Ten years of football (soccer) injuries in the literature. A bibliometric approach

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Summary

The aim of this research is to analyse the scientific production of publications produced during a decade (2010-2019) about injuries in football (soccer). A bibliographic search was done for publications featuring key terms such as football, soccer, and injuries. We searched for studies in journals that had a five-year impact factor in the Journal Citation Report in the "Sport Sciences" category. The PRISMA methodology was used. The following bibliometric indicators were analysed: number of publications by journal; country of origin; country of publication; publications per year; number of authors; authors' native language; evidence level; type of study; sex; anatomical location and topographic location of injuries. To assess the level of evidence, the Oxford Centre for Evidence-Based Medicine (CEBM) level of evidence classification was used, dichotomised as follows: articles with level 1 and level 2 evidence were 'high evidence', and articles with levels 3, 4, and 5 were 'low evidence'. The statistical tests were performed using SPSS V. 28. A total of 222 articles published in four journals met the inclusion criteria. Production rose as the decade progressed. The highest frequency was in 2013. *The British Journal of Sports Medicine* (BJSM) had the highest number of publications. *Sports Medicine* (SM) had the most authors per article and the highest level of evidence. The United States was the main producer. There were more publications regarding injuries in males, and in males and females, compared to publications that only took females into account. More muscle, thigh, and hip injuries were described. The level of evidence was generally low. The increase in scientific production related to football (soccer) injuries during the decade reflect an elevated interest for the subject matter. Publications that prevail around this theme consider injuries in the thigh and lower extremities and in men.

Key words:
Football. Soccer. Injuries. Bibliometrics. Evidence-based medicine.

Diez años de lesiones de fútbol en la literatura. Una aproximación bibliométrica

Resumen

Con el objetivo de analizar la producción científica de publicaciones realizadas durante una década (2010-2019) sobre lesiones en el fútbol, se realizó una búsqueda bibliográfica de publicaciones con términos clave como fútbol, soccer y lesiones, en revistas con mayor Factor de Impacto acumulado en 5 años en el Journal Citation Report, en la categoría "Sport Sciences". Se utilizó la metodología PRISMA. Se analizaron los indicadores bibliométricos: número de publicaciones por revista; país de origen; país de publicación; publicaciones por año; número de autores; lengua materna de los autores; nivel de evidencia; tipo de estudio; sexo; localización anatómica, y localización topográfica de las lesiones. Para evaluar el nivel de evidencia se utilizó la clasificación del Oxford Centre for Evidence-Based Medicine (CEBM) y se dicotomizó en alto (artículos con niveles de evidencia 1 y 2) y bajo (artículos con nivel de evidencia 3, 4 y 5). El análisis estadístico se realizó con SPSS V.28. Un total de 222 artículos publicados en cuatro revistas cumplieron con los criterios de inclusión. La producción aumentó a medida que avanzaba la década, siendo mayor en 2013. El *British Journal of Sports Medicine* (BJSM) realizó el mayor número de publicaciones. La revista *Sports Medicine* (SM) tuvo la mayor cantidad de autores por artículo y el mayor nivel de evidencia. Estados Unidos fue el principal productor. Hubo más publicaciones que investigaron las lesiones en hombres, y en hombres y mujeres, en comparación con las publicaciones que solo tomaron en cuenta a las mujeres. Se describieron más lesiones musculares, en muslo y en cadera. El nivel de evidencia en general fue bajo. El incremento de la producción científica durante la década refleja un elevado interés en el tema. Predominaron las publicaciones acerca de lesiones en la cadera y extremidades inferiores y en hombres.

Palabras clave:
Fútbol. Soccer. Lesiones. Bibliometría. Medicina basada en la evidencia.

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Introduction

Bibliometrics can be understood as a research technique that analyses the size, growth, and distribution of publications in a scientific field[1]. This type of studies helps researchers to analyse existing knowledge, through the study of publication patterns using quantitative analysis and statistics[2]. To fulfil their mission, researchers need to identify relevant studies on a topic of interest and to critically assess the level of the evidence presented[3].

Evidence-Based Medicine (EBM) is defined as the judicious utilisation of the best scientific evidence available to make decisions about the care and treatment of patients[4]. "Evidence-based medicine is defined as a conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients"[5]. The practice of EBM integrates the individual clinical expertise with the best available external clinical evidence[6]. The need for EBM in the treatment of football (soccer) injuries is justified given the ever-increasing demands of this sport, with more games per calendar year with insufficient recovery time between games, all of this to win games, titles and trophies[7,8]. When injured, athletes need to obtain the best treatment available to return to the field as soon as possible. While physicians need to keep abreast of current knowledge to inform their medical practice[4,9], the increasing number of academic publications on the subject of football makes it difficult for them to assimilate the never-ending stream of new information. In addition, scientific inquiry into football is saturated with empirical contributions from different sources and networks that have produced misleading knowledge and evidence[10].

