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ORIGINAL

PREVENTION MEASURES FOR FUTSAL INJURIES. A COMPARISON BETWEEN TWO SEASONS

MEDIDAS DE PREVENCIÓN DE LESIONES DE FUTSAL. UNA COMPARACIÓN ENTRE DOS TEMPORADAS

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ABSTRACT

Different studies show that training load is an important cause in the involvement of sports injuries and have identified variables such as the volume and intensity of training that are key to injury prevention. The objective of this study is to reduce the incidence of injuries by implementing six preventive measures. The study included 12 players of the first team of "Sala 10 Zaragoza" of the First Division of the Futsal League of Spain. This is a longitudinal comparative study of the incidence of injuries in the 2016-2017 season and the 2004-2005 season. The results obtained reveal a total of 28 and 108 registered injuries and a lesion incidence of 6.86 and 19.72 during the 2016-2017 season and the 2004-2005 season, respectively. The number of match minutes lost was much lower in the 2016-2017 season, compared to the 2004-2005 season, 6,660 versus 31,500 minutes.

KEYWORDS: team sports, performance, training, injuries, prevention.

RESUMEN

Diferentes estudios evidencian que la carga de entrenamiento es una causa importante en la afectación de lesiones deportivas y han identificado variables como el volumen y la intensidad del entrenamiento claves para la prevención de lesiones. El objetivo de este estudio es reducir la incidencia de lesiones implementando seis medidas preventivas. El estudio incluyó 12 jugadores del primer equipo de "Sala 10 Zaragoza" de la Primera División de la Liga de Futsal de España. Se trata de un estudio longitudinal comparativo de la incidencia de lesiones en la temporada 2016-2017 y la temporada 2004-2005. Los resultados obtenidos revelan un total de 28 y 108 lesiones registradas y una incidencia lesional de 6,86 y 19,72 durante la temporada 2016-2017 y la temporada 2004-2005, respectivamente. El número de minutos de partido perdidos fue mucho más bajo en la temporada 2016-2017, en comparación con la temporada 2004-2005, 6.660 frente a 31.500 minutos.

PALABRAS CLAVE: deporte de equipo, rendimiento, entrenamiento, lesions, prevención.

1. INTRODUCTION

Players' fitness and performance in training sessions and competition determine team planning. Therefore, preventing injuries is crucial for the coaching team[1].

There are a growing number of studies focused on the incidence of sports injuries (IoI) and their characteristics due in part to the high cost that injuries have for clubs at the economic and sports level[2].

To investigate the causes of injuries, it is necessary to understand their incidence, risk factors and mechanisms. Each sports modality has its own characteristics, environment and risk factors[2-4].

IoI values represent the number of injuries that occur every 1,000 hours of play[5] (inj./1,000h). The sports modalities most frequently studied are those with a higher incidence on society. That is the case of soccer[6-8] with an IoI within the 17-24 range in European and Asian professional soccer[9-11] and 8-9 in Spanish professional soccer[12]. The intrinsic factors of futsal are similar to those of soccer. However, extrinsic factors differ, thus requiring specific studies to be performed. There is scant literature on IoI in futsal[13-15], and the studies available have different objectives and methodologies, which hinders the performance of comparative studies[16-17].

Approach to the problem: Our research group[14] made a follow-up of a professional futsal team during the 2004-2005 season with the aim of determining the impact of injuries on players' fitness, team's performance and work planning. The results showed that all players missed at least one training session due to some kind of injury. The high IoI observed as compared to that

reported in previous studies[15-17] led us to adjust our training methods and analyze the causes of the high number of injuries registered.

A number of methods have been developed over the years to control training loads and prevent injuries both, quantitatively and qualitatively[18-20]. Some authors have pointed training load as a major cause of sports injuries[21-23] and have identified variables such as workload and training intensity and frequency as key to the prevention of injuries. Similarly, it is essential to assess the impact of workloads to optimize players' performance, prevent injuries related either to overtraining or deficient training, and ensure that players compete with all the guarantees and in an optimal fitness state[14,24].

Following the proposal of these authors, we designed a series of preventive measures to reduce the number of injuries in the 2016-2017 season with respect to the 2004-2005 season. Data collection could not be performed with all the guarantees until the 2011-2012 season due to the challenges of standardizing data collection and measuring methods. The option of including a control group in the study was dismissed, as we worked with a professional team where results are very important.

