

A Bibliometric Analysis of Soccer Biomechanics

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Abstract: Soccer biomechanics is a field that applies principles of mechanics to improve performance and reduce the risk of injury for soccer players. The purpose of this research is to perform a mapping review of the existing knowledge in the current literature, identify leading researchers and institutions, and explore emerging research topics. After conducting a mini literature review, a bibliometric analysis was carried out using the VOSviewer software. The data imported into VOSviewer was obtained from the Scopus database and included 951 records. The analysis performed included: (a) performance analysis to calculate the number of records per year and the authors with the most citations; (b) science mapping analysis (co-authorship, co-citation, and bibliographic coupling); and (c) clustering analysis through the co-occurrence analysis of author keywords. Our findings highlight a significant growth in research publications on soccer biomechanics over the past few decades, with a notable increase in the number of articles published in high-impact journals. Additionally, the clustering analysis resulted in seven clusters, with each cluster providing valuable insights into different aspects of soccer biomechanics, which clearly reflects the multifaceted nature of the field.

Keywords: scientometric analysis; association football; kinetics; kinematics; injuries; performance



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1. Introduction

Biomechanics is the scientific discipline that examines the mechanical aspects of living organisms. It involves the study of forces and their effects on living systems and it plays a crucial role in understanding human movement and performance [1]. The field can be broadly categorized into three areas: clinical biomechanics, which focuses on gait, neuromuscular control, and rehabilitation; occupational biomechanics, which deals with ergonomics and human movement in work environments; and sports biomechanics, which aims to enhance performance and reduce injury risk in athletic activities [2,3]. Specifically, sports biomechanics involves analyzing movements, optimizing techniques, and understanding the mechanisms behind injuries to develop better training and rehabilitation protocols [4]. Therefore, it is a dynamic field that applies principles of mechanics to understand and improve athletic performance.

Soccer, often referred to as association football, has widespread popularity worldwide, with an estimated 265 million players and over 4 billion fans globally [5]. Soccer's popularity makes it a significant area of interest for sports science research, including biomechanics [6]. Biomechanics helps in analyzing player movements, enhancing kicking techniques, and improving footwear and equipment design [3]. For instance, studies have shown that the design of soccer shoes can significantly impact player performance and injury risk by affecting traction, stability, and comfort [7]. Additionally, biomechanics is

crucial in understanding the physical demands of football, such as aerobic and anaerobic energy systems involved in different activities during a match [5]. Therefore, the application of biomechanical principles allows coaches and trainers to develop effective training programs and strategies with the aim of increasing athletic performance while reducing the risk of injuries.

Bibliometric analysis is a powerful method for evaluating research trends, collaborations, and the impact of scientific publications within a specific field [8,9]. This method involves the quantitative analysis of bibliographic data, such as citation counts, co-citation patterns, and co-authorship networks, to uncover the structure and dynamics of research areas [10]. Bibliometric analysis helps identify influential works, leading researchers, and key institutions, as well as emerging topics and research gaps [11]. Techniques such as citation analysis measure the frequency of citations a publication receives, whereas co-citation analysis examines how often two documents are cited together and provides a clear insight of the relationships between different pieces of publication [12]. Additionally, bibliographic coupling links documents that share common references, which helps map the evolution of research themes over time [13]. The utilization of these methods allows researchers to gain a comprehensive understanding of the intellectual landscape of soccer biomechanics, guiding future research directions and informing evidence-based practices.

VOSviewer is a powerful software tool designed for constructing and visualizing bibliometric networks, with applications in various fields of science and technology. This software was developed by the Centre for Science and Technology Studies (CWTS) at Leiden University to allow researchers to create maps based on network data, including co-authorship, co-occurrence, and citation relationships [14]. One of the key strengths of VOSviewer is its advanced visualization capabilities, which include network, overlay, and density visualizations, making it easier to interpret complex bibliometric data [15]. The software can process data from multiple sources such as Web of Science, Scopus, and PubMed, and can also handle data in RIS and CSV formats [16]. Additionally, VOSviewer offers a user-friendly interface with zoom and scroll functionalities, facilitating detailed examination of bibliometric maps and enhancing the overall user experience [16]. This makes VOSviewer an essential tool for researchers conducting bibliometric analysis, particularly in the field of sports biomechanics.

The importance of bibliometric analysis in the field of soccer biomechanics lies in its ability to systematically evaluate the research landscape, identify key trends, and highlight influential works and contributors. Given football's status as the most popular sport globally, understanding the biomechanics involved can lead to significant improvements in player performance and injury prevention [3,5]. By applying advanced bibliometric tools such as VOSviewer, researchers can uncover valuable insights into the collaborative networks and thematic developments within this field [16]. Therefore, this study aims to conduct a comprehensive bibliometric analysis of the soccer biomechanics literature to map the existing knowledge, identify leading researchers and institutions, and explore emerging research trends [11]. Ultimately, the findings from this analysis will inform future research directions and support the development of evidence-based practices in soccer training and rehabilitation, contributing to the overall advancement of the sport.