Treating sports injuries is often challenging, costly, and time consuming[11]. Given the increasing participation in football recently, topics related to football injuries are of great interest[10,12,13]. Furthermore, the economic, social, and health burdens resulting from the high incidence of football-related injuries are also the main factors behind the recent interest in football injuries[14]. Given this context, the necessity of a review to quantify the quality of football-related studies and to identify the areas that have attracted the most research interest becomes evident.

The aim of this study is to outline the evolution of publications regarding football-soccer related injuries over a time span of ten years, to show what areas were most studied in order to know which ones carry greater interest and potential for further exploration, to identify which journals have published the most regarding football injuries, and to explore the levels of evidence. Thus, the main objective of this investigation is to analyse the scientific production of football injuries by using the following bibliometric indicators: country of affiliation, country of publication, publications per year, journal production, number of authors per publication, authors' native language, evidence level, type of study, sex, anatomical location of the injuries, and topographic location of the injuries.

Material and method

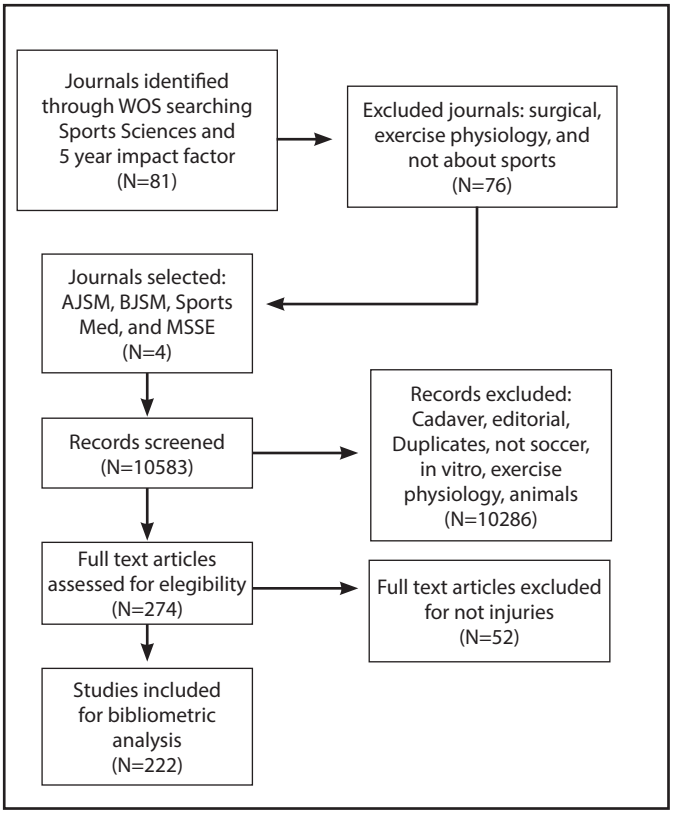
This bibliometric analysis was conducted in accordance with the PRISMA-DTA Statement[15].

A wide variety of journals with 5- year JIF were selected through searching the Journal Citation Reports™ database (JCR) in the category 'Sport Sciences'. After excluding journals that worked with subjects such as surgery and exercise physiology and those that were not about sports per se, four journals remained: British Journal of Sports Medicine (BJSM), American Journal of Sports Medicine (AJSM), Sports Medicine (SM), and Medicine and Science in Sports and Exercise (MSSE). The journal impact factor (JIF) was obtained from the JCR 2020 edition. In 2019, BJSM had a JIF of 12.68, with a 5-year JIF of 10.67; AJSM had a JIF with a 5-year JIF of 6.8; SM had a JIF of 8.5, with a 5-year JIF of 9.7; and MSSE had a JIF of 4.02, with a 5-Year JIF of 5.09.

Of those four source journals selected, a bibliographic search was developed in the Web of Science database (WoS) collecting records from 2010 to 2019. The following were excluded: articles that studied sports through cadavers; editorials; articles relating to sports other than soccer (such as American football, Australian football, and Gaelic football); studies involving in vitro research; exercise physiology studies; studies with animals; studies that were not related to injuries, and of course duplicates. This search strategy returned 222 articles which were the ones that were bibliometrically analysed. See Figure 1 for a flow diagram.

Data extracted from the articles were as follows: number of publications by journal; country of origin; country of publication; publications per year; number of authors; authors' native language (refers to the language of the institution where the main author is affiliated),

Figure 1. PRISMA flow of studies for the review.



evidence level; type of study (therapeutic, prognostic, diagnostic, and economic); sex (male and female); anatomical location (ligament, joint, tendon, bone, and muscle) and topographic location (head, back, pelvis, hip, thigh, knee, leg, ankle, and foot) of injuries. To assess the level of evidence, the Oxford Centre for Evidence-Based Medicine (CEBM) level of evidence classification was used, dichotomised as follows: articles with level 1 and level 2 evidence were 'high evidence', and articles with levels 3, 4, and 5 were 'low evidence'.

