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Research article

Injury incidence in a Spanish sub-elite professional football team: A prospective study during four consecutive seasons

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Abstract
The aim of this study was to investigate the injury incidence and injury characteristics of a Spanish sub-elite professional football team during four consecutive seasons. A team was followed prospectively from the season 2003-2004 to 2006-2007 and individual player exposure and time loss injuries were recorded during all club training sessions and matches. A total of 313 time-loss injuries were recorded. The mean injury incidence was 10.9 injuries/1000 hours (5.2 injuries/1000 training hours and 44.1 injuries/1000 match hours). The injury incidence during competitive matches was higher ($p < 0.001$) than in friendly matches (55.8 vs. 22.6 injuries/1000 hours). The incidence of major injuries (>28 days absence) was 0.4 injuries/1000 hours. The thigh was the most commonly (35%) injured region and caused 29% of all competitive match absence. Muscle injuries in the four main groups of the lower limbs (hamstrings, adductors, quadriceps and calf muscles) caused 43% of competitive match unavailability. The results of this study show that the risk to sustain a major injury in the course of the season was low for sub-elite footballers in comparison to elite players. Thigh strains were the first cause of absence in competition due to injury.

Key words: Soccer, epidemiology, hamstrings, match play.

Introduction

The adoption by the Fédération Internationale de Football Association Medical Assessment and Research Centre (F-MARC) of an international consensus statement on injury definitions and data collection procedures has allowed an objective recording of the epidemiology of male adult football during the last decade (Fuller et al., 2006; Hägglund et al., 2005). Most of these studies have been carried out in Union des Associations Europeénnes de Football (UEFA) clubs (Ekstrand, 2008; Ekstrand et al., 2004; Waldén et al., 2005) and national teams (Hägglund et al., 2009a) tournaments as well as in other northern European leagues (Árnason et al., 1996; Ekstrand et al., 2006; Hawkins et al., 1999; Hägglund et al., 2005; 2006; 2009b). However, despite Spain being one of the countries with a greatest success in the sport, to our knowledge, no study has attempted to exclusively examine the injury incidence in a Spanish national tournament.

Injury incidences have been frequently employed as a quantitative parameter to allow comparison between studies. Complementarily, absence in competitive matches due to injury might be an additional qualitative tool to help understanding the meaningfulness of the injury episodes. Therefore, it appears essential to assess the influence of the different type of injuries on match unavailability as they might have a profound impact on team performance (Hägglund et al., 2009a). Recent studies have determined that the physical demands of match play are dependent on the standard of competition (Bradley et al., 2009; Di Salvo et al., 2009) and have shown a higher injury rate when playing two matches per week versus one match per week (Dupont et al., 2010). It would be expected that the risk to sustain major injuries (>28 days absence) would also be related to the standard of the competition and, therefore, sub-elite teams would present a lower incidence of major injuries in comparison to elite teams. Additionally, thigh strains have been reported to be the most common injury subtype on different populations of European elite footballers (Árnason et al., 2004; Ekstrand et al., 2011; Hawkins et al., 1999; Hägglund et al., 2005; Waldén et al., 2005). As the risk of injuries might differ between countries (Waldén et al., 2005) it is important to assess the incidence of thigh strains in a Spanish competition to help providing injury patterns to national football coaches to assist the development of specific injury prevention strategies in order to reduce the overall injury burden.

The aim of the present study was to investigate the injury incidence and injury characteristics of a Spanish sub-elite professional football team during four consecutive seasons. The hypotheses were that: (a) the players would present a low risk of sustaining major injuries in comparison to elite footballers, and (b) thigh strains would be the first cause of match unavailability.

Methods

Study sample and study period

A prospective cohort study was carried out in a Spanish Division Two "B" club during four consecutive competitive seasons: from 2003-2004 to 2006-2007. This category is the third highest national division and, therefore, the competitive standard of the players was considered sub-elite as UEFA defines elite level as the two highest national football league divisions (Ekstrand et al., 2006). All the players from the first team squad took part in the study and gave their signed informed consent after written explanations of the observational design. The players were professionals and their mean ± standard deviation age, stature and body mass was 24.8 ± 3.5 years, 1.79 ± 0.05 m and 75.3 ± 5.3 kg, respectively. No significant differences were detected among the basic anthropometric characteristics of the players between the four seasons. Twenty-two players formed the squad every year comprising the following playing positions: 2 goalkeepers, 4 fullbacks, 4 central defenders, 4 wide midfielders, 4 central midfielders and 4 forwards. This investigation

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Table 1. Exposure data for a Spanish sub-elite team.

