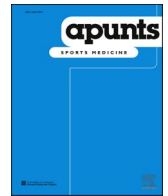




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Review

Scientific trends and emerging topics in youth female soccer: A bibliometric perspective

Elena Mainer-Pardos^{a,*}, Oliver Gonzalo-Skok^b, Hadi Nobari^c, Alberto Roso-Moliner^a^a Health Sciences Faculty, Universidad San Jorge, Autov. A23 Km 299, Villanueva de Gállego 50830 Zaragoza, Spain^b Department of Communication and Education, Universidad Loyola Andalucía, 41704 Seville, Spain^c LFE Research Group, Department of Health and Human Performance, Faculty of Physical Activity and Sport Science (INEF), Universidad Politécnica de Madrid, Madrid, Spain

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ABSTRACT

Soccer is the most widely played sport worldwide, and women's participation has grown exponentially through media visibility, institutional support, and increased opportunities. Young female athletes are important for ensuring the sustainable development of the sport. However, no bibliometric analysis has yet focused specifically on youth women's soccer. This study aims to fill this gap. A comprehensive search was conducted using the Web of Science database to retrieve scientific articles related to youth women's soccer, analysing titles, abstracts, and keywords without year restrictions. Results show that research in this field has increased steadily, particularly since 2015. Authors such as Stacey Emmonds, research groups in the USA, and journals including the Scandinavian Journal of Medicine and Science in Sports are leading contributions. Key topics include injury prevention, physical performance, and talent development. This study provides an overview of influential authors, countries, journals, and thematic trends, identifying gaps to guide future research and policy development.

Introduction

Soccer is the most widely practiced sport in the world, with over 265 million registered players globally, including >30 million females.¹ Between 2006 and 2018, female participation in soccer increased by 14 %, according to "FIFA's Big Count", and projections aim to double this number by 2026 through targeted development strategies.¹ This growing participation has been supported by enhanced media coverage, institutional investment, and expanded opportunities for girls and women to engage in soccer across all levels of competition.¹

Alongside this global growth, rising media interest and financial support have accelerated the professionalisation of women's soccer at an unprecedented pace.^{2,3} As part of its "Making Football Truly Global" strategy, FIFA (Fédération Internationale de Football Association) pledged one billion USD between 2020 and 2022 to further develop the women's game,¹ resulting in a significant shift in the sport's landscape (over 60 % of women's leagues are now predominantly composed of professional players).⁴ This transformation has not only raised the

competitive level of elite women's soccer but also heightened the financial expectations placed on clubs and federations, which increasingly depend on sporting success to ensure sustainability.⁵ As a result, while international recruitment remains a common strategy, there is growing emphasis on the development of homegrown talent through structured academy systems,^{6,7} a shift particularly relevant for the youth female population.

Youth female soccer players have become a strategic focus in long-term development models, as their progression from grassroots to elite levels requires a multidimensional approach that integrates physical, technical, psychological, and social competencies.^{8,9} The World Health Organization defines adolescence as the period between 10 and 19 years of age,⁸ a phase marked by complex biological and neuromuscular changes that coincide with increased exposure to structured training and competitive environments. Studies show that players who successfully transition between age categories tend to outperform their peers in agility, endurance, and technical skills such as dribbling and ball control.^{10,11} These attributes are central to talent identification processes

Abbreviations: FIFA, Fédération Internationale de Football Association; UEFA, Union of European Football Associations; ACL, Anterior Cruciate Ligament; GPS, Global Positioning System; WoS, Web of Science; SJMS, Scandinavian Journal of Medicine & Science in Sports; JSCR, Journal of Strength and Conditioning Research; RED-S, Relative Energy Deficiency in Sport.

* Corresponding author at: Campus Universitario Villanueva de Gállego, Autovía A-23 Zaragoza-Huesca, Km 299, 50.830 Villanueva de Gállego, Zaragoza, Spain.

E-mail address: epardos@usj.es (E. Mainer-Pardos).

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and may serve as predictors of progression to senior-level soccer.¹²

At the same time, the physical demands of modern soccer (including sprinting, changes of direction, and frequent physical contact) place youth female players at greater risk of injury, particularly during periods of rapid growth.^{13,14} Their development is further shaped by the variety and intensity of soccer-specific and multisport activities they engage in during this stage.^{15,16} Factors such as the training environment, coaching style, and psychosocial context also influence how talent is expressed and nurtured across different settings. While much of the existing literature on athlete development has focused on male populations, research in youth female soccer is emerging as a distinct and growing field of academic inquiry that warrants systematic exploration. In this regard, bibliometric analysis offers a robust methodological framework for investigating such developments, enabling researchers to evaluate scientific output, map thematic trends, and identify collaboration patterns across disciplines.¹⁷ In women's soccer, this approach has gained momentum in recent years, reflecting an increase in academic interest aligned with the sport's expanding global presence. Three major bibliometric studies have addressed this area. Kirkendall and Krustup¹⁸ analysed nearly 17,000 soccer articles, finding that only a small percentage focused on women, with predominant themes including ACL (anterior cruciate ligament) injuries and head trauma, while performance-related topics were underrepresented. Ventaja-Cruz et al.¹⁹ evaluated 127 publications and highlighted a steady rise in output since 2010, focusing on areas such as injury prevention, psychological variables, and international collaboration. The most comprehensive analysis to date, by Cherappurath et al.,²⁰ included over 1000 articles and revealed emerging research lines in GPS (Global Positioning System) monitoring, gender disparities, and performance profiling. Despite these contributions, no bibliometric study has focused specifically on youth female soccer, a growing subfield with unique characteristics linked to talent development, biological age, physical maturation, and injury risk. Given the rise in youth female participation and the increasing volume of related publications, a systematic analysis of this niche is both timely and necessary.

This study aims to fill this gap by conducting the first bibliometric analysis focused solely on youth female soccer. In doing so, it seeks to answer the following research questions: (1) What are the main scientific trends in the study of youth female soccer? (2) Who are the most influential authors, institutions, and countries in this field? (3) What are the dominant topics, collaboration networks, and emerging areas of research? Ultimately, this bibliometric review aspires to offer a comprehensive understanding of the academic landscape in youth female soccer, while identifying new directions for future investigations.

