

## DETERMINING FACTORS OF SPORT INJURIES IN AMATEUR SPORTS IN SPAIN

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### ABSTRACT

**INTRODUCTION AND OBJECTIVES:** An epidemiological study of descriptive and analytical cases was developed. The aim was to evaluate sports injuries occurring during the practice of recreational sport in the geographical area of all regions of Spain. **METHODS:** Trauma medical centers and physiotherapy clinics were selected. Surveys were passed through interviewers in a total of 1616 subjects who had suffered an injury in the last 12 months while practicing sport as a leisure activity. The information collection was performed using a digital database hosted on a web server connected to a digital survey through which the subjects' responses were recorded. **RESULTS:** The sports where most injuries occurred was football (27.6% of all accidents), followed by running (8.6%), futsal (7.9%) and basketball (7.7 %). Attending the underlying determinant factors of injury, some relation between them were found, which may lead us to better know the injuries causation. **CONCLUSIONS:** The results show a general description of the influence that sports injuries and their consequences mean in Spanish society. More comparative studies of cases of injured and uninjured athletes in amateur sport would be advisable to establish preventive campaigns.

**Key Words:** sports injuries, amateur sport, determining factors, risk factors, Spain

### RESUMEN

**INTRODUCCIÓN Y OBJETIVOS:** Se realizó un estudio epidemiológico de casos, descriptivo y analítico. El objetivo fue la valoración de las lesiones deportivas producidas durante la práctica de deporte de ocio en todas las Comunidades Autónomas de España. **MÉTODO:** Se seleccionaron centros de traumatología y de fisioterapia y se realizaron encuestas por medio de entrevistadores a un total de 1616 sujetos que hubieran sufrido una lesión en los últimos 12 meses practicando deporte a modo de ocio. La compilación de la información se realizó mediante una base de datos digital hospedada en un servidor web vinculado a una encuesta digital. **RESULTADOS:** El deporte donde se produjo mayor número de lesiones fue el fútbol (27,6% del total de accidentes); seguido por la carrera (8,6%), el fútbol sala (7,9%) y el baloncesto (7,7%). Atendiendo a factores determinantes más importantes de las lesiones, **CONCLUSIONES:** Los resultados muestran una descriptiva general de los factores determinantes de lesiones en deportistas amateur. Atendiendo a los factores determinantes, se encontraron algunas relaciones entre ellos que nos podrían llevar a un mejor conocimiento de la causa de las lesiones. Más estudios comparativos de casos y controles de lesiones en deporte amateur serían recomendables para establecer campañas de prevención.

**Palabras clave:** lesiones deportivas, deporte amateur, factores determinantes, factores de riesgo, España

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## INTRODUCTION

Sports activities are of great importance in today's society. According to the Spanish Sporting Habits Survey 2010, about 16 million people between 15 and 75 years old in the country perform a sport, which accounts for 43% of the total national population in that age group. Furthermore, this percentage of practice is a growing trend to such an extent that from 1980 to 2010 there was an increase of 20 percentage points in the practise of sport among people between 15 and 65 years old (de Deportes, 2010). The most popular sports in Spain are: fitness training (soft gymnastics, including maintenance intensive here, at home and at the pool) with 35% of the total population, football (outdoor and indoor) with 27.5%, swimming with the 22.4%, cycling (19.4%), running/jogging (12.9%), climbing/hiking (8.6%), basketball (7.7%), tennis (6.9%), athletics (6%), paddle (5.9%), skiing and other winter sports (4.4%) and strength training (4.3%).

### *The sports profile*

The vast majority of people who exercise do the activity on their own (75%), regardless of any institution or sports club (de Deportes, 2010). We also found that 74% of those who do practise sports as a leisure activity, do so without worrying about competing. Another 12% also compete between friends for purely recreational purposes, and 10% and 3% of athletes participate in local/provincial or national leagues, respectively. Within these percentages, it is important to note that, in the last 10 years, a trend appears to increase the recreational sport and (an increase of 8%), while other disciplines are maintained at the same rate or even decrease slightly.