Years	03-04	04-05	05-06	07-08	Mean (SD)	95% CI
Training sessions	167	171	172	180	173 (5)	164-181
Matches	57	66	51	58	58 (6)	48-68
Competitive	*41*	*38*	*38*	*38*	*39 (2)*	*36-41*
Friendly	*16*	*28*	*13*	*20*	*19 (7)*	*9-30*
Total	224	237	223	238	231 (8)	218-243

conforms to the code of ethics of the Declaration of Helsinki and was lead with the accordance of the local Institutional Review Board.

Exposure registration

Individual exposure time during training and match play was calculated for each player throughout the entire seasons in a daily attendance form. After Hägglund et al. (2005) training sessions were defined as a coach directed physical activity carried out with the team. Match exposure was calculated when playing against teams from different clubs and subdivided into friendly and competitive (League and Cup) matches for further analysis.

Injury registration and definitions

The injury criterion adopted in this study followed the UEFA Medical Committee time loss definition: "an injury that occurred during a scheduled training session or match that caused absence from the next training session or match" (Hägglund et al., 2005). The same qualified physiotherapist, member of the medical staff, was responsible for data collection attending to all practice sessions and matches during the entire period of study. Injuries were recorded on a computerized standard report form including information about the date of injury, whether the injury occurred during training or match play, the injury type, location, severity, mechanism and diagnosis.

Injuries were categorised as traumatic or overuse. Traumatic injuries were defined as those resulting from an identifiable event and were characterized by an acute onset, whereas overuse injuries were caused by repeated microtraumas without a specific event responsible for the injury (Fuller et al., 2006; Waldén et al., 2005). Traumatic injuries were further classified into strains, sprains, contusions, fractures, dislocations and other injuries based on the instruction manuals created for the UEFA studies (Hägglund et al., 2005). Injury severity was classified according to the number of days of absence from participation as slight (1-3 days absence), minor (4-7 days absence), moderate (8-28 days absence) and major (>28 days absence). In addition, the number of days of absence from training sessions and competitive matches was recorded for further analysis. A player was considered fully rehabilitated after an injury when he was given clearance by the medical staff to participate fully in team training and match play. Recurrent injuries were considered as an injury occurring after an initial injury of the same type and at the same site within two months after returning to full participation (Hägglund et al., 2005).

Statistical analysis

All statistical analyses were conducted using SPSS for Windows Version 15.0 (SPSS Inc., Chicago, IL, USA). Comparison of anthropometric data between seasons was carried out using a one-way analysis of variance (ANOVA). Injury incidence was calculated as the number of injuries per 1000 hours of exposure and presented with 95% confidence intervals (incidence/exp(1.96 x standard error of log(incidence)) to incidence x exp(1.96 x standard error of log(incidence))). χ^2 statistical tests were carried out to assess if the number, type, location and severity of injuries were uniformly distributed during training and match play and between playing positions. Statistical significance was set at $p < 0.05$. Data are presented as means ± standard deviations (SD).

Results

Exposure and risk of injury

The total exposure was 28694 hours, of which 24509 hours were team training and 4185 hours match play (2716 hours competitive match play and 1469 hours friendly march play). There were no significant differences in the number of training sessions and matches between the four seasons (Table 1). A total of 313 time loss injuries were recorded during the study period. On average, a player incurred 3.6 ± 0.7 injuries and missed 2.9 ± 0.4 competitive matches each season, which represented that, on average, 7.4 ± 2.9% of the players from the team were absent per competitive match due to injury. The percentage of players that sustained at least one recordable injury averaged 88%, whereas 63% of the players missed at least one competitive match due to injury. Table 2 summarises the number of injuries and the injury incidence. The injury incidence was higher ($p < 0.001$) in competitive matches than in friendly matches and training. The overall risk of injury was 10.9 injuries/1000 hours of exposure. Table 3 shows how the injury incidence was not significantly affected by playing position. However, goalkeepers missed the less ($p < 0.001$) number of competitive matches due to injury.

