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Injury Rate in Professional Soccer Players within the Community of Madrid: A Comparative, Epidemiological Cohort Study among the First, Second and Second B Divisions

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Abstract

Background: Soccer is a sport with international reach and presence. Injury rates in this sport are high, and these have a high economic impact on soccer clubs.

Objectives: To report the incidence, type and circumstances of injuries sustained by professional soccer players in Spain across three playing categories: first division, second division, second division B.

Study design: A prospective, descriptive, epidemiological cohort study.

Participants: The inclusion criteria consisted of all male players with an existing contract within the first team. Players with old injuries were not excluded and neither were those who were injured when data collection began. The number of players in the sample included 100 professional soccer players.

Methods: This prospective, observational study examined time-lost injuries occurring during 2016/2017 season among 100 male players from 4 soccer clubs based on a comprehensive data recording form.

Main Outcome Measurements: Date and mechanisms of injury, body area injured, diagnosis, severity, and time-off (days) for each player were collected.

Results: 142 injuries were recorded. The injury incidence rate was 2.58 injuries per 1000 hours exposure. The number of injuries decreased the higher the professional category, thus a statistically significant difference was found with a greater number on injuries in the second division B players (3.03) compared to first division (2.27) and second division (1.92). Direct player-to-player contact was responsible for 66.9% of injuries. The majority (80.98%) of injuries occurred in the lower limb, of which the thigh was the most injured area (40%) followed by the knee (19.13%). Muscle injuries were the most frequent form of injury (52.10%), of which the hamstrings were the most affected muscle.

Conclusion: These findings help identify the most common injury patterns. This data may be used to improve current injury prevention programs.

Keywords: Epidemiology; Soccer; Lower extremity; Muscles

Introduction

In Spain, soccer is by far the sport with the most followers. There are 869,320 federated soccer players in Spain, and the number of clubs equals 21,027 [1]. In addition, the economic impact of soccer is vast, adding up to approximately 1% of the gross domestic product in Spain [2]. Furthermore, it is also one of the sports with the highest risk of injury. Indeed, several studies have confirmed that this sport is responsible for between 6 to 9 sports injuries per 1,000 hours exposure, which, compared to other sports, is a high figure [3-5]. In Europe, soccer is responsible for between 25 and 50 percent of sports injuries registered [6]. Only a few sports, such as rugby present incidence rates that are higher than soccer [7,8]. It is important to note that in professional soccer, any injury sustained by a player inevitably is associated with, on the one hand, suffering for the player, but also an important economic loss for the club, with the ensuing repercussion in first level events to follow [9]. Despite the high injury rates, there is no consensus regarding the number or injuries or the underlying mechanisms [10,11]. In order to help to inform an improved consensus regarding injury rate and bearing in mind the fact that soccer is the most practiced sport in Spain, this research project aimed to study professional soccer players in the community of Madrid in order to collect and describe the data regarding the number of injuries, the most frequent injuries, their distribution, type, location (tissues and anatomical location), moment in which these occurred, cause and severity. Furthermore, we sought to compare the injury rate among players from the different professional categories (first division, second division, second division B).

Methods

An epidemiological, observational, prospective and descriptive study was performed. The sample considered all the soccer teams of the 1st, 2nd and 2nd B division categories of the autonomous community of Madrid, Spain. A stratified cluster sampling method was used, considering stratification of the categories of the first division, second division A and second division B.

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Participants

The inclusion criteria consisted of all male players with an existing contract within the first team. Players with old injuries were not excluded and neither were those who were injured when data collection began. In these cases the player was included in the study, however the injury the player was recovering from was not included in the study for statistical analysis and the exposure factor was not registered until the player was completely recovered from said injury. Injuries were defined as an event occurring during a training session or programmed match leading to the absence of the player at the subsequent training session or match [12]. Furthermore we only registered injuries occurring during training sessions or during matches whether these were official or not. Thus, injuries occurring when performing other activities were not recorded. Players who, at the end of the season presented some kind of injury were followed up until final recovery. In the cases in which an injured player abandoned the club during the season, the player was followed up until recovery.

