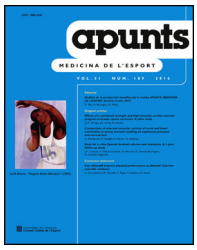
Apunts Med Esport. 2019;54(204):139–147

apunts
MEDICINA DE L'ESPORT
www.apunts/org



SCIENTIFIC LETTER

Analysis of the injuries of a professional basketball team during 22 seasons attended by the same physiotherapist

Análisis de las lesiones de un equipo profesional de baloncesto durante 22 temporadas atendidas por un mismo fisioterapeuta

Basketball is a sport known around the world. At the professional level, the National Basketball Association (NBA) is recognised as the strongest league and the one in which the best basketball players are found. At the European level, the most important competition is the EuroLeague, where the best teams from the leagues in each country play. The Football Club/*Fútbol Club* Barcelona (FC Barcelona) has had a basketball section since 1926 and has competed in the EuroLeague since it was established.

Basketball has been considered to be a sport in which injuries are very frequent. Among the sports that participate in the Olympic Games, it is considered one of moderate risk.[1]

Systematic monitoring of injuries and medical conditions is an essential requirement for efficacy in the protection of athletes' health. Epidemiological data help ensure proper planning and provision of medical attention for the athletes and, what is even more important, make it possible to develop strategies and measures to prevent injuries and medical conditions.[2] However, there are only a limited number of follow-up studies carried out on professional basketball teams, from both the academic perspective and from that of a professional team, especially in reference to European basketball.

The objective of this study was to describe the injury epidemiology of the players on a professional basketball club with the same physiotherapist for 22 years. The injury trends during this 22-year period were described globally and according to anatomical site affected, the type of injuries and severity (time absent from the sport), based on the type of trainer. Whether the number and type of injuries had varied over time were also analysed.

Materials and methods

Study design

This was a retrospective cohort study in which 170 basketball players from the same professional club over 22 seasons (1993/94–2015/16) were analysed. All the athletes signed an informed consent at the beginning of the season giving permission for their data to be used in their benefit and for their anonymised data to be used to carry out epidemiological studies. This study was approved by the Committee on Science and Ethics of the FC Barcelona.

Data collection

The team physiotherapist recorded, for 22 years, all the incidents that happened to the players during the training sessions and games. The same methodology for recording and analysis was used, varying only with respect to technological advances. The variables described and recorded in this study were player, trainer, ethnic group, height, position, affiliate status, anatomical site affected by the injury, type of injury, severity (sports time loss). In this study, the players' positions were the one each trainer initially stipulated when the players joined the club, although they could change later on. The players with a status of 'affiliate' (vinculados in Spanish) are those that play with the FC Barcelona senior team (whether in training sessions or games) while being members of the reserve team.

For every injury that happened, the day and time, exact moment and place where the injury happened (in a training session or a game), and the initial diagnosis were recorded. Injuries that the physiotherapist considered more severe were referred to the team physician, who confirmed the diagnosis based on a physical examination and imaging tests such as sonography or magnetic resonance imaging (MRI).

From the 2006–2007 season to the 2015–2016 season, all the injuries were recorded and stored using the FC Barcelona software ''GEM'' first and later on, ''COR.'' Before the 2007–2008 season, the physiotherapist recorded the information using spreadsheets. All the injuries from the entire study period were categorised following the Orchard Sports

https://doi.org/10.1016/j.apunts.2019.07.006

Table 1 Descriptive statistics for the sample of players.

Descriptive summary of the sample						
General	N		Age			Height
	170		26.5 (SD: 4.48)			200.08 (SD: 9.62)
Ethnic group			Caucasian	African-American		Mixed
	N (%)		132 (77.65)	35 (20.59)		3 (1.76)
Position		Point guard	Shooting guard	Small forward	Power forward	Centre
	N (%)	37 (21.77)	11 (6.5)	55 (32.35)	18 (10.58)	49 (28.8)
	Age (mean, SD)	27.6 (4.18)	28.5 (4.21)	26.4 (4.92)	27.6 (4.18)	25.0 (3.84)
	Height (mean, SD)	189.2 (3.75)	194.6 (4.53)	200.4 (4.97)	207.9 (3.61)	211.1 (4.68)
Affiliate status				Professional		Affiliate
	N (%)			121 (71.2)		49 (28.8)

SD: standard deviation.

Injury Classification System (OSICS-10). This classification is hierarchically structured with four letters assigned to each type of injury. The first letter refers to the anatomical injury site; the second, to the specific tissue injured or the type of injuries; and the other two letters serve to elaborate on the diagnosis.[3,4]

Injury diagnosis and classification

An injury was considered to be any situation occurring during a team training session or a game that made it necessary for the physician and/or physiotherapist to conduct a physical examination of the player after that training session/game. Each such situation consequently required a working diagnosis, which generally needed only treatment by the physiotherapist and did not cause any loss of training or games.

