Competition injuries				Training injuries					
	N	%	Inc.	95% CI	N	%	Inc.	95% CI	P	N	%	Inc.	95% CI	
Muscles and tendons	696	53.8	3.043	2.825	3.277	272	51.9	22.595	20.063	25.446	424	55.1	1.957	1.779
Joints (non-bone) and ligaments	315	24.4	1.377	1.233	1.538	113	21.6	9.387	7.806	11.288	202	26.3	0.932	0.812
Contusions	184	14.2	0.804	0.696	0.929	95	18.1	7.892	6.454	9.649	89	11.6	0.411	0.334
Other	34	2.6	0.149	0.106	0.208	12	2.3	0.997	0.566	1.755	22	2.9	0.102	0.067
Fractures and bone stress	33	2.6	0.144	0.103	0.203	14	2.7	1.163	0.689	1.964	19	2.5	0.088	0.056
Lacerations and skin lesions	22	1.7	0.096	0.063	0.146	11	2.1	0.914	0.506	1.65	11	1.3	0.051	0.028
Central/peripheral nervous system	9	0.7	0.039	0.02	0.076	7	1.3	0.581	0.277	1.22	2	0.3	0.009	0.002

Notes: Results are shown as frequency (N), proportion (%) and incidence (Inc., per 1000 h of exposure). CI, Confidence Intervals. *P < 0.05 between competition and training.

training). The incidence rates of overuse injuries and traumatic injuries were greater during competition than during training (25.9 and 17.6 vs. 2.5 and 1.1 injuries per 1000 h; all $P < 0.05$). Both overuse (65.7%) and traumatic injuries (34.3%) were related to an average time loss per injury of 11.4 days (min: 1, max: 215 and min: 1, max: 247, respectively) (Table III).

Injury severity and recurrence

Injuries of all degrees of severity occurred more commonly in competition than in training (all $P < 0.05$). Most frequent injuries involved minimal (35.7%, 2.2 ± 0.7 days of time loss), mild (26.8%, 5.1 ± 1.1 days of time loss) and moderate severity (29.2%, 14.5 ± 5.6 days of time loss) (table IV).

Figure 1 shows the incidence rates of recurrent injuries according to their severity. The incidence of recurrent injuries was greater during competition (0.8–2.2) than during training (0.1–0.3) (all $P < 0.05$). In addition, equally severe and more severe recurrent injuries occurred during competition with greater frequency (2.2 and 1.6, respectively) than less severe injuries (0.8).

Injury incidence per month

Figure 2 shows the incidence of training injuries per month throughout the season. The incidence of injuries in the pre-season (July and August) was greater than the incidence during the rest of the season ($P < 0.05$). In addition, more injuries occurred during competitive phase I than during competitive phase II ($P < 0.05$). The incidence of training injuries tended to decrease throughout the season.

Figure 3 shows the incidence of injuries that occurred during competition each month throughout the season. The incidence of injuries in the competitive phase II was greater than the incidence in the competitive phase I ($P < 0.05$). Despite a progressive increase from September, the incidence of injuries dropped in December and especially in April, peaking in March and May.

Discussion

To our knowledge, this is the first study examining the incidence and the characteristics of injuries among the players in a large number of Spanish teams competing in the First Division. The main findings of this study indicate that (1) competition causes more injuries than training; (2) the top 3 injuries were thigh muscle injuries, ankle sprain and hip muscle injuries; (3) competition is associated with a greater severity of injuries than training; and

Table III. Incidence of injuries (by nature) in the First Division Spanish Football League.

Nature of injury	All injuries				Competition injuries				P	Training injuries			
	N	%	Inc.	95% CI	N	%	Inc.	95% CI		N	%	Inc.	95% CI
Overuse	850	65.7	3.716	3.474 3.974	312	59.5	25.918	23.196 28.959	*	538	70.0	2.483	2.281 2.702
Traumatic	443	34.3	1.937	1.764 2.126	212	40.5	17.611	15.393 20.149	*	231	30.0	1.066	0.937 1.213

Notes: Results are shown as frequency (N), proportion (%) and incidence (Inc., per 1000 h of exposure). CI, Confidence Intervals.
* $P < 0.05$ between competition and training.

Table IV. Incidence of injuries (by severity) in the First Division Spanish Football League.

