



Research Article

Injury Incidence of a Spanish Elite Female Soccer Team during a Competitive Season. A Case Study

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Abstract

The aim of this study was to examine the injury incidence and characteristics of a Spanish female elite soccer team ($n=22$ players) during an entire competitive season. Time loss injuries and individual exposure times were recorded during all team training sessions and matches during the 2009-2010 season, following the Union des Associations Européennes de Football (UEFA) consensus statement on injury definitions and data collection procedures in studies of soccer injuries. The overall injury risk was 5.1 injuries per 1000 hours. The incidence of injury during training and match play was 3.9 and 14.4 injuries per 1000 hours, respectively. The number of injuries was not ($P<0.05$) uniformly distributed during all the months of the season as the first (August) and last two (April and May) months presented the highest injury frequency. A player sustained, on average, 1.7 injuries per season and missed 1.5 competitive matches. Ankle sprain was the most common (31%) injury diagnosis and, together with knee sprains, caused two thirds of total match absence. The present study showed the injury incidence and characteristics of a Spanish female elite soccer team during one competitive season. Training workloads should be monitored and controlled in the critical periods of the season. Specific injury prevention strategies should be implemented for female players to reduce the risk of incurring the most common injuries.

Keywords: Football, epidemiology, injury prevention.

Introduction

Female soccer has experienced tremendous growth over the last years. The Fédération Internationale de Football Association (FIFA) estimates that over 26 million women participate in the sport. Many female footballers have reached professionalism and take part of the most prestigious leagues in United States, Japan, Norway, Sweden, Germany or England. This expansion of the sport has led the Union of

European Football Associations (UEFA) to the organization of the first Women's Champions League in the 2009-2010 season, imitating the worldwide greatest male clubs tournament.

Despite this incipient increase in the impact of the sport, research in female soccer is lagging behind male's counterparts. Distance covered during a match has been reported similar for female and male players, although male players

cover a greater amount of match distance by high-intensity running (Mohr *et al.*, 2003, 2008; Krstrup *et al.*, 2005). In addition, gender differences have been detected in endurance and anaerobic performances, as male players covered a greater distance during the yo-yo intermittent recovery level 1 test (Krstrup *et al.*, 2003) and presented a fastest 15-m sprint time that did female players (Mujika *et al.*, 2009). Altogether, these data suggest that the physical demands of female elite soccer match play are lower than that of male soccer.

Injury incidences in different populations of female footballers have been reported in the literature (Giza *et al.*, 2005; Jacobson and Tegner, 2007; Tegnander *et al.*, 2008) with an overall lower injury risk than presented by male players (Hawkins and Fuller, 1999; Waldén *et al.*, 2005; Hägglund *et al.*, 2009a) but with a higher predominance of knee injuries. An increased general joint laxity and an age over 25 years were identified by Östenberg and Roos (2000) as risk factors for knee injuries in females. All of these investigations have been carried out with Scandinavian and American female players, where there is a greater tradition of female soccer. Interestingly, western European countries as Spain have nowadays increased the number of practitioners. As soccer injury epidemiology might experience regional differences (Jacobson and Tegner, 2007; Waldén *et al.*, 2005), it appears important to examine if the injury patterns of a western European team lies within data previously reported in the literature. To our knowledge, no study has examined injury epidemiology in Spanish female soccer, so this information should be an important feedback for coaches to develop specific injury prevention strategies to avoid increasing the injury burden.

Therefore, the aim of this study was to examine the injury incidence and characteristics of a Spanish female elite soccer team during an entire season.