A chi-square test for association was used to analyse most of the categorical and nominal variables; for continuous variables, a Kruskal-Wallis H test was performed. These tests were chosen because none of the variables had a normal distribution. The statistical tests were performed using SPSS V. 28. All statistical comparisons were bilateral; $p < .05$ was considered statistically significant.

Results

Country of affiliation

Country of affiliation corresponding to the country of filiation of the first author. Most studies regarding injuries in football were undertaken in the United States (23.9%), followed by the United Kingdom (13.1%) and Sweden (11.7%). These countries produced almost half (48.7%) of the total number of articles. See Table 1.

Table 1. Frequency of publications by country of affiliation.

Country	Country of affiliation		
	Frequency (N=222)	Percentage	Cumulative percentage
United States	53	23.9	23.9
United Kingdom	29	13.1	36.9
Sweden	26	11.7	48.6
Denmark	16	7.2	55.9
Switzerland	14	6.3	62.2
Norway	12	5.4	67.6
New Zealand	8	3.6	71.2
Qatar	8	3.6	74.8
Australia	7	3.2	77.9
Italy	6	2.7	80.6
Germany	5	2.3	82.9
Canada	5	2.3	85.1
Ireland	4	1.8	86.9
Japan	4	1.8	88.7
Belgium	3	1.4	90.1
Spain	3	1.4	91.4
Finland	3	1.4	92.8
France	3	1.4	94.1
Greece	3	1.4	95.5
Netherlands	3	1.4	96.8
Other*	7	3.5	100.0

*Saudi Arabia. Austria, Brazil, China, Iran, Mexico and Portugal (1 publication; 0.5% each).

Country of publication

In the ten-year period under review, British journals (BJSM and SM) published 145 articles (65.3%) and American journals (MSSE and AJSM) published 77 articles (34.7%).

Publications per year

The ten-year span was divided quinquennially. British journals published 49 articles in the first quinquennium (33.8%) and 96 articles in the second quinquennium (66.2%). American journals published 57 articles in the first quinquennium (74%) and 20 articles in the second quinquennium (26%). In the first quinquennium, most articles regarding injuries in football were written by American journals (53.7%) whereas in the second quinquennium British journals published more football injury-related articles (82.8%) than American journals. According to this analysis, the differences in publications highlighted above between British and American journals was statistically significant ($p < .001$), with a moderate association between the variables ($p < .001$).

Journal production

The data shows that half of the articles considered for this analysis come from the BJSM (51,28%), followed by the AJSM (26,6%), the SM journal (13,5%), and the MSSE journal (8,1%). This means that almost 65% of the articles published regarding injuries in football come from British journals. This also shows a trend to rise in article production in all journals, except in AJSM, see Figure 2. Regarding years of publication, the production of journals reached a peak in 2013, with 33 articles published in total (14.9%). Additionally, in this same year, British journals published 21 articles (63.3% of the annual total; 9.5% of the overall total), while American journals published only 12 articles (36.4% of the annual total; 5.4% of the overall total). The graph shows that in the first 5-year period the BJSM and the AJSM published the most articles, compared to the number of articles published by the SM Journal and the MSSE journal. Nonetheless, in the second 5-year period there is a change in the number of publications, with the BJSM and Sports Medicine starting to publish the most, and the AJSM decreasing its rate of publications significantly.