Data collection

We elaborated a form for data collection based on a UEFA proposal, which was used during the first week of the preseason. In this form we collected personal data, anthropometric data, sports characteristics of each player (position on the field, dominant leg...), date of injury, mechanisms of injury, body area injured, injured structure, diagnosis, severity, minute of match or training results (in the case that this occurred during competition) and time-off (days) for each player together with the sports medical history of the players. Severity of injury was determined by the number of days between the occurrence of injury until medical leave ranging from mild (between 1 and 7 days), moderate (between 8 and 28 days) and severe (more than 28 days).

Procedure

First, we randomly selected one club of the three first category clubs, one club from the three second-category clubs and two from the six B category clubs. We then informed the selected clubs regarding the study procedure and aim based on an information sheet which also contained instruction and definition of terms for the registry of injuries. All four clubs participated voluntarily and all players signed an informed consent form prior to participation in this study. All injuries occurring throughout the 2016-2017 season between 1st July 2016 and 1st May 2017 were recorded by doctors from the clubs. This included both the pre-season and season periods. All training sessions and matches were performed on natural grass. The number of players in the sample included 100 professional soccer players with an existing contract during the aforementioned season. This sample size was determined considering that each team has 25 federated players.

All players and their legal tutors were informed of the nature and characteristics of the study and signed informed consent prior to participation, in accordance with the principles of the Declaration of Helsinki. The rights of subjects were protected as all clubs were provided with a confidentiality form based on the organic law for protection of personal data.

Data analysis

A descriptive statistical analysis of the quantitative data was conducted in order to describe the sample. This included the calculation of the mean, standard deviation, maximum, minimum, median figures. The Kolmogorv-Smirnov test was used to determine the normal distribution of the sample. We then drew up contingency tables for the relation between qualitative variables (Crosstabs procedure). The Fisher exact test or Chi squared test was used to compare the independence or influence between two qualitative variables; injured tissue and player position. In addition, ANOVA variance analyses were performed to compare multiple means regarding two conditions. The SPSS 19.0 software package for windows was used for statistical calculations, considering $p<0.05$.

Results

In total, 100 professional players were recruited for this study and followed up. All players accepted to participate in this study. No players changed team during the season. The mean age of players was 25.26 ± 4.94 years, error 0.96, IC: 24.29; 26.23, without differences statistically significant among the categories (p=0,121), their mean weight was 75.24 ± 4.51, error 0.88, IC: 178.34; 180.1, without differences statistically significant (p=0,626), and their height was 179.22 ± 4.48, error 0.88, IC: 74.36; 76.12. With differences statistically significant in the size among the categories (p=0.000) being the 1st Division players those who average more height, 182,36 cm (5,98 ft) and the 2nd B Division players the shortest with an average 178,04 cm (5,84 ft). Twenty-five players belonged to the first division, 25 belonged to the second division, and 50 players belonged to the second B category. Table 1 displays the player position of the study participants. Four players were followed up due to injuries at the end of the season. The follow-up periods for these players were 8, 16, 21 and 63 days, respectively.

Injuries incidence and severity

In total, 142 injuries were recorded, 33 among the first division players, 27 among second division, and 82 among second B division players (46 in one club and 36 in another), these represented 23.2%, 19% and 57.5% of all injuries, respectively. Significant 95% (p=0.037) differences were found between the number of injuries in each category: the injuries were similar between the 1st and 2nd division; however the players of the 2nd division B suffered 0.56 injuries more than those of the 2nd division.

Regarding the total incidence of injuries in our study, we obtained a value of 2.58 injuries for every 1,000 hours exposure. The injury rate during training sessions equaled 1.56 injuries for every 1.000 hours training. During matches, the injury rate registered was 6.6 injuries per 1.000 hours exposure to the risk. Most injuries took place during matches (51%) *vs.* training (49%). During competitive matches more injuries took place in the second part of the match: 89 injuries of the 142 total injuries. When studying these injuries occurring during matches, we found differences among divisions, 5.0 injuries per 1,000 hours in competition in the 2nd division, 5.42 injuries in the 1st division per 1,000 hours of match, and 7.8 injuries in the 2nd division B for every 1,000 hours exposure.