2. Material and Methods

2.1. Procedure

The search was conducted in the Scopus database on 15 June 2024, using the Boolean expression (TITLE (“biomechanics” OR “biomechanical”) OR KEY (“biomechanics” OR “biomechanical”) AND TITLE-ABS-KEY (“soccer” OR “association football”). The initial search yielded 1181 records. Using Scopus filters, records that were not published in journals (i.e., books, book chapters, conference papers, conference reviews) were excluded. Similarly, records categorized as reviews, editorials, letters to the editors, notes, and errata were also excluded. For the 1025 articles that remained, the title and abstract were checked, and records that lacked an abstract, those not related to soccer (but merely

mentioned the word soccer in the abstract), as well as some cases where the database had not recognized review articles and thus had not been automatically excluded in previous stages were removed. Ultimately, 951 records met the criteria for inclusion in the bibliometric analysis. Figure 1 depicts the selection process of the 951 articles used for the bibliometric analysis. The information shown in Figure 2 was extracted from the database into a CSV file. After conducting a mini literature review based on the abstracts of the articles, the CSV file was then imported into the free software VOSviewer (version 1.6.20) to perform the bibliometric analysis.

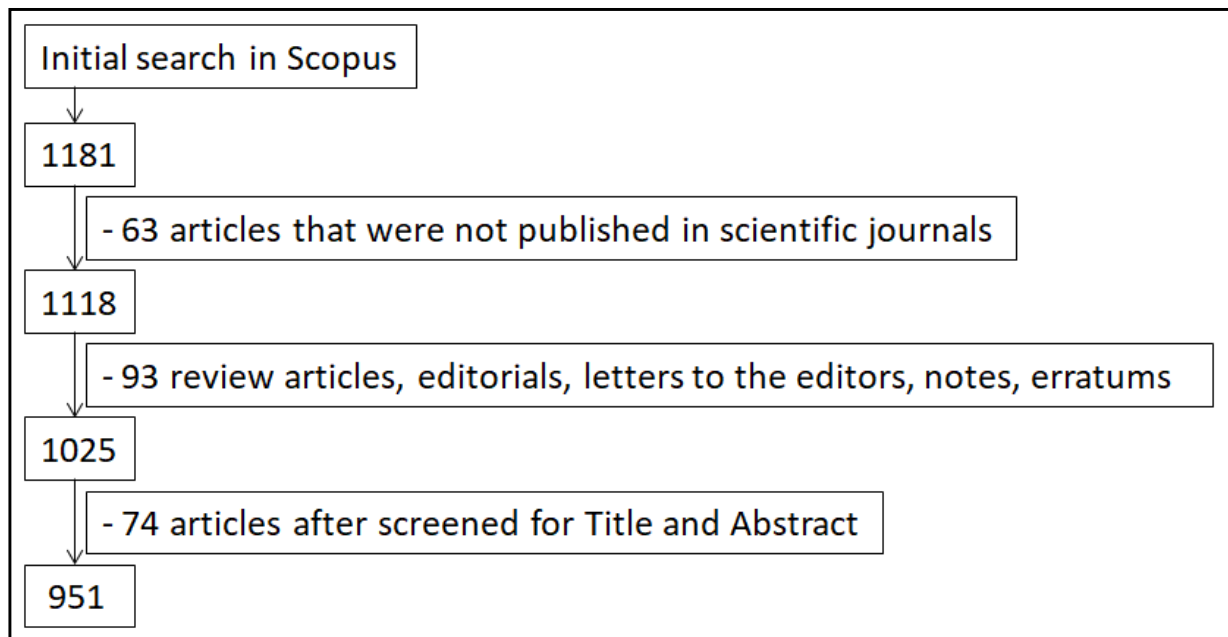


Figure 1. The stages of the article selection process.

What information do you want to export?

<input checked="" type="checkbox"/> Citation information	<input checked="" type="checkbox"/> Bibliographical information	<input checked="" type="checkbox"/> Abstract & keywords	<input type="checkbox"/> Funding details	<input checked="" type="checkbox"/> Other information
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<input checked="" type="checkbox"/> Source title	<input checked="" type="checkbox"/> Editor(s)			
<input checked="" type="checkbox"/> Volume, issues, pages	<input checked="" type="checkbox"/> Language of original document			
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Figure 2. The information extracted from Scopus into a CSV file.