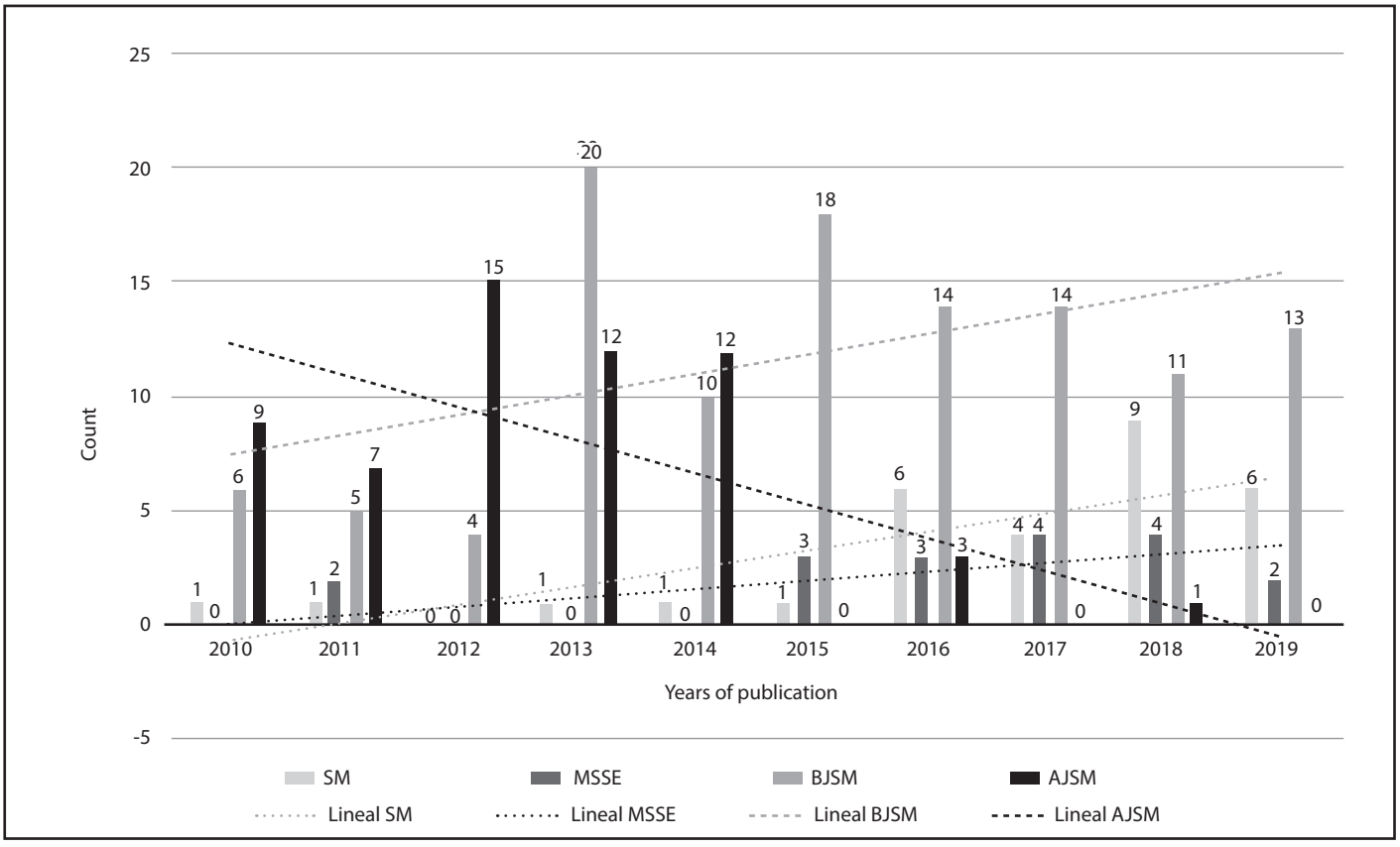
Number of authors

The journal with the highest mean number of authors was SM ($M = 8.73$), followed by MSSE ($M = 6.33$), BJSM ($M = 5.3$), and AJSM ($M = 5.00$). The number of authors was statistically and significantly different between the different journals ($p = .025$). Post-hoc analyses indicated that the differences were more marked between AJSM and SM ($p = .013$).

Authors' native language

To determine whether the native language of the majority of authors was English, the sample was divided between those with anglophone and non-anglophone authors. It was found that 105 authors (47.3%) did not have English as their native language and 117 (52.7%) had English as their native language.

Figure 2. Journal production and years of publication.



The number of non-anglophone authors in BJSM was significantly higher than in the other journals. A greater number of anglophone authors was found in SM, AJSM, and MSSE (p = .003).

Evidence level

An analysis of the publications' evidence levels found that 36.4% of the publications presented a level of evidence 2. The level of evidence 1 was least represented with 6.7%. There were 24.3% articles with level of evidence 3 and 22.9% with level of evidence 4. There were 9,4% articles with level of evidence 5. See Table 2.

Dichotomizing the evidence levels in terms of the total number of articles published, 96 (43.2%) presented a high level of evidence and 126 (56.7%) presented a low level of evidence.

SM was the only journal in which most articles presented a high level of evidence (60%). Fifty percent of the articles published in SM were systematic reviews (SRs), cohort studies or ecological studies. Three articles (10%) in SM presented level of evidence 1 and 3 presented level of evidence 3 (p = .013). The BJSM has the most articles in all the levels of evidence. Nonetheless, many of its articles (59,11%) have low levels of evidence. Despite this, the BJSM has 38 articles that are systematic reviews, cohort studies, or ecological studies, which represent a high level of evidence. The AJSM doesn't have articles classified in the first level of evidence, and most of its articles (59,18%) have low levels of evidence. The MSSE overall has very few articles published regarding injuries in football (soccer). Most of its articles have low levels of evidence (60,9%). see Figure 3.

In order to find out the trend of the evidence levels of the different publications, we have analysed this variable as a continuous variable, this shows us where the evidence levels tend to cluster. Regarding the mean level of evidence per journal, SM presented the highest level of evidence (M = 2.8), followed by AJSM and MSSE, both with a mean of 2.9. BJSM's mean was lowest, M = 3.0, see Figure 4.