Methods

Study design

Bibliometric analysis, originally introduced by Pritchard in 1969,²¹ is a quantitative method used to systematically evaluate and visualize academic literature.²² This methodology involves the analysis of authorship, journal sources, research topics, collaboration networks, and citation structures.^{23,24} Following the standard procedure for bibliometric studies,²⁵ this investigation was structured into five key stages: study design, data collection, data analysis, data visualization, and interpretation.

The primary objective of this study was to map the scientific production and thematic trends within youth female soccer research, identifying the most influential contributors, prevalent research areas, and emerging topics.

Search strategy

A comprehensive search was performed on April 13, 2025, using the Web of Science Core Collection (WoS) database. WoS was selected due

to its extensive coverage of peer-reviewed journals and its compatibility with bibliometric visualization tools such as VOSviewer.^{25,26} The search focused on retrieving scientific articles related to youth female soccer, analysing the title, abstract, and keyword fields, with no restrictions on publication year. As a result, a total of 464 articles were obtained for analysis.

To construct the search, a Boolean strategy was applied, comprising two main components combined with the AND operator:

- The first component included terms associated with female soccer (e.g., “female soccer”, “women soccer”, “girls soccer”, “female football”, “women football”, “girls football”), connected by the OR operator.
- The second component targeted the youth population (e.g., “youth”, “adolescent”, “junior”, “U18”, “U17”, “U16”, “U15”, “U14”, “U13”, “U12”, “U11”, “child soccer”, “grassroots football”), again linked through OR.

Thus, the final Boolean search query used was:

(“female soccer” OR “women soccer” OR “girls soccer” OR “female football” OR “women football” OR “girls football”) AND (youth OR adolescent OR junior OR U18 OR U17 OR U16 OR U15 OR U14 OR U13 OR U12 OR U11 “child soccer” OR “grassroots football”)

Following the search, documents were filtered to include only peer-reviewed articles, conference papers, and reviews, written in English, and indexed within the Web of Science Core Collection. Priority was given to entries where the keywords appeared in the article title, ensuring greater relevance to the research topic.²⁷

Selection criteria

The articles retrieved were screened based on predefined eligibility criteria.

Studies were included if they:

- were written in English;
- focused on youth female soccer players or included mixed-gender populations with data extractable for female players;
- were original research articles, conference papers, or reviews directly related to performance, injury prevention, development, or characteristics in female youth soccer.

Exclusion criteria were:

- studies focusing exclusively on male athletes;
- studies not clearly specifying the youth population aged 10–18;
- papers addressing multiple sports without a specific focus on soccer.

Initial screening was based on titles and abstracts. If eligibility was unclear, the full text was reviewed when accessible.

After screening, a final dataset was created, encompassing all eligible studies for bibliometric and performance analysis (Fig. 1).

Data extraction and software tools

All metadata from the selected articles were exported from the Web of Science platform in Excel (.xls) format. The exported data included information such as author names, institutional affiliations, titles, abstracts, keywords, journal titles, years of publication, and number of citations.

The dataset was cleaned and organized in Microsoft Excel to eliminate duplicates, standardize terms, and correct minor inconsistencies (e.g., variations in journal or keyword names due to spelling differences).

Bibliometric analysis was performed using VOSviewer (version 1.6.20).²⁸ The following types of analyses were carried out:

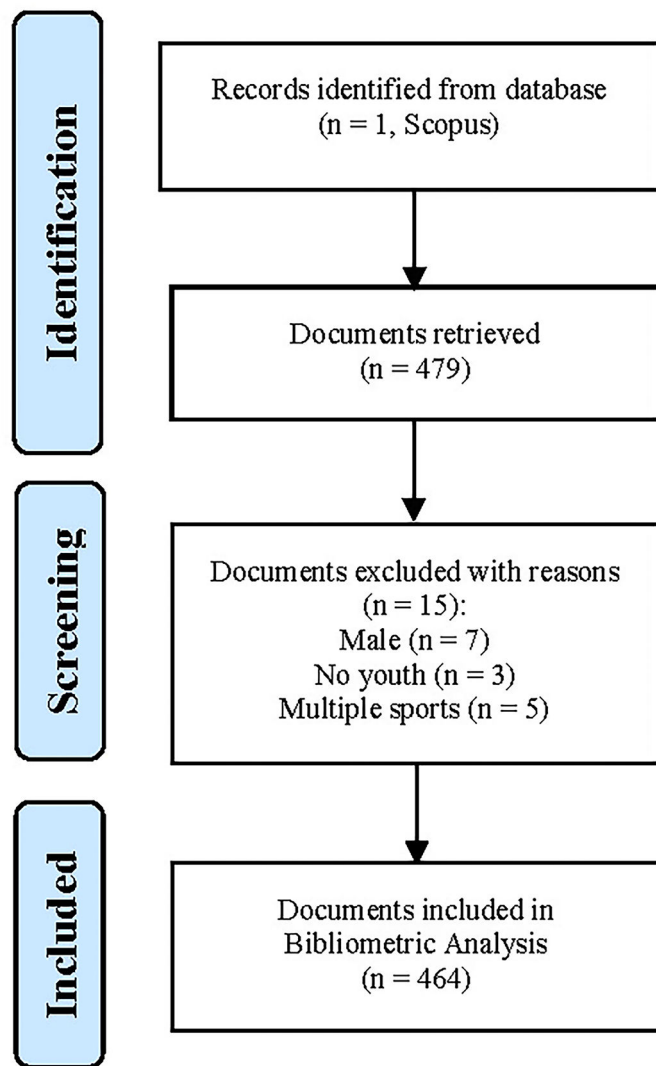


Fig. 1. Flow chart for inclusion and exclusion of studies.

- Co-authorship analysis: to identify collaborations among researchers and institutions.
- Co-citation analysis: to detect the most influential references within the research field.
- Bibliographic coupling: to examine the degree of relatedness between documents based on shared references.
- Keyword co-occurrence analysis: to explore research themes and identify emerging topics.