Methods

All the subjects from the study belonged to one of the strongest Spanish clubs, with

players being recruited from all around the country, according to their level of performance. During the season of study, 2009-2010, the team won the Spanish premier league ("Super-league") and took part in the UEFA Women's Champions League. All the players from the first team squad ($n=22$) were included in the study and classified according to their playing position into goalkeepers ($n=2$), defenders ($n=8$), midfielders ($n=8$), and forwards ($n=4$). The mean and standard deviation age for the players was 25.1 ± 3.0 years, height 1.66 ± 0.06 m, weight 59.0 ± 6.6 kg, and body fat (calculated after Faulkner, 1968) $12.9 \pm 1.5\%$. Before the commencement of the season, all the players were physically examined by a qualified physician with no injuries detected on the players. Hence, all the subjects were injury-free at the start of the investigation period. All the players received verbal and written information about the study and gave their informed consent before the investigation. The study was approved by the Local Ethical Committee.

The investigated period in this study followed the typical western European soccer season, with training beginning during the summer (August) and concluding in late spring (May). The procedure for data collection and analysis has been precisely described in previous papers (Mallo *et al.* 2011; Mallo and Dellal, 2012). A qualified physiotherapist, present at all sessions and matches, recorded individual exposure times and time loss injuries in computerized forms following the UEFA consensus statement on injury definitions previously reported in studies of soccer injuries (Hägglund *et al.*, 2005; Fuller *et al.*, 2006). Training sessions were considered as all team based activities carried out under the supervision of a first team coach, whereas matches involved friendly and competitive match play against other clubs. Injuries were recorded when leading to a player being unable to fully participate in future training and match play, and classified according to type and location. Injury severity was calculated from the number of days that elapsed from injury to full participation and categorized into: (1) slight: 1-3 days absence; (2) minor: 4-7

days absence; (3) moderate: 8-28 days absence; and (4) major: >28 days absence. Mechanism of injury was also considered for analysis with injuries resulting from contact or non-contact with another player or surface. Recurrent injuries were defined as an injury of the same type and the same location as an index injury after returning to full participation.

All statistical analyses were conducted using SPSS for Windows version 15.0 (SPSS Inc., Chicago, IL, USA). Injury incidence was defined as the number of injuries sustained per 1000 hours of football activity. Chi-squared test calculations were carried out to assess if the number of injuries were uniformly distributed between months of the season and playing positions. Statistical significance was set at $P < 0.05$. Data are presented as means and standard deviations.

Results

A total of 39 injuries occurred in 7695 hours of football exposure, with an overall

injury incidence of 5.1 injuries per 1000 hours. The number of injuries sustained during training was 27 (incidence: 3.9 injuries per 1000 hours) whereas 12 injuries occurred during match play (incidence: 14.4 injuries per 1000 hours). The number of injuries was not uniformly distributed during all the months of the season ($X^2_{(9)} = 18.18$; $P = 0.033$; Figure 1) as the first (August) and last two (April and May) months presented the highest injury frequency. No significant differences ($P > 0.05$) were detected in the frequency of injuries by playing positions. In total, all the injuries caused 384 absence days and 243 and 33 absences to training and competitive matches, respectively (Table 1). Of the 22 players in the team, 17 (77%) sustained at least one injury during the season. The percentage of players that missed at least one competitive match due to injury amounted 55%.

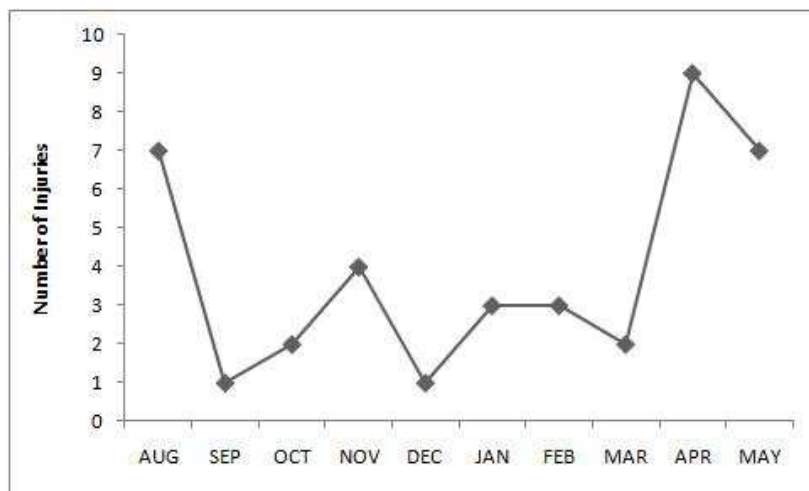


Figure 1. Seasonal Distribution of Injury Occurrences in Spanish Female Football Players