A time-loss injury was considered to be any injury occurring during the season in a training session or a game that caused an absence from at least the following training session or game. This definition is the one accepted in the epidemiological study consensus of the Union of European Football Associations (UEFA)[5,6] and has been used in the majority of sports in recent years. Any injury or accident that had no relationship with basketball was excluded from this study.

Players with injuries causing time loss or requiring specific treatment followed a rehabilitation programme under the guidance of the individual responsible for the physiotherapy, as well as the recommendations of international guidelines and, especially since 2009, those of the FC Barcelona itself.[7,8] To establish the time for return to play, the criteria proposed in the previously-mentioned guidelines were followed.

Statistical analysis

A descriptive study of all the injuries was carried out, calculating the absolute frequencies and their percentages based on the injury site, type of pathology and severity. In addition, a descriptive analysis of the injuries was performed based on the ethnic group, player position, affiliate status, type of trainer and season. The frequency distribution was calculated for qualitative variables, and measures of central tendency and dispersion were calculated for the quantitative variables. The statistics software IBM SPSS Statistics 21 and statistical program R were used in all the analyses.

Results

Players

Between the 1993/94–2015/16 seasons, 170 professional players from a single club were treated in national and international games. Player characteristics, by ethnic group, position and affiliate status, are presented in Table 1. Mean player age was 26.5 years (standard deviation [SD]: 4.48), with a mean height of 200 cm (SD: 9.6). Most players were Caucasian (77.65%) and professionals (71.2%), and the position of centre was the most frequent (28.8%).

Frequency distribution of the injuries treated

From all the players, a total of 3452 injuries were collected. The injury characteristics are shown in Table 2, and their comparative evolution during the 22 seasons included in this study are presented in Fig. 1.

The characteristics of the injuries based on anatomical site and the type of injury can be seen in Table 3 (sites) and in Table 4 (type of injury).

Table 5 shows the results of the analysis of injuries according to trainer, considering the injury site, the type of injury and the player's position in the game.

Frequency distribution of time-loss injuries

The 310 injuries that caused time losses are described in Table 6, analysing them by ethnic group, player position in

Table 2 Descriptive statistics of the injuries treated.

General	N					
	3452					
Ethnic group		Caucasian		African-American	Mixed	
	N (%)	3040 (85.9)		482 (13.6)	16 (.5)	
Position		Point guard	Shooting guard	Small forward	Power forward	Centre
	N (%)	780 (22)	632 (17.9)	733 (20.7)	347 (9.8)	1046 (29.6)
Affiliate status		Professional		Affiliate		
	N (%)	3151 (89.1)		387 (10.9)		

*These data do not include 86 injuries lost to follow-up due to the lack of information about the diagnosis, time of injury and treatment given.

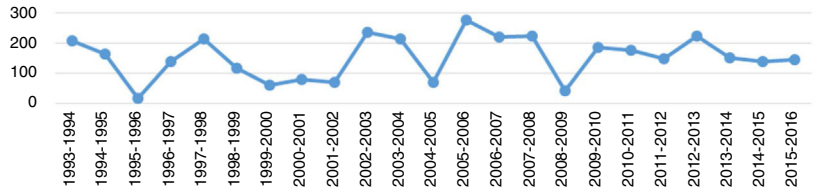


Fig. 1 Number of injuries by season*.
*The data for the 1995–1996 season are incomplete, because all the physiotherapy material was transferred to another sports centre (from Palau Sant Jordi to Palau Blaugrana).

Table 3 Number of injuries (%) by anatomical site according to the Orchard Sports Injury Classification System (OSICS) and OSICS codes.

OSICS label	Frequency (%)
Lower Limb	1799 (52.1)
Knee	429 (12.4)
Upper leg	392 (11.4)
Lower leg	350 (10.1)
Ankle	348 (10.1)
Foot	280 (8.1)
Trunk and Spine	456 (13.2)
Chest	35 (1.0)
Trunk and abdomen	20 (.6)
Thoracic spine	100 (2.9)
Lumbar spine	301 (8.7)
Upper Limb	526 (15.2)
Shoulder	109 (3.2)
Upper arm	16 (.5)
Elbow	76 (2.2)
Forearm	20 (.6)
Wrist and hand	305 (8.8)
Head and Neck	375 (10.9)
Head	228 (6.6)
Neck	147 (4.3)
Pelvis and Groin	273 (7.9)
Hip and groin	221 (6.4)
Pelvis and buttocks	52 (1.5)
Other	23 (.7)
Site not specified	19 (.6)
Medical	3 (.1)
No present medical condition/injury	1 (.0)
Total	3,452 (100)

Table 4 Type of pathology according to the Orchard Sports Injury Classification System (OSICS) and OSICS codes.