Comparing the levels of evidence with the years of publication, no significant associations between the levels of evidence published in the articles were found across the 10-year span (p = .75).

Table 2. Overall evidence level.

Evidence Level	Frequency
1	15
2	81
3	54
4	51
5	21

Figure 3. Evidence level per journal.

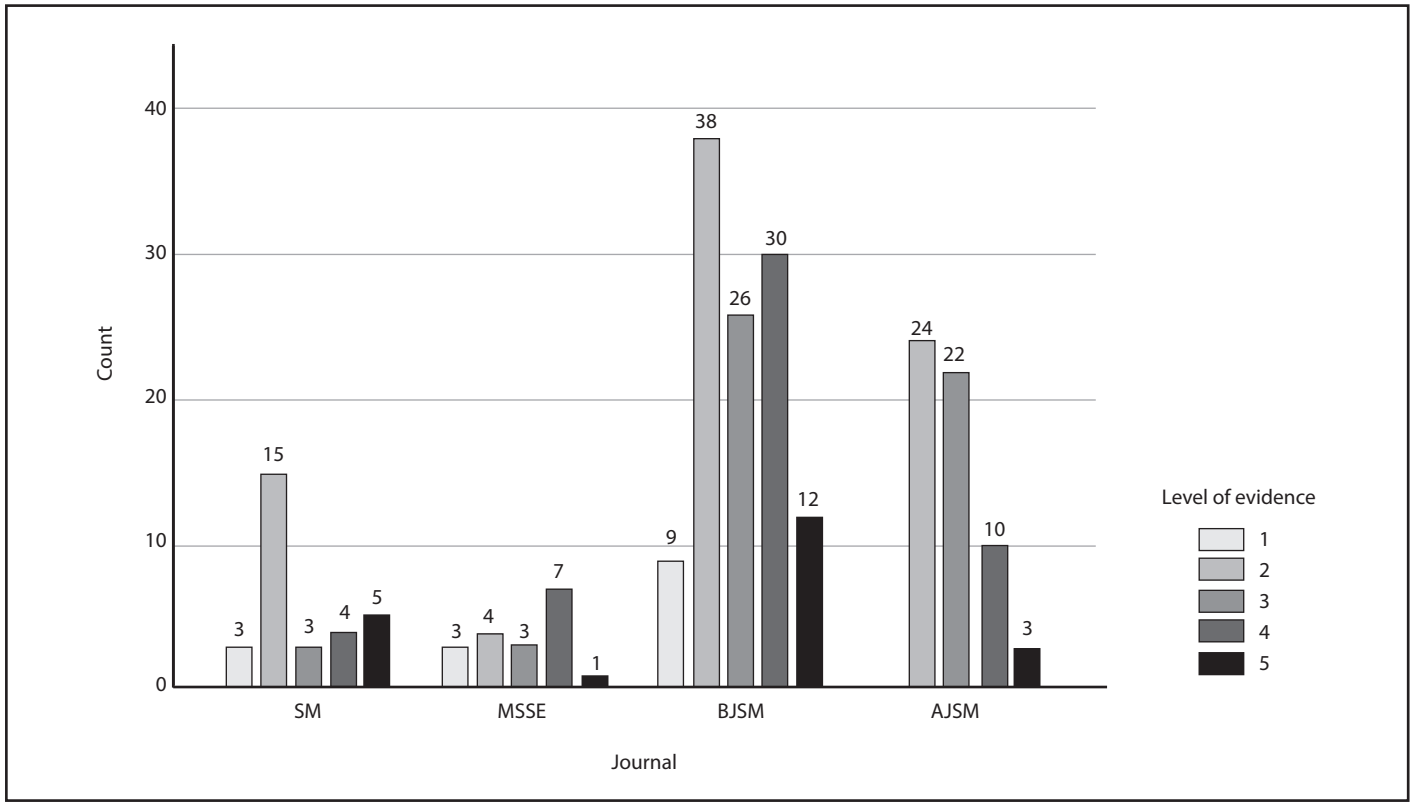


Figure 4. Mean evidence level per journal.