Regarding the injury rate among categories, differences were observed in the total rate of injuries. Thus, the lowest injury rate was registered in the 2nd division: 1.92 injuries/1,000 hours. In the 1st division this was slightly higher: 2.27 injuries/1,000 hours, whereas

Position	N
Defense	36
Striker	20
Midfielder	32
Goalkeeper	12
Total	100

Table 1: Distribution of players by position.

the highest was the 2nd division B in which the injury rate was 3.03 injuries/1,000 hours exposure. Finding differences statistically among categories (p=0.034). In our study each player suffered an average of 1.4 injuries by the end of the season. Most injuries were mild (42.95%), followed by moderate (39.43%) and severe injuries which were the least frequent injury type (17.60%) (Table 2).

Time-loss

The time loss of injuries (Figure 1) equaled 756 days for first category players, 796 for second division players, 609 for one of the 2nd division B teams, and 666 for the remaining 2nd division B team.

Injury details	Total (n=142)	95% CI
Lower limb injuries	115	80.99%
Hip	6	4.23%
Thigh	47	33.10%
Gluteus	5	3.52%
Knee	22	15.49%
Lower leg	13	9.15%
Ankle	21	14.79%
Foot	1	0.70%
Upper limb injuries	14	9.86%
Trunk injuries	6	4.23%
Head injuries	7	4.93%
Mechanism of injury		
Contact injury	47	33.10%
Non-contact injury	95	66.90%
Recurrent/new injury		
New injury	127	89.44%
Recurrent injury	15	10.56%
Injury severity		
Mild	61	42.96%
Moderate	56	39.44%
Severe	25	17.60%

Table 2: Injury details

Mechanism and nature of injuries

The mechanism of injury was mainly due to physical contact (66.9% *vs.* 33.1% non-contact injuries) not finding differences statistically among categories (p=0.710) (Table 2). Up to 10.56% of injuries were recurrent. Two peaks in the incidence of injuries were observed: in January and in the last two months of competition, independent of the category.

Location (body part)

If we analyze the injuries per body region, in our study we observed that most injuries affected the lower limb (Table 2), in which 115 injuries were registered, equaling a percentage of 80.98% over the total injuries. In this region, the most affected area was the thigh, presenting the greatest number of injuries (Table 2). In second place, although at a lower rate, we encountered upper limb injuries, 14 injuries in total, representing 9.58% of injuries. Head injuries 4.92% of which there were 2 cases and lastly in the trunk, 6 injuries were reported representing 4.92% of the total.

Location (tissue)

Muscle injuries were most frequent in our study, in total 74 muscle injuries were recorded, representing 52.10% of the total injuries. Thus, muscle injuries represented more than half of the total injuries recorded. Joint injuries were the second most frequent tissue affected, with 49 injuries recorded in this sample, representing 34.50% of the total injuries. Significantly lower figures corresponded to bone injuries and contusions, of which we registered 9 and 10 cases respectively. The hamstrings were the muscles that suffered the most injuries in our study we registered 31 injuries in this area, which in percentage represented 42.46% of the total muscle injuries registered. In second place regarding the number of muscle injuries we found the triceps surae muscle, in which 13 injuries were registered, representing 17.80% of the total and in fourth place, 10 injuries affecting the quadriceps muscle were