OSICS label	Frequency (%)
Muscular/Tendinous	2168 (63.1)
Muscular injury	1783 (51.9)
Tendon injury	385 (11.2)
Cartilage and ligament injuries	853 (24.8)
Synovitis, pinching, bursitis	50 (1.5)
Cartilage injury	40 (1.2)
Arthritis	5 (.1)
Joint sprains	758 (22.1)
Bony injuries	38 (1.2)
Fracture	23 (.7)
Stress fracture	10 (.3)
Other stress injuries	9 (.3)
Other	377 (10.9)
Injury not specified	37 (1.1)
Other non-specified injuries in another part	3 (.1)
Organ injury	8 (.2)
Whiplash injury	1 (.0)
Nerve injury	15 (.4)
Joint dislocations	3 (.1)
Bruises/ haematoma	59 (1.7)
Laceration / abrasion	251 (7.3)
Total	3,436[a] (100)

[a] These data do not include 16 types of injuries that could not be recorded correctly during follow-up.

the game and affiliate status. In Table 7, the analysis of these injuries based on site is presented, while Table 8 shows the analysis according to the type of injury.

Table 5 Injuries by athletic trainer.

Trainer	AG	DI	JM	MC	SP	XP
A – Descriptive summary						
Total injuries (%)	757 (22)	208 (6)	517 (15)	62 (1.8)	714 (20.7)	1186 (34.4)
Number of seasons* (months)	6 (60)	1 (10)	3 (30)	1 (6)	3 (25)	8.5 (85)
Number of injuries per season (%)	126 (12.5)	208 (20.8)	172 (17.2)	62 (10.3)	238 (28.57)	148 (13.95)
B – Anatomical site						
Lower Limb	417 (23.2)	395 (22)	33 (1.8)	126 (7)	273 (15.2)	555 (30.9)
Trunk and spine	84 (18.4)	83 (18.2)	13 (2.9)	21 (4.6)	68 (14.9)	187 (41)
Upper limb	86 (21.4)	71 (17.7)	6 (1.5)	19 (4.7)	52 (13)	167 (41.6)
Head and neck	70 (18.7)	68 (18.1)	6 (1.6)	25 (6.7)	65 (17.3)	141 (37.6)
Pelvis and groin	80 (29.3)	66 (24.2)	4 (1.5)	18 (6.6)	27 (9.9)	78 (28.6)
Others	0 (0)	4 (17.4)	0 (0)	0 (0)	7 (30.4)	12 (52.2)
C – Type of pathology						
Muscle/Tendon	447 (20.6)	481 (22.2)	42 (1.9)	112 (5.2)	322(14.9)	764 (35.2)
Cartilage and ligament injuries	210 (24.6)	152 (17.8)	15 (1.8)	63 (7.4%)	135 (15.8)	278 (32.6)
Bony injuries	14 (33.3)	9 (21.4)	2 (4.8)	6 (14.3)	0 (0.0)	11 (26.2)
Others	85 (22.8)	72 (19.3)	6 (1.6)	22 (5.9)	56 (15.0)	132 (35.4)
D – Player's position						
Power forward	0 (.0)	80 (23.1)	14 (4.0)	0 (.0)	66 (19.0)	187 (53.9)
Small forward	283 (38.6)	85 (11.6)	6 (0.8)	60 (8.2)	68 (9.3)	231 (31.5)
Point guard	193 (24.7)	193 (24.7)	6 (0.8)	58 (7.4)	89 (11.4)	241 (30.9)
Shooting guard	23 (3.6)	206 (32.6)	20 (3.2)	1 (0.2)	102 (16.1)	280 (44.3)
Centre	291 (27.8)	157 (15.0)	23 (2.2)	95 (9.1)	200 (19.1)	280 (26.8)

Table 6 Descriptive statistics of the injuries causing sports time loss.

General	N					
	310					
Ethnicity	Caucasian	African-American			Mixed	
N (%)	273 (88.1)	33 (11.0)			3 (1.0)	
Position	Point guard	Shooting guard	Small forward	Power forward	Centre	
N (%)	70 (22.6)	83 (26.8)	56 (18.1)	26 (8.4)	75 (24.2)	
Affiliate status	Professional		Affiliate			
N (%)	277 (89.4)		33 (10.6)			

The time-loss injuries were also analysed considering severity according to days lost, as well as injury site and the type of pathology (see Table 9). The comparative evolution of the time-loss injuries over the 22 seasons is presented in Fig. 2.