The bibliometric techniques applied, the units of analysis, thresholds, weights, and types of visualizations are summarized in Table 1.

Thresholds were applied for each type of analysis (e.g., minimum number of documents or citations) to focus on the most significant contributors and avoid fragmentation.^{29–31}

Visualization maps were generated where nodes represented authors, countries, journals, keywords, or articles, and links illustrated relationships based on the selected bibliometric criterion.

Complementary descriptive statistics, such as the number of publications per year, most productive authors, institutions, journals, and countries, were calculated using Microsoft Excel and Power BI (web version). In addition, data (e.g., annual publication counts) were downloaded separately to create chronological graphs, offering insights into the temporal evolution of research activity.

Table 1

Summary of the bibliometric analysis methods applied.

Technique	Unit of analysis	Limitations	Weights	Type of visualization
Co-authorship	Authors	Minimum number of documents of an author = 2; Only authors linked to at least one other author	Documents	Network
Co-occurrence	Author keywords	Minimum number of occurrences of a keyword = 3	Occurrences	Network
Co-citation	Authors	Minimum number of citations of an author = 20	Citations	Network
Bibliographic coupling	Documents	Minimum number of citations of a document = 3	Documents	Network
Co-authorship (Countries)	Countries	Minimum number of documents of a country = 5	Documents	Network

Results

Scientific production over time

The number of publications related to youth female soccer research has steadily increased over the past three decades, with a significant acceleration observed from 2015 onwards (Fig. 2). Between 1995 and 2005, scientific output remained low, with fewer than five articles published per year. However, from 2010 onwards, a progressive increase is evident, culminating in a peak of 66 publications in 2024. This trend indicates a growing academic interest in the field of youth female soccer, particularly in the last decade, corresponding with the overall rise in visibility and investment in women's soccer worldwide.

Leading authors, countries, journals, and keywords

Table 2 summarizes the top 10 most productive authors, countries, journals, and the most frequent keywords in youth female soccer research. Among the authors, Stacey Emmonds leads with 11 documents and 248 total citations, followed by Naomi Datson and Peter Krstrup. Regarding countries, the United States is the leading contributor with 156 documents and 6250 citations, followed by England and Canada. The most influential journals include the Scandinavian Journal of Medicine & Science in Sports and the Journal of Strength and Conditioning Research. The most recurrent keywords identified were “soccer”, “football”, “youth”, and “adolescent”, reflecting the thematic focus of the literature.

Bibliographic coupling analysis

Bibliographic coupling analysis reveals the relatedness of research documents based on shared references (Fig. 3). This analysis identified three main clusters, each representing a thematic focus within youth female soccer research: (1) injury prevention strategies, (2) performance analysis and physical demands, and (3) talent development and training methodologies. Notable documents such as those by Mandelbaum et al. (2005), Soligard et al. (2008), and Faude et al. (2013) emerged as central nodes in the network, indicating their frequent co-citation with other studies. These works appear to serve as foundational references that connect multiple lines of research, reflecting their strong influence in shaping this field.

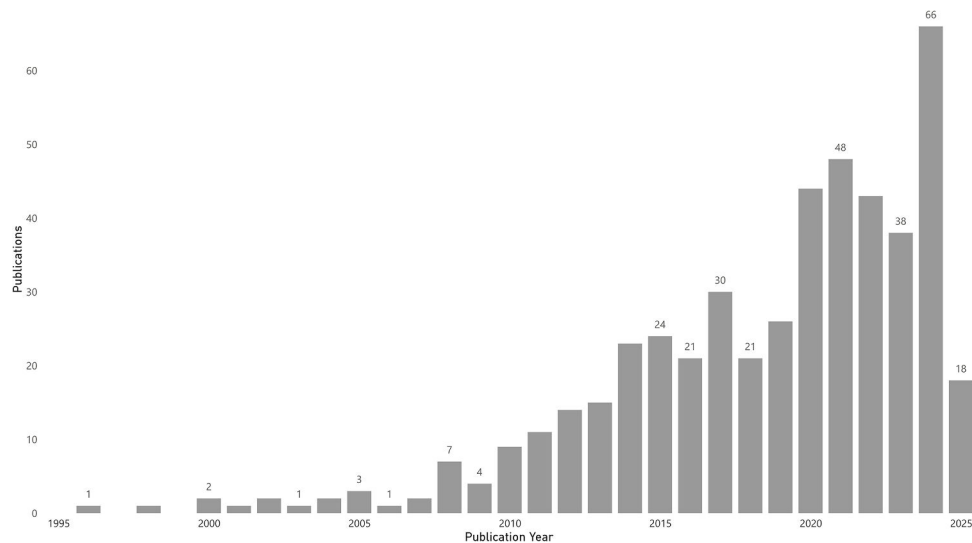


Fig. 2. Scientific production over time.

Table 2

Top 10 authors, countries, journals and keywords in youth female soccer research.

Rank	Author (Documents / Total Citations)	Country (Documents / Total Citations)	Journal (Articles / Total Citations)	Keyword (Occurrences)
1	Emmonds, Stacey (11 / 248)	USA (156 / 6250)	Scandinavian journal of medicine and science in sports (23 / 1141)	soccer (102)
2	Datson, Naomi (10 / 205)	England (83 / 2502)	Journal of strength and conditioning research (19 / 865)	football (70)
3	Krustrup, Peter (8 / 283)	Canada (47 / 1519)	American journal of sports medicine (18 / 2061)	youth (28)
4	Emery, Carolyn A. (7 / 599)	Spain (40 / 479)	Journal of sports sciences (18 / 620)	adolescent (25)
5	Steffen, Kathrin (6 / 1039)	Sweden (35 / 1219)	Science and medicine in football (13 / 151)	female (23)
6	Harkness- Armstrong, Alice (6 / 77)	Brazil (35 / 503)	International journal of sports science and coaching (13 / 276)	injury prevention (21)
7	Gonzalo-Skok, Oliver (6 / 128)	Australia (34 / 1630)	Sports (11 / 49)	adolescents (18)
8	Myer, Gregory D. (6 / 252)	Norway (29 / 1803)	British journal of sports medicine (10 / 962)	sports (17)
9	Bishop, Chris (6 / 238)	Germany (27 / 632)	Orthopaedic journal of sports medicine (10 / 191)	youth sport (15)
10	Jones, Ben (5 / 157)	Switzerland (18 / 1615)	Journal of athletic training (9 / 296)	performance (15)

Co-authorship network

Co-authorship analysis (Fig. 4) provides insights into collaboration patterns among researchers. The network highlights several cohesive collaboration groups, notably around Stacey Emmonds, Gregory D. Myer, Peter Krustrup, and Carolyn A. Emery. Despite the presence of

collaborative clusters, the network shows some fragmentation, suggesting opportunities for fostering broader international collaborations in future research.