The **object of study** was to verify the effectiveness of six preventive work measures in reducing the incidence of injury in a professional futsal team.

2. MATERIALS AND METHODS

The study participants were the players of the first squad "Sala 10 Zaragoza" of the Spanish First Division futsal. The characteristics of the participants (n = 12) in the 2016-2017 season were: age 27.00 ± 5.12 years; height 1.75 ± 0.0594 m; weight 73.97 ± 6.13 kg; and in the 2004-2005 season (n = 14) they were: age 29.00 ± 6.10 years; height 1.77 ± 0.0522 m; weight 75.77 ± 5.19 kg.

It is a longitudinal study of the 2016-2017 season and comparative with respect to the 2004-2005 season.

The method employed was approved by the Ethics Committee of the University of Zaragoza, Spain, according to the guidelines of the Declaration of Helsinki regarding human experimentation, which was approved in 1974 and modified in 2008. Informed consent was obtained from all players. Participants were free to withdraw from the study at any time.

Inclusion criteria were being a player of the first team or the youth team and attending training sessions regularly.

Exclusion criteria were not attending training sessions regularly, having long-duration injuries and not completing half of the season.

Descriptive and inferential statistics analysis of the different variables was performed using the SPS, version 19, software package (Licence property of the University of Zaragoza).

The association or independence between categorical variables were assessed by Pearson's chi-squared test (χ^2). When significant correlations were identified, adjusted residuals of Haberman (RA) were used to identify the categories causing statistical significance. Contingency coefficient (C) was used to measure correlations.

Given the characteristics of the sample, normal distribution was not expected. Therefore, correlations between quantitative variables were assessed by Spearman's rho (ρ)[24]. Statistical significance was established at α=0,05. Excel spreadsheets were used to data collection. We collected all variables affecting a season planning: training load, contents, injuries and training minutes missed. Injury data were collected according to the guidelines of the Injury Consensus Group through the Federation Internationale de Football Association Medical Assessment and Research Centre (F-MARC) [5].

To verify the comparability of the results obtained in both seasons as established by Fuller et al. (2006) [5], we studied the same team using the same data collection methodology and the same observer. Both seasons had similar characteristics. In the 2004-2005 season there were 203 labor days, 70 rest days, 222 training sessions and 31 official matches. In the 2016-2017 season there were 195 labor days, 85 rest days, 218 training sessions and 30 official matches. In both seasons, the team accomplished its primary goal: qualifying for the National league, which is achieved by the top eight teams. The sports level of the study subjects and the training methodology used by the coaches were also similar[25].

The measures adopted in the 2016-2017 season with respect to the 2004-2005 season in which they were not implemented, were:

- Reducing the overall season workloa[23].
- Reducing the duration of training session[26].
- Reducing training intensity by diminishing the number of ascending microcycles and increasing maintenance microcycles[18].
- Players had to keep a daily log of perceived exertion and intensity[27-28].
- Respecting the healing process of injuries before coming back with the team[5,12].
- Introducing specific exercises focused on propioceptive training and neuromuscular control (2% and 3% of training time, respectively) [29].

3. RESULTS

A total of 28 injuries and an IoI of 6.86 were registered in the 2016-2017 season, which represents a considered improvement with respect to the 2004-2005 season, with 108 injuries and an IoI of 19.72. The months with the highest incidence of injuries were January (8.96) and April (7.87), while the months with the lowest incidence were December (1.89) and March (3.29). The values obtained for the 2004-2005 season were significantly higher in all months as compared to the 2011-2012 season. The highest IoI was obtained in the months of August (30.96), December (24.79) and October (21.62), while the lowest IoI was registered in February (12.68). In the 2011-2012 season a higher number

of injuries were registered during maintenance microcycles as compared to ascending microcycles, something that did not happen in the 2004-2005 season (table 1).