Discussion

Basketball has evolved considerably over recent years with respect to regulations, training session length and intensity, and game density. This has caused changes in the demands on and physical characteristics of the players.[9] However, it is not known how this fact has really affected the incidence of injuries in the teams, particularly on the professional players.

Scientific literature on epidemiology in European basketball is practically non-existent. Extrapolating the results from the epidemiological studies on the American National Basketball Association (NBA) would not be comparable, given that the game, and especially the rhythm, of the basketball played in the USA is different from that played in Europe. This is especially true as far as the physical level is concerned (American basketball is much more physical, while European basketball is much more tactical). We have been unable to find any studies to date that compare the different rules upheld by the NBA and the International Basketball Federation (FIBA, from the organisation's name in French), the number of games in each competition, the physical demands in each of the competitions and other possible factors in terms of whether there have been changes in the risk or pattern of injuries.

In 2010, Drakos et al.[10] published one of the only studies that describe the injury pattern of NBA basketball players, covering a period of 17 seasons, from 1988 to 1989 to 2004–2005. However, as has been commented, it is not known if the results and conclusions are useful for and applicable to players in the European leagues. Along the same line, a systematic review of epidemiological studies on basketball[11] has recently been published, in which 268 articles were selected; of these, 11 were eligible for the integrative review and only 5 were included to extract

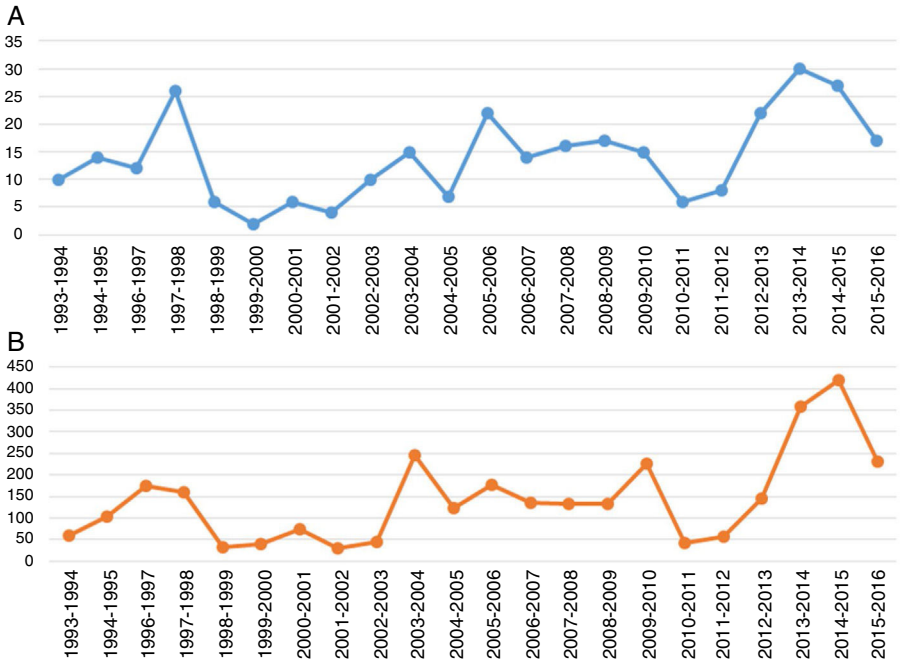


Fig. 2 Number of injuries causing time loss by season. Panel A - Total number of time-loss injuries. Panel B - Days of time loss by season*.
*The data for the 1995–1996 season are incomplete, because all the physiotherapy material was transferred to another sports centre (from Palau Sant Jordi to Palau Blaugrana).

data on injuries in male basketball players, none of which referred to European players or competitions.

Basketball in Europe is one of the sports with the greatest following; it has the most participation as far as professional and non-professional federation licenses are concerned. It seems obvious that an in-depth epidemiological study on injuries in European basketball, such as this study, would be of great interest for sports physicians and physiotherapists working on basketball teams. In addition, such a study would be very useful to ascertain whether there are similarities with the epidemiological studies on American basketball.

Analysis based on anatomical injury site

In the present study, the sites most often affected are the lower limbs (52.1%), followed by the upper limbs (15.2%), and the trunk and spine (13.2%). These data coincide with the existing literature. In a 6-season retrospective study on NBA basketball, Deitch et al.[12] conclude that lower limb injuries could reach up to 65%. In European basketball, in a study conducted on the Belgium league, 51.2% of the injuries are seen to occur in lower limbs,[13] data very similar to those presented in this study.

