Research Article

Injuries in Female 7-a-side Football Players in Cantabria, Spain: An Epidemiological Study

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Abstract

Objectives: To report the epidemiology of injuries sustained by female 7-a-side football players in Spain.

Design: a prospective, descriptive epidemiological study.

Setting: Female football is a sport with international reach. Despite its popularity, the incidence of injuries in female football players is high.

Participants: 41 players from three teams.

Main Outcome Measures: The data recorded included information regarding the injury, date and place of occurrence, player position, severity and time off. The OSICS system was used for injury classification. Individual exposure times were calculated during training sessions and matches.

Results: 90 injuries were recorded. Most injuries were mild, representing 53.3% of all injuries. The lower limb was the most affected body area (71.1%). Muscle injuries were the most frequent form of injury (40.0%), specifically muscle fiber ruptures, of which there were 12 reported cases. Non-contact injuries were more common (57%). The injury rate in female football players in Cantabria is 7.89 injuries per 1,000 hours of exposure. During training sessions, 2.98 injuries occurred for every 1,000 hours, whereas during matches this increased to 62 injuries per 1,000 hours of risk exposure.

Conclusions: The most common injury was the muscle fiber rupture of the hamstring muscles, representing 13.3% of total injuries.

Keywords: Female; Football; Injury; Lower Extremity; Muscles; Sick Leave

Introduction

Football is the most popular sport in the world. Representing 265 million players, plus approximately 5 million technicians, referees, trainers and other related figures [1]. At present there is no other sport on a global level that can equal the number of participants; if we were to add the number of members, supporters and family members of players, the numbers would add up to 1.000 million people related with the sport [1]. One in 25 people plays football, and 2 people out of 6 have some kind of link with the sport [1]. Furthermore, of 265 million players, 26 million are women, representing 9.81% of all athletes [1].

Seven-a-side football is a sport derived from football, from which it shares the general playing rules. The main difference is that teams are formed by 7 players, one of whom is the goalkeeper. The dimensions of the field are equal to those of standard football fields. In the 2016/17 season, the Cantabrian Federation of Football in Spain played the first regional female 7-a-side football league in the history of the region. This novel competition, named "Preferably Feminine", is conformed of 7 teams, and more than 100 players over the age of 14. Currently in the region of Cantabria there are 700 federated female players [2].

Despite its popularity, football is a sport that poses one of the greatest risks of injury; in Europe it is responsible for between 25% and 50% of the injuries registered [3]. Considering this definition, it is problematic trying to establish the most appropriate threshold after which it should be reported as an injury [4-6] as, due to the differences in the intrinsic and extrinsic characteristics of the different sports, the same definition is not always valid for any sport [7.8]. How we define an injury is still unclear, and this requires clarification. However, at present two generally accepted definitions exist:

a) Any physical pain, independent of its consequences, considering the injury as any incident requiring assistance or medical treatment [5,9], independently of whether or not this leads to withdrawal from competition or training [10].

b) Those that lead to withdrawal from competitions or trainings, including injuries that lead to restrictions or cause the athlete to spend less time in competition or training, and those that only involve withdrawal from competition [5,10-12].

The International Federation of Association Football (FIFA) Medical Assessment and Research Centre defines injuries as any physical pain suffered by a player which is the result of a game or football training session, without considering the need for medical attention or the time lost in activities related to football [7,8].

Furthermore, according to the UEFA football safety project, an injury is an event that occurs during a training season or match and which leads to the absence of the player in the subsequent training session or match [13]. This was the definition of injury used in the present study.

In addition, there is a lack of consensus regarding the most common mechanism by which a player suffers an injury. Thus, according to Tscholl et al., contact injuries represent up to 86% of the total injuries [3], which is in contrast with Paus et al., who report that 80% of injuries are of a non-contact nature [14]. Non-contact injuries are more common during training than during competition [15]. The greatest number of injuries is registered while running, this is related to fatigue, both nervous as well as muscular [16]. Thus, many non-contact injuries can be avoided with correct physical preparation, stretching and good technique [17].

