Injury occurrence and related performance factors in ACB players

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Summary

The aim of this study is to analyse whether there are significant relationships between the occurrence of injuries and official ACB statistical variables related to performance, anthropometry and play position. Statistical variables of 554 professional basketball players (age: 26.97±4.86 years, height: 199.23±8.80 cm, minutes per season: 441.18 ± 301.41) in ACB competition were analysed for two seasons (2012-13 and 2013-14). In addition, injury reports were registered and injuries were categorized taking into account OSICS-10 classification. Anthropometric variables (weight, height, BMI) and age were also analysed. Ankle (77 players; 23.7% of total injured players) and knee (52 players; 16.0% of total injured players) were the most reported injuries. There were no relationships between weight or BMI and the occurrence of injuries ($P>0.05$). Shooting-guards, power-forwards and centers suffered more injuries in average than point-guards and small-forwards ($P<0.05$). Players who reported any anatomical injury played more minutes during the regular season (527±260 *vs.* 380±315 min; $P=0.000$). Significant differences ($P<0.05$) were also found in statistics per minute of points (0.382±0,114 *vs*. 0.352±0,284), performance rating (0.391±0,172 *vs*. 0.290±0,469), rebounds (0.167±0,092 *vs.* 0.151±0,110), assists (0.066±0.045 *vs*. 0.062±0.065), goals made (0.138±0.047 *vs.* 0.125±0.083), blocks made (0.015±0.019 *vs*. 0.013±0.019), dunks (0.013±0.022 *vs*. 0.009±0,017), steals (0.034±0.015 vs. 0,032±0.024), received fouls (0.105±0.040 *vs*. 0.096±0.093), free throws attempted (0.093±0.044 *vs*. 0.091±0.166) and +/- statistic (-0.013±0.241 *vs.* -0.124±0.640). Players who were injured during the season did more actions per minute in average for every variable, excepting the blocks against. Statistical performance variables influence the occurrence of injuries, especially those variables that measure positive actions imply a higher risk of injury. Higher performance in basketball involves a higher risk of injury.

Key words:
Basketball. Injuries. Performance. Anthropometry. Game position.

Ocurrencia de lesiones y factores de rendimiento asociados en jugadores ACB

Resumen

El objetivo de este estudio es analizar la relación entre la ocurrencia de lesiones y los valores de rendimiento recogidos en las estadísticas oficiales de la liga ACB, variables antropométricas y de posición de juego. Se ha analizado la información estadística de 554 jugadores de baloncesto profesional (edad: 26,97±4,86 años, estatura: 199,23±8,80 cm, minutos por temporada: 441,18±301,41) en la liga regular ACB durante dos temporadas (2012-13 y 2013-14). Además, se han recogido los partes médicos de cada jornada y categorizado las lesiones según el sistema OSICS 10. También se han incluido variables de tipo antropométrico (peso, estatura e IMC) y la edad. Las lesiones con mayor incidencia fueron las de tobillo (77 jugadores; 23,7% del total de lesionados) y rodilla (52 jugadores; 16,0% del total de lesionados). No se encontraron relaciones entre el peso o el IMC y la ocurrencia de lesiones ($P>0,05$). Los escoltas, ala-pívots y pívots padecieron más lesiones de media que los bases y los aleros ($P<0,05$). Los jugadores que padecieron alguna lesión disputaron más minutos durante la temporada regular (527±260 *vs*. 380±315 min; $P=0,000$). Además, se observaron diferencias significativas ($P<0,05$) en las estadísticas por minuto de la liga ACB en puntos (0,382±0,114 *vs.* 0,352±0,284), valoración (0,391±0,172 *vs*. 0,290±0,469), rebotes (0,167±0,092 *vs.* 0,151±0,110), asistencias (0,066±0,045 *vs*. 0,062±0,065), tiros convertidos (0,138±0,047 *vs*. 0,125±0,083), tapones a favor (0,015±0,019 *vs.* 0,013±0,019), mates (0,013±0,022 *vs*. 0,009±0,017), recuperaciones (0,034±0,015 vs. 0,032±0,024), faltas recibidas (0,105±0,040 vs. 0,096±0,093), tiros libres intentados (0,093±0,044 vs. 0,091±0,166), estadística +/- (-0,013±0,241 *vs*. -0,124±0,640). Los jugadores que presentaron alguna lesión anatómica realizaron más acciones de media por minuto en todos los aspectos, excepto en los tapones en contra. Las variables de rendimiento estadístico de la liga ACB influyen en la ocurrencia de lesiones y las variables que indican acciones positivas implican un mayor riesgo de padecer lesiones.