Severity	All injuries				Competition injuries				P	Training injuries			
	N	%	Inc.	95% CI	N	%	Inc.	95% CI		N	%	Inc.	95% CI
Minimal	462	35.7	2.020	1.844 2.213	155	29.6	12.876	11.000 15.071	*	307	39.9	1.417	1.267 1.584
Mild	346	26.8	1.513	1.361 1.681	153	29.2	12.710	10.847 14.892	*	193	25.1	0.891	0.773 1.026
Moderate	377	29.2	1.648	1.490 1.823	169	32.2	14.039	12.074 16.323	*	208	27.1	0.960	0.838 1.100
Severe	108	8.3	0.472	0.391 0.570	47	9.0	3.904	2.933 5.196	*	61	7.9	0.281	0.219 0.362

Notes: Results are shown as frequency (N), proportion (%) and incidence (Inc., per 1000 h of exposure). CI, Confidence Intervals.
* $P < 0.05$ between competition and training.

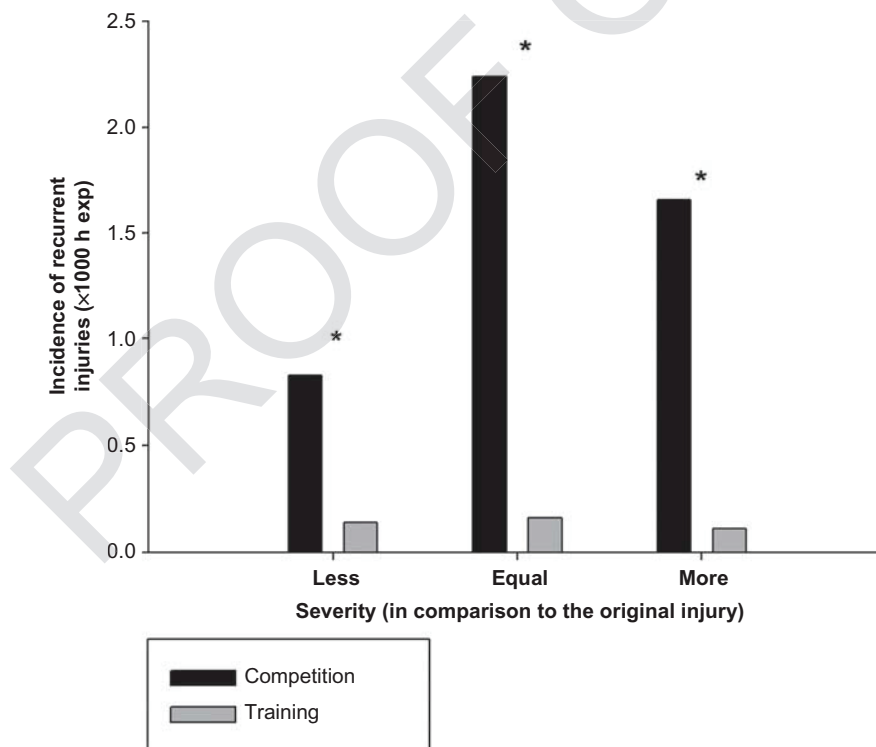


Figure 1. Incidence of recurrent injuries according to severity in the First Division Spanish Football League.

* $P < 0.05$ between competition and training.

(4) the incidence of injuries during training decreases throughout the season, whereas the incidence of injuries during competition increases.

First, our results showed that injury incidence was 12.3 times greater in competition than in training (43.53 vs. 3.55), as previous studies have shown. 265