At present, there are few epidemiological studies focused on injuries sustained by female football players, less still regarding football 7-a-side and female football in Spain. In particular, a significant gap exists regarding detailed knowledge regarding recovery times, mechanisms of injury and exposure times. This data is necessary in order to advance understanding of how and when injuries occur and for the purpose of prevention.

This study was performed with the following objectives:

- To perform an objective epidemiological study of the injuries sustained by female football players in the Cantabrian Football Federation.

- To identify which is the most common injury, the body region affected and the most commonly injured tissue, together with the mechanism of injury and severity.

- To establish whether there is a relation between the players' anthropometric measurements and the type and number of injuries sustained.

- To establish which player position suffers the most injuries.

- To determine the period in the year of highest risk of injury.

- To determine whether the total exposure time is the most relevant factor in relation to the appearance of injuries.

Material and Methods

Study Population

Female players enrolled in a prospective, descriptive, observational study conducted during the 2016/2017 season across three teams of female 7-a-side football, from the Community of Cantabria, Spain. Participants were randomly and voluntarily chosen. Eligible subjects included those who had an up-to-date federation license during the season under study. We did not exclude players with old injuries nor those who were already injured as of September 1, however in these cases, the injury that

they presented was not included in the study, and the exposure factor was not considered until the player completely recovered from the injury.

Each club was provided with an information pack which contained a letter introducing the study aims and objectives, instructions for participation and details regarding the terminology used. Furthermore, they were provided with a confidentiality form for the registration of information based on the 15/1999 Organic Law of November 13, for the protection of personal data. All the players as well as their legal tutors were informed of the nature of the study and they signed an informed consent form based on the declaration of Helsinki for research involving human subjects [18].

Main Measures

Injuries: body region affected

We registered all injuries occurring between September 1, 2016 and April 26, 2017. Injuries were defined according to Hägglund et al [13]. We included injuries during the preseason as well as during the competition season. We only registered the injuries that occurred during the official and non-official training sessions and matches. Injuries or illnesses that occurred or were related with other activities were not included in the analysis.

The data were compiled by the medical services of the clubs (which included the doctor and physiotherapist), using a data collection form based on the FIFA consensus proposal for epidemiological studies in Football. This form recorded the following data for each injury: player identification, player position, date and time of injury, injury sustained during training or competition, mechanism of injury, body area and structure affected, diagnosis, severity, result (in the case of matches), time off (days). Injury severity was determined based on the length of time off required. Thus, mild injuries required between 1 to 7 days' time off, moderate injuries required between 8 and 28 days and severe injuries necessitated over 28 days leave. For the classification of injuries, the OSICS system was used (version 10), as one of the most commonly used systems for coding injury diagnosis in sports injury surveillance systems [19]. During the first week of the preseason we collected the anthropometric data (weight and height) and the medical sports history of each player. Additionally, exposure time for each player was calculated for each player both for matches as well as training periods, based on the following formula:

- Competition: n players x 1.5 hours x number of matches

- Training: number of players x weekly hours training x 30 weeks.

All the players were followed-up from the moment they were included in the study until the completion of the study, even in the cases in which they abandoned the club they belonged to.

Statistical Analysis

We performed a descriptive statistical analysis of the quantitative data in order to describe the sample, which included the calculation of the mean, standard deviation, maximum, minimum, median figures. 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 (one-way) variance analyses were performed to compare multiple means regarding two conditions. For the calculation of statistical tests, we used the SPSS 19.0 software package, considering $p<0.05$.

Results

Study Population

Forty-one female football players enrolled in this study. The mean age of the players was 22.2 years±2.85 (range 18- 29). Their mean height was 158.01 cm±4.73 (range 156-174). The players weighed a mean of 56.07 kilograms ±4.74 (range 50-65).

Injury Incidence

In total 90 injuries were recorded. Of the 41 players included in this study 31 players sustained injuries, giving a rate of 0.76 injuries registered per player. In this study we registered 7.89 injuries in total per 1,000 hours of exposure. The rate of injuries during competition was 63 injuries for every 1,000 hours of exposure to the risk, whereas during training it was 2.98 injuries every 1,000 hours exposure.