Table 1. Injuries by month and type of mycrocicle. 2004-2005 season vs. 2016-2017 season

	2004-2005			2016-2017		
	Workload (min[a])	Injuries	IoI[b]	Workload (min)	Injuries	IoI
August	4,360	27	30.96	4,000	4	4.76
September	4,120	17	20.63	2,900	4	6.24
October	2,775	12	21.62	2,700	4	6.77
November	3,130	8	12.78	2,655	3	5.76
December	2,420	12	24.79	2,640	1	1.89
January	2,630	7	13.31	1,700	3	8.96
February	2,365	6	12.68	2,925	2	4.14
March	2,670	11	20.60	2,190	2	3.29
April	2,915	8	13.72	2,260	3	7.87
May	---	0	---	2,195	2	4.57
Total	27,385	108	19.72	24,960	28	6.86
	Injuries	%Injuries	AR[c]	Injuries	%Injuries	AR
Microcycle Ascending	63	58.3	2.2	10	35,7	-2.2
Microcycle Maintenance	24	22.2	-3.6	15	53,6	3.6
Microcycle Descending	21	19.4	1.4	3	10,7	-1.4
Total	108	100.00	---	28	100,00	---
	$x^{2\,(d)} = 12.939$. P [(e)]$=0.002$. C [(f)]$=0.297$. Cmax [(g)]$=0.71$					

[a]Minutes, [b]Incidence of Injuries, [c]Adjusted Residual, [d]Chi-squared, [e]Rho, [f]Contingency Coefficient, [g]Maximum Contingency Coefficient.

In both seasons, most injuries occurred during training seasons. The number of injuries occurred during a match was much lower in the 2016-2017 season as compared to the 2004-2005 season, with 7 and 14 injuries, respectively (table 2).

Table 2. Number of injuries occurred during training sessions, competition and other situations. 2004-2005 season vs. 2016-2017 season

	2004-2005				2016-2017			
	Injuries	%Injuries	AR[a]	IoI[b]	Injuries	%Injuries	AR	IoI
Training	79	73.1	1.9	17.95	15	54.9	-1.7	3.82
Match	14	13	-1.3	31.39	7	24.1	1.4	15.73
Other	15	13.9	-1.2	---	6	21	1.1	---
Total	108	100.00	---	---	28	100.00	---	---
	$x^{2\,(c)} = 3{,}690$. p [(d)]$=0{,}158$.							

[a]Incidence of Injuries, [b]Adjusted Residual, [c]Chi-squared, [d]Rho.

In the 2016-2017 season most injuries (42.9%) were due to trauma. Conversely, in the 2004-2005 season most injuries (55.6%) were due to overload. There were no recurring injuries during the 2016-2017 season, while 15.74% of injuries in the 2004-2005 season were recurring injuries. It is worth highlighting the significant reduction of minutes missed due to injury, which

passed from 31,500 in the 2004-2005 season to 6,660 in the 2016-2017 season (table 3).

Table 3. Number of injuries by cause and recurring injuries. 2004-2005 season vs. 2016-2017 season

	2004-2005			2016-2017		
	Injuries	%Injuries	AR[a]	Injuries	%Injuries	AR
Trauma	15	13.9	-3.3	12	42.9	3.5
Overload	60	55.6	2.6	8	28.5	-2.4
Ligament	15	13.9	0.9	3	10.7	-0.3
Other	18	16.7	-0.8	5	17.9	0.6
Total	108	100.00	---	28	100.00	---
	x^{2} [b] =13.273. p [c]=0.004. C [d]=0.3. Cmax [e]=0.71					
	Minutes missed	Injuries	%Injuries	Minutes missed	Injuries	%Injuries
Recurring injuries	13,260	17	15.74	0	0	0.00
Non-recurring	22,140	91	84.26	7,640	28	100.00
Total	35,400	108	100.00	7,640	28	100.00

[a]Adjusted Residual, [b]Chi-squared, [c]Rho, [d]Contingency Coeficiente, [e]Maximum Contingency Coefficient.

4. DISCUSSION

The IoI obtained for the 2016-2017 season (6.86) (table 1) was below that reported in previous studies for other sports modalities such as professional soccer, which report an IoI ranging between 6 and 9[6,9-10].

By months, the IoI in the 2016-2017 season (table 1) was especially low in August, as it is the first month of the preseason. One of the causes might be that the training workload was reduced for all players with minor injuries. According to Anderson et al. (2003) [23] "altering or modifying training programs may be the best method to reduce player's susceptibility to injuries".

Since *Self-perceived exertion* was registered prior to the training session (previous SPE) the coaching and medical team could identify any potential risk factor that could be deleterious to player's health. The months with the highest incidence of injuries were January and April, while the months with the lowest incidence were December and March. The cause behind these results is the urge to achieve enough points to meet the established sports goals for January, April and May. The values obtained for the 2004-2005 season were significantly higher for all months as compared to the 2016-2017 season. A higher IoI was obtained for the months of August, December and October, while a lower IoI was registered in February.