Table 2. Number of injuries and injury incidence (number of injuries/1000 hours of exposure) in a Spanish sub-elite team.

		Injury incidence		
	Injuries (*n*)	Mean	SD	95% CI
Training	129	5.2	0.8	3.9-6.6
Match play	184	44.1	6.6	33.6-54.6
Competitive	*146*	*55.8***	*9.4*	*40.9-70.8*
Friendly	*28*	*22.6***	*6.0*	*13.2-32.1*
Total	313	10.9	1.4	8.7-13.0

** $p < 0.01$ from Training. *** $p < 0.001$ from Training and Friendly.

Injury severity and recurrent injuries

Table 4 shows injury severity. Injuries represented a total of 2454 absence days, 881 absences to training sessions and 246 absences to competitive matches. Recurrent injuries accounted for 9% (27/313) of all injuries sustained during the study period. Moderate and major severity muscle (7/35) and joint (4/20) injuries experienced the

Table 3. Injury incidence per 1000 hours and number of matches missed due to injury in a Spanish sub-elite team from different playing positions.

	Training	Match	Total	Match Absence
Goalkeeper	7 (5)	4 (2)	11 (4)	8 (3) ***
Fullback	24 (19)	37 (20)	61 (19)	48 (20)
Central Defender	18 (14)	40 (22)	58 (19)	43 (17)
Wide Midfielder	20 (16)	31 (17)	51 (16)	51 (21)
Central Midfielder	33 (26)	38 (21)	71 (23)	56 (23)
Forward	27 (21)	34 (18)	61 (19)	40 (16)
Total	129 (100)	184 (100)	313 (100)	246 (100)

Values in parentheses are percentages. Aproximation of the percentages has been made to equal 100%.
*** $p < 0.001$ from other playing positins.

highest recurrent injury rate.

Injury types and locations

As it can be seen from Table 5, 89% of the injuries affected the lower extremities, representing 94% of competitive match absence. Overuse injuries (40%) were the single most common injury subtype although muscle strains caused the highest competitive match absence (43%). The number of strains was not uniformly distributed between the four major groups from the lower limb as hamstring strains (28/62) were more frequent ($p < 0.01$) than adductors (11/62), quadriceps (10/62) and calf muscles (9/62) strains. The incidence of hamstring strains was 1.0 injuries/1000 hours. Ankle (32/52) and knee (18/52) joints constituted 96% of all sprains, with an incidence of 1.2 and 0.6 injuries/1000 hours, respectively.

Discussion

The epidemiology of football injuries in elite teams has been well documented during the last years. However, less is known about the injury incidence when playing at lower competitive standards. The overall injury rate of Spanish footballers (10.9 injuries/1000 hours exposure) was slightly higher than that previously reported in the literature (Ekstrand, 2008; Ekstrand et al., 2009; Hawkins et al., 1999; Waldén et al., 2005). This could be explained by the superior amount of injuries sustained during match play (44 injuries/1000 hours) in comparison to values calculated for European teams (21-30 injuries/1000 hours) (Ekstrand, 2008; Ekstrand et al., 2009; Hawkins et al., 1999; Waldén et al., 2005). However, two recent studies have also shown high match play incidences during the 2010 World Cup (Dvorak et al., 2011) and for the national team of Qatar (Eirale et al., 2010). This difference in the total amount of injuries could be due to regional variations in the playing style of the teams or to different injury definitions (Dvorak et al., 2011; Hawkins et al., 1999).