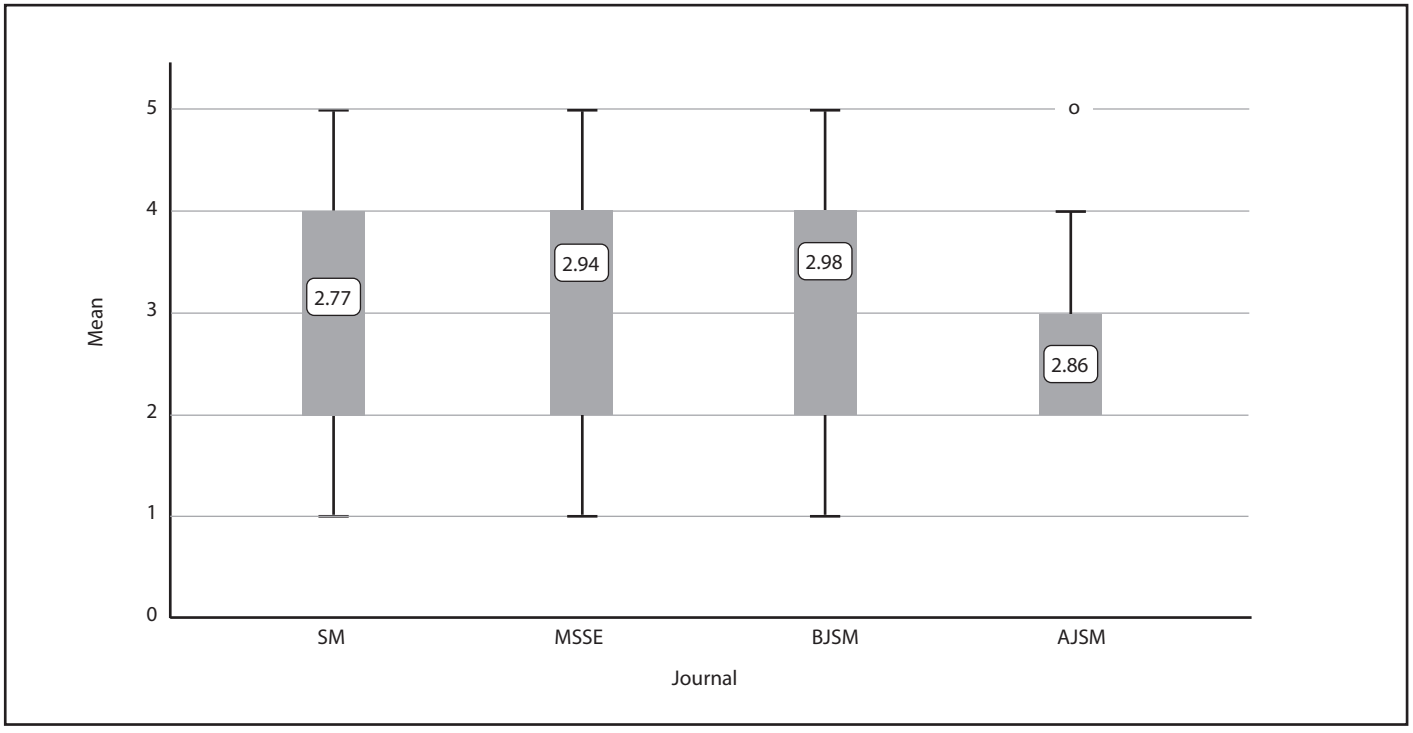


Table 3. Type of study per journal.

	Journal				
Type of study	**SM**	**MSSE**	**BJSM**	**AJSM**	**Total**
Therapeutic	11	1	15	2	29
Prognosis	10	14	72	44	140
Diagnosis	2	1	12	6	21
Economic	7	2	16	7	32
Total	30	18	115	59	222

SM: Sport Medicine; MSSE: Medicine and Science in Sport and Exercise; BJSM: British Journal of Sport Medicine; AJSM: American Journal of Sport Medicine.

With respect to native language, anglophone authors published more articles with high levels of evidence, and non-anglophone authors published more articles with low levels of evidence (p = .027).

Type of study

Many publications (63%) developed a prognosis and history, followed by economic and decision analysis studies (14.4%), therapeutic, prevention, aetiology and damage studies (13%), and diagnosis studies (9.5%). In terms of the relationship between type of study and journal, BJSM and SM published most of the therapeutic, prevention, and aetiology and damage studies. Most of the economic and decision analysis studies were published in BJSM, followed by AJSM and SM. In addition, it is noteworthy that most MSSE studies concerned prognosis and the history of injuries (p = .002), see Table 3.

No statistically significant associations between the variables were found when type of study was compared with evidence level (p = .872).

Sex

A total of 125 (56.3%) studies were conducted with males, 79 studies (35.5%) included both male and female, and 18 (8.1%) included only females.

Of the publications selected for this study, SM published football-related studies involving only males or both sexes but published no studies involving only females. Most of the studies published in MSSE involved only males, with only a few investigating both sexes or only females. Regarding the studies in BJSM, most involved only males, followed by studies involving both sexes, with the least number involving only females; however, it is noteworthy that BJSM published the most studies pertaining to only females. Most of the studies published in AJSM included both sexes, followed by male-only studies and a few that only involved females (p= .005).

After examining the association between sex and years of publication, when considering for the analysis the division into two quinquennium, it was found that studies involving only males were more numerous in the second quinquennium than in the first. In contrast, studies involving both sexes or only females were less numerous in the second quinquennium than in the first (p = .002).

Table 4. Anatomical location of injuries.

