Epidemiology of injury in a non professional basketball club during a regular season: a prospective study

Pablo Carnero Martín de Soto[1,2], Juan F. Abellán Guillén[3,4], Alfredo Rodríguez León[2], María J. Bravo Zurita[5], Ismael Menéndez Quintanilla[1]

[1]Hospital Regional Universitario de Málaga. Málaga. [2]Arthrosport. Zaragoza. [3]Hospital Morales Meseguer, Murcia. [4]Universidad Católica San Antonio de Murcia. Murcia. [5]Unit of Human Reproduction Hospital El Ángel. Málaga.

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Summary

Introduction: The knowledge about patterns of injury in non professional and adolescent basketball players is the base for prevention programs. While large series about injuries in professional basketball players have been published previously, little is known in non professional and young-in-training athletes. This study aims to describe the epidemiology of injuries, relate it with gender and type of activity in a non-professional basketball club over one season.
Material and method: Two hundred and thirty players (Mean age: 17.3, SD 5.7 years, 73.9% males) were enrolled in a one season prospective study. An injury report form was used to systematically collect all data and was filled weekly by each player. Characteristics of injuries were described and its distribution by gender and type of activity. Incidence of injury is shown as number of injuries /1000 hours exposure.
Results: Overall incidence was 3.86 injuries /1000h. The ankle (32.3%) was the most common location of injury and sprain (35.5%) the most frequent diagnosis, which was also seen in subgroups analysis. Mean time loss was 7.52 sessions (SD 11.28) Wrist injuries meant largest time loss (14.5 sessions, SD 13.43). Males showed higher incidence than females (4.16/1000h vs 3.04/1000h), who were more prone to fractures and upper extremity injuries. During competition, incidence of injury was 11.7 times higher than practices, and patterns of injury differed in each setting.
Conclusion: Ankle sprain was the most common injury in our study. Wrist injuries meant the longest time loss. Males got injured more often than females. Injuries during competition were notably more frequent than during practice with different patterns of injuries.

Key words:
Sports. Adolescent. Incidence. Ankle. Sprain.

Epidemiología lesional en club de baloncesto no profesional durante una temporada regular: estudio prospectivo

Resumen

Introducción: Conocer los patrones de lesión en baloncesto es la base para desarrollar programas preventivos. Aunque se han publicado grandes series en jugadores profesionales, poco se conoce sobre jugadores en formación y no profesionales. El objetivo de este estudio es describir la epidemiología de las lesiones en un club de baloncesto no profesional durante una temporada, y relacionarla con el género y el tipo de actividad competitiva.
Material y método: Doscientos treinta jugadores (edad media: 17,3, DS 5,7 años, 73,9% varones) se incluyeron en un estudio prospectivo a lo largo de una temporada. Un cuestionario sobre aparición de lesiones se utilizó para registrar los datos y se rellenó semanalmente por cada jugador. Se describieron las características de las lesiones y su distribución por género y tipo de actividad. La incidencia lesional se muestra como número de lesiones/1000 horas de exposición.
Resultados: La incidencia global fue de 3,86 lesiones /1.000 h. El tobillo (32,3%) fue la localización más común y el esguince (35,5%) el diagnóstico más frecuente. Esto también se observó en los análisis de subgrupos. El tiempo medio de baja fue de 7,52 sesiones (DS 11,28). Las lesiones de la muñeca conllevaron tiempos de baja más prolongados (14,5 sesiones, DS 13,43). Los varones presentaron una incidencia mayor que las mujeres (4,16/1000h *vs* 3,04/1000h), las cuales mostraron mayor tendencia a sufrir fracturas y lesiones del miembro superior. La incidencia de lesión durante la competición fue 11,7 veces mayor que durante el entrenamiento, y los patrones de lesión diferían.
Conclusión: El esguince de tobillo fue la lesión más frecuente en nuestro estudio. Las lesiones de muñeca supusieron mayores tiempos de baja. Los varones se lesionaron con más frecuencia que las mujeres. Las lesiones durante la competición fueron notablemente más frecuentes que durante el entrenamiento y presentaron diferente espectro.

Palabras clave:
Deporte. Adolescente. Incidencia. Tobillo. Esguince.

Correspondencia: Pablo Carnero Martín de Soto
E-mail: pablocarneromds@hotmail.com

Introduction

Basketball is the second most practiced sport in the world after football. About 11% of world population has played basketball at different levels of competition. The International Basketball Federation (FIBA) represents 213 national federations and about 450 million players[1]. The Spanish Basketball Federation counts with 400153 licensed players and 3968 clubs[2].