### *Sports epidemiology*

Although epidemiological research is not a new phenomenon; development of epidemiologic methodology in recent decades has opened new vistas and great interest in many application fields, including sports medicine (Gil, 2008). The epidemiological approach helps to better understand the incidence and causes of injuries and enables to establish planning prevention programs and medical resources correctly distributed (Sherry & Wilson, 2002). In such studies, it is necessary to employ a rigorous methodology, applicable in both the design phase and in the phase of data analysis, avoiding or minimizing the appearance of undesired systematic bias (van Mechelen, Hlobil, & Kemper, 1992).

Data obtained from epidemiological studies of sports injuries are essential to develop prevention methods, treatments, or even rehabilitation strategies for injuries and the effects caused by them (Brooks & Fuller, 2006). Through these kinds of studies it is easier to understand the mechanisms and causal

factors involved in the production of sports injuries (C. Finch, Valuri, & Ozanne-Smith, 1998; Ristolainen et al., 2010).

### *Sports consequences*

Regular practice and increasingly frequent sporting activities among the Spanish population, provides many benefits in different aspects for health. However, the performance of physical activity, either professionally or as entertainment in leisure time, it is not exempt from some potential negative side effects. Any type of sport, involving exercise, always poses a risk to the physical integrity of the practitioner, as it can take the body to physical exhaustion; what we call a situation of overstrain. Lack of habit in sports and lack of adaptation to those situations of overstrain, increases the chances of injury (Salguero, ). Therefore, we must consider that injuries are a significant risk, which can actually occur during physical exercise. These injuries involve a number of negative consequences such as: Pain, loss of physical condition, limitations on participation in activities of daily living, work leave, and an overall decreased quality of life (Mora, Araya, & Ozols, 2004).

The injuries may constitute a significant percentage of work leave (Chamorro et al., 2009), which is an economic cost to companies and public and private institutions. In addition to this cost to economic and business productivity level, we also found other negative consequences of injuries sustained in sports or recreational activities (de Deportes, 2010), such as: healthcare costs, both public and private, unproductiveness at work or academic issues (number of days lost at work or school and effects or damage that could affect to the athletes in their daily lives.

For these reasons, we may consider interesting to perform an epidemiological study to determine what influence the injuries have in today's society and describe which sports and causes motivate these accidents. Through all this, the ultimate goal is to prevent injuries.

### *Determining factors of sports injuries*

Within the field of the study of sports injuries, epidemiology is very focused on the research and identification of risk factors that increase the chances of injury. In the literature many studies can be found focusing on the clarification of risk factors in sport. A multifactorial approach must be taken in assessing aetiology or causation of sports related injuries (Meeuwisse, 1994). Through knowledge of these risk factors, we can establish prevention campaigns to control them.

## METHOD

A descriptive and analytical epidemiological study of cases was developed. The objective was the evaluation of sports injuries during the practice of leisure sport in the geographical area of all regions of Spain. To obtain information on each region, a target city was selected; usually the capital of the province or the city of the same population. The "consecutive case" sampling technique was applied, selecting all patients' who fulfilled the inclusion criteria within a specified time period (from 1 October 2010 to 30 June 2011). This sampling technique is the best non-probabilistic technique and the most suitable for our study (Hulley et al., 1997).

### *The survey*

The design was done with reference to the "Enquête permanente sur les accidents de la vie courante" of the French Institut of Veille Sanitaire (Ricard, Rigou, & Th lot, 2008), modified and adapted by the researchers to the study population. The questionnaire consisted of three distinct parts where data of the injured participant, the accident and the treatment and consequences of injury were collected.

The study variables, quantitative and qualitative, were collected with different scales. Subsequently, in cases where it was necessary for the statistical analysis, some of them were recoded into new categories providing enhanced accuracy thereof.