Body Region Affected

Lower limb injuries were dominant, representing 71% of all injuries (Figure 1). Within the lower limb, the area with the most injuries was the upper leg region which represented 32.4 % of the total injuries affecting the lower limb, followed by the knee, ankle, lower leg region, foot, and, lastly, the hip (Figure 2).
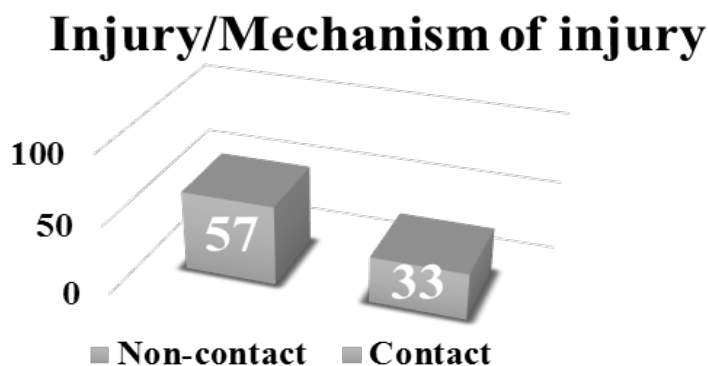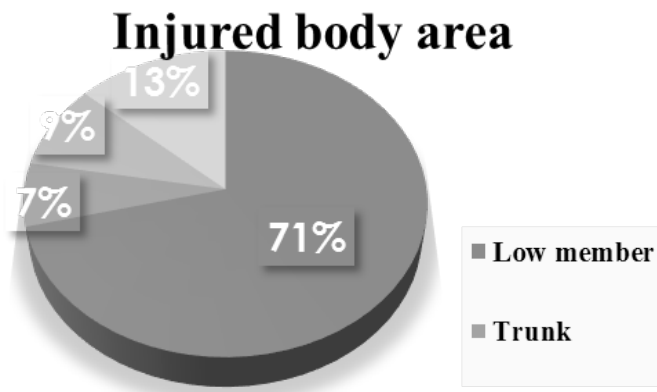

Figure 1: Mechanism of Injury.

Figure 2: Injuries classified by affected body área.

Tissue Affected

Regarding the most injured tissue, muscle injuries predominated, representing 40% of the total, followed by ligament and joint injuries and, lastly injuries to the tendon. Within the muscle injuries, the most affected area was the hamstring region, in which muscle fiber ruptures were the most common injury, representing 13.3% of the total injuries registered, followed by muscle strains affecting the same area, representing 4.4% of the total.

As for ligament injuries, the most common injury was ankle sprains affecting the Lateral Collateral Ligament (LCL), with a 13.3% incidence, followed by the Medial Collateral Ligament (MCL) of the knee, and in third place, the Anterior Cruciate Ligament (ACL).

Mechanism of Injury and Severity

Non-contact injuries were more predominant, representing 63.3% of total injuries, compared to 33% of non-contact injuries. A predominance of mild injuries was registered, represented by 48 injuries, followed by moderate injuries (n=28) and severe injuries, representing 14 of total. We also analyzed the variable 'severity' in relation with the type of tissue affected, and found a strong association between severe injuries and bone tissue.

Recovery times and time off

The injuries assessed in our study derived in a total of 2.510 days' time off. Statistically significant differences were found regarding the type of tissue in which the injuries occurred and the sick days that these amounted to. There was also a significant interaction when analyzing the number of sick days and the severity of the injury. However statistically significant differences were not found in relation with the player position, which affirms the fact that the type of injured tissue and the severity of the injury influence the number of sick days in relation to the injuries, whereas the player's position on the field does not influence the

number of days needed for recovery.

Age, height, and weight in relation to playing position

We did not find significant relations regarding the age of players and their playing position on the field, therefore we can affirm that age does not influence the playing position.

A statistically significant interaction was found when comparing the data for playing position and height, revealing that on average, goalkeepers were taller than the rest of players. We obtained significant results with regard to the weight of the players and their position, as defenders were the heaviest players, whereas the midfielders were the lightest. Thus, it seems that the anthropometric characteristics influence the placement of the players on the field, as the demands are different according to the field are in which the game takes place.