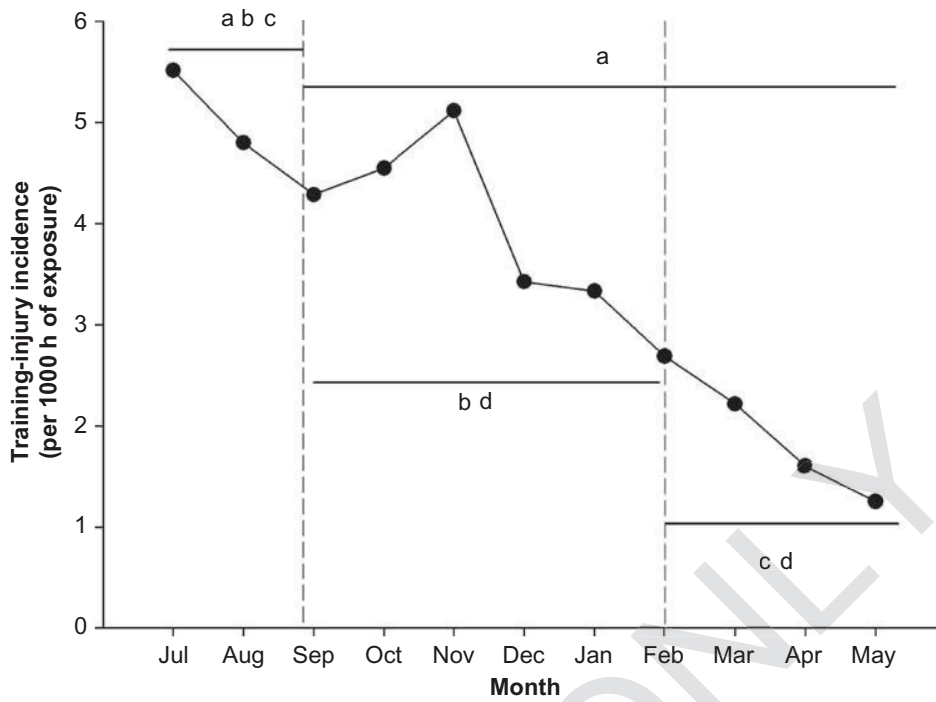


Figure 2. Monthly incidence of training injuries according to the phases of the season for the First Division Spanish Football League.

^{abcd}Common superscripts indicate a significant difference.

^a $P < 0.05$ between pre-season and rest of the season.

^b $P < 0.05$ between pre-season and competitive phase I.

^c $P < 0.05$ between pre-season and competitive phase II.

^d $P < 0.05$ between competitive periods I and II.

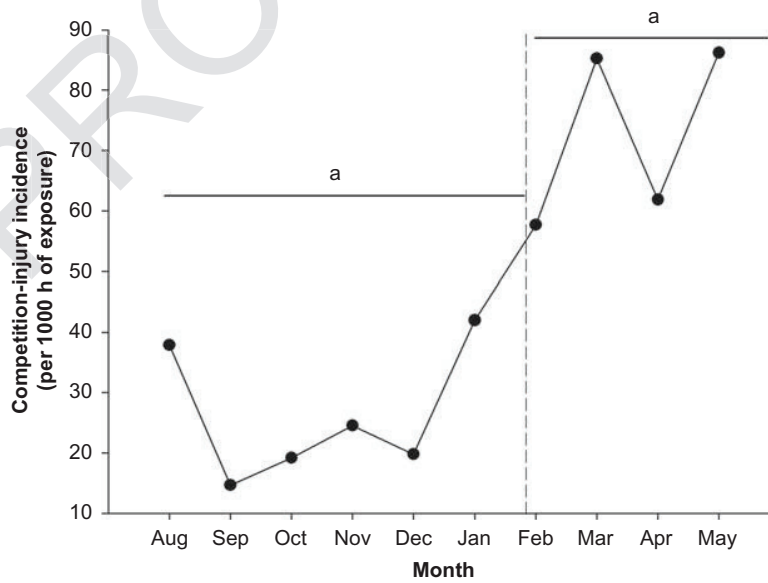


Figure 3. Monthly incidence of competition injuries according to the phases of the season for the First Division Spanish Football League.

^a $P < 0.05$ between competitive phase I and II.

Morgan and Oberlander (2001) showed that competition was associated with 12.2 times more injuries than training (35.3 vs. 2.9) in the American Major Soccer (Football) League. Recently, Ekstrand et al. (2011b) studied 23 of the 50 best European teams (2001–2008) and showed that competition was associated with 6.7 times more injuries than training (27.5 vs. 4.1). Hagglund et al. (2005) showed that the incidence of injuries was greater in competition than in training in the top Danish (28.2 vs. 11.8) and Swedish (26.2 vs. 6.0) male football divisions. These important differences between competition and training may occur because the intensity is greater during competition than during training, which creates a higher risk of injury. In addition, other factors such as the calculation of exposure time or even different levels of competitiveness during matches may explain these differences between studies.