Focusing on specific anatomical injury area, most injuries in our study are produced in the knee (12.4%) and the ankle (10.1%). These results differ to a certain degree with the review by Andreoli et al.[11] in which it is seen that in basketball in general (men, women and veterans), the knee and the ankle were the sites most affected, with 21.9% and 17.8%, respectively. In male professional players, 28.4% of the injuries occurred in the ankle and the foot, followed by the thigh, hip and leg (19.3%) and the knee (17.5%). In the present study, ankle and foot injuries were 19.2%; thigh, hip and leg injuries added up to 30.2%; and knee injuries accounted for 12.4%.

Based on the data obtained in our study, the ankle is not the site most affected, in contrast to the results of the study by Carazzato et al.[14] even though the majority of the studies existing do indicate this.[10–12] What is especially notable in our study is the high incidence of injuries involving the area of the thigh, hip and leg. This elevated incidence is probably due to the fact that there are more muscular and/or tendon injuries correctly recorded from the beginning of the study than ligament injuries of the ankle and knee.

Another of our findings that stand out is that there severe injuries in the knee are rare, but injuries from overuse are common. This has a relatively simple explanation; it stems from the way the players stand and move: during most of the game, the knee is semi-flexed at approximately 30° and the tension maintained favours the appearance of pathologies from overuse of the patellar tendon. This is particularly true in the area where the patellar tendon intersects with the inferior pole of the kneecap, a pathology called jumper's knee.

At the muscle level, the injuries through direct mechanisms (contusion) of the vastus lateralis muscle of the quadriceps occur very often; they are direct contusions with the opponent's knee. Hamstring muscle injuries are also frequent and, at the level of the leg, a great number of gastrocnemius overload injuries and tearing of the medial gastrocnemius and the soleus muscle are produced (the latter ones in more veteran players).

Only 10.1% of injuries occur in the area of the ankle. At the level of clinical experience of basketball team physicians

Table 7 Injuries causing sports time loss (%) by anatomical site according to the OSICS classification system and codes.

OSICS label	Frequency (%)
Lower Limb	176 (56.8)
Knee	35 (11.3)
Upper leg	33 (10.8)
Lower leg	35 (11.3)
Ankle	33 (10.6)
Foot	40 (12.9)
Trunk and Spine	42 (13.5)
Thorax	4 (1.3)
Trunk and abdomen	2 (.6)
Thoracic spine	11 (3.5)
Lumbar spine	25 (8.1)
Upper Limb	37 (11.9)
Shoulder	8 (2.6)
Upper arm	1 (.3)
Elbow	9 (2.9)
Lower arm	1 (.3)
Wrist and hand	18 (5.8)
Head and Neck	30 (9.7)
Head	16 (5.2)
Neck	14 (4.5)
Pelvis and Groin	24 (7.7)
Hip and groin	21 (6.8)
Pelvis and buttocks	3 (1.0)
Others	1 (.3)
Site not specified	1 (.3)
Medical	0 (.0)
No present medical condition/injury	0 (.0)
Total	310 (100.0)

OSICS: Orchard Sports Injury Classification System.

Table 8 Injuries causing sports time-loss (%) by the type of injury according to the OSICS classification system and codes.

OSICS label	Frequency (%)
Muscular/Tendinous	194 (63.0)
Muscular injury	158 (52.0)
Tendon injury	36 (11.8)
Cartilage and ligament injuries	76 (25.0)
Synovitis, pinching, bursitis	8 (2.6)
Cartilage injury	8 (2.6)
Arthritis	0 (0.0)
Joint sprains	60 (19.7)
Bony injuries	13 (4.2)
Fracture	3 (1.0)
Stress fracture	10 (3.2)
Others stress injuries	0 (.0)
Others	25 (8.1)
Injury not specified	0 (.0)
Other non-specified injuries in another part	0 (.0)
Organ injury	1 (.3)
Whiplash injury	0 (.0)
Nerve injury	2 (.7)
Joint dislocations	0 (.0)
Bruises/ haematoma	5 (1.6)
Laceration/abrasion	17 (5.6)
Total	310 (100.0)

OSICS: Orchard Sports Injury Classification System.

and physiotherapist, the ankle has historically been viewed as one of the areas with the greatest potential likelihood of pathology. However, the data show that this is not so, and the reason is probably that there is more attention paid to prevention from both the standpoint of proprioception work and preventative taping bandages in high-risk training sessions and games.

Due to the characteristics of this sport itself and, in contrast to others such as handball, injuries of the upper limb (shoulder, upper arm and elbow) are not normally seen in basketball. In the review by Andreoli et al.[11] shoulder

Table 9 Injury severity based on days of sports time loss (general and by anatomical site and pathology type).