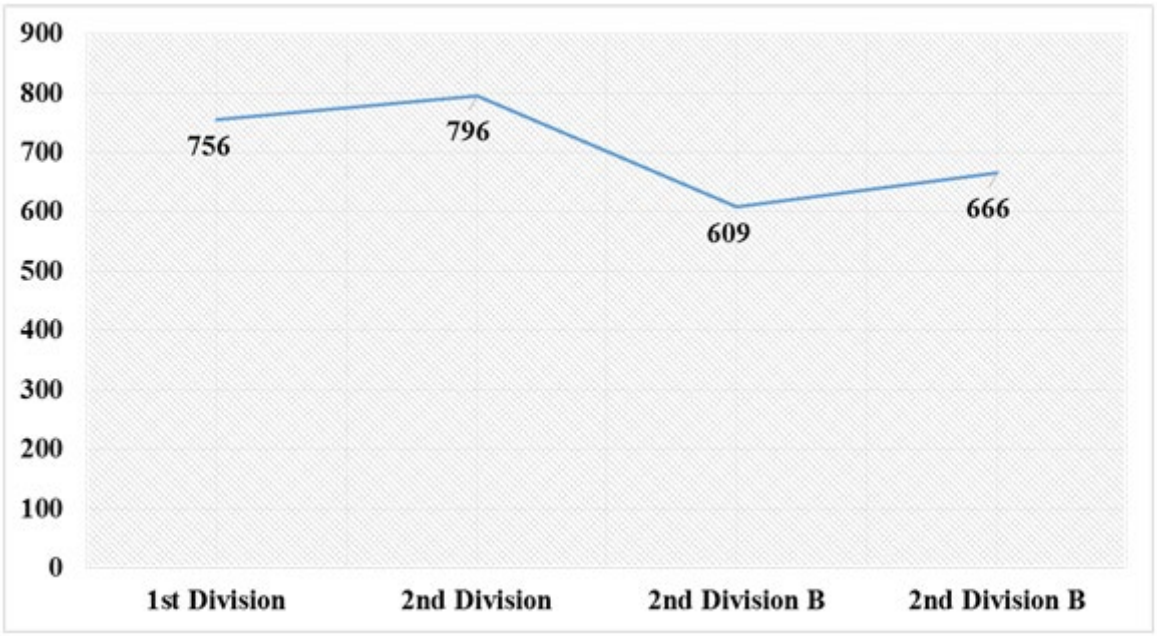

Figure 1: Time loss (in days).

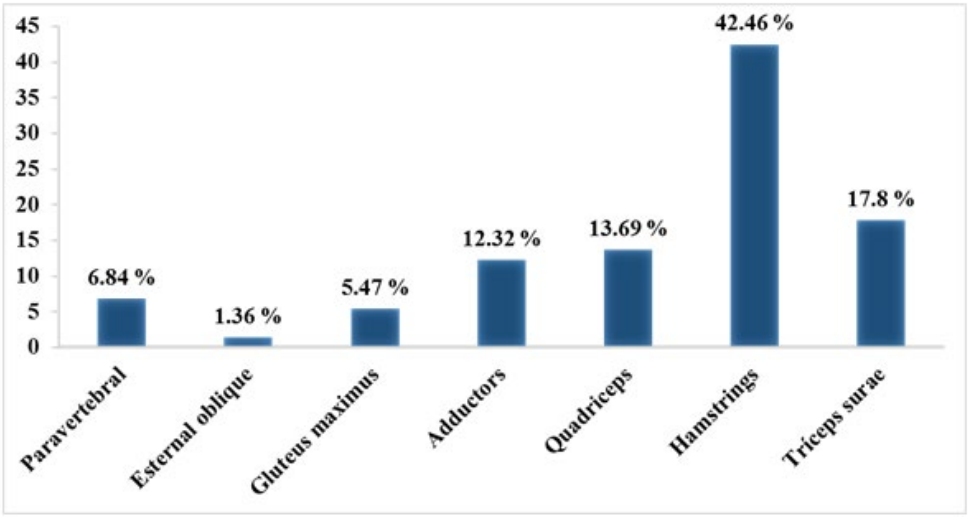

Figure 2: Percentage of Injuries per muscle.

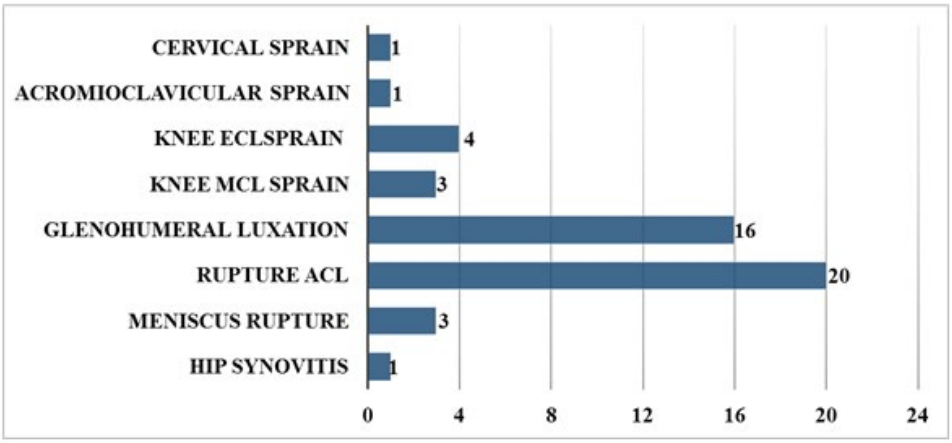

Figure 3: Number of injuries per joint.