### *Data collection*

It was conducted by pollsters. Surveys were distributed in medical rehabilitation centres or physiotherapy and sports centres arranged prior to baseline. A digital survey was hosted on a website created specifically for the study. This online survey was linked directly to a database hosted on the same web server. The answers in the survey gave the option to be recorded directly in the database at the same time when the questions were formulated and the data was confirmed at the end. However, to record the surveys directly in digital format, it was necessary to have a computer or device with internet access at the collection site, which in most cases was not possible. Therefore, the preferred method was to collect data on paper and then record the answers in the online database (process carried out by the pollsters of each region).

Before the data collection, we contacted the pollsters and they were informed about the protocol that should be followed. In addition to this, specific training to achieve the highest uniformity possible in the collection of the information in all the regions was carried out. The training was developed through: phone calls, video conferencing (Skype or Gtalk), e-mail, and creating a private group communication on the social network Facebook. Particular

emphasis was placed on maintaining continuous contact with the interviewers throughout the study; especially in the phase prior to the formation and collection of data during the field work. Thus, the use of all means of communication previously mentioned was promoted. An information/update protocol on the status of data collection in each region by sending a weekly report was created by each of the pollsters.

#### *The data collection centres*

After initial contact with the heads of the centres, it came to an agreement with each of them, in which the consent to the collection and use of data was expressed.

#### *Subjects*

People between 18 and 65 who had suffered an injury sustained during participation in recreational sports between October 1, 2010 and June 30, 2011 were included as subjects.

#### *Ethical considerations*

Prior to the inclusion of patients in the study, they were informed of the purpose and objectives, and that it was an investigation supported by the MAPFRE Foundation, under the direction of the Laboratory of Sports Biomechanics, Faculty of Science Physical Activity and Sport - INEF (UPM). Confidentiality of the information provided was guaranteed; which would be used exclusively for research and a statistical criterion aims.

#### *Data treatment*

The information collection was performed by a digital database hosted on a web server connected to a digital survey through which the data of the subjects were recorded. This data was exported to Excel for review, and the final analysis was performed with the SPSS 19.0 statistical package.

#### *Descriptive study*

The different variables included in the three sections of the survey were evaluated. Frequencies, absolute and relative, of the qualitative variables, and the mean and SD of the quantitative nature were calculated. Subsequently, the different variables stratified by sex and age were described. The sample was divided in subjects of 35 years old or younger and older than 35 years old, following the pattern of previous studies that suggests that dynamic musculoskeletal performance presents a behavioural change that age (Tanaka & Seals, 2003).

### Analytical study

Prior to performing the analysis, the quantitative variables were recoded into qualitative variables, in order to facilitate analysis and improve the statistical power of it.

To test the strength of association between variables, contingency tables were performed using the Pearson chi-square statistic, applying the Yates correction was considered statistically significant when the p exact asymptote was  $\leq 0.05$ . When it came to dichotomous variables, the risk measure was calculated.

To minimize the effect that the sample size may have on the quantification of the chi square contingency coefficient were used Phi and Cramer's V.

Standardized residuals were calculated and corrected, to accurately interpret the meaning of the detected association.

## RESULTS

### General description of the sample

The sample consisted of 1616 injured subjects distributed among the regions of Spain (Figure 1), of which 1172 were men (72.5%) and 444 women (27.5%). 74.4% of the injured subjects were less than or equal to 35 years old and the remaining 25.6% were older than that age (Figure 2).