Palabras clave:
Baloncesto. Lesiones. Rendimiento. Antropometría. Posición de juego.

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Introduction

Sports activities increase the risk of injury which, in some cases, could cause permanent disability[1] or joint degeneration in the long term[2]. Different types of sports are associated with certain injury patterns and types, while age, gender and type of activity (for example: recreational or competitive) are influential factors in the risk of sustaining injury[3-5]. This risk has increased in the case of practising basketball: the sport has progressed towards an increasingly more physical game in which contact is accepted and expected6. Present-day basketball emphasises the speed and power of its players, as well as the strength and rapidity required to control the opponent's position, get a rebound or shoot a basket. A greater incidence has been observed (number of injuries per player, each year) the higher the level of competition[7], with particular mention of professional levels[8,9].

Longitudinal studies on professional, university and lower category basketball players have served to describe the characteristics of the injuries occurring in this sport[10]. In general, injuries are significantly more common during a match than during training[11,12] and are more frequent when there is contact between players[13]. Although improvements have been made in the safety of playing basketball, injuries are still influential on insurance costs, lost working days and the use of medical resources[14].

In scientific literature, the epidemiology of injuries in basketball has been described, based on a number of factors. The most prominent include the total incidence of injuries on the number of injuries per hours of exposure at matches and/or training sessions[8,12,15,16], the difference in the incidence of injuries at different competition levels[15,17,18], the incidence of injuries with regard to the body site or type of injury (bruise, muscle injury, ligament strain, etc.)[6,8,12], the incidence of the injuries based on the cause of the injury (with contact, without contact, jumping, sprinting etc.) and the incidence of injuries based on anthropometric variables (age, weight BMI, height, sex, etc.)[6,15,18-20].

However, few investigations have studied the relationship existing between the occurrence of injury and the performance of players during the matches. The studies existing have mainly been conducted in the United States (NBA), studying differences in performance after sustaining long term injuries or injuries requiring surgery[21,22]. A study of the relationships between performance and incident occurrence could offer information of interest to trainers and fitness coaches and promote specific preventive type work[5,23] with the profiles of players that are most likely to sustain injury. Moreover, this information could be of assistance in decision making with regard to any changes in the rules of this sport, directed at reducing injuries.

With this aim in mind, this study is directed at analysing the occurrence of injuries and the relationship with sporting performance for basketball players in the ACB professional league, as well as the effect of the match position and anthropometric variables.

Material and method

Design

In order to analyse basketball player injuries in the ACB league, a cross-sectional, descriptive, retrospective methodology was used to study the injuries and performance of players based on the information provided by the official website of the ACB league[24] for each of the injury reports prior to each regular league match for the seasons 2012-13 and 2013-14.

Participants

The study population comprised all the players (554) forming part of the ACB league for seasons 2012-13 and 2013-14. The following requirements were established for inclusion in the study: i) to have played at least one match in the ACB league and ii) not to have played in another team in the same competition during the season. A sample of 554 ACB league players during seasons 2012-13 and 2013-14 met both requirements and, therefore, were included in this study.