The description of the epidemiology of injuries of every sport is the basis to develop injuries prevention programs. However, published epidemiological registries vary in methodology and in the communication of results, which complicates obtaining reliable conclusions[3]. Results also differ widely depending on the population of study, like professional players[4], non-professional / recreational[5] or young-in training- players[6-8].

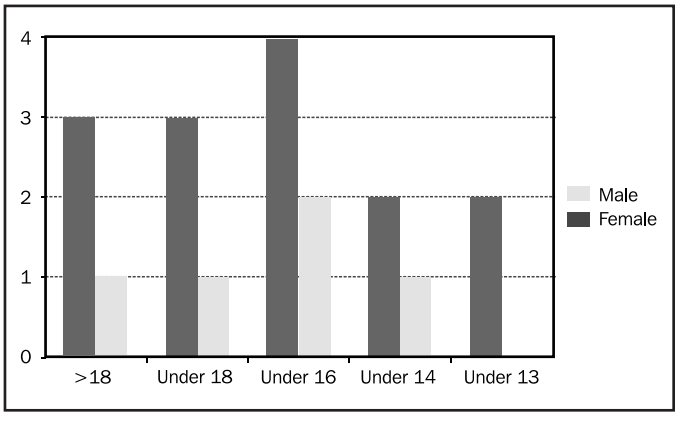
Several databases have been developed in an attempt to analyze information about injuries in basketball. The vast majority of the high-quality publications about this issue are based on them[9-11].

The knowledge about injuries in our geographical area could provide excellent information to develop prevention programs in non-professional and adolescent players, who are the majority of players in the world. The aim of this study is to describe the epidemiology of injuries, relate it with gender and type of activity and to establish the incidence of injury in non-professional basketball players belonging to a Spanish non-professional basketball club.

Material and method

Approval from the ethical committee from the Hospital Regional Universitario de Malaga was obtained. A prospective observational study was carried out registering injuries during the 2015 – 2016 regular season in a local non-professional basketball club. Nineteen teams were enrolled (14 male, 5 female) with a total of 230 players included (170 men, 60 women). Each team participated in their corresponding age-category league. Figure 1 represents categories of every participating team. Inclusion criteria were players aged 12 to 40 that participated in teams with a minimum of 2 practice sessions every week. Exclusion criteria were players under 12 or over 40, athletes that declined to participate and injuries that happened before the beginning of the preseason or after the end of the regular season. Informed consent was obtained from all participants.

Figure 1. Categories of participant teams.



An injury report form was developed based on a previous form of the Epidemiological Study of the Spanish Medical Basketball Association[12], which was adapted to the characteristics of non-professional and young- in training players. Information about age, sex, height, weight, side of injury, player position, type of injury, mechanism, location of injury, time loss measured as number of training or games lost, type of return to play (complete return to play, partial return to play with individual training or partial return to play with collective training), moment of the season (preseason, first half of regular season, second half of regular season), type of activity at the moment of injury (training or competition) and weekly time of exposure to training and games were collected.

An injury was defined as any harm sustained during training or competition resulting in inability to play. The form was filled weekly by every athlete included in the study. Diagnosis of injury was confirmed by the team doctor, who also performed the weekly follow up of injured players.

Qualitative data are shown as average, quantitative as mean and standard deviation (SD). Incidence is represented as injuries /1000 h exposure. Chi-square test was used to compare categorical variables; non-parametric tests were used to compare continuous data. p-values < 0.05 were considered statistically significant. All statistical analysis was conducted by the use of the program SPSS 20.0 (IBM CORPORATION, Armonk, NY, USA).

Results

A total of 124 injuries were diagnosed during the study period. Mean age of injured players was 17.27 (SD 5.69) years old. Mean height and weight of injured players were 1.76 (SD 0.1) meters and 73.17 (SD 10.89) kilograms respectively. Mean weekly exposure was 5.53 (SD 0.76) hours training and 0.27 (SD 0.09) hours in competition. Table 1 shows information about characteristics of injuries in total population.

Global injury rate was 3.86 /1000h exposure. In the subgroup analysis, males showed higher incidence than females (4.16/1000 h exposure and 3.04 /1000 h exposure respectively). Injury rate was 11.7 times higher in competition (29.14 injuries /1000h exposure) than during practices (2.49 injuries/1000 h exposure).