Co-citation analysis

Co-citation analysis (Fig. 5) identifies authors who are frequently cited together, reflecting the intellectual structure of the field. The network reveals three dominant citation clusters: a performance and physical development group led by authors such as Vescovi, Krustrup, and Mohr, an injury prevention and biomechanics cluster centered around Soligard, Mandelbaum, and Hewett, and a group focusing on psychological, epidemiological, and developmental aspects including Steffen and Bizzini. This distribution underscores the multifaceted nature of youth female soccer research.

Keyword co-occurrence analysis

Keyword co-occurrence analysis (Fig. 6) visualizes thematic areas based on the frequency and co-appearance of author keywords. The largest nodes correspond to “soccer”, “football”, “youth”, “injury prevention”, and “adolescent”, indicating the major thematic focus of the field. Distinct thematic clusters were identified: injury prevention and neuromuscular training, growth, maturation, and physical performance, and match analysis and tactical aspects. The map suggests an emerging emphasis on topics such as fatigue, periodization, and mental health, pointing to potential future research directions.

International collaboration analysis

The international collaboration network (Fig. 7) highlights the contributions and partnerships between countries. The USA and England appear as central hubs in the network, maintaining strong collaborative ties with countries such as Canada, Australia, Germany, and Norway. The presence of multiple collaboration lines suggests a growing but still regionally focused research network in youth female soccer.

Discussion

Evolution of research activity

Since 2006, there has been a 3.5 % increase in the number of soccer players, including 275 million players, amateurs and professionals.³²

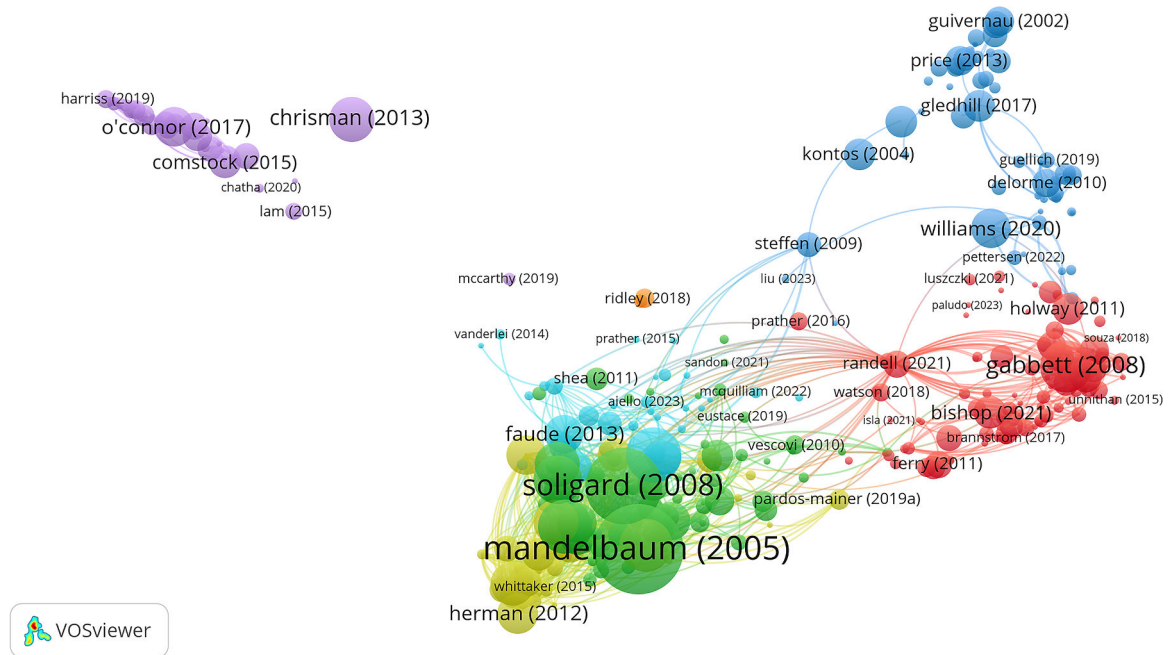


Fig. 3. Bibliographic coupling analysis.