2.2. Bibliometric Analysis

Three different bibliometric analysis techniques were used, namely performance analysis, science mapping, and clustering. Regarding the performance analysis, the top 20 journals in citations were identified, as well as the number of documents per year. Science mapping examined the relationships between different research components. In this study, co-authorship analysis, co-citation analysis, and bibliographic coupling analysis were conducted. Co-authorship analysis examines the interactions among scholars. In

co-citation analysis, two publications are connected when they co-occur in the reference list of another document, while bibliographic coupling relies on the common references of two documents [11]. Finally, clustering is an enrichment technique for bibliometric analysis whose primary goal is to create thematic or social clusters [11]. In this study, it was applied through the co-occurrence analysis of author keywords to create thematic clusters.

3. Mini Literature Review

Biomechanics plays a crucial role in understanding and enhancing the performance and safety of soccer players. The study of biomechanics in soccer helps improve performance, reduce injury risks, and develop training programs that enhance players' capabilities [3,17–19]. Through the use of tools such as motion capture systems, force plates, and electromyography, researchers can analyze the mechanics of movements like kicking, running, and jumping to provide insights into optimal techniques [20–22].

Kicking is a recognized fundamental skill in soccer that significantly impacts game outcomes. Studies have focused on the biomechanics of different types of kicks, such as the instep and side-foot kicks. These analyses reveal that factors like joint angles, muscle activation, and limb coordination are critical for generating power and accuracy [23–26]. For instance, the instep kick involves a complex interaction of the hip, knee, and ankle joints, with proper timing and muscle force application being essential for effective performance [6,27,28].

Running biomechanics in soccer involves the study of gait patterns, stride length, and ground reaction forces. Efficient running mechanics can enhance a player's speed and endurance while minimizing the risk of injuries [29–31]. Research indicates that soccer players benefit from training programs that focus on optimizing their running form and improving their strength and flexibility [32,33]. Further, the analysis of sprinting and sudden directional changes is essential, as these movements are frequent in soccer and contribute to the physical demands of the game [34,35].

Injury prevention is a significant focus within soccer biomechanics, with particular attention given to the mechanisms of common injuries such as ACL (anterior cruciate ligament) tears, ankle sprains, and muscle strains [36–39]. Biomechanical studies have identified several risk factors, including improper landing techniques, muscle imbalances, and joint instability [40,41]. For example, research has shown that female soccer players are at a higher risk for ACL injuries due to biomechanical differences such as greater knee valgus angles during landing [20,42,43]. Interventions such as neuromuscular coordination and strength conditioning are recommended to enhance stability and reduce injury risks [44–46].

The role of footwear and playing surfaces is also a critical area of research in soccer biomechanics. The interaction between the player's footwear and the playing surface can influence performance and injury risk [47–49]. Studies have examined the effects of different types of cleats and turf on player stability, traction, and comfort [50,51]. For instance, research has shown that shoes with proper traction and shock absorption can reduce the risk of injury and enhance overall performance [52,53].

Furthermore, heading the ball is a unique aspect of soccer that poses specific biomechanical challenges. The impact forces during heading can lead to acute and chronic injuries, including concussions and long-term brain damage [54–56]. Biomechanical studies focus on understanding the forces involved and developing techniques to prevent the risk of injury [57,58]. Proper heading techniques and the use of neck muscles to absorb impact forces are essential for reducing injury risks [56,59,60].

Therefore, by systematically analyzing the movements and forces involved in soccer games, researchers can develop evidence-based training programs and safety protocols that enhance the quality of the sport [61,62]. The continuous advancements in biomechanical research and technology promise further improvements in the safety and performance of soccer players at all levels [20,37].

4. Bibliometric Analysis

4.1. Performance Analysis

Figure 3 shows the annual number of publications related to soccer biomechanics from 1976 to 2024. The x-axis represents the years and the y-axis, the number of publications. The data reveals a significant increase in the number of publications over the decades, with notable growth starting in the 2000s and peaking around the 2020s. The year 2021 produced the most publications (90). This trend indicates a growing interest and investment in research within the field of soccer biomechanics, reflecting advancements in both technology and scientific understanding.