Severity	Slight(1–3 days)	Mild(4–7 days)	Moderate(8–28 days)	Severe(>28 days)	Total
A – General					
Total injuries (%)	129 (41.6)	74 (23.9)	80 (25.8)	27 (8.7)	310 (100)
B – Anatomical site					
Lower limb	75 (58.1)	36 (48.6)	46 (57.5)	19 (70-4.0)	173 (56.8)
Trunk and spine	17 (13.2)	9 (12.2)	11 (13.4)	5 (18.5.0)	42 (13.5)
Upper limb	18 (14.0)	8 (10.8)	9 (11.0)	2 (7.4)	37 (11.9)
Head and neck	8 (6.2)	13 (17.6)	9 (11)	0 (0)	30 (9.7)
Pelvis and groin	10 (7.8)	8 (10.8)	5 (6.1)	1 (3.7)	24 (7.7)
Other	1 (0.8)	0 (0)	0 (0)	0 (0)	1 (0.3)
Total	129 (100)	74 (100)	80 (100)	27 (100)	310 (100)
C – Type of pathology					
Muscular/Tendinous	74 (57.4)	52 (70.3)	50 (62.5)	18 (72.0)	194 (63.0)
Cartilage and ligament injuries	37 (28.7)	11 (14.9)	23 (28.7)	5 (20.0)	76 (24.7)
Bony injuries	5 (3.9)	4 (5.4)	1 (1.3)	3 (11.1)	13 (4.2)
Other	13 (10.1)	7 (9.5)	4 (5.0)	1 (4.0)	25 (8.1)
Total	129 (100)	74 (100)	78 (100)	27 (100)	308 (100)

Slight: 1–3 days; mild: 4–7 days; moderate: 8–28 days; Severe: > 28 days.

injuries account for 6.2% of all injuries and, in our series, they represent 5.9%.

At the level of the upper limb, the fingers are another of the areas significantly involved in injuries. They are generally caused by direct mechanism (from a poor reception of the ball, which hits the fingertips) or because the finger gets caught in another player's shirt. In our study, wrist and finger injuries account for 8.8%, a figure that is very similar to that in the systematic review by Andreoli et al.[11] (8.9% in professional players).

In the present study, the injuries of the trunk and spine represent 11.2%. This percentage is slightly above that observed in the studies analysed by Andreoli et al.[11] (7.5%) and that of Starkey et al.[15] (6.9% in NBA players). Our general case material in the study stems from 2 main situations. First of all, injuries happen through direct contusions on the flank or lumbar area itself. In the second place, they occur from overload in the lumbar area; it is important to remember that in each landing after a jump, the buffering waves directly impact the lumbar area (this was, at that time, one of the reasons prompting the development of all the range of sports shoes with cushioning).

In the anatomical area of the head and neck, injury incidence varies among the studies consulted, ranging between 8% and 14%.[12,15,16] These data fully coincide with those obtained in our study for the head and neck area (11.9%). These injuries are principally injuries and/or wounds caused by direct contusions or muscle contractures at the cervical level.

Analysis according to the type of injuries

Tendon and muscle injuries are the most frequent in our study. This fact is especially important because it demonstrates a clear trend towards which injuries are evolving in current basketball. In the studies mentioned up to now, ankle injuries and sprains are, generally speaking, the most common. In the study by Drakos et al.[10] on NBA players, ankle sprains were the most frequent injuries (1658 injuries, which represented 13.2%), followed by patellofemoral pain (1493 injuries; 11.9%), backaches (999 injuries; 7.9%) and hamstring injuries (413 injuries, which represented only 3.3%).

In our study, the most frequent injuries are the muscular, with a frequency of 51.9%, as well as the tendon, with 11.2%. The ligament injuries in our study, such as joint sprains, accounted for 19.2%. There are 2 body areas with greater incidence: the ankles, due to sprains, and the fingers (capsulitis), due to the impact of the ball against the fingers, especially when the ball hits the fingertips.

Cartilage injuries (especially in the knees) were 2.6% in our study, while synovitis basically knee and ankle) accounted for 2.5%. These are injuries from overload due to continuous jumping and the player's position standing and moving in permanent semi-flexion. This position makes it possible for the player to initiate a jump or a run almost instantly.

Bony injuries, or fractures, are rare (1.2%) in our study. Perhaps the most characteristic bony injuries have been of the fingers, with stress fractures likewise common. The latter appear mainly affecting the base of the fifth metatarsal. This can be explained by the repeated impact received in both jumping and in landing with considerable player weight, and also considering the speed of the fall and the often off-balance position in which players fall.

Analysis of the injuries according to game position

In the literature review on basketball injury epidemiology, no article has been found to date linking the injuries observed with the game positions of the players. There is only the study by Tummala et al.[17] which mentions solely ankle injuries ankle and concludes that the centers are the players most affected by lateral ankle sprains, especially involving rebounds.