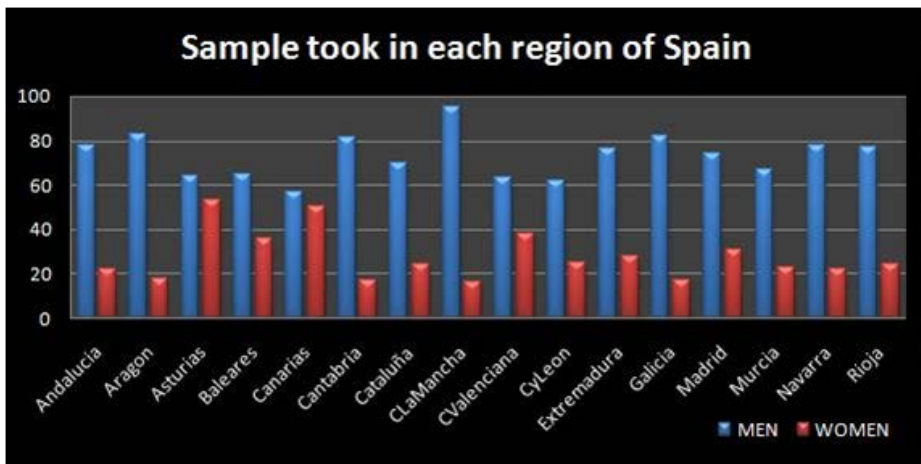


FIGURE 1: Sample distributed in the different regions of Spain

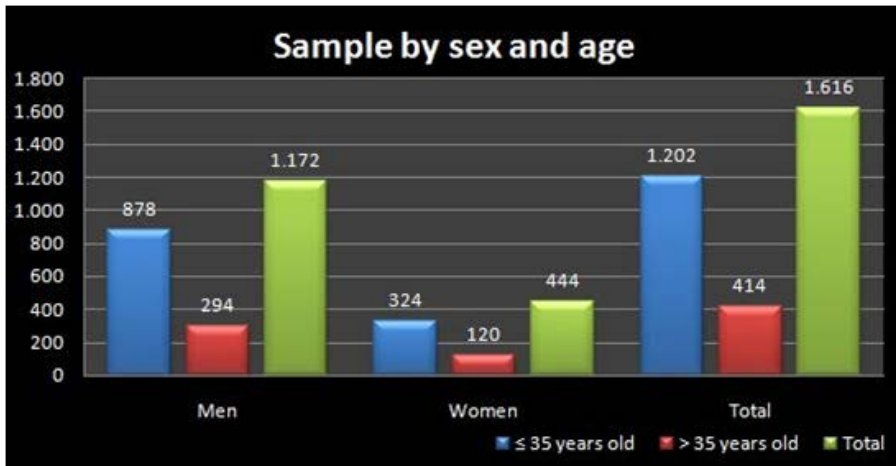


FIGURE 2: Sample by sex and age

Analyzing the area of the body in which the lesion occurs, we can find that the most of them were located in the lower limb (69.3%) and the upper limb (21.2%). This behaviour did not show statistically significant differences between men and women in both age groups.

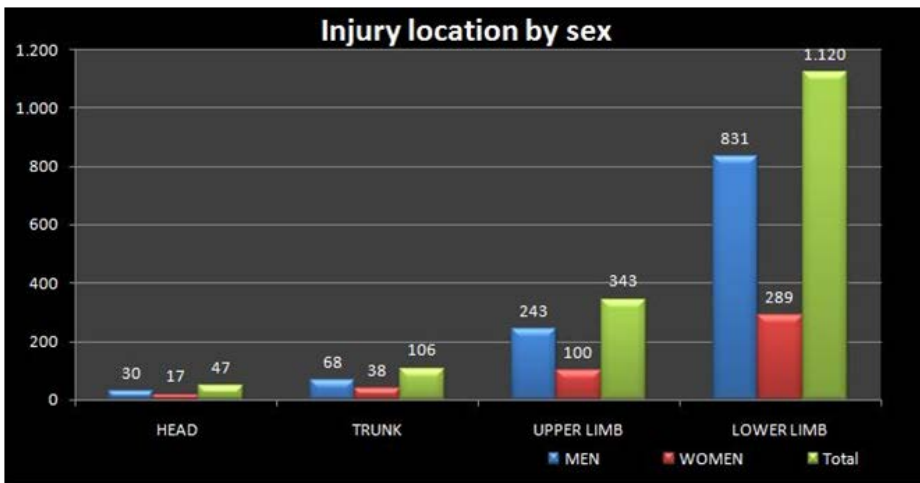


FIGURE 3: Injuries location by sex

*Profile of the injured man*

The sample of cases has a high educational level. The vast majority of them studied secondary education or higher (83%). As it might be expected, given that the 75% are under 36, the majority were working (57%) and the third of them were students (33%). As for the number of sports sessions per week, it has been found that most common was doing sport more than 3 times (47%),