Procedure

We examined the information on "Novedades y Parte Médico" (news and medical report) on the official ACB basketball league website[24], corresponding to the Regular League for seasons 2012-13 and 2013-14, with a total of 68 matches recorded. All the injury reports were obtained for all the matches played. Based on this information, we identified which league players had been injured, the type of injury sustained, recording the body site of the same. The OSICS classification was used to classify the injuries[25].

Subsequently, the total individual statistics were obtained for each player for each of the two seasons[24]. The statistics showed the performance of the players for each variable, in absolute values (total for the season) and for each match played. As the risk of sustaining injuries increased with the match exposure time in minutes[26], the original data were used to calculate the individual statistics per minute for each player. In this way, the time effect was eliminated in the correlation between actions and playing time (the greater the playing time, the more actions made). Data not related to performance were also collected, such as: height, weight, date of birth and playing position[24]. Age was calculated by deducting the player's date of birth from the year corresponding to the last regular league match played in the season studied.

Statistical analysis

Absolute frequencies and percentages were used to analyse the qualitative variables. Contingency tables with Pearson's $\chi 2$ statistic were used to analyse the relationship between qualitative variables.

For the quantitative variables, the Kolmogorov-Smirnov test was used to check the normality of the variables for a sample. The data are presented as mean ± standard deviation. To determine whether or not there are any significant differences between players sustaining a type of injury during the season, the different match performance variables were taken and a means comparison was made, using the t-test for variables with a normal distribution and the Mann-Whitney U statistic for those nonparametric variables. The significance level was set at $P<0.05$ for all cases.

The PASW Statistics 18 software program was used for the statistical analysis.

Results

Table 1 shows the results for the incidence of injuries. From this, it can be seen that the most common body injuries are to the knee (25.85%), ankle (19.17%), leg (between the ankle and knee) (12.18%) and foot (9.43%). The lower extremities account for approximately 80% of the total number of injury reports. Injuries to the ankle (23.69%), knee (16.00%), leg (between ankle and knee) (10.46%), wrist and hand (8.92%) are the most common injuries sustained by players during a season. Injuries to the knee (4.69±6.27), foot (4.68±4.93) and hip and groin (4,07±5,48) account for the greatest number of convalescence days during the season. The most common injury sustained by players (ankle) accounted for an average of 2.5±2.56 convalescence days per player. In general, each injured player lost an average of 4.21±4.54 days, slightly less (4.04±4.59) in the case of body injuries.

With regard to the percentage of players presenting a certain type of injury during the season, the most common injuries were to the ankle (13.90%), knee (9.39%) and medical illnesses or infections (9.21%).

Table 2 shows the statistical performance variables with regard to the occurrence of body injuries. During the regular season, players with some body injury played more minutes on average (527±260 *vs.* 380±315 min; P=0.000). Moreover, significant differences were observed (P<0.05) in all game statistics, both for throw statistics (attempted and made), rebounds (total, offensive and defensive), blocks (for and against), dunks, fouls received, as well as the +/- statistic (partial marker in the game while a certain player is on court), and the rating (all the variables calculated per minute played). Those players sustaining some type of body injury, performed an average of more actions per minute in all aspects commented except in the case of blocks against, where they received less actions of this type.

With regard to anthropometric variables, no significant differences were found between players with an body injury, based on height, weight and BMI (P>0.05). However, statistically significant differences were observed when taking the age of the players into account (P=0.000). Players with some body injury during the regular season were older than the group of players with no injuries (28.06 *vs.* 26.19 years; P=0.000). Finally, the analysis of injuries based on the game positions of the players gave statistically significant differences (P<0.05) in the case of the shooting guards (1.87±2.88 injuries), power forwards (1.81±3.76 injuries) and centres (2.07±4.54 injuries), who sustained more injuries on average than the point guards (1.23±3.18 injuries) and the small forwards (1.49±3.06 injuries).

Table 1. Incidence of injuries by reports, players and convalescence days.