According to the characteristics of the 170 players in our study sample, the players with the greatest number of injuries are those playing in the position of centre. This is due to their own physical characteristics, given that they are generally the ones that weigh the most, are the tallest and shift the most weight in their movements.

In second place, the most injuries appear in athletes in the position known as point guard or playmaker. These are smaller players, weighing less, but they are very fast and explosive in their moves; that is the reason why their musculoskeletal system is exposed to more types of injuries, especially muscular ones. In the last places, the positions of small forward, power forward and shooting guard were found. The characteristics of these players are their speed and quick shots, and they usually play a bit far from the basket; consequently, they are exposed to less physical contact.

Analysis of the injuries by trainer

There is no other article in the scientific literature comparing the injuries observed over different seasons in a single team according to the different basketball trainers. The injuries differentiated by trainer can vary widely due to the philosophy, style and work methods that each trainer has.

Ekstrand et al.[18] have recently published an article noting how trainer style can affect the incidence of injury in professional football/soccer. This is the first study to find a relationship between the form or style of training and the incidence of injury; specifically, it finds a link with the leadership style of the group and the severity of the injuries and willingness of the players. In our study and remembering physiotherapist experience, we can sense trends with respect to frequencies and types of injury, but our study is purely descriptive.

Analysis of the injuries according to severity and return to play

Among all the sports time-loss injuries in the data, those that occur most frequently are tendon and muscle injuries affecting the lower limb. As has been mentioned previously, these data fully coincide with similar studies available to date.[10,16,19] In these studies, there is no classification of the injuries according to degree of severity such as that provided in the present study (Table 9). Our data reveal that the greatest number of time-loss injuries were very slight

(1–3 days of time loss), with 41.6% of the injuries; followed by the moderate (8–28 days of loss), with 25.8%. In their study, Drakos et al.[10] indicate that the injury that causes the greatest number of games lost due to injury are those involving patellofemoral pain, accounting for 17.5% of all the causes.

Just as Starkey et al.[15] point out in their study, there has been a clear trend towards rising number of injuries and severity of injuries. This is due in great part to the increase in the physical demands of the game and to the characteristics of the players themselves, as they are ever taller, stronger and faster. Likewise, improved diagnostic tools and the awareness that epidemiological databases need to be created for each sport can also be a factor to consider in this jump in the number of injuries recorded.

Conclusion

In this study, 3452 injuries in 170 professional basketball players were analysed. The injuries were recorded and classified by the same team physiotherapist following the same criteria for the 22 seasons that the study lasted and for which there were 7 different trainers. The most notable results are that there were more injuries in the lower limbs (52.1%), regardless of playing level (professional and affiliate) and ethnic group (Caucasian and African-American), and that tendon and muscle injuries (61% of all injuries) were more frequent than chondral and ligament ones. The centers were the players with the most risk of suffering injuries and the trainer did not seem to be determinant in the pattern of injuries. As for severity, the most frequent injuries were slight ones (1–3 days of time loss).

Conflict of interests

The authors have no conflicts of interest to declare.

Acknowledgements

We wish to thank all the professional basketball players that formed part of the FC Barcelona team during the seasons from 1993/94 to 2015/16.