Regarding IoI values and their association with training load (table 1), the results obtained for the 2004-2005 season showed a ρ=0.38, which indicates that the IoI decreased when the training volume was reduced. For this reason, *the overall training load was reduced in the 2016-2017 season as a preventive measure*. Nonetheless, a ρ=-0.63 was obtained for the 2016-2017 season, which indicates that when the training load was increased, the IoI decreased. The cause of such an apparently contradictory circumstance is that the reduction in the number of injuries was so dramatic that any small change

between months can cause wide variations. These results do not contradict the conclusions drawn by Anderson et al. (2003)[23] in their study with female university athletes. Anderson reported a correlation between training load and IoI of r=0.675 and reported that the frequency of injuries increases in the first two weeks, when the training load is higher and the athlete has not yet adapted to the training sessions, and it decreases progressively in the following weeks.

In terms of daily training load, the existing epidemiologic and injury prevention studies[15] report that as the training session/match reaches the end, the likelihood of having an injury increases. *One of the preventive measures adopted to reduce the IoI in the 2016-2017 season was reducing the duration of training sessions by nine minutes,* passing from 99 to 90 minutes. This way, we support the theory that training sessions should be as similar to the competition as possible[26]. We recommend to adjust training sessions to the duration of competition matches, since we observed that high quality training sessions are preferable to training sessions of a higher duration. It is established that the duration of futsal matches ranges between 75 and 85 minutes. It cannot be known what would have happened if the duration of training sessions had been similar to that of matches. This should be considered in future research studies.

With regard to the relationship between type of microcycle and injuries in the 2016-2017 season (table 1), a higher number of injuries were registered in maintenance microcycles (53.6%) as compared to the other types of microcycles (AR=3.6). If we compare the two seasons, an association is observed between the number of injuries and the type of microcycle (p=0.002 which represents a statistical difference). Thus, a higher number of injuries were registered in ascending microcycles in the 2004-2005 season, representing 58.3% (AR=2.2).

In the 2016-2017 season a higher number of injuries were registered during maintenance microcycles as compared to ascending microcycles. According to Castagna et al. (2009)[18] in a study including eight professional futsal players, players work 46 to 52% of the match at intensities exceeding 80 and 90% of VO2max and HRmax, respectively. Considering this, in the 2016-2017 season we increased the duration of the training session to real play situations. *Consequently, we increased maintenance microcycles and reduced ascending microcycles.*

The results shown in table 2 indicate that the percentage of injuries sustained during training sessions was 54.9% (AR=-1.7) and 73.1% (AR=1.9) in the 2016-2017 season and the 2004-2005 season, respectively. p=0.158 indicates that the differences observed between the two seasons in terms of injuries occurred during training sessions and competition matches were not statistically significant.

The IoIs during training sessions was much lower (3.82) in the 2016-2017 than in the 2004-2005 season (17.95) and significantly below the values observed in previous studies[6,7-12], which report an IoI ranging between 5 and 6. Such differences may be due to the fact that in the 2016-2017 season *baseline*

perceived exertion values were assessed and used to constantly modify training loads and reduce the number of injuries occurred during training sessions.

The number of injuries registered in competition matches was much lower in the 2016-2017 season as compared to the 2004-2005 season, with 7 and 14 injuries, respectively. However, the percentage of injuries sustained during competition matches was higher in the 2016-2017 season (24.1%). During competition, IoIs were 15.73 and 31.39 in the 2016-2017 and the 2004-2005 season, respectively. Most studies[4,8,12] have observed that, due to the inherent characteristics of the competition, the fact of playing in a match increases the likelihood of sustaining an injury as compared to engaging in a training session.

In the 2016-2017 season, a higher proportion of injuries was due to trauma (42.9%, AR=3.5) (table 3), while in the 2004-2005 season injuries were most frequently due to overload (55.6%). p=0.004 indicated a statistically significant difference between the two seasons. Notwithstanding the above and considering absolute values, the number of injuries decreased in the 2016-2017 season.

In their study with soccer players, Noya and Manuel (2012)[12] reported that 49.1% of injuries were muscle injuries, and 15.1% were ligament injuries. Other studies (6-7) report lower values for muscle injuries (21-37%) and varying values for ligament injuries (13-22%).