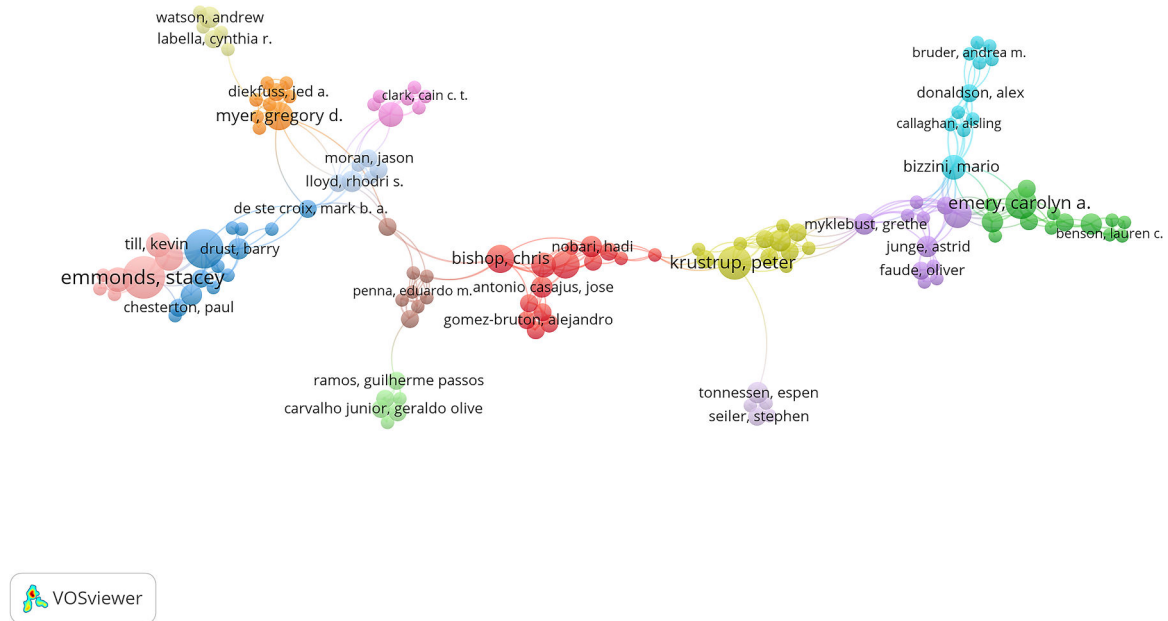


Fig. 4. Co-authorship network.

According to FIFA data for 2023, there are 16.6 million women and girls playing organised soccer, marking a 24 % rise compared with figures from 2019.³² 3.9 million of these players hold federal licences and 19,064 are professional soccer players.³² Among the countries with the highest number of federation licences, the United States leads with a total of 1720,000 (with no age breakdown), followed by Canada with 203,496 (168,928 under 20 years old and 34,568 aged 20 or over), England with 200,967 (159,467 under 20 and 41,500 aged 20 or over), Germany with 197,575 (104,768 under 20 and 92,807 aged 20 or over), Sweden with 196,907 (100,102 under 20 and 96,805 aged 20 or over), France with 166,690 (119,885 under 20 and 46,805 aged 20 or over), and the Netherlands with 161,905 (88,406 under 20 and 73,499 aged 20 or over).³² Additionally, in 2023, the total number of competitions for

players under 20 reached 4743, compared to 1717 in 2019.³² According to the FIFA Women's Football Strategy 2024–2027, “Women's Football Development Programmes” are considered a fundamental tool for continuing to drive growth, professionalisation, and equity in soccer.³²

As shown in Fig. 1, research related to women's youth soccer has increased over the last 30 years, with exponential growth since 2015. Until the early 2000s, scientific output was limited and largely focused on the sociology of sport, examining female participation, sociocultural barriers to development, and the historical context of women's soccer.³³ From the mid-2000s onwards, academic production began to rise, driven by an increase in international competitions (such as the FIFA Women's World Cup) and the efforts of universities and organisations like UEFA (Union of European Football Associations) and FIFA to gather data. The

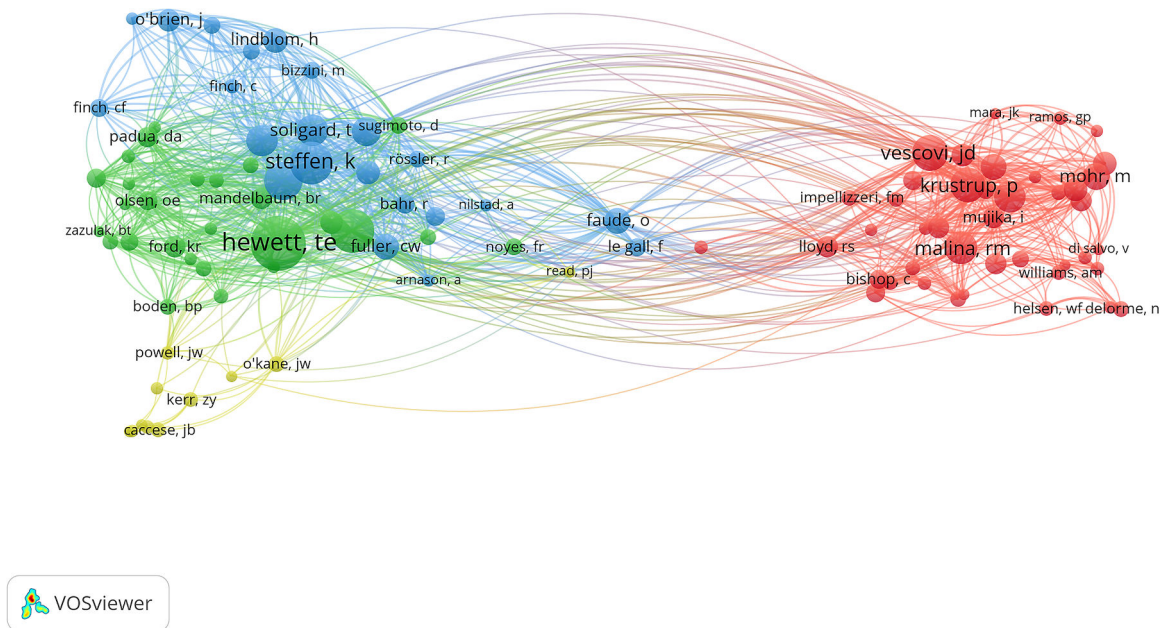


Fig. 5. Co-citation analysis.