References

1. Soligard T, Steffen K, Palmer D, Alonso JM, Bahr R, Lopes AD, Engebretsen L. Sports injury and illness incidence in the Rio de Janeiro 2016 Olympic Summer Games: a prospective study of 11274 athletes from 207 countries. Br J Sports Med. 2017;51:1265–71, http://dx.doi.org/10.1136/bjsports-2017-097956.
2. van Mechelen W, Hlobil H, Kemper HCG. Incidence, severity, aetiology and prevention of sports injuries. Sports Med. 1992;14:82–99, http://dx.doi.org/10.2165/00007256-199214020-00002.
3. Rae K, Orchard J. The Orchard Sports Injury Classification System (OSICS) Version 10. Clin J Sport Med. 2007;17. Retrieved from https://journals.lww.com/cjsportsmed/Fulltext/2007/05000/The_Orchard_Sports_Injury_Classification_System.7.aspx
4. Orchard J. Revision, uptake and coding issues related to the open access Orchard Sports Injury Classification System (OSICS) versions 8, 9 and 10.1. Open Access J Sports Med. 2010;207, http://dx.doi.org/10.2147/oajsm.s7715.
5. Waldén M, Hägglund M, Ekstrand J. UEFA Champions League study: A prospective study of injuries in professional football during the 2001–2002 season. Br J Sports Med. 2005;39:542–6, http://dx.doi.org/10.1136/bjsm.2004.014571.
6. Fuller CW, Ekstrand J, Junge A, Andersen TE, Bahr R, Dvorak J, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. Br J Sports Med. 2006;40:193–201, http://dx.doi.org/10.1136/bjsm.2005.025270.
7. del Futbol Club Barcelona SM, Clinical Practice Guide for Muscular Injuries. Epidemiology, diagnosis, treatment and prevention. Apunts Medicina de l'Esport (English Edition). 2009;44:179–203. Retrieved from https://www.apunts.org/en-clinical-practice-guide-for-muscular-articulo-X1886658109286614 ER.
8. Barcelona FC, Barcelona FC. Guía de práctica clínica de las tendinopatías : diagnóstico, tratamiento y prevención. Apunts Med Esport. 2012;47(176):143–68.
9. Cormery B, Marcil M, Bouvard M. Rule change incidence on physiological characteristics of elite basketball players: a 10-year-period investigation. Br J Sports Med. 2008;42:25–30, http://dx.doi.org/10.1136/bjsm.2006.033316.
10. Drakos MC, Domb B, Starkey C, Callahan L, Allen AA. Injury in the National Basketball Association: A 17-year overview. Sports Health. 2010;2:284–90, http://dx.doi.org/10.1177/1941738109357303.
11. Andreoli CV, Chiaramonti BC, Biruel E, Pochini A, Ejnisman B, Cohen M. Epidemiology of sports injuries in basketball: integrative systematic review. BMJ. 2018;4:e000468, http://dx.doi.org/10.1136/bmjsem-2018-000468.
12. Deitch JR, Starkey C, Walters SL, Moseley JB. Injury Risk in Professional Basketball Players: A Comparison of Women's National Basketball Association and National Basketball Association Athletes. Am J Sports Med. 2006;34:1077–83, http://dx.doi.org/10.1177/0363546505285383.
13. Cumps E, Verhagen E, Meeusen R. Prospective epidemiological study of basketball injuries during one competitive season: ankle sprains and overuse knee injuries. J Sport Sci Med. 2007;6:204–11.
14. Carazzato J, Campos L, Carazzato S. Incidência de lesões traumáticas em atletas competitivos de dez tipos de modalidades esportivas. Rev Bras Ortop. 1992;27:745–58.
15. Starkey C. Injuries and illnesses in the national basketball association. J Athl Train. 2000;35:161–7.
16. Dick R, Hertel J, Agel J, Grossman J, Marshall SW. Descriptive epidemiology of collegiate men's basketball injuries: National Collegiate Athletic Association Injury Surveillance System, 1988–1989 Through 2003–2004. J Athl Train. 2007;42:194–201.
17. Tummala SV, Hartigan DE, Makovicka JL, Patel KA, Chhabra A. 10-Year Epidemiology of Ankle Injuries in Men's and Women's Collegiate Basketball. Orthop J Sports Med. 2018;6:1–9, http://dx.doi.org/10.1177/2325967118805400.
18. Ekstrand J, Lundqvist D, Lagerbäck L, Vouillamoz M, Papadimitiou N, Karlsson J. Is there a correlation between coaches' leadership styles and injuries in elite football teams? A study of 36 elite teams in 17 countries. Br J Sports Med. 2018;52:527–31, http://dx.doi.org/10.1136/bjsports-2017-098001.
19. Harmer PA. Basketball injuries–prevention. Med Sport Sci Basel. 2005;49:31–61, http://dx.doi.org/10.1159/000085341.

Toni Bove[a,b], Gil Rodas[a,c], Carles Pedret[d,e], Francisco Esparza[i], Martí Casals[a,f,g,h]

[a] *Medical Department, Futbol Club Barcelona, Barcelona, Spain*
[b] *Doctorando de la Facultad de Medicina de la Universidad Católica de Murcia, Murcia, Spain*
[c] *Sports Medicine Department, Clinic/Sant Joan de Deu Hospital, Barcelona, Spain*
[d] *Medicine and Imaging Department, Clinica Creu Blanca, Barcelona, Spain*
[e] *Ultrasonography Department, Clinica Diagonal, Esplugues de Llobregat, Spain*
[f] *Sport Performance Analysis Research Group (SPARG), University of Vic − Central University of Catalonia, Barcelona, Spain*
[g] *Sport and Physical Activity Studies Centre (CEEAF), University of Vic − Central University of Catalonia, Barcelona, Spain*
[h] *School of Health and Sports Sciences (EUSES), Universitat de Girona, Salt, Spain*
[i] *Department of Sports Medicine, Universidad Católica de Murcia, Murcia, Spain*

21 June 2019
Available online 10 September 2019