Second, according to location our results showed the highest incidence of injuries to the lower extremities, particularly the thigh, followed by the ankle, hip/groin and knee. These results based on Spanish players align with the results based on European (Ekstrand et al., 2011b; Hagglund et al., 2005; Hawkins et al., 2001; Walden et al., 2005b) and American male professional football players (Morgan & Oberlander, 2001). According to type, we found results similar to previous studies where the highest incidences of injury were related to muscles and tendons, joints and ligaments, and contusions (Ekstrand et al., 2011b; Hagglund et al., 2005; Hawkins et al., 2001; Walden et al., 2005b). According to nature, we showed that overuse injuries were more prevalent (66%) and had twice the incidence rate (3.7 vs. 1.9) of traumatic injuries, with incidence rates being greater during competition than during training.

Third, our results showed that the most reported injuries (63%) were of minimal or mild (≤ 7 days) severity, while severe injuries (> 28 days) only represented 8% of the total number of injuries. The current scientific literature on modern football shows a slightly greater severity of injuries than our study found (Drawer & Fuller, 2002; Ekstrand et al., 2011b; Hawkins et al., 2001; Morgan & Oberlander, 2001; Walden et al., 2005b). Ekstrand et al. (2011b) found that 50% of injuries were at least of moderate severity (37% in our study with 8–28 days out of competition). Similarly, Hawkins et al. (2001) studied football players from the four professional English leagues and showed that 68% of injuries involved more than 8 days out of competition. The results from the UEFA Champions League and the Major Football League showed that 15% of injuries were severe (Morgan & Oberlander, 2001; Walden et al., 2005b). It is likely that differences in training protocols and styles of play among countries could explain the slightly lower severity of injuries in

the Spanish league. In addition, 11% of the injuries were classified as recurrent injuries, as previous European studies have found (Ekstrand, Hagglund, & Walden, 2010; Ekstrand et al., 2011a; Walden, Hagglund, & Ekstrand, 2005a, 2005b). These data suggest the need to improve the criteria required for players to return to play, as well as the rehabilitation processes, to reduce the risk of recurrent injuries (Fuller & Walker, 2006). In this regard, designing functional tests in order to check the progress of the players during the rehabilitation process is a research topic that needs more emphasis.

Finally, our data showed significant differences in injury incidence depending on the phase of the season, as previous studies have found (Dauty & Collon, 2011; Ekstrand et al., 2011b; Hawkins et al., 2001; Morgan & Oberlander, 2001; Walden et al., 2005b; Woods et al., 2002). In the present study, the highest incidence of training injuries was observed during the pre-season, most likely because of inadequate recovery between seasons and/or inappropriate demands during the pre-season. For some players trying to secure a place in the first squad might be associated with an increased injury risk, as their intensity during training could be higher. The incidence of injuries during competition peaked during competitive phase II. This increase might be explained by deconditioning and/or by an increase in the intensity of play because of the importance of the results, which are crucial during this phase of the season (Morgan & Oberlander, 2001).

Study limitations and strengths

The main limitation of the study is the estimation of the exposure time. Both competition exposure and training exposure were estimated on a weekly basis (to avoid recall bias, a daily estimate would have been preferable) based on the mean number of players per team (not on the actual number of players present at a particular club event). Moreover, time exposure with national teams was not obtained for the present study. Therefore, we consider that exposure time could be underestimated. In relation to injuries, those with duration of zero days, and some types such as abrasions, were not recorded. In addition, the players' histories of previous injuries, and injuries with national teams, were not taken into account. Therefore, we may have missed some additional data on injuries. As a consequence of this, the real injury incidence could slightly differ from the one showed in our results. The study design, which mainly followed the recommendations of the FIFA Consensus Statement (Fuller et al., 2006), and the large homogeneous sample of elite male football players (427 players from 16 teams in the First Division Spanish Football League) are the main strengths of our study.

380 **Conclusions**

Injury incidence in the First Division Spanish Football League is similar to other European Leagues. Competition causes more injuries and is associated with injuries of greater severity than training. In addition, it is important to note the differences in injury incidence between competition and training in each phase of the season. Injuries caused by overuse and thigh-related injuries were the most common injuries among the players. Special attention should be paid during the pre-season and the competitive phase II in order to prevent training and competition injuries, respectively.

Further studies analysing changes in injury incidence between different seasons and using more accurate exposure time recording are needed to confirm our data and to establish specific prevention protocols for the First Division Spanish Football.

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