Table 1. Injury Severity in Spanish Female Football Players in Relation to Days of Absence (Mean \pm s). Legend: Slight: 1-3 Days Absence; Minor: 4-7 Days Absence; Moderate: 8-28 Days Absence; and Major: >28 Days Absence

	Injuries	Injury incidence (1000 h)	Absence (days)	Absence (training sessions)	Absence (matches)
Slight	12 (31%)	1.6	2.3 \pm 0.9	1.2 \pm 0.6	0.1 \pm 0.3
Minor	8 (21%)	1.0	5.6 \pm 0.9	3.3 \pm 1.0	0.3 \pm 0.5
Moderate	17 (43%)	2.2	13.9 \pm 4.6	8.1 \pm 3.6	1.2 \pm 0.8
Major	2 (5%)	0.3	47.0 \pm 25.5	35.5 \pm 31.8	5.0 \pm 2.8
Total	39 (100%)	5.1	10.3 \pm 11.3	6.4 \pm 9.4	0.8 \pm 1.3

Ligament sprains were the most common type of injury (38%), followed by strains (26%) and overuse (23%) injuries (Table 2). As it can be seen in Table 2, the ankle (38%) was the most commonly injured region followed by the thigh (26%). In addition, ankle and knee injuries accounted each for 33% of the total match absence. Muscle strains principally affected the four major muscle groups of the lower limbs:

quadriceps (30%), hamstrings (30%), calf muscles (20%) and adductors (10%). Hamstrings experienced the highest (56%) incidence of overuse injuries; however, patellar tendinopathy caused a higher match absence (9%). One third (13/39) of the injuries were caused by contact with another player and caused 42% of all match absence. Thirteen percent of all injuries were recurrent episodes (5/39).

Table 2. Injury Types, Location in Spanish Female Football Players in Relation to Severity and Days of Absence

	Slight	Minor	Moderate	Major	Total Injuries	Absence (matches)
Types						
Sprain	2 (17)	3 (38)	9 (53)	1 (50)	15 (38)	19 (58)
Strain	2 (17)	2 (25)	6 (35)	0	10 (26)	10 (30)
Contusion	3 (25)	0	1 (6)	0	4 (10)	0
Fracture	0	0	0	0	0	0
Dislocation	0	0	0	0	0	0
Other	0	0	1 (6)	0	1 (3)	1 (3)
Overuse	5 (42)	3 (38)	0	1 (50)	9 (23)	3 (9)
Location						
Head/face/neck	0	0	1 (6)	0	1 (3)	1 (3)
Back/trunk	1 (8)	0	0	0	1 (3)	1 (3)
Hip/groin	0	0	1 (6)	0	2 (5)	2 (6)
Thigh	4 (33)	2 (25)	4 (24)	0	10 (26)	4 (12)
Knee	0	1 (13)	1 (6)	2 (100)	4 (10)	11 (33)
Lower leg	1 (8)	2 (25)	1 (6)	0	4 (10)	3 (9)
Ankle	4 (33)	3 (38)	8 (47)	0	15 (38)	11 (33)
Foot	0	0	1 (6)	0	1 (3)	0
Upper Extrem.	1 (8)	0	0	0	1 (3)	0
Total	12 (100)	8 (100)	17 (100)	2 (100)	39 (100)	33 (100)

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

Discussion

The overall injury incidence of Spanish female footballers was 5.1 injuries per 1000 hours, with a higher injury risk during match play than during training. The frequency of injuries was not uniformly distributed during the season, peaking at the beginning and at the end of the season. On average, each player sustained 1.7 injuries per season and missed 1.5 competitive matches. Ligament sprains were the most common injury type constituting 38% of all injuries and causing 58% of the total match absence. Thirteen percent of all the injuries were recurrent injuries.