Anatomical Location	Frequency	Percentage
Muscle	29	13.06%
Bone	6	2.70%
Tendon	13	5.86%
Joint	17	7.66%
Ligament	21	9.46%
Multiple, others	136	61.26%

Anatomical location

More than half of the articles (61.3%) described injuries in multiple locations. Reports about specific injury locations ordered by frequency were as follows: muscle injuries 13.1%, ligament 9.5%, joint 7.7%, tendon 5.9%, and bone 2.7%; (p = .037), see Table 4.

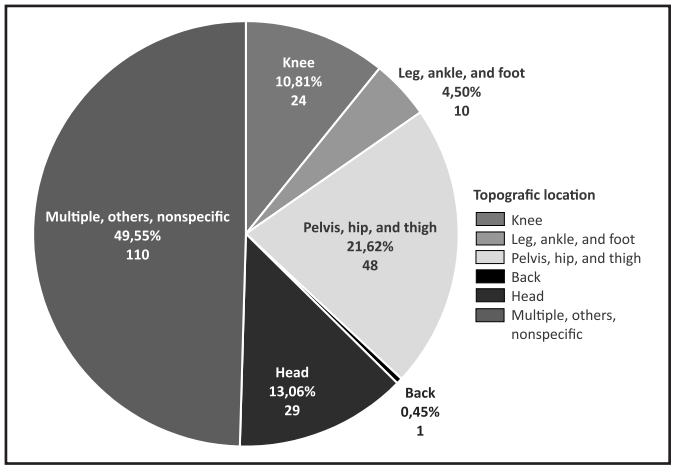
There was a statistically significant association between the variables, implying that studies on injuries to tendons and bones presented higher levels of evidence than studies regarding injuries to muscles, joints, ligaments, and multiple locations (p = .037). There was no significant statistical association between the level of evidence and the anatomical location of the injury (p = .057).

Topographic location

Almost half of the articles (49.5%) described injuries in multiple locations; injuries in the hip and thigh comprised 21.6% publications; injuries to the head make up 13.1% of the publications; injuries to the knee were studied in 10.8% publications; and injuries to the leg, ankle, and foot were studied in 4.5% publications, see Figure 5.

Regarding associations between topographic location and country of publication, British journals published more studies involving multiple injuries and injuries to the pelvis, hip, and thigh, while American journals

Figure 5. Topographic location of injuries across publications.



published more studies about injuries to the knee and head. Studies pertaining to leg, ankle and foot injuries were equally represented in British and American journals (p = .009).

An analysis of the relationship between sex and topographic location indicated that most of the studies that included only females investigated multiple injuries, followed by injuries to the knee, and then the head. Most of the studies that included only males in their sample reported multiple injuries, followed by injuries to the pelvis, hip, and thigh; knee; head; and leg, ankle and foot, (p = .002).

Discussion

The data shows that there is an overall trend to rise in article production over the past 10 years. This shows that there is a growing interest in developing knowledge around the understanding of football injuries (their prognosis, location, and treatment). The United States had the highest number of studies (23.9%). Nonetheless, most of the articles in this study were published in high-impact British journals (65.31%). This finding coincides with other bibliometric studies in traumatology[16,17], in which the United States was found to be the country with the highest levels of authorship.

Europe developed 59.46% of the total academic production considered in this analysis, followed by America (27.03%), Asia (6.76%), and Oceania (6.76%). It is noteworthy that countries with an important football tradition, such as Spain and Italy, only developed 4.1% of the total production of studies relating to football injuries.

During the decade considered for this analysis, more than half of the articles were published by BJSM (p = .013) with a peak in production in 2013 (20 publications). This shows a global tendency to increase publications across the four journals. This coincides with the 2012 London Olympics, European Football Championship 2012 (Eurocup)[18], and increased scientific production in football commented on in other bibliometric studies[10,19].

With respect to the number of authors, the journal with the highest number of authors per article was SM, M = 8.73; AJSM had the lowest number, M = 5.00 (p = .025). In other bibliometric studies, it has been observed that having many authors can be interpreted in different ways: it can reflect a high degree of collaboration or an aggrandizement of the number of authors as a consequence of having the presence of honorific or phantom authors, and other studies have reported a 21% prevalence of these types of authors[20].

Regarding levels of evidence, 56.7% of the studies reviewed had a low level of evidence. This asymmetry in evidence levels may be explained by differences in categories and scenarios regarding the sport of football which affects research infrastructure. Consequently, large studies are limited to the footballing elite. However, this study included meta-analysis and randomized controlled trials (RCTs) in the areas of training endurance and performance, with special focus on the prevention of injuries[21–23]; it also comprised studies that evaluated the efficacy of football programmes, such FIFA's 11+ Kids[24,25], along with SRs corresponding to FIFA studies in young football players[26]. This constitutes valuable input for medical teams and technicians responsible for managing the training loads and attending to the mental health of football players.