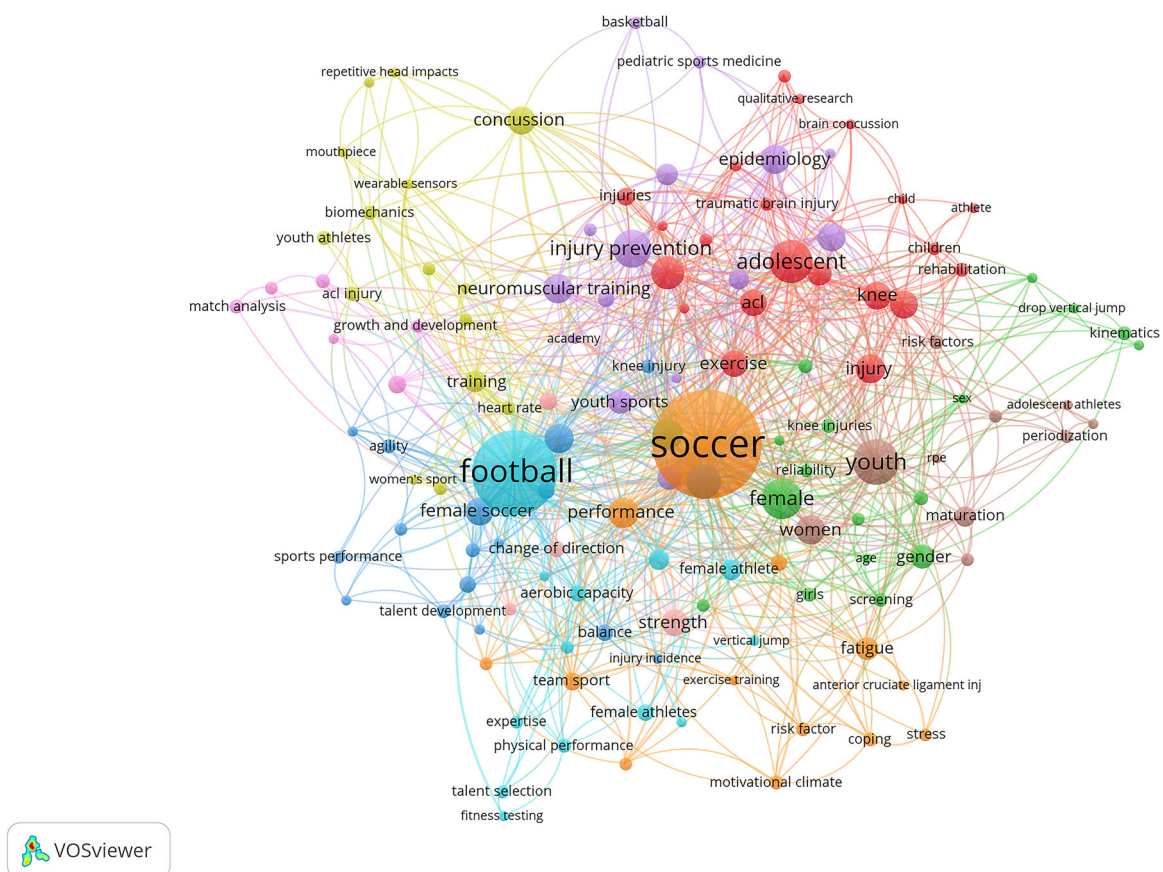


Fig. 6. Keyword co-occurrence analysis.

scope of research expanded to include exercise physiology aimed at performance enhancement³⁴ and injury prevention.³⁵ In the last decade, the scientific study of women's soccer has experienced considerable growth in both quantity and quality, establishing itself as a distinct field within sport sciences. According to a recent bibliometric analysis,³⁶ the number of publications indexed in Scopus on women's soccer has

quintupled between 2014 and 2023, with over 1000 articles appearing in the last five years. The United States, the United Kingdom, Australia, Norway, and Spain lead this scientific output.³⁶ Studies have moved beyond simply replicating male models to focus on the physiological, biomechanical, psychological, and sociocultural particularities of female players. Moreover, there has been a notable increase in research

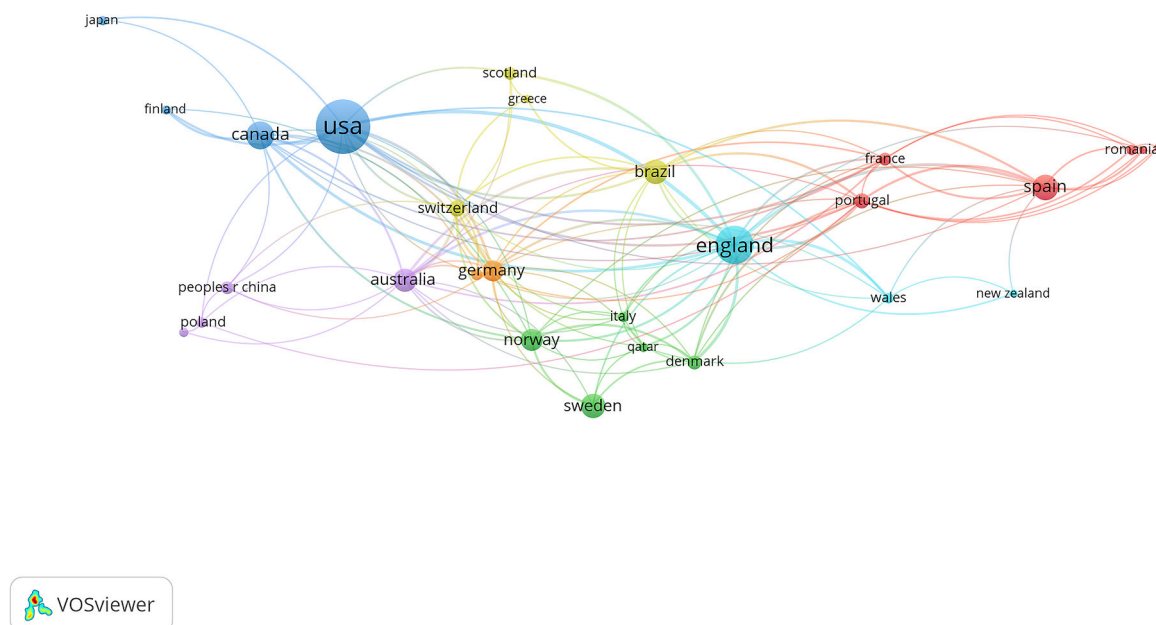


Fig. 7. International collaboration analysis.