or 2-3 times a week (36%). These sessions lasted between 1 and 2 hours in 70% in men. In terms of age differences the most important was that the subjects of younger age group (35 years) that practice sport more than three times per week (50%) was significantly higher than those above 35 years of age (38 %).

#### *Profile of the injured woman*

The women's sample, like men one, had a high educational level. Almost 90% had secondary studies (26%) or higher (61%). Most of them were working (53%) or were students (34%). Women had a different behaviour pattern than men in terms of the amount of physical activity performed. Most respondents (77%) completed 2-3 sessions per week (40%) or more than 3 times per week (38%). Although in the majority (56%) sessions 1-2 hours were performed (70% in men), almost a third (30%) had sessions lasting less than 1 hour. As in the case of men, women in the younger age group tend to be more active (more than 2 times per week in sessions of 1-2 hours) than the older age group (2-3 times per week in sessions of 1-2 hours or within 1 hour).

According to the study population, women tended to spend a little less time than men practicing sport.

#### *Injuries related to the sport practiced*

The sport where most injuries occurred was football (446 injuries). Other sports, as a running (139 injuries), futsal (127) and basketball (125), reported more than 100 accidents each, followed by tennis (92), paddle (79) and athletics (71). Table I details the percentage of injuries shown in each sport in the total, and those rates divided by sex in each sport.



TABLE 1  
Percentage of injuries by sports and by sex

<b>Sport that produced the injury</b>	<b>Men</b>	<b>Women</b>	<b>Total</b>
<b>Football</b>	34.81%	8.56%	27.60%
<b>Running</b>	6.66%	13.74%	8.60%
<b>Futsal</b>	10.07%	2.03%	7.74%
<b>Basketball</b>	7.76%	7.66%	7.68%
<b>Tennis</b>	4.78%	8.11%	5.69%
<b>Paddel</b>	3.67%	8.11%	4.89%
<b>Athletics</b>	4.27%	4.73%	4.39%
<b>Martial Arts</b>	3.75%	2.93%	3.53%
<b>Fitness-Bodybuilding</b>	2.99%	2.70%	2.91%
<b>Cycling</b>	3.50%	1.35%	2.91%
<b>Handball</b>	1.96%	4.28%	2.60%
<b>Skiing</b>	1.45%	4.73%	2.35%
<b>Hiking</b>	2.30%	2.03%	2.23%
<b>Rugby</b>	1.62%	3.15%	2.04%
<b>Gymnastics</b>	1.28%	3.60%	1.92%
<b>Swimming</b>	1.28%	2.93%	1.73%
<b>Golf</b>	1.02%	0.45%	0.87%

Overall, the number of injured subjects in the younger group was higher than those over 35 years old (74.4% and 25.6% respectively). The number of accidents in sports is significantly different depending on the age of the practitioner; finding where the number of sports injuries is primarily the younger group: rugby, gymnastics, soccer, handball, basketball, martial arts and football.

Although the number of injured participants in the younger group was still high, the percentage of injuries in the older group was statistically greater than expected in the following sports: golf, paddle, running, tennis, athletics, bodybuilding, cycling, skiing, hiking and swimming.