Global mean time loss was 7.52 (SD 11.28) sessions. Figure 2 represents mean time loss by gender and time of activity. By location, wrist injuries had the largest mean time loss (14.5 mean sessions lost, SD 13.43) followed by knee injuries (14.29, SD 28.34) and calf (10.2, SD 10.15) ($p=0.26$). By type of injury the largest mean time loss was ligament tear which conducted to the end of the season in two cases. Both cases were anterior cruciate ligament tears. Following type of injuries with largest mean time loss were meniscal / cartilage tear (108, SD 0) and fractures (22.67, SD 21.93) ($p=0.02$). A total of 8 fractures were counted during the study. 2 (25%) were nasal bone fractures, 2 (25%) were rib fractures, 1 (12.5%) was a buckle fracture at distal radius and 3 (37.5%) were buckle fractures at hand phalanges.

Table 1. Main characteristics of injuries.

	%		%		%
Sex		**Type of injury**		**Location of injury**	
Male	79	Concussion	0.8	Head	0.8
Female	21	Fracture	6.5	Face	4.8
Side of injury		Dislocation	1.6	Ribs – chest	4
Right	41.3	Sprain	35.5	Lower back	8.9
Left	39.7	Ligamentous tear	1.6	Pelvis – sacrum	1.6
N/A	19	Meniscal / cartilage tear	1.6	Elbow	1.6
Player position		Tendinopathy	4	Wrist	1.6
Outsider	47.8	Muscle tear	12.9	Hand	1.6
Insider	25.2	Contusion	11.3	Finger	6.5
Mechanism		Bursitis/fasciitis	7.3	Thumb	2.4
Trauma w/o contact	30.6	Epidermal injury	2.4	Groin	4
Player contact	28.2	Muscle soreness	9.7	Thigh	7.3
Recurrent	9.7	Dental injury	0.8	Knee	13.7
Ball contact	9.7	Artritis	1.6	Calf	4
Static object contact	6.5	Other	2.4	Ankle	32.3
Other	15.3			Toe	4.8
Moment of season		**RTP**			
Preseason	18.5	Complete	72.7	**Type of activity**	
First season half	37.9	Partial individual	14.9	Training	61.3
Second season half	43.5	Partial collective	12.4	Competition	38.7

Abbreviations: N/A: Not Applicable; RTP: Return To Play; w/o: without.

Figure 2. Time loss.

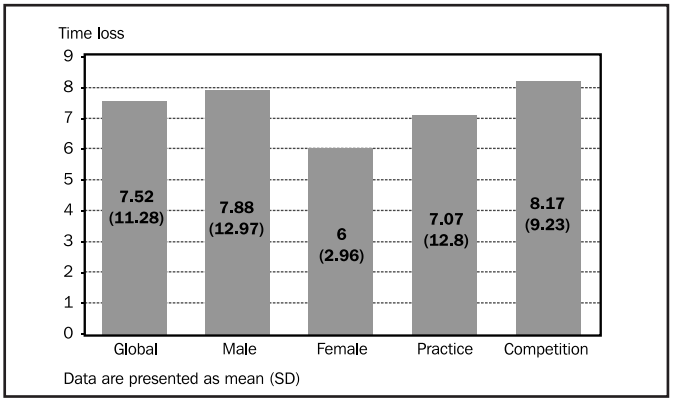


Table 2 and Table 3 shows injuries characteristics distributed by gender and type of activity.

Discussion

This study presents the epidemiology of injury in a Spanish basketball club entirely compound by adolescents and recreational players.

The incidence of injury was 3.86/1000 h exposure, similar than other registries, where injury rates vary from 3 to 9.8 injuries /1000 h[5,13,14], and lower in comparison with other contact sports like handball[15] or football[8], or even non-contact sports like volleyball[8]. However, comparing incidence of injury with other reports is not easy because it may be expressed in very different measure units like number of injuries / 1000 players[6], number of injuries / 1000 athletic exposures[9,10,16] or number of injuries / 1000 h exposure. Furthermore, several articles about basketball injuries are carried out in Emergency Departments[6,11,17], which provide very important information about characteristics of injuries but incidence cannot be calculated. The statement of universal measure units seems critical to obtain reliable information about incidence of injuries.

The ankle was the most frequent location of injury (32.3%), and sprains the most frequent diagnosis (35.5%) in the global analysis. These results are similar to previous reports, where ankle sprains represent 23-40% of all basketball injuries[18-21]. The knee was the second in the list (13.7%), and also the second in mean time loss (14.28; SD 28.34). It is remarkable the large SD compared to the mean time loss in knee injuries. This fact is due to the high variability of injuries that can occur at the knee, where very serious (ACL and meniscal tears) and mild injuries (Osgood-Schlatter disease) can coexist. Several articles show similar results than ours in terms of frequency of knee inuries[4,9,18] and importance[10,22]. We can assume that the knee is a very susceptible location for serious injuries in basketball, but an accurate diagnosis is required as it is a common location of banal injuries as well. The wrist was the location with largest mean time loss (14.5, SD13.43) because a buckle fracture which required splinting occurred here. However, it is not a common location of injury as only 2 injuries were registered here.