relating to positional physical demands,³⁷ ACL injury prevention,³⁸ and the impact of the menstrual cycle on sporting performance.³⁹ Concurrently, research into technical–tactical analysis using GPS technology and video analysis has deepened,⁴⁰ along with sociopsychological topics like female leadership and equitable access to resources.⁴¹ International competitions (notably the FIFA Women’s World Cups in 2019 and 2023) have acted as catalysts for federations, clubs, and universities to prioritise applied research into women’s soccer development. As a result, there has been a growing presence of female researchers in the field, as well as the formation of networks and scientific groups solely dedicated to studying women’s soccer.³²

Regarding research on young female footballers, scientific growth has been substantial, focusing on their physical, technical, and psychological development. Various studies have addressed areas such as physiological characteristics,⁴² injury profiles and prevention,⁴³ maturation status,⁴⁴ and the effect of training on performance and talent development from early stages.^{45–48} Additionally, studies such as Lloyd & Oliver (2012) emphasise the importance of tailoring training programmes to biological development stages rather than just chronological age, promoting comprehensive and sustained training structures.⁴⁹

In recent years, women’s soccer has led the growth of research in women’s team sports, both in terms of publication volume and thematic diversity, compared to other female team sports such as basketball, volleyball, and hockey, which have also seen progress, albeit to a lesser extent.⁵⁰ For example, in addition to the bibliometric analysis previously mentioned,³⁶ a 2019 review identified 1634 articles on women’s soccer, with a significant increase since 2010.⁵¹ The most researched topics included sports medicine (521 articles), strength and conditioning (331), and sociology (299). The majority of studies focused on elite and senior-level players.⁵¹

If we look at publications in similar sports such as basketball, a bibliometric study that investigated publications between 1969–2021⁵⁰ found a total of 584 publications related to this sport in Scopus, although it did not specify how many of them were exclusively about women’s basketball. This study highlights a significant rise in scientific production from 2011 onwards, with 66 publications in 2020 and 74 in 2021, indicating a growing academic interest in the sport.⁵⁰

Another sport similar to soccer that could be analysed is women’s volleyball. Saharullah et al.⁵² conducted a bibliometric analysis including studies between 2019–2023 and identified a total of 1105

publications related to volleyball training in Scopus and Web of Science. Of these, there was a consistent increase in annual publications, peaking in 2022 with 275 articles. Although the study did not specify how many of these focused exclusively on women’s volleyball, a significant proportion addressed topics relevant to female athletes, such as strength training, injury prevention, and performance analysis.⁵²

Finally, in terms of women’s hockey research, although an exact number of publications on women’s hockey in Scopus is not available, a 2019 bibliometric study analysed global scientific output on hockey, identifying 3849 unique records in the Web of Science database between 1989 and 2016. However, this study also did not clarify how many of these focused specifically on women’s hockey.⁵³

Within this context, women’s soccer stands out not only for the highest volume of scientific production, but also for its specificity, thematic diversity, and sustained growth rate, establishing itself as the female team sport with the greatest international research projection.

Leading contributors and publishing outlets

In this bibliometric analysis of scientific production on youth women’s soccer, a clear concentration of research is observed among certain authors, countries, and specialised journals. The leadership of researchers such as Stacey Emmonds, with a remarkable output (11 publications) and number of citations (248), suggests a consolidation of leading figures in the field, while the continued presence of authors such as Naomi Datson (10 publications and 205 citations) and Peter Krusturup (8 publications and 283 citations) further reinforces the thematic stability within this line of research.

The predominance of the United States (156 documents and 6250 citations), United Kingdom (83 documents and 2502 citations), and Canada (47 documents and 1519 citations) as the most productive countries may be linked to their policies promoting youth women’s sport development and access to well-established academic and sporting structures.³² Moreover, as previously mentioned, these three countries also hold the highest number of female soccer licenses, reflecting a more robust infrastructure and interest in the sport.³² In terms of institutional support, countries like the USA and the UK provide explicit backing from sports federations, universities, and scientific funding programmes to foster research in women’s sports.^{32,41} In countries with consolidated professional leagues, the availability of data, access to athletes, and

scientific infrastructure facilitates applied research in areas such as performance, health, biomechanics, and tactical analysis.⁴⁰ Universities in countries such as the United Kingdom, Australia, Canada and Spain are promoting lines of research focused on the health, leadership and equality of women in sport.³⁹ Finally, the hosting of FIFA Women's World Cups in Canada (2015), France (2019) and Australia-New Zealand (2023) has led to increased media attention, which in turn has boosted subsequent scientific output.³²

The high frequency of publication in journals such as the *Scandinavian Journal of Medicine & Science in Sports* (SJMS) and the *Journal of Strength and Conditioning Research* (JSCR) on this topic is due, in part, to the fact that both journals focus on exercise physiology, sports performance and injury prevention, topics closely related to young female soccer players. In the case of SJMS, notable articles address themes such as training load monitoring,⁵⁴ physical performance during adolescence,⁵⁵ and gender differences in athletic development.⁵⁶ Meanwhile, JSCR has published numerous studies on strength training,⁵⁷ soccer-specific physical testing,⁵⁸ and injury prevention protocols,⁵⁹ particularly in adolescent female players. The relevance of these journals in the field reflects not only the growing academic interest in youth women's soccer, but also the consolidation of a scientific foundation supporting safe and effective interventions for this developing population.