TABLE 2  
Percentage of injuries by age group in each sport

<b>Sport that produced the injury</b>	<b>Until 35 years old</b>	<b>Older than 35 years old</b>
<b>Rugby</b>	93.9%	6.1%
<b>Gymnastics</b>	93.5%	6.5%
<b>Football</b>	91.3%	8.7%
<b>Handball</b>	90.5%	9.5%
<b>Basketball</b>	87.2%	12.8%
<b>Martial Arts</b>	86.0%	14.0%
<b>Futsal</b>	79.5%	20.5%
<b>Swimming</b>	64.3%	35.7%
<b>Cycling</b>	61.7%	38.3%
<b>Tennis</b>	60.9%	39.1%
<b>Skiing</b>	60.5%	39.5%
<b>Fitness-Bodybuilding</b>	59.6%	40.4%
<b>Athletics</b>	59.2%	40.8%
<b>Hiking</b>	55.6%	44.4%
<b>Running</b>	51.8%	48.2%
<b>Paddel</b>	46.8%	53.2%
<b>Golf</b>	21.4%	78.6%

#### *Determining factors of injury in men*

72% of the accidents were suffered by men. Nearly half of the injured sample (45%), had been playing football or futsal, followed by "running-athletics" (11%), the integration "paddle-tennis" (8.5%) and basketball (8%). Martial arts and cycling reached almost 4% of accidents each. Just over 40% of the injured subjects had federal licenses and the activity was being carried out by them, without any professional organization.

The vast majority of accidents were caused during a recreational activity (52%) or in amateur competitions (29%). Significantly, the subjects older than 35 years old were mainly injured when performing a leisure activity (70%). The sample of subjects younger than 35 years old who were injured was greater than expected when they were competing (34%).

60% of the injured subjects were practicing the sport that produced the injury 2-3 times per week (33%) or more than 3 times per week (26%).

Accidents occurred mostly at an intermediate time during the practice (42%) or at the end of the activity (31%), and they were less common at beginning of activity.

Indoor accidents (29%) and those produced on artificial grass and in the outdoor area (31%) are those that occur more frequently.

The main reasons stated by the injured were: by chance (27%), physical fatigue and /or muscular problems (23%), and contact with another athlete (21%). To a lesser extent other causes were recklessness (10%) and neglect (8%).

The younger subjects were significantly more injured by physical contact (24%) than the older ones. And the older had more accidents due to physical problems (29%) than the younger ones.

#### *Determining factors of injury in women*

In contrast to men, the percentage of injured women was very distributed among different sports; running-athletics gave the highest percentage (19%) followed by tennis-paddle (16%) and football-futsal (11%). Finally, basketball and skiing produced a considerable number of accidents (8% and 5% of the total, respectively). Less than half of them had federal licenses or were engaged in the activities by organizing themselves (40%).

The majority of accidents occurred during a leisure activity (64%) or training (20%). Only 15% occurred while competing (always amateur competitions).

The vast majority (87%) of women over 35 were injured doing a leisure activity; practically no accidents occurred during the competition in this age group (2%).

Younger women were still getting injured much more during sports-entertainment, but the percentage of accidents during the competition rose to 20%.

As in the men's group, 61% of them practiced the sport that produced injury 2 or 3 times a week or more. 23% did it once a week.

Accidents occurred mostly (70%) at an intermediate time (half practice) or at the end of the activity.

Most of the injuries occurred in closed facilities (40%), and outdoors (18%).

The main reasons given for the accident were by chance (26%) and physical problems of the subject (25%). Other major causes were neglect (14%), contact with another athlete (12%) and recklessness (10%). It is remarkable that women in the older group were mainly injured by physical problems (34%) and only the 3% of them suffered the injury by contact with another athlete. Younger women were injured by physical contact (15%); which means a higher percentage than older women, but less than men of the same age (24%).

*Determining factors by injury location in men*

When the physical activity was done in a competition, there was an increase of injuries located in the head (37%) and the lower limb (33%).

The injuries in the upper limb occurred mainly indoor (42.6%) and the probability of suffering an accident located in the head increased on road surfaces.

Injuries by contact with another person induced more head injuries (35%) than any other injury location (21%) and those caused by "physical problems" affected the trunk (43%) more than any other body locations (23%).