OSICS	LA	Reports(n)	% PLA	JL (n)	% JLA	% J	JDC (weeks)
A	Ankle	181	19.17	77	23.69	13.90	2.35±2.56
B	Pelvis and buttocks	4	0.42	3	0.92	0.54	1.33±0.57
C	Thorax	2	0.21	2	0.62	0.36	1.00±0.00
D	Thoracic spine	20	2.12	12	3.70	2.17	1.67±0.47
E	Elbow	8	0.84	5	1.54	0.90	1.60±0.55
F	Foot	89	9.43	19	5.85	3.43	4.68±4.93
G	Hip and groin	57	6.04	14	4.31	2.53	4.07±5.48
H	Head	17	1.80	11	3.38	1.99	1.55±1.21
K	Knee	244	25.85	52	16.00	9.39	4.69±6.27
L	Lumbar spine	35	3.70	19	5.85	3.43	1.84±2.12
M	Infection	63	N/A	51	N/A	9.21	1.24±0.68
N	Neck	14	1.48	11	3.38	1.99	1.27±0.93
O	Abdomen	15	1.59	3	0.92	0.54	2.00±1.73
Q	Leg	115	12.18	34	10.46	6.14	3.38±3.67
R	Forearm	7	0.74	2	0.62	0.36	3.50±3.54
S	Shoulder	26	2.75	9	2.77	1.62	2.89±2.20
T	Thigh	43	4.56	23	7.08	4.15	1.87±1.18
U	Arm	0	0.00	0	0.00	0.00	0.00±0.00
W	Wrist and hand	67	7.10	29	8.92	5.23	2.31±1.98
X	Not specified	247	-	108	-	19.49	2.29±2.23
Total		1254	100.00	484	100.00	100.00	4.21±4.54

OSICS: injury code. LA: Body Site. %PLA: percentage of Reports in relation to total number of Body Injuries. JL: Injured Players. %JAC:percentage of Players in relation to the total number of Body Injuries. %JAC:percentage of Players in relation to the total number of Body Injuries. JDC: Convalescence Days.

Table 2. Relevant performance variables with regard to the occurrence of body injuries.

Study variable (per minute of play)	Not injured	Injured	*P*
Total Minutes	380±315	527±260	0.000*
Points	0.352±0.284	0.382±0.114	0.000*
3-point field goals made	0.034±0.040	0.036±0.027	0.011*
2-point field goals made	0.091±0.082	0.102±0.054	0.003*
Field goals made	0.125±0.083	0.138±0.047	0.000*
Free throws made	0.068±0.161	0.071±0.034	0.000*
Free throws attempted	0.091±0.166	0.093±0.044	0.000*
Offensive rebounds	0.045±0.042	0.049±0.035	0.025*
Defensive rebounds	0.106±0.094	0.118±0.075	0.002*
Total rebounds	0.151±0.110	0.167±0.092	0.016*
Assists	0.062±0.065	0.066±0.045	0.001*
Steals	0.032±0.024	0.034±0.015	0.016*
Blocks for	0.013±0.019	0.015±0.019	0.000*
Blocks against	0.016±0.038	0.013±0.008	0.003*
Dunks	0.009±0.017	0.013±0.022	0.001*
Fouls received	0.096±0.093	0.105±0.040	0.000*
+/- Statistic	-0.124±0.640	-0.013±0.241	0.006*
Rating	0.290±0.469	0.391±0.172	0.000*

Discussion

The aim of this investigation was to study the occurrence of injuries and the relationship with performance factors for professional ACB basketball players. The results obtained show how ankle and knee injuries prevail over other injuries, both for the number of days in which the player is convalescing and in the total number of players injured. These results are consistent with those of other studies, which indicate that the most common injuries in basketball are those to the lower extremities[10,12], of which ankle injuries are the most frequent[8,27,28]. Taking into account the combined frequency of ankle and foot injuries (33.89% of injury days), this gives a similar percentage to that obtained by Borowski *et al*.[11] for North American high school leagues. With regard to the total number of injured players, knee injuries were in second place, concurring with a number of studies conducted in Europe at a professional level[15,29] and in the United States at university and high school levels.[6,16].