Thematic focus and hot topics

The keyword co-occurrence analysis (Fig. 6) reveals significant patterns in the thematic research structure on youth women's soccer. Terms such as "soccer," "football," "youth," "injury prevention," and "adolescent" as central nodes reflect the most frequently addressed topics and also the current priorities within the field. These results coincide with the concern for injury prevention (e.g. ACL) in young populations,⁴⁶ as well as with increasing interest in neuromuscular training strategies tailored to biological development.³⁵ The identified clusters group topics such as maturation and physical performance, tactical analysis, and physical preparation, indicating a progressive diversification of research lines. Interestingly, the map also suggests growth in other emerging areas such as fatigue, training periodisation and mental health, topics that are currently underexplored in the context of youth women's soccer. From all of this information it highlights the need for a more general approach to the experience of young female footballers, thus identifying their physical demands and psychological wellbeing.⁶⁰

When analysing the key directions to pursue in research on young female soccer players, the need for specific approaches becomes clear, one of which considers the physiological, psychological, socio-cultural, and training planning characteristics particular to these athletes. Regarding physiological aspects, one of the main advances has been the menstrual cycle, which may influence performance, fatigue, and recovery. McNulty et al. (2020) emphasise that ignoring these fluctuations can jeopardise both athletic performance and long-term health, and recommend greater individualisation of training.³⁹ In addition, recent research suggests that the 'female athlete triad' has evolved into the more integrative concept of 'relative energy deficiency in sport' (RED-S), which includes bone and reproductive health as well as metabolic, immunological and psychological consequences.⁶¹ Turning to psychological aspects, mental health is an essential dimension in the development of young female soccer players. Emmonds et al. (2024) observed that up to 65 % of players may experience distress symptoms, particularly following serious injuries, underlining the need for psychological interventions within the sporting environment.⁶² In this regard, Kenttä et al. (2020) highlight that factors such as gender inequality or poor institutional environments can contribute to the development of anxiety, depression, and eating disorders, particularly in high-performance contexts.⁴¹ From a sociological perspective, it is also crucial to consider the structural context in which women's soccer develops. Jean Williams (2007) documents the historical and cultural

barriers that have limited women's access to sport, noting that many of these still persist globally.⁶³ Moreover, Burton and Leberman (2017) point to the low representation of women in technical and leadership roles within sports organisations, which hinders the creation of inclusive and gender-sensitive environments.⁶⁴ Finally, training periodisation has proven fundamental to optimising performance and reducing injury risk. Rachael Nelson (2017) found that planning adapted to the competitive calendar significantly improves anaerobic power in university-level players.⁶⁵ Complementarily, Romero-Moraleda et al. (2023) analysed internal and external loads throughout a full season in Spanish players, concluding that careful management of the weekly microcycle is key to maintaining the balance between stimulus and recovery.⁶⁶

Lastly, the transfer of scientific knowledge to the competitive environment remains one of the major challenges. Krstrup et al. (2008) argue that findings obtained in laboratory settings must be carefully contextualised to reflect the real demands of competitive women's soccer.³⁴ It requires close collaboration between researchers and team technical staff. In this regard, women's soccer has been the main driver of scientific advances within women's sport, both in terms of volume and diversity of publications. However, significant gaps remain in literature, particularly with regard to the longitudinal impact of particular interventions, mental health and the effective transfer of knowledge to the real-world competitive environment. Future research should therefore prioritise integrative approaches that simultaneously address physiological, psychological, socio-cultural and training planning dimensions.

Research gaps and future directions

Despite the sustained growth of scientific interest in youth women's soccer, important gaps in literature persist, limiting a comprehensive understanding of players' development. Firstly, the scarcity of longitudinal studies represents a methodological weakness, preventing the analysis of training effects, biological growth, or interventions over time. Furthermore, there is a clear geographical concentration in scientific output, with Anglo-Saxon countries such as the United States, England, and Canada dominating. At the same time, realities from regions with lower research infrastructure (e.g., Latin America or Africa) remain underrepresented—thereby limiting the global applicability of current findings. Likewise, most studies focus on isolated areas, such as physical performance or injury prevention, without incorporating psychosocial or contextual variables. It demonstrates the need for more interdisciplinary approaches integrating sports psychology, sociology, and nutrition. Finally, scientific collaboration network analyses (see Fig. 7) reveal weak connections between international research groups, with limited cooperation between regions, which hampers the development of a global and diverse strategy for youth women's soccer.

Practical implications for coaches and practitioners

The findings and gaps identified in the literature on youth women's soccer offer valuable applications for coaches, strength and conditioning staff, and grassroots soccer clubs. Firstly, the lack of longitudinal studies suggests that coaches should implement individualised tracking systems throughout players' development, recording data on growth, maturation, training load and psychosocial well-being. This approach would allow decisions to be made on training progression and injury prevention. Furthermore, given the scarcity of interdisciplinary research, training programmes should prioritise content that integrates physical, psychological and social aspects of performance, especially in adolescence. For federations and schools, this scarce international collaboration represents a strategic opportunity to foster cooperation networks with other countries and increase knowledge.

Limitations and strengths

This study has several limitations. First, the search was conducted exclusively in the Web of Science (WoS) database and was limited to articles in English, which may have introduced a bias in the literature analysed. This methodological decision may have excluded relevant studies published in other languages or in complementary databases (Scopus, PubMed or Scielo). Furthermore, as this is a bibliometric analysis, the results depend largely on the keywords assigned by the authors. It is also important to note that bibliometric studies have a limited capacity to anticipate short-term trends or interpret each study in depth.

On the other hand, this study offers important strengths. It represents the first comprehensive bibliometric analysis focused specifically on youth women's soccer, making a significant contribution to a developing field. Furthermore, it provides a global overview of the most influential authors, the countries with the highest output, the key journals and the predominant thematic lines, which provides good guidance for future research. Finally, this approach allows for the identification of critical gaps and key elements for designing more effective scientific and sports policies.

Conclusions

This research shows a growth in the scientific production on youth women's soccer, mainly due to the global impulse in the development of this sport. In addition, the United States is the country with the highest number of publications and citations, followed by England and Canada, while authors such as Stacey Emmonds and journals such as the Scandinavian Journal of Medicine & Science in Sports stand out for their influence in this field.

Injury prevention, physical performance analysis and talent development are the most recurrent topics that can best help to understand the needs of sportswomen. On the other hand, the analysis of co-authorship networks reveals some nuclei of active collaboration, however, there is also a need to strengthen international cooperation.

Likewise, the keywords show the thematic diversity of the field, highlighting physical, psychological and tactical aspects (mental health, fatigue and periodisation). Finally, although an international collaboration network is in full development, it is still dominated by a few countries, which opens up the possibility of fostering further collaboration in youth women's soccer research.

Conflicts of interest

The authors declare no conflict of interest.

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