Despite the increasing number of female soccer practitioners in Spain, little is known about the injury epidemiology of this population of sportswomen. Unlike other countries such as United States, Germany or England, there is not yet a professional league in Spain and, therefore, the level of the teams playing in the highest national league presents a high heterogeneity. A typical Spanish top division team carries out three 1.5 hours training sessions per week and plays a competitive game every weekend. All the training activities are carried out on the field as there are no gym facilities available for these teams. Hägglund *et al.* (2006) concluded that an injury surveillance study during one entire season can provide an overview of the injury epidemiology in a specific environment. For instance, this study was based on the winner team of the 2009-2010 national league that reached the Round of 32 in the UEFA Champions League. To allow comparisons with other studies, the investigation respected the consensus statement on injury definitions and data collection procedures described by Hägglund *et al.* (2005) and Fuller *et al.* (2006).

The first step in the prevention of soccer injuries is to examine the injury occurrence (Jacobson and Tegner, 2007). The injury risk of Spanish female footballers during training (3.9 injuries per 1000 hours) and match play (14.4 injuries per 1000 hours) was very similar than that experienced by

Swedish premier league players (Jacobson and Tegner, 2007; Hägglund *et al.*, 2009a). However, a recent study carried out in the women's premier soccer league in Germany (Gaulrapp *et al.*, 2010) has shown a higher injury incidence during match play (23.6 injuries per 1000 hours). In addition, the injury incidence has been reported even higher during international tournaments (Junge and Dvorak, 2007) principally due to the competition calendar, as in these championships the teams compete every two or three days. Nevertheless, both at club and national team levels, the injury incidences are lower during training and match play for female in relation to male players (Hawkins and Fuller, 1999; Waldén *et al.*, 2005; Ekstrand, 2008), probably due to lower physical demands experienced by female players during competition in relation to their male counterparts (Krustrup *et al.*, 2005; Mohr *et al.*, 2003, 2008).

Severity represents a greater problem than the frequency of the injury episodes. For instance, it is important to assess the meaningfulness of injuries by the days of absence and by match unavailability. In this study the average number of injured players per match was 1.0, which represented that 96% of the squad was injury-free during each competitive match. The fact that the team played one match per week allowed higher match availability than for male elite teams, which usually present a congested match calendar, playing twice a week during long periods. Almost half of the injuries had less than a week recovery periods, whereas the remaining 49% were considered as moderate or major injuries. Apparently, there were no gender differences in severity of injuries, as the risk for incurring a moderate or major injury was similar in female and male soccer (Waldén *et al.*, 2005; Hägglund *et al.*, 2009b).

This study found that the risk to sustain an injury was higher at the beginning and at the end of the season. Overuse injuries have been proven to be more common during pre-season both in female (Jacobson and Tegner, 2007) and male (Hägglund *et al.*, 2009a) footballers. The players come from a

one or two month off-season period and are usually exposed to a high demanding training during the pre-season. Therefore, reintroduction to training should be gradual and cautious to avoid these injuries. The initial competitive matches have also been identified as a critical period to sustain injuries for both genders of elite players (Waldén *et al.*, 2005; Gaulrapp *et al.*, 2010) which suggests the importance of introducing competitive-based exercises in the final part of the pre-season to allow adaptations to the competitive demands. Additionally, several studies have found an increased number of injuries during the latter stages of the competitive season (Giza *et al.*, 2005; Ekstrand and Hilding, 1999). This period usually includes the most important matches of the season and, therefore, the players are heavily mentally and physically challenged, elevating the risk to incur injuries.