The influence of gender in injury rate in basketball is controversial. Most reports show, as we do, that males get injured more often than females with variable differences[19]. Dick *et al*[9] and Agel *et al*[10] registries about male and female injuries in fifteen consecutive National College Athletics Association league seasons showed an incidence of 9.9 and 4.3 injuries / 1000 athletic exposures in games and practice respectively for males *versus* 7.68 and 3.99 injuries / 1000 athletic exposures for females. On the other hand, Manonelles-Marqueta *et al*[21], Borowski *et al*[7] and Cumps *et al*[5] found that female injury rate was higher, with this

Table 2. Comparison of injuries distribution by gender.

	Male	Female	p		Male	Female	p
Age	17.4 (5.9)	17.4 (6.5)	0.67	**Location of injury**			
Type of injury				Head	1	0	
Concussion	1	0		Face	6.1	0	
Fracture	5.1	11.5		Ribs – chest	5.1	0	
Dislocation	2	0		Lower back	8.2	11.5	
Sprain	37.8	26.9		Pelvis – sacrum	2	0	
Ligamentous tear	1	3.8		Elbow	0	7.7	
Meniscal / cartilage tear	1	3.8		Wrist	1	3.8	
Tendinopathy	2	11.5	0.042	Hand	2	0	0.042
Muscle tear	14.3	7.7		Finger	3.1	19.2	
Contusion	13.3	3.8		Thumb	3.1	0	
Bursitis/fasciitis	7.1	7.7		Groin	3.1	7.7	
Epidermal injury	3	0		Thigh	7.1	7.7	
Muscle soreness	10.2	7.7		Knee	13.3	15.4	
Dental injury	1	0		Calf	5.1	0	
Artritis	0	7.7		Ankle	34.7	23.1	
Other	1	7.7		Toe	5.1	3.8	
RTP				**Type of activity**			
Complete	75.3	62.5	0.287	Training	57.1	76.9	0.066
Partial individual	12.4	25		Competition	42.9	23.1	
Partial collective	12.4	12.5		**Side of injury**			
Player position				Right	41.1	42.3	0.514
Outsider	73	80.8	0.424	Left	37.9	46.2	
Insider	27	19.2		N/A	21	11.5	
Mechanism				**Moment of season**			
Trauma w/o contact	33.7	19.2	0.009	Preseason	30.4	11.5	0.479
Player contact	31.6	15.4		First season half	35.7	46.2	
Recurrent	8.2	15.4		Second season half	43.9	42.3	
Ball contact	5.1	26.9					
Static object contact	7.1	3.8					
Other	14.3	19.2					

Data are presented as mean (SD) or %
Abbreviations: N/A: Not Applicable; RTP: Return To Play; w/o: without.

last study showing largest incidences than ours in both groups (11.1 female injuries /1000 h, 8.5 male injuries /1000 h). However, Rechel *et al*[16] reported that women got injured more often than males in competition (3.6 /1000 h *vs* 2.98 /1000 h) and men did during practice (1.37 /1000h *vs* 1.46/1000 h). A possible explanation for the difference of incidence we obtained between groups is that the women group was not as numerous as the men group, because the reduced number of female players that listed in the club.

The patterns of injury according to gender are not clear. Fractures comprise 15-16% of all injuries in basketball[8,17], and are more prone to happen in women in the upper limb, specially wrist and fingers. These findings were confirmed in our series. Manonelles-Marqueta *et al*[21] showed that ankle sprain was again the most common injury in professional female players, but it frequency was significantly lower than in our series (11.7% *vs.* 23.1%) and other reports, followed closely by patellar tendinopathy or condropathy (11.03%). In contrast, we found that the knee was only the third most common location of injury in females (15.4%), with finger injuries (19.2%) in second place. The size of our sample was not big enough to make conclusions about the influence of gender in anterior cruciate ligament tears rates. Mihata *et al*[23] found that anterior cruciate ligament tear incidence was almost three times greater in female basketball players. Concussions were only present in men, while Noble *et al*[24] reported than females' rate was noticeably higher (4.8- 6.1 /1000 athletic exposures *vs* 3.4- 3.5 /1000 athletic exposures). The differences in group sizes could again explain this fact.