Discussion

This study provides epidemiological data regarding injuries affecting female 7-a-side football players. An analysis of the 90 injuries reported in this study showed that the most affected body area was the lower limb representing 71.1% of all injuries, in particular the upper leg region, followed by knee and ankle injuries. In other studies, the results are variable, and thus in the literature reviewed we have failed to find a concrete anatomical area with a greater number of injuries in female football.

Muscle injuries were the most affected tissue, which is similar to data reported in the study by Giza et al. [20]. This may be due to extrinsic factors such as the characteristics of the terrain, as football is practiced in surfaces that change according to the climate, or due to factors related to footwear such as the length and shape of the studs etc., Also, intrinsic factors may be present such as muscle imbalances in the knee extensor muscles of players. In contrast to these results, other studies have indicated that the ligaments were the most affected tissue [21-23]. Regarding ligament injuries, the most common injury was ankle sprains affecting the Lateral Collateral Ligament (LCL), with a 13.3% incidence, followed by the Medial Collateral Ligament (MCL) of the knee, Similar results were observed in other studies, confirming that the LCL injury at the ankle joint is most common ligament injury in female football players. It is thought that this is due to the height of the studs, which provoke less ankle stability, as well as the state of the game field, whether it is dry or poorly maintained (in this study, artificial grass was the playing surface used during all activities). It is worth highlighting the high incidence of injuries affecting the ACL, which is two to four times higher in females than in males [8,24,25]. Our study registered four injuries in 41 players, which is in line with prior studies [26]. Anatomic factors such as the Q angle could be responsible for a greater number of ACL injuries in female players compared to males. Also, the size and form of the intercondylar notch has been related to the risk of suffering this

injury, as women have a narrower intercondylar notch than men, which implies having ligaments of less width, thus decreasing their maximal resistance to traction before rupture. Furthermore, hormonal factors have been related to this type of injuries, as the injury rate is greater during the first half of the menstrual cycle, as opposed to the second half. This is because during the periovulatory period, there are a greater number of estrogens in the ACL fibroblasts, in which the action of estradiol decreases the synthesis of procollagen in the same, thus decreasing the tensile strength of the ligament [27].

The injuries assessed in our study derived in a total of 2.510 days of sick leave. There are no prior references in which sick days are reflected as a consequence of the injuries suffered by players, although a prior study conducted with male football players reported 706 sick days per season [28].

According to the severity of the injury, in this study there has been a predominance of mild injuries, represented by 48 injuries, which is supported by the literature findings [21-23]. Regarding the mechanism of injury, in this study, the most frequent mechanism was non-contact injuries. This differs from other studies in which the most common mechanism of injury was reported to be contact injuries [22,26]. It is understood that this is due to the fact that these studies are performed in different countries, and the degree of permissiveness regarding the rules may differ in relation to Spanish players.

Of 90 observed injuries, 62 of these occurred during the season, whereas the 28 remaining injuries occurred during the preseason. Similar data has been reported in male football, in which 71.83% of injuries occur during the season, and 28.16% occur during the preseason [28]. According to the moment of the injury, 34 injuries occurred during the training periods whereas 56 took place during matches. These results are similar to those reported by Giza et al. [20] and Le Gall et al. [23] although they differ from a study performed in the Norwegian elite league [21], in which a larger number of injuries were registered during the training periods compared to during matches. Notably, both the physical and mental demands placed on players are greater during matches than during training sessions, therefore it seems logical that more injuries should take place during competition.