Furthermore, there are coincidences with the results of other studies that point to the relative predominance of knee and back injuries, with hip and groin injuries being less common[8], and hand and wrist injuries as the most frequent in the upper extremities[11,27]. Leg injuries (between the ankle and knee) were the third in importance, being significantly higher than those of other, similar studies conducted on the NBA *(National Basketball Association)*, in which this type of injury was the fifth in number of occurrences[6,8,20]. It should also be mentioned that it is possible to appreciate a slight increase in the occurrence of this type of injury, from the older to the more recent studies: 4.8%[8], 7.6%[6,20] and 9.2% in our data.

Wrist or hand injuries were the fourth in the number of injured players and the fifth in the total number of injury reports. Specifically, wrist injuries accounted for 7.1% of the total of known body injuries. This percentage is exactly the same as that analysed in the NBA years before[8], although slightly lower than a number of studies conducted in North America[6] and Europe[15] which placed the number of injuries of this type at around 9% of the total. In general, the data for the incidence of hand and wrist injuries concur with other works conducted for basketball, pointing to this body site as the most susceptible to injury with regard to the upper extremities[6,8,10,14,15,20].

A foot injury incident was recorded (5.9%) in the range defined by other studies conducted at the NBA: 7.9%[20], 7.6%[6] and 4.2%[8] in relation to the total number of injuries. This situation is repeated for hip injuries: 4.3% in relation to a 7.5%[20], a 6.2%[6], and a 2.4%[8]; and in head or skull injuries (3.4%) in relation to the 1.9%[8], 5.3%[20] and 5.7%[6] recorded in other studies of the NBA. The low incidence of injuries to the thoracic column, neck, shoulder, elbow, thorax, pelvis, abdomen and forearm concur with studies of the NBA[6,8,20]. This similarity between studies and competitions is probably due to the similar energy and muscle demands of basketball at a professional level[30].

With regard to performance factors, it is extremely interesting that those players sustaining some type of injury obtained better averages in all positive aspects of the match statistics. Moreover, the difference in averages for negative factors is not significant, except for the blocks against, in which lower averages were obtained (implying better action). It appears that the best players are more exposed to injuries, given the fact that those players sustaining some type of injury, obtained a better statistical performance per minute than those players that were not injured. As indicated by some studies, the evolution of basketball towards a sport where contact is permitted[6,12], may have something to do with this fact. Numerous studies indicate that the most common cause of injury is landing from a jump[10,15,31]. With actions of this type, there is more risk of injury than changes of pace dribble[15], so that it is not surprising that injured players have obtained better averages in rebounds and dunks. Likewise, all the actions implicitly involve a jump during normal performance (except for free throws). The 2 and 3-point throws, blocks and rebounds are generally performed with a jump, where the risk of injury is increased.

Offensive actions have traditionally been identified as significantly more likely to produce injuries[15]. The importance of points, field goals made and rating, give grounds to expect that those players with great offensive skills are more likely to be injured. This may be due to their capacity to score points, which would increase the level of contact with the defence. The fact that injured players have averaged more steals may be due to the predominance of contact in this type of action, although it should be borne in mind that this does not always happen in this way.

The players with the greatest rating in the ACB final statistics are more likely to sustain injuries. The rating is a statistical value that depends

on offensive and defensive actions alike, but can be considered as a mixed variable in which offensive actions have a greater contribution. The case of the fouls received deserves particular attention. Contact between players has been considered to be a variable that is particularly likely to cause injuries, and injured players suffer more fouls per minute played. The study conducted by Hootman *et al.*[12] on university competition in the USA - National Collegiate Athletic Association (NCAA) identified that 58% of competition injuries were due to physical contact.