The analysis of injury severity revealed a different pattern in relation to the players taking part in the UEFA Champions League (Ekstrand et al., 2009; Waldén et al., 2005). The footballers investigated in the present study had a 2-fold higher incidence of slight injuries, whereas the incidence of major injuries was 1/3 of previous data on elite players, which could be explained by the increased physical match demands and the congested calendar of competitions inherent to elite teams. Complementary, it is also important to examine the meaningfulness of the injury episodes by calculating the player´s availability in competition. On average, each player missed 2.9 competitive matches per season due to injury. Therefore, a team with 22 footballers playing one competitive match per week can expect 60-65 match absences per season. Over a 38 match league, this means the coach has, on average, 93% injury-free player availability during the competition period. The overall injury incidence was very similar for all outfield playing positions as previously reported by Morgan and Oberlander (2001) and Fuller et al. (2004). Altogether, these injury incidence data can be very useful to football managers when organizing the squad, as they can have an estimation of the number of players needed depending on the type of competition in which the team is going to take part.

To our knowledge, all previous epidemiological studies in football have considered together for analysis friendly and competitive matches, following the UEFA instruction manuals (Fuller et al., 2006; Hägglund et al., 2005). In the present study we investigated if the type of injury sustained by the players was influenced by the type of match. Our results revealed that the injury incidence of competitive match play was 2.5 fold that of friendly matches. Competition requires players to perform at their most of their physical capacity and, therefore, the risk of sustaining an injury is elevated. On the other hand, friendly matches are usually employed as a preparation for the official competition in order to acquire an optimal fitness status and, for instance, players are less challenged, which reduces the risk of injury. Complementarily, friendly matches showed a 4.3 times higher injury risk than training, again probably influenced by the lower number of agonistic situations experienced in training in

Table 4. Injury severity in a Spanish sub-elite team.

	Injuries (n)	Injury incidence (1000 h)	Absence (days)	Absence (training sessions)	Absence (matches)
Slight	160	5.6	2.1 (0.7)	1.4 (0.7)	0.1 (0.2)
Minor	70	2.4	4.9 (1.1)	3.1 (1.2)	0.4 (0.5)
Moderate	71	2.5	14.2 (5.5)	8.1 (3.5)	1.7 (1.1)
Major	12	0.4	64.1 (31.0)	24.8 (11.5)	7.1 (3.2)
Total	313	10.9	7.8 (13.8)	3.8 (4.7)	0.8 (1.7)

Values in parentheses are number (%) or mean (SD)

Table 5. Injury location, types and severity in a Spanish sub-elite team.

		Slight	Minor	Moderate	Major	Total Injuries	Absence (matches)
Location	**Head/face/neck**	1 (1)	0 (0)	2 (3)	0 (0)	3 (1)	3 (1)
	Back/trunk	17 (11)	5 (7)	2 (3)	0 (0)	24 (8)	7 (3)
	Hip/Groin	32 (20)	8 (11)	8 (11)	4 (33)	52 (17)	48 (20)
	Thigh	57 (36)	23 (33)	31 (44)	0 (0)	111 (35)	71 (29)
	Knee	14 (9)	10 (14)	6 (8)	2 (17)	32 (10)	26 (11)
	Lower leg	13 (8)	7 (10)	5 (7)	1 (8)	26 (8)	24 (10)
	Ankle	11 (7)	15 (21)	14 (20)	4 (33)	44 (14)	46 (19)
	Foot	12 (8)	1 (1)	1 (1)	1 (8)	15 (5)	17 (7)
	Upper extremity	3 (2)	1 (1)	2 (3)	0 (0)	6 (2)	4 (2)
	Total	160 (100)	70 (100)	71 (100)	12 (100)	313 (100)	246 (100)
Type	**Sprain**	12 (8)	16 (23)	19 (27)	5 (42)	52 (17)	58 (24)
	Strain	7 (4)	13 (19)	40 (56)	2 (17)	62 (20)	107 (43)
	Contusion	52 (33)	12 (17)	3 (4)	0 (0)	67 (21)	8 (3)
	Fracture	0 (0)	0 (0)	3 (4)	1 (8)	4 (1)	20 (8)
	Dislocation	0 (0)	0 (0)	0 (0)	1 (8)	1 (0)	9 (4)
	Other	1 (1)	1 (1)	0 (0)	0 (0)	2 (1)	1 (0)
	Overuse	88 (55)	28 (40)	6 (8)	3 (25)	125 (40)	43 (17)
	Total	160 (100)	70 (100)	71 (100)	12 (100)	313 (100)	246 (100)

Values in parentheses are percentages. Aproximation of the percentages has been made to equal 100%.

comparison to friendly games. These data are of special interest for teams playing one competitive match per week. Football coaches must evaluate the benefits of introducing periodical friendly matches in the course of the week as they can increase the risk of injuries. This is also supported by a recent observation carried out by Dupont et al. (2010) who reported a higher injury rate when two competitive matches were played per week.