Categories, Position and Age	Total (n=142)	95% CI
First division	33	23.20%
Second division	27	19.00%
Second division B	82	57.70%
Defense players	59	41.50%
Striker	39	27.50%
Midfielder	37	26.10%
Goalkeeper	7	4.90%
<20	31	21.83%
21-25	43	30.28%
26-30	39	27.46%
>30	29	20.42%

Table 3: Injury by player category, position and age.

reported, representing 13.69% of all injuries (Figure 2).

In our study, joint injuries were the second most frequent injuries after muscle injuries. We registered 49 joint injuries, representing 34.50% of the total. Within the joint injuries, ankle sprains affecting the lateral collateral ligament were the most frequent, with a total of 20 injuries, which represented 40.81% of the total. In second place the medial collateral knee ligament, of which we had 16 cases, representing 32.65% of all injuries (Figure 3).

Injuries by player position and age

We found statistically significant differences 95% (p=0.000) between the number of injuries and the positions held by players on the field. The strikers are the players who in proportion suffer the most injuries, suffering 0.79 more injuries than midfielders and 1.37 more injuries than goalkeepers. In second place, the defenders suffered 1.06 injuries more than goalkeepers. The analysis of injuries by age revealed that the age group suffering the greatest amount of injuries was from 21 to 25 years, suffering 43 injuries, representing 30.28% of the total

injuries. The players with the least injuries were those belonging to the group of over 30 years old, who suffered 29 injuries, representing a total percentage of 20.42% (Table 3).

Discussion

This study sought to provide a comprehensive analysis and description of the injuries sustained by professional elite soccer players in the community of Madrid among three different divisions. We were unable to find studies in the literature that compared the injuries within the different soccer categories. However, we have found studies that report a similar number of injuries compared to ours. Thus, Crozier et al. [11] performed a study based on a team of the British Premier league, reporting that 39.1 injuries occurred during one season. We found significant differences in the number of injuries sustained by players in different categories, with players in the second B division sustaining more injuries. We believe this is due to several factors. On the one hand, the fact that the players in the second division B are frequently semiprofessionals and perform other professional work besides their sports occupation and the fact that training and competing after 8 hours' work can be a factor that predisposes players to have an injury. On the other hand, on a technical level, regarding coaches and trainers, their technical level is inversely proportional to the team's category and therefore, it can be assumed that there is a great variability in the training systems and a worse control of the overload player's experience, which is also conditioned by past experiences. All of these may be a risk factor in the appearance of injuries. Thus, we believe that the category is a factor that affects the number of injuries suffered by the soccer player, as the number of injuries is inversely proportional to the player's category.

Strikers suffered the most injuries, independent of their playing category. Naturally, these differences may be due to the peculiarities of each position in the game, with strikers suffering many more tackles on behalf of the defenders, performing explosive sprints, and their actions are on occasion extreme, due to the possibility of scoring a goal. In contrast, the goalkeepers suffer less injury as they do not suffer tackles on a regular basis by other players, they cannot be touched in the small area and they do not perform sprints on a regular basis. Thus, we can affirm that the position occupied by the player on the field is a factor that influences the number of injuries suffered by soccer players.