Incidence of injury was remarkably higher during competition than during training. This trend is attributed to the higher intensity during a competitive match. The influence of external agents like playing in different surfaces when playing as visitors has to be pointed out in recreational players. This difference in injury rates has already been described in basketball[10,11,25] and in other contact sports[8,26]. However, the competition- practice incidence of injury ratio we obtained was larger than others reports (11.7:1 *vs* 2-9.4:1). In contrast, Barber Foss *et al*[8] found that incidence during practice was 7.4 higher in volleyball players. Although volleyball and basketball could be comparable as both sports imply continuous changes of direction and jumping, it seems clear that physical contact between players is a major factor in development of injuries in basketball.

During games, acute injuries were predominant, while overload injuries were during practice. Contusions were almost three times more

Table 3. Comparison of injuries distributed by type of activity.

	Training	Competition	p		Training	Competition	p
Age	17.1 (5.1)	18 (7.1)	0.97	**Location of injury**			
Type of injury				Head	0	2.1	
Concussion	0	2.1		Face	3.9	6.2	
Fracture	6.6	6.2		Ribs – chest	2.6	6.2	
Dislocation	0	4.2		Lower back	13.2	2.1	
Sprain	43.4	22.9		Pelvis – sacrum	2.6	0	
Ligamentous tear	0	4.2		Elbow	0	4.2	
Meniscal / cartilage tear	1.3	2.1		Wrist	1.3	2.1	
Tendinopathy	6.6	0	0.01	Hand	0	4.2	0.046
Muscle tear	9.2	18.8		Finger	6.6	6.2	
Contusion	6.6	18.8		Thumb	2.6	2.1	
Bursitis/fasciitis	9.2	4.2		Groin	3.9	4.2	
Epidermal injury	1.3	4.2		Thigh	6.6	8.3	
Muscle soreness	13.2	4.2		Knee	13.2	14.6	
Dental injury	0	2.1		Calf	0	10.4	
Artritis	2.6	0		Ankle	36.8	25	
Other	0	6.2		Toe	6.6	2.1	
RTP				**Side of injury**			
Complete	73.7	71.1		Right	41.9	40.4	
Partial individual	18.4	8.9	0.08	Left	37.8	42.6	0.84
Partial collective	7.9	20		N/A	20.3	17	
Mechanism				**Moment of season**			
Trauma w/o contact	27.6	35.4		Preseason	21.1	14.6	
Player contact	23.7	2.1		First season half	34.2	43.8	0.49
Recurrent	14.5	35.4		Second season half	44.7	41.7	
Ball contact	9.2	10.4	0.17	**Player position**			
Static object contact	7.9	4.2		Outsider	74.6	75	0.42
Other	17.1	12.5		Insider	25.4	25	

Data are presented as mean (SD) or %
Abbreviations: N/A: Not Applicable; RTP: Return To Play; w/o: without.

frequent during competition than during practices. Therefore, common contusion locations, like head, face and ribs – chest presented higher injury rates in games with statistical significance. On the other hand, typical overload diagnosis like bursitis, tendinopathy and muscle soreness where more frequent during training, and preferable locations where knee and lower back.

The influence of the type of activity in the severity of injuries in basketball remains controversial. Although a direct relationship between intensity of the play and seriousness of injury could be established reasonably, injury rates seem to be almost identical in competition and in practice[9,10] or statistical significance has not been obtained[19]. Competition injuries meant largest mean time loss in our register but differences were not statistically significant.

Our study presents several limitations. The first one is the definition of injury as any harm that result in inability to play. Any health issue that limited physical performance but did not imply missing a game or practice was not considered an injury. This could drive to an underestimation of the incidence of injuries. However, we think that this underestimation could be limited by the fact that the absence during a session due to body harm is higher in recreational players, who are not forced to play for financial reasons. Furthermore, most of reports used the same definition of injury[7,9,10]. Another limitation was that the club did not have economical support to sustain assistance to injured players, so the costs of the treatments were carried out by the federative insurances and, many times, by the own player. This fact probably contributed to increase time loss as individual recovery programs could not be developed in the club structure. As commented before, the different sizes of gender groups difficult comparison of results.

Conclusions

The incidence of injury was 3.86/1000 h exposure, lower than other contact sports. Men presented higher injury rate than females (4.16/1000 h exposure *vs.* 3.04 /1000h exposure). Incidence of injury during competition was 11.7 times higher than during practice. Ankle sprain was the most frequent injury independently of gender and type of activity. Women were more prone to upper limb injuries and fractures, while men had longer time loss. Contusions were almost three times more common during competition than during practices, while overload injuries like bursitis, tendinopathy and muscle soreness appeared significantly more during practices.

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