This difference with respect to our study concerning the prevalence of muscle injuries is due to the assessment of *baseline perceived exertion*, which allowed to adjust training load and intensity during training sessions. The reduction in the number and percentage of ligament injuries may be caused by the preventive measures adopted in the 2016-2017 season, which consisted of *including specific training exercices for propioception and neuromuscular control.* This combined with a strength program are the neuromuscular pillars of an injury prevention plan, as established by Van Tiggelen et al. (2008)[29]. This type of work was focused on strengthening active protection mechanisms through systematical stimulation, which forced athletes to control, think and interiorize their movements, which provided them with a higher control of their movements.

The studies available highlight the relevance of respecting the healing process to prevent injury recurrence[5]. No recurring injuries were registered during the 2016-2017 season (table 3). This is due to the premise of *not forcing the time of recovery*, regardless of the athlete. This premise was established from the beginning of the season and was one of the preventive measures adopted with respect to the 2001-2004 season.

In the 2004-2005 season, 15.74% of injuries were recurring injuries, which represented 37.45% of training and match time missed. These data are consistent with those observed in previous studies[6-8], which report that recurring injuries stand for 7-35% of total injuries, and slightly higher than those reported by Noya and Manuel (2012)[12] (11.9%) for Spanish professional soccer players.

This demonstrates that recurring injuries require more healing days and become more serious than other injuries.

The reason may be the pressure of competition, the urge to play and the need to reach the established objectives. This leads the coaching team to force some players by reducing the healing time and making them come back to the competition before the injury is completely healed[6]. Team needs are put ahead of player's health, which promotes the "culture of risk" and is very important in professional sports[30]. The time missed due to injury or illness was 7,640 minutes in the 2016-2017 season, which stands for 2.4% of the total time of exposure, vs. 35,400 minutes in the 2004-2005 season, which stands for 10.7% of the total time of exposure (table 3). There was a remarkable reduction of minutes missed due to injury, which passed from 31,500 in the 2004-2005 season to 6,660 in the 2016-2017 season.

This significant reduction in the minutes missed had an impat on competition matches. In the 2016-2017 season, only five players missed one or several matches due to injury, totaling ten matches, as compared to the 2004-2005 season, where ten players missed a total of 40 matches. While in the 2004-2005 season there were always one or two injured players who could not compete, in the 2016-2017 season almost all players were always available for competition.

We can affirm that the smaller and heterogeneous a team is, the more caution must be exercised to prevent injuries[14].

5. CONCLUSIONS

1. A significant reduction in the incidence of injuries was achieved in the 2016-2017 season with respect to the 2004-2005 season.
2. The measures adopted were effective in preventing the occurrence of sports injuries.

Practical Implications

1. It is necessary to implement preventive measures that are feasible for any coaching team.
2. The intervention in preventive programs must be realistic and consider the resources available for every team.
3. Adjusting the type and intensity of training sessions may be useful in the prevention of sports injuries.

7. REFERENCES

1. Sánchez F, Gómez A. Epidemiología de las lesiones en baloncesto. Rev Int Med Cienc Act Fis Deporte 2008; 8 (32): 270-281
2. Llanas P, Lledó E. La epidemiología del fútbol: una revisión sistemática. Rev Int Med Cienc Act Fís Deporte 2010; 10 (37): 22-40.