Regarding the month that injuries took place, as observed in figure 3, September registered the greatest number of injuries (n=19), followed by March (n=17) and April (n=18), then January (n=12). Similar results were obtained in the study by Le Gal et al. [23] in the French football elite. This is believed to be due to the lack of preparation at the start of the season, as the players return from a holiday period characterized by fewer hours of training, uncontrolled weight-gain, and extended travel times (i.e. players are more sedentary). Similar findings are related with the

month of January, which follows a vacation period. The burn-out accumulated at the end of the season, due to the physical and mental stress, as well as the importance of the last matches which require a high level of demand, appear to be some of the factors that trigger the onset of injuries at this time in the season.
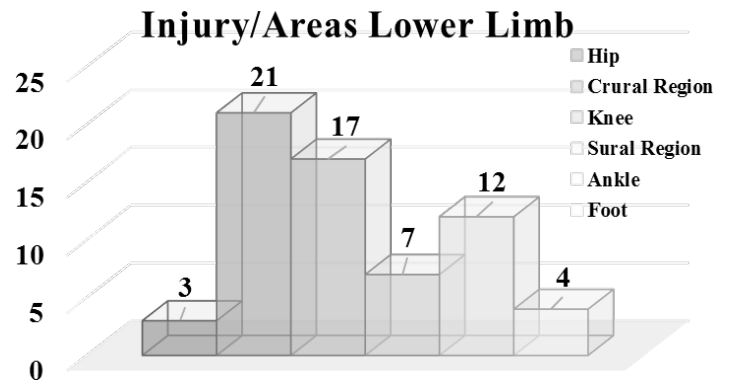
Figure 3: Type of injuries produced in the lower limb.

Figure 4: Nº of injuries by month.

Considering the peak in injuries during a game, the greatest number of injuries occurred when the score was against the team, accounting for 58% of the total of injuries studied. We failed to find other studies relating this data to female football, although there are reports in male football which also report greater injury rates when the team is losing [28-29].

Regarding the total rate of injury, in this study we found 7.89 injuries per 1,000 hours of exposure. The rate of injuries during the competition was 63 injuries for every 1,000 hours of exposure to the risk, whereas during training it was 2.98 injuries every 1,000 hours, similar to other studies in which they registered an injury rate equal to 67.4 injuries per 1,000 hours of exposure to the risk. [26] Furthermore it is worth highlighting that the injury rate in female football is higher than in male football, a finding that has been supported by many studies [28,30-31].

The mean age of players was similar to other studies [32]. The height was similar to previous reports [32-33]. Height and playing position correspond with the study performed by Bahamondes et al. [33] It is thought that this is due to the varying demands of the different positions on the game field.

There is a clear difference between the goalkeepers and the rest of the positions. The former suffers the least injuries, with only 9 injuries of the 90 total injuries registered. According to the total number of injuries and the position of the players, we observed that the defenders are those who suffer from the most injuries, followed by the strikers, midfielders, and lastly, the goalkeepers [20-21]. We understand that these differences may be due to the demands of each position, and the level of competition that occurs in the matches.

Our study had several limitations. A larger sample is needed to determine the true incidence and prevalence of injuries. Also, our definition of injury did not include minor injuries not requiring sick leave, thus additional injuries may have occurred that were not registered. Due to the lack of similar studies performed in this population we had difficulty comparing these results with previous studies.

Conclusions

This report provides details regarding the extent and nature of injuries affecting female athletes. In relation to the study objectives, we conclude that female football 7-a-side players sustain a high incidence of injury. Most injuries were mild, and there was a predominance of muscle injuries. Future research should investigate why female players are at a greater risk of injury as well as determine specific prevention strategies. An ongoing effort should be made by medical staff to register injuries and circumstances.

Key Points

- Findings
o The rate of injury in female football within the community of Cantabria is 7.89 injuries per 1,000 hours exposure.

o According to our findings, the most affected body area was the lower limb. representing 71.1% of all injuries, concretely, the posterior aspect of the thigh.

- Implications:
• Physiotherapists working with female football players should consider these findings in order to improve injury prevention strategies.

o Further research should strive to investigate risk factors.

- Caution

o External validity is limited due to the reduced sample size.

Study Approved by Institutional Review Board:

All players at each enrolled club provided written consent to allow their data be used in the study including pre-season clinical assessment, match and training exposure and reported injury and illness throughout the season. Ethical approval was obtained from the Faculty of Health Sciences Ethics Committee at Alfonso X El Sabio University and study data was coded for anonymity.

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