As stated elsewhere, 'where RCTs are often not available, a systematic literature review of other published studies is the next 'best' form of evidence'[27]. Given the low number of RCTs, this could be applied to football. In relation to the SRs analyzed during this study, some of them with meta-analyses, it was found that they refer to topics related to risk factors for injuries and injury prevention and the treatment of sports injuries[28–33]. However, there were 56.7% articles with low levels of evidence; this represents an opportunity for improvement in the area for researchers who are making an incursion into football.

With respect to study type, the majority were prognosis and natural history studies (63%), while the minority were diagnostic studies (9.5%). Most of the studies described injury behaviour and its influence on football players' fulfilment[34–40], and few investigations were dedicated to the utility of diagnostic tests in pathologies such as tendinopathies or groin pain[41–44]. The high prevalence of economic studies is striking[45–47] (14.4%). As observed in other publications, there is an increase in studies of innovation in football[19,26], in aspects such as the use of tools for injury prediction[48], decision-making about the continuity of prevention programmes[25], analysis of beneficial effects generated by preventive programs[49,50], adaptations derived from specific skills training[51], and talent identification[46].

In relation to sex, there were a greater number of studies involving only males (56,3%) than only females (8.1%). Further, studies reported a lower number of football studies involving females compared to males and an even greater scarcity of publications involving elite female football players, despite an increase in the popularity of females football[13,52,53]. In this study, we observed a lower number of publications about injuries in females; nevertheless, these publications have a high level of evidence. It was found that there was a higher rate of studies with female participants in the first five years[29,36,54], with a special focus on knee injuries in adolescent football players[36]; however, there was an unfortunate downward trend in the second five-year period. This suggests a commitment to scientific quality in this field. As a consequence, it is necessary to expand the number of studies with female participants in order to improve their availability to carry out comparative studies with males, which in the end strengthens the possibility of decision-making.

Regarding the anatomical location of injuries, a greater presence of muscle injuries was found, followed by injuries to the ligaments, joints, tendons, and bones. It is striking that tendon and bone studies have a higher level of evidence than those involving other anatomical structures: evaluating their content, it has been observed that they are also epidemiological studies[38,55–58], or that they evaluate the effectiveness of injury prevention programmes involving structures that are not exclusively tendons, such as the hamstrings[56]. In addition, many of these studies were performed with support from large organizations such as Union of European Football Associations, providing for large population samples[56,58].

With respect to topographic locations, the distribution found in this study coincides with the epidemiologic distribution described in other reports that noted a general prevalence of muscle and thigh injuries, followed by head injuries[8,20,58]. Furthermore, this study's finding of a high frequency of research reporting hip, joint, and thigh injuries in males coincides with injury patterns reported by UEFA studies, with a higher incidence of such injuries in elite football players[7,59,60]. Regarding

female football, there has been a higher presence of articles reporting head and knee injuries; this finding is coherent with the report of the Football Association (FA) highlighting the importance of knee injuries and the injury profile for females described by Spanish authors in a SR[52,53], although in the present study there was no special emphasis on head injuries. In contrast with the previous studies, a study conducted with college female football players by the National Collegiate Athletic Association (NCAA) exposes a concern about the rate of this type of injury in females, mentioning that 'the concussion rate in NCAA female soccer is almost twice as high as the rate in male soccer'[59]. In football, head injuries have been the object of analysis in the field of biomechanics research in order to propose evidence-based rules and policies, as well as guide developments based on agreed criteria regarding return to play after suffering a concussion[61–63]. In this field, American journals stand out in the number of reports about head injuries, with a particular focus on neurocognitive symptoms after concussion[63,64].

Study limitations

This study was limited to 222 papers selected from the WOS database, and thus there may be valuable information in other publications outside the scope of this study. The exclusion of surgery and exercise physiology journals can be considered a limitation as well, since we could have rejected articles related to football injuries. Nevertheless, this report performed a detailed evaluation to exclude articles about Gaelic, Australian, and American football to increase the quality of the study; at the same time, an entirely quantitative approach was avoided and a qualitative assessment of evidence levels in terms of CEBM criteria was included. This approach is intended to contribute to current and future research in this field.

Conclusions

In conclusion, this review found that during the decade from 2010 to 2019, the frequency of football and sports studies grew, reflecting an increasing interest in this area. We found that BJSM was the journal with the highest number of publications, followed by AJSM, and the United States was the country with the highest level of authorship. A noteworthy finding was that there were more studies involving males than females. Finally, we found that football injury studies in general present a low level of evidence while female football studies exhibit a higher level of evidence.

Registration

This review was not registered.

Acknowledgments

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Conflict of interest

The authors do not declare a conflict of interest.

Availability of data

Data is available at Repositorio Institucional de la Consejería de Sanidad de la Comunidad de Madrid (https://hdl.handle.net/20.500.12530/54436).

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