As reported in other previous studies, the injuries most commonly involved the lower extremities (Jacobson and Tegner, 2007; Tegnander *et al.*, 2008; Junge and Dvorak, 2007). Specifically, ankle sprains was the most common diagnosis (31%) supporting recent observations carried out with Norwegian and German premier league players (Tegnander *et al.*, 2008; Gaulrapp *et al.*, 2010). The fact that the Spanish players presented higher rates of ankle sprains than reported elsewhere (1.6 injuries per 1000 hours) could be due to the playing surface. To date, most of the matches in the Spanish league are played in artificial turf, which has been shown to have a trend towards more ankle sprains than natural grass (Steffen and Andersen, 2007). The knee has been identified as an additional commonly injured region in other investigations (Giza *et al.*, 2005; Östenberg and Roos, 2000). In the present study, despite presenting a lower incidence rate, knee injuries required longer recovery periods than ankle sprains. Altogether, knee and ankle injuries represented two thirds of total match absence, which recommends the introduction of preventive routines to reduce these indexes (Van Mechelen *et al.*, 1992). Proprioceptive training has proven useful to prevent ankle and knee injuries (Hewett *et al.*, 1999; Junge *et al.*, 2002) and,

therefore, the risk of ankle sprains in football was reduced by 50% in Swedish male players during the last years (Ekstrand, 2008). Furthermore, anterior cruciate ligament injuries represent an important threat for female players (Giza *et al.*, 2005; Tegnander *et al.*, 2008) and, therefore, special care should be taken with this population of sportswomen. The elevated frequency of ligament sprains implies that the pattern of injuries for female players differs from their male counterparts. Studies carried out in male soccer have shown that the thigh is most injured region (Hawkins and Fuller, 1999; Ekstrand, 2008) and muscle strains represent one of the main causes of match unavailability (Waldén *et al.*, 2005; Ekstrand *et al.*, 2011). The incidence of muscle strains (1.3 injuries per 1000 hours) in the actual study was identical than that reported for Swedish elite players (Jacobson and Tegner, 2007) but lower than that of elite male players: 1.6 injuries per 1000 hours (Ekstrand, 2008) It could be expected that an increase in the pace of play would recall the players to increase the number of sprints and the risk of incurring in muscle strains. Therefore, the introduction of preventive exercises would be beneficial to reduce the risk of muscle injuries, especially as the level of the game increases (Árnason *et al.*, 2008).

Player-to-player contact caused 33% of all injuries and 42% of all match unavailability. These values are lower than those reported in other studies (Jacobson and Tegner, 2007; Junge and Dvorak, 2007) suggesting that the playing style of the teams may influence the mechanism of injury. Sliding-in tackles have been reported to have the highest injury potential in women's football (Tscholl *et al.*, 2007). It could be expected a lower number of sliding-in tackles in Spanish football due to differences in the level of the contending teams and the fact that the games are played in artificial turf. Female players have also been reported to suffer a high frequency of head injuries (Giza *et al.*, 2005; Tegnander *et al.*, 2008; Gaulrapp *et al.*, 2010), which could be troublesome because of the potential for long-term cognitive deficits (Dvorak *et al.*, 2007). In the actual study, one concussion due to player-to-player collision was

registered, which supports the statement presented by Boden *et al.* (1998) which expected one concussion per team per year. Finally, recurrent injuries represented 13% of all injuries. This is a lower value than those reported for female (Jacobson and Tegner, 2007) and male players (Hawkins and Fuller, 1999; Ekstrand, 2008) and reinforces the importance of taking an exhaustive control of the rehabilitation of the injured player to help to reduce the risk of re-injuries.

Finally, it is important to state the limitation of the study. The fact that only one team was followed over one season suggests that complementary research should be carried out to bring light to this topic. Nevertheless, these data can help Spanish coaches to implement injury prevention strategies when managing similar kind of female soccer teams.

Conclusion

The present study showed the injury incidence and characteristics of a Spanish female elite soccer team during one competitive season. The highest risk of injuries was registered at the beginning and at the end of the season, reinforcing the importance of controlling the workload in these critical periods. Female footballers were most commonly injured in the ankle, knee and thigh. Specific injury prevention strategies should be implemented for female players to reduce the risk of incurring these injuries.

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