Attempted and made free throws were indicated as decisive factors in the occurrence of injuries: injured players attempted and made more free throws per minute of play. This fact may appear surprising, given the fact that a free throw is an action in which no jumping or contact is involved. However, it should be borne in mind that a free throw is the result of a foul (implying contact) and, on many occasions, the throw simultaneously involves taking a shot at the basket (implying a jump). Although studies have been made that indicate a greater predisposition to injury with regard to contact or a jump[6,13], it is necessary to explore the relationship existing between free throws and injuries in order to clarify this possible explanation.

Assists have been identified as a determining factor in the occurrence of injuries, although passing and receiving the ball is not considered to be so decisive as jumping, in order to produce an injury of this type[15]. However, account should be taken of the fact that many assists are made with a jump in order to dish the ball when getting a defensive assist. This aspect should be studied more deeply, as the passing and jumping actions take place simultaneously on many occasions.

On the other hand, it was to be expected that injured players should have had significantly more minutes of game exposure time, given the fact that other studies indicate the logical importance of the relationship between a greater exposure time and a higher risk of injury[9,12]. Finally, it is interesting to emphasise that neither weight, height nor BMI were significant variables with regard to injury occurrence. This fact suggests that these variables are not as determinant in injury exposure as the technical level and level of involvement in the game, in addition to other variables that are outside the scope of this study, such as physical preparation and prior history of injuries sustained by these athletes[1,9,12].

As limitations to this study, we would highlight, on the one hand, the fact that there is no indication of the reasons for the injuries (contact, non-contact, jumping, sprinting, etc.) or the types of injuries (muscle, bone, tendon, ligament, etc.), which would enable a deeper analysis of the injuries sustained in the ACB league. On the other hand, it should be pointed out that we did not have access to the minutes of training exposure for each player. Therefore, we have only taken account of the exposure to injuries during matches. Due to the design of this investigation, it was not possible to resolve these two constraints. However, we consider that the information provided may be of interest in order to progress in the understanding of professional basketball injuries in Spain, by compiling the injuries occurring in all top professional teams during two complete seasons, providing a new way of studying injuries and relating them to statistical performance. It would be advisable to conduct prospective studies, although it would be complicated to do so with reliable data from all the teams involved.

Conclusion

There are differences between the match statistics for injured and uninjured players during the professional basketball season in Spain. The weight and height of players are not determining variables in the occurrence of injuries. The most common injuries are to the ankle and knee, and there are differences in injury occurrence between the different game positions.

Conflict of interests

The authors have no conflict of interest whatsoever.