As revealed in other studies (Ekstrand, 2008; Ekstrand et al., 2009; Hawkins et al., 1999), the location of the most common injury was the thigh, with a higher occurrence of posterior in relation to anterior injuries. Muscle injuries principally affected the four main groups of the lower limbs: hamstrings, adductors, quadriceps and calf muscles. Hamstring strains caused the highest match absence, with a similar incidence (1.0 injuries/1000 hours) than that reported for European elite players (Árnason et al., 1996; Hawkins et al., 1999; Hägglund et al., 2005; 2006; Waldén et al., 2005; Woods et al., 2004). The number of sprains was similar than strains although they caused a lower match absence. The incidence of knee and ankle sprains was 0.6 and 1.2 injuries per 1000 hours, respectively. The risk of ankle sprains was higher than that experienced by UEFA Champions League players: 0.8 injuries/1000 hours (Ekstrand, 2008). The fact that some of the away matches were played on artificial turf, whereas the home games were played on natural grass, could help explaining this superior value, as Ekstrand et al. (2006) showed a higher incidence of ankle strains when football was played on artificial turf compared with natural grass. Another important issue in epidemiological studies is recurrent injuries. The overall recurrence index in the present study was lower than that reported for different European elite players (Ekstrand, 2008; Hawkins et al., 1999; Waldén et al., 2005). However, moderate and major severity muscle and joint injuries accounted 20% recurrent episodes. As it has been previously shown (Ekstrand et al., 2011) that reinjuries cause longer absences than the primary injuries, this data highlights the importance of controlling the rehabilitation of this kind of injuries. In addition, it appears essential to identify previous injuries in players, as they represent the main risk factor for recurrence, especially in hamstrings, groin and knee joint injuries (Árnason et al., 2004; Hägglund et al., 2006).

The present study examined the injury epidemiology of a unique football team in the course of four consecutive seasons. Therefore, one of the limitations of this study is that the results cannot be generalized to all sub-elite teams as there are many different factors (coaching staff, training methodology and workloads, medical services and facilities, environmental conditions, etc.) than can affect the injury burden. Nevertheless, the analysis of the injury risk factors and injury mechanisms suggests that a sub-elite team could benefit from introducing preventive exercises in the training program to reduce muscular (Askling et al., 2003; Árnason et al., 2008; Holmich et al., 1999; Mjolsnes et al., 2004; Witvrouw et al., 2003) and ligament (Caraffa et al., 1996; Hägglund et al., 2003; Junge et al., 2002) injury risks as these were the main cause of competitive match unavailability.

Conclusion

The principal finding of this study was that the incidence of major injuries was lower in a Spanish sub-elite football team in comparison to elite European football teams (Ekstrand, 2008; Ekstrand et al., 2009; Hawkins et al., 1999; Waldén et al., 2005). On average, a player incurred 3.6 injuries (0.1 major injuries) and missed 2.9 competitive matches each season. The injury incidence during competitive matches was higher ($p < 0.001$) than in friendly matches and in training (55.8 vs. 22.6 vs. 5.2 injuries/1000 hours, respectively). Injuries located in the four main muscles of the leg (hamstrings, quadriceps, adductors and calf muscles) and knee and ankle joints were the main causes of match unavailability.

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Key points

- The incidence of major injuries (absence greater than 4 weeks) was lower in a Spanish sub-elite football team than in elite European teams.
- The risk of sustaining an injury was 2.5 fold higher ($p < 0.001$) in official than in friendly matches.
- Lower limb muscular (hamstrings, quadriceps, hip adductors and calf muscles) and joint (knee and ankle) injuries were the main causes of match unavailability.

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