3. Nogueira R, Oliveira L. Epidemiologic analysis of injuries occurred during the 15th Brazilian Indoor Soccer (Futsal) Sub 20 Team Selection Championship. Rev Bras Med Esporte 2006; 12.
4. Murphy DF, Connolly DAJ, Beynnon B. Risk factors for lower extremity injury: a review of the literature. Br J Sports Med 2003; 37: 13-29.
5. Fuller CW, Ekstrand J, Junge A, 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.
6. Hagglund M, Walden M, Ekstrand J. Injury incidence and distribution in elite football: a prospective study of the Danish and the Swedish top divisions. Scand J Med Sci Sports 2005; 15 (1): 21-28.
7. Walden M, Hagglund 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 (8): 542-546.
8. Walden M, Hagglund M, Ekstrand J. High risk of new knee injury in elite footballers with previous anterior cruciate ligament injury. Br J Sports Med 2006; 40 (2): 158-162.
9. Ekstrand J, Walden M, Hagglund M. A congested football calendar and the wellbeing of players: correlation between match exposure of European footballers before the World Cup 2002 and their injuries and performances during that World Cup. Br J sports Med 2004; 38 (4): 493-497.
10. Yoon YS, Chai M, Shin DW. Football injuries at Asian tournaments. Am J Sports Med 2004; 32 (1): 365-425.
11. Rahnama N, Reilly T, Lees A. Injury risk associated with playing actions during competitive soccer. Br J Sports Med 2002; 35 (5): 354-359.
12. Noya S, Manuel S. Epidemiología de las lesiones en el fútbol profesional español en la temporada 2008-2009. Arch Med Deporte 2012; 150 (4): 750-766.
13. Cain LE, Nicholson LL, Adams RD, et al. Foot morphology and foot/ankle injury in indoor football. J Sci Med Sport 2007; 10 (5): 311-319
14. Álvarez J, Manonelles P, Giménez L, et al. Incidencia lesional y su repercusión en la planificación del entrenamiento en fútbol sala. Arch Med Deporte 2009; 26 (4): 261-272.
15. Junge A, Dvorak J, Graf-Baumann T, et al. Football injuries during FIFA tournaments and the Olympic Games, 1998-2001: development and implementation of a injury-reporting system. Am J Sports Med 2004; 32 (1): 80-89.
16. Lindenfeld TN, Schmitt DJ, Hendy MP, et al. Incidence of injury in indoor soccer. Am J Sports Med 1994; 22: 364-371
17. Inklaar H, Bol E, Schmikli SL, et al. Injuries in male soccer players: team risk analysis. Int J Sports Med 1996; 17 (3): 229-234.
18. Castagna C, D' Ottavio S, Granda Vera J, et al. Match demands of profesional Futsal: a case study. J Sci Med Sport 2009; 12 (4): 490-494.
19. Borresen J, Lambert MI. Quantifying training load: A comparison of subjective and objective methods. Int J Sports Psychiol Perform 2008; 3 (1): 16-30.
20. Stagno KM, Thatcher R, Van Someren KA. A modified TRIMP to quantify the in-season training load of team sport players. J Sports Sci 2007; 25 (6): 629-634.

21. Dellal A, Chamari K, Píntus A, et al. Heart rate responses during small-sided games and short intermittent runníng traíning in elite soccer players: A comparative study. J Strength Cond Res 2008; 22 (5): 1449-1457.
22. Reilly, T. Traininq specificity for soccer. Int J Appl Sports Sci 2005; 17 (2): 17-25.
23. Anderson L, Triplett-McBride T, Foster C, et al. Impact of training patterns on incidence of illness and injury during a women`s collegiate basketball season. J Strength Cond Res 2003; 17 (4): 734-738.
24. Van Mechelen W, Hlabil H, Komper HC. Incidente, severity, aetiology and prevention of sports injuries: a review of concepts. Sports Med 1992; 14: 82-99.
25. Edwards RHT. Biochemical bases of fatigue in exercise performance: catastrophe theory of muscular fatigue. En: Maughan RJ, Gleeson M, Greenhaff, PL, editores. Biochemistry of exercise and training. Champaign: Human Kinetics 1983; p. 3-28.
26. Alvarez J, Corona P, Giménez L, et al. Necesidades cardiovasculares y metabólicas del fútbol-sala: análisis de la competición. Apunts Educación Física y Deportes 2002; 67: 45-51.
27. Del Campo J. La intensidad del entrenamiento en jugadores de baloncesto medida a través de la percepción de esfuerzo y fatiga [Tesis doctoral]. Madrid: Universidad de Madrid, Departamento de Físicas e Instalaciones Aplicadas a la Edificación, al Medio Ambiente y al Urbanismo. E.T.S. Arquitectura. 2004.
28. Drobnic F, Puigdellívol T, Bové T. Bases científicas para la salud y un óptimo rendimiento en baloncesto. Madrid: Ergon. 2009.
29. Van Tiggelen D, Wickes S, Stevens V, et al. Effective prevention of sports injuries: a model integrating efficacy, efficiency, compliance and risk-taking behaviour. Br J Sports Med 2008; 42: 648-652.
30. Roderick M, Waddington I, Parker G. Playing hurt: Managing injuries in English professional football. Int Rev Soc Sport 2000; 35: 165-180.

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