Bibliography

1. Bahr R, Holme I. Risk factors for sports injuries - a methodological approach. *Br J Sports Med.* 2003;37(5):384-92.
2. Maffulli N, Longo UG, Gougoulias N, Caine D, Denaro V. Sport injuries: a review of outcomes. *Br Med Bull.* 2011;97(1):47-80.
3. Beynnon BD, Vacek PM, Murphy D, Alosa D, Paller D. First-time inversion ankle ligament trauma - The effects of sex, level of competition, and sport on the incidence of injury. *Am J Sports Med.* 2005;33(10):1485-91.
4. Foss KDB, Myer GD, Hewett TE. Epidemiology of basketball, soccer, and volleyball injuries in middle-school female athletes. *Phys Sportsmed*. 2014;42(2):146-53.
5. Kilic Ö, van Os V, Kemler E, Barendrecht M, Gouttebarge V. The "Sequence of Prevention" for musculoskeletal injuries among recreational basketballers: a systematic review of the scientific literature. *Phys Sportsmed*. 2018;16:1-16.
6. Drakos MC, Domb B, Starkey C, Callahan L, Allen AA. Injury in the national basketball association: a 17-year overview. *Sports Health*. 2010;2(4):284-90.
7. Waterman BR, Belmont PJ, Cameron KL, DeBerardino TM, Owens BD. Epidemiology of ankle sprain at the United States Military Academy. *Am J Sports Med.* 2010;38(4):797-803.
8. Starkey C. Injuries and illnesses in the National Basketball Association: A 10-year. *J Athl Train.* 2000;35(2):161-7.
9. Murphy DF, Connolly DAJ, Beynnon BD. Risk factors for lower extremity injury: a review of the literature. *Br J Sports Med*. 2003;37(1):13-29.
10. Newman JS, Newberg AH. Basketball Injuries. *Radiol Clin North Am.* 2010;48(6):1095-111.
11. Borowski LA, Yard EE, Fields SK, Comstock RD. The Epidemiology of US High School Basketball Injuries, 2005-2007. *Am J Sports Med*. 2008;36(12):2328-35.
12. Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: Summary and recommendations for injury prevention initiatives. *J Athl Train*. 2007;42(2):311-9.
13. Guyette R. Facial injuries in basketball players. *Clin Sports Med*. 1993;12(2):247-64.
14. Harmer PA. Basketball injuries. *Med Sport Sci.* 2005;49:31-61.
15. 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(2):204-11.
16. Messina DF, Farney WC, DeLee JC. The incidence of injury in Texas high school basketball - A prospective study among male and female athletes. *Am J Sports Med.* 1999;27(3):294-9.
17. Waterman BR, Belmont PJ, Cameron KL, Svoboda SJ, Alitz CJ, Owens BD. Risk Factors for Syndesmotic and Medial Ankle Sprain Role of Sex, Sport, and Level of Competition. *Am J Sports Med.* 2011;39(5):992-8.
18. McKay GD, Goldie PA, Payne WR, Oakes BW. Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Med*. 2001;35(2):103-8.
19. Narazaki K, Berg K, Stergiou N, Chen B. Physiological demands of competitive basketball. *Scand J Med Sci Sports.* 2009;19(3):425-32.
20. Deitch JR, Starkey C, Walters SL, Moseley JB. Injury risk in professional basketball players. *Am J Sports Med*. 2006;34(7):1077-83.

21. Busfield BT, Kharrazi FD, Starkey C, Lombardo SJ, Seegmiller J. Performance outcomes of anterior cruciate ligament reconstruction in the National Basketball Association. *Arthroscopy.* 2009;25(8):825-30.
22. Harris JD, Erickson BJ, Bach Jr BR, Abrams GD, Cvetanovich GL, Forsythe B, *et al*. Return-to-sport and performance after anterior cruciate ligament reconstruction in National Basketball Association players. *Sports Health*. 2013;5(6):562-8.
23. Bonato M, Benis R, La Torre A. Neuromuscular training reduces lower limb injuries in elite female basketball players. A cluster randomized controlled trial. *Scand J Med Sci Sports.* 2017;28(4):1451-60.
24. ACB. Página web oficial de la Asociación de Clubes de Baloncesto (consultado 21-11-2014). Disponible en: www.acb.com.
25. Orchard J, Rae K, Brooks J, Hagglund M, Til L, Wales D, *et al*. 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;1:207-14.
26. 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(3):193-201. Epub 2006/03/01.
27. 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(2):194-201.
28. Sánchez F, Gómez A. Epidemiología de las lesiones deportivas en baloncesto. *Cuadernos de psicología del deporte*. 2009;9:61.
29. Colliander E, Eriksson E, Herkel M, Skold P. Injuries in Swedish elite basketball. *Orthopedics.* 1986;9(2):225-7.
30. Read PJ, Hughes J, Stewart P, Chavda S, Bishop C, Edwards M, *et al*. A needs analysis and field-based testing battery for basketball. *Strength Cond J.* 2014;36(3):13-20.
31. DeHaven KE, Lintner DM. Athletic injuries: comparison by age, sport, and gender. *Am J Sports Med.* 1986;14(3):218-24.