*Determining factors by injury location in women*

In contrast with the results found in men, there was not a significant higher risk of injury depending on the reason given for practising the sport.

Women tended to be injured in the trunk (67%) when they performed the activity indoors. Although the number of injuries on the trunk was small, this finding is relevant because it indicates a strong relationship between trunk injuries and physical activities when they were carried out indoor (basketball, swimming, gymnastics, fitness-bodybuilding, etc.).

Significant differences were not found between the injury location and the reason given for the accident happened.

*Determining factors by injury type in men*

Bone fractures (44%) and torn ligaments (55%) were more likely to occur during a competition.

The surface in which the activity was performed had a great relationship with the injuries that occurred. While the overall number of injuries on grass is 13% the percentage ligament ruptures became 28% on this surface. Similarly the percentage of fractures on grass is also higher than expected (23%).

The relation between the reason of the accident and the type of injuries in male subjects shows the following results:

- The subjects suffered more torn ligaments (46%), joint injuries (37%) and sprains (31%) than expected when the reason given for the accident was "due to chance".
- When the reason given was neglect, it occurred more with superficial lesions (23%) and sprains (14%) than expected (8%).
- There were more bone fractures (45%), sprains (34%) and superficial lesions (33%) by contact with other athletes than expected (21%).
- If the reason given was "physical problems", muscular (45%) and tendons injuries (31%) appeared more than expected (23%).

*Determining factors by injury type in women.*

The results in women, in contrast with men ones, show that the objective with which the sport that originated the injury was practiced was not related with the injury type.

The surface had a significant relation in the following cases:

- Practicing sport outdoors produced more superficial lesions (29%) than any other injury type (18%).
- Indoors, the muscular injuries were more frequent (52%) than expected (38%).
- Using road surface produced more sprains (21%) than expected.
- The torn ligaments were more likely to appear when the activity was performed in an artificial surface (20%) than the rest of injury types on this surface (8%).

The relations between the reason of practice and the type of injuries in women were really similar to the ones found in the men's group, and showed the following results:

- The subjects suffered more torn ligaments (37%), joint injuries (32%) than expected when the reason given for the accident was "due to chance".
- When the reason given was neglect, more superficial lesions (21%) and sprains (24%) occurred than expected (14%).
- There were more bone fractures (30%) and superficial lesions (25%) by contact with other athletes than expected (12%).
- If the reason given for the accident was "physical problems", muscular (39%) and tendons injuries (33%) appeared more than expected (25%).

#### DISCUSSION AND CONCLUSIONS

Although the prospect case-control method was shown as the best option to develop epidemiologic studies (van Mechelen et al., 1992), the retrospect interview method was used before in different researching studies (Clarsen, Myklebust, & Bahr, 2013; Emery, Meeuwisse, & McAllister, 2006; C. Finch & Cassell, 2006).

This study retrospectively interviewed 1616 subjects that suffered an injury doing any kind of recreational sport. Taking into account the recommendations of previous studies (Bahr & Holme, 2003); this sample size is strong enough to consider the results relevant. Moreover, in the most of the studies, the sample is taken from a specific region, area or city of a country (C. Finch & Cassell, 2006). In the present research, the sample was taken from different regions that belong to the same country. The reason for it is to get to

know the results of amateur sports injuries on the general population in Spain, avoiding any bias based on the different sports habits of every region.

The results obtained in this study show a general description of the influence of sports injuries in the Spanish society. Through this study we try to analyze a field not so studied in Spain: the epidemiology of sports injuries in amateur subjects. Thus, we can establish some general conclusions as a description of the problem that generates the production of injuries in the growing population of amateur sport practitioners.

Following this line, comparative case-control studies in amateur sports would be advisable; to extract more detailed information on the causes and mechanisms of production of the injuries. The ultimate goal is to establish prevention campaigns that allow the practice of sport in a healthier way; without any "side effects" of sports related injuries.

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