When comparing our data with those obtained in other studies, we observe a considerable disparity regarding injury rates. Steffen et al. [13] performed a comparative study regarding the injury risk in different playing surfaces reporting a total average of injuries per 1,000 hours' exposure equaling 2.8 which corresponds to an injury risk of 1.2 injuries per 1,000 hours training, while during matches the injury rate was 8.7 injuries per 1,000 playing hours [13]. Furthermore, we detected a clear tendency in the fact that, the older the studies are the greater the injury risk seems to be however the more recent studies report data that is more similar to our study. This may be due to decreased permissiveness regarding rough play and a stricter application of the playing rules based on the recommendations made in 2004 by the International Soccer Association Board [14]. Regarding injury rates by division, Noya and Sillero, in their study performed in the 1st and 2nd division of the Spanish league, reported an injury rate in the 2nd division of 8.9 injuries/1,000 hours' exposure and in the 1st division this figure was 9.0 injuries/1,000 hours' exposure to the risk [4].

The significant differences found between categories are due to the injury rate during competition. This confirms prior studies which have reported a greater incidence of injury during competition. Noya and Sillero [15] report an injury rate during training in the 1st division of 6.2 injuries per 1,000 hours training and 6.3 injuries per 1,000 hours' exposure.

In our study each player suffered an average of 1.4 injuries by the end of the season. Similar findings were reported by Crozier and Taylor, Hawkins et al. [11,16] who reported 1.3 and 1.4 injuries per player and per season.

Our finding regarding the lower limb as the most injured body part is in consensus with the literature [6,11,13,15,17-34]. Muscle injuries were most frequent in our study, representing over half of the total injuries recorded. The literature reviewed confirmed the higher incidence of muscle injuries, as the most frequent injuries in soccer [5,10,16,22,23,25,27,35-41].

The hamstrings muscles were the site of the most muscle injuries, representing 42.46% of the total muscle injuries registered. We found several studies which support these findings [4,20,42-45]. We believe that this finding may be explained by extrinsic factors, such as the characteristics of the playing terrain, as soccer is practiced on changing surfaces due to the climate, the length of the grass, the amount of watering prior to the match, etc., and the length and shape of the studs or intrinsic factors such as a muscle imbalance with the knee extensor muscles. Thus, we can affirm that the most affected muscles in soccer are the hamstring muscles.

In our study, joint injuries were the second most frequent injuries after muscle injuries, representing 34.50% of the total. Within the joint injuries, the ankle sprains affecting the lateral collateral ligament were the most frequent. In the literature reviewed we have found a number of studies that identify joint injuries as the second most frequent after muscle injuries [4,5,16,22,27,46,34-47]. Thus, we can affirm that joint injuries are the second most frequent after muscle injuries.

The analysis of injuries by age revealed that the age group suffering the greatest amount of injuries was from 21 to 25 years, suffering 43 injuries, representing 30.28% of the total injuries. The players with the least injuries were those belonging to the group of over 30 years old, who suffered 29 injuries, representing a total percentage of 20.42%. We were unable to find published reports to compare the tendency regarding injuries by age. However, we have found studies stating that the number of injuries sustained by players increases with age [47]. However, this contrasts with other reports, as according to Carr most injuries occur in teenage years.

More injuries took place in the second part of matches, confirming findings by prior studies [10,11,16,23,27,36,41] and may be due to the physical and psychical tiredness that the soccer player accumulates during the match, which makes the player more vulnerable to suffer injuries.

We also observed that the players in our study sustained more injuries when they were losing (51.40%), than when they were equal (26.76%) or were winning (21.83%) [20] reported similar data, a greater injury rate when the score was equal or winning, which could be due to the stress and anxiety associated with an adverse score. Further studies are required with larger samples to confirm these results and over longer time periods [48].

Conclusion

This report provides details regarding the characteristics and incidence of injuries in professional soccer players in Spain. These findings offer insight to the prevalence of injuries in this population and

may help improve injury prevention programs, especially regarding the lower categories.

Key Points

Findings

1. The injury rate in professional soccer players in the Community of Madrid, Spain is 2.58 injuries per 1000 hours exposure. This injury rate decreases in higher categories: with a 2.27 injury rate in the first division, 1.92 in the second division and 3.03 in the second division B.

2. The most frequent injuries in soccer are mild (42.95%), followed by moderate (39.43%) and severe (17.60%) injuries.

Implications

Soccer clubs and medical teams working with professional soccer players should consider these findings in order to improve current injury prevention strategies, especially regarding players in the lower categories.

Caution

Minor injuries not requiring time off from play were not included in the definition of injury. External validity is limited due to the reduced sample size.

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