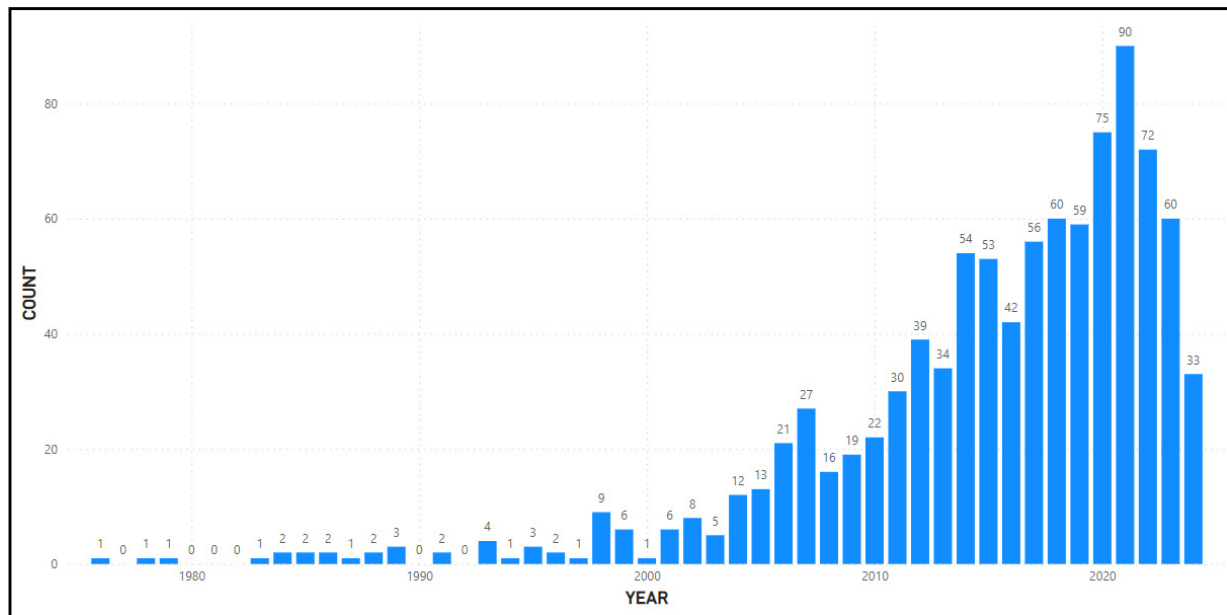


Figure 3. Annual number of publications on soccer biomechanics (1976–2024).

Table 1 shows the top 20 journals in citations. The analysis of journals publishing soccer biomechanics articles reveals a diverse range of influential publications. Leading journals in sports medicine and biomechanics dominate in citations, reflecting their critical role in advancing research and their broad acceptance within the scientific community. The interdisciplinary nature and practical relevance of soccer biomechanics research further underscore the field's importance in both academic and practical contexts. The “American Journal of Sports Medicine” stands out significantly with the highest number of citations (6699). Other highly cited journals include the “Journal of Sports Sciences” (2353 citations) and the “Journal of Strength and Conditioning Research” (2331 citations). This indicates that research on soccer biomechanics is not limited to specialized journals but is also recognized and valued in more general sports medicine publications. Furthermore, the presence in the list of journals such as “Sports Biomechanics” and “Journal of Biomechanics” underscores their relevance and specialization in the field. Despite having fewer documents, their citation counts (839 and 626, respectively) reflect the quality and importance of the research they publish. Finally, it is worth noting that there are journals that have shown significant contributions to the field in recent years. For example, the journal, Applied Sciences (MDPI), has two publications in 2024 [63,64] and two more in the previous two years [65,66].

Table 1. The top 20 journals in citations.

N	Source	Citations	Documents
1	American Journal of Sports Medicine	6699	31
2	Journal of Sports Sciences	2353	66
3	Journal of Strength and Conditioning Research	2331	51
4	British Journal of Sports Medicine	1545	22
5	Medicine and Science in Sports and Exercise	1338	24
6	Clinical Journal of Sport Medicine	1252	19
7	Clinical Biomechanics	1109	19
8	Journal of Athletic Training	1009	19
9	Knee Surgery, Sports Traumatology, Arthroscopy	859	13
10	Sports Biomechanics	839	45
11	Neurosurgery	659	3
12	Scandinavian Journal of Medicine and Science in Sports	643	26
13	Human Movement Science	639	17
14	Journal of Biomechanics	626	15
15	Journal of Sports Medicine and Physical Fitness	570	27
16	International Journal of Sports Medicine	531	13
17	Journal of Sports Science and Medicine	431	6
18	Gait and Posture	420	16
19	Plos One	416	19
20	Physical Therapy in Sport	397	26

4.2. Science Mapping

4.2.1. Co-Authorship Analysis

We performed co-authorship analysis using authors (Figure 4) and organizations (Table 2) as units of analysis. In the first case, we set as a limitation that only the connected authors who have participated in at least two publications can be seen on the map. Figure 4 illustrates the network of collaborations among authors on football biomechanics. This network helps to understand how collaborations between researchers contribute to the development of the field and which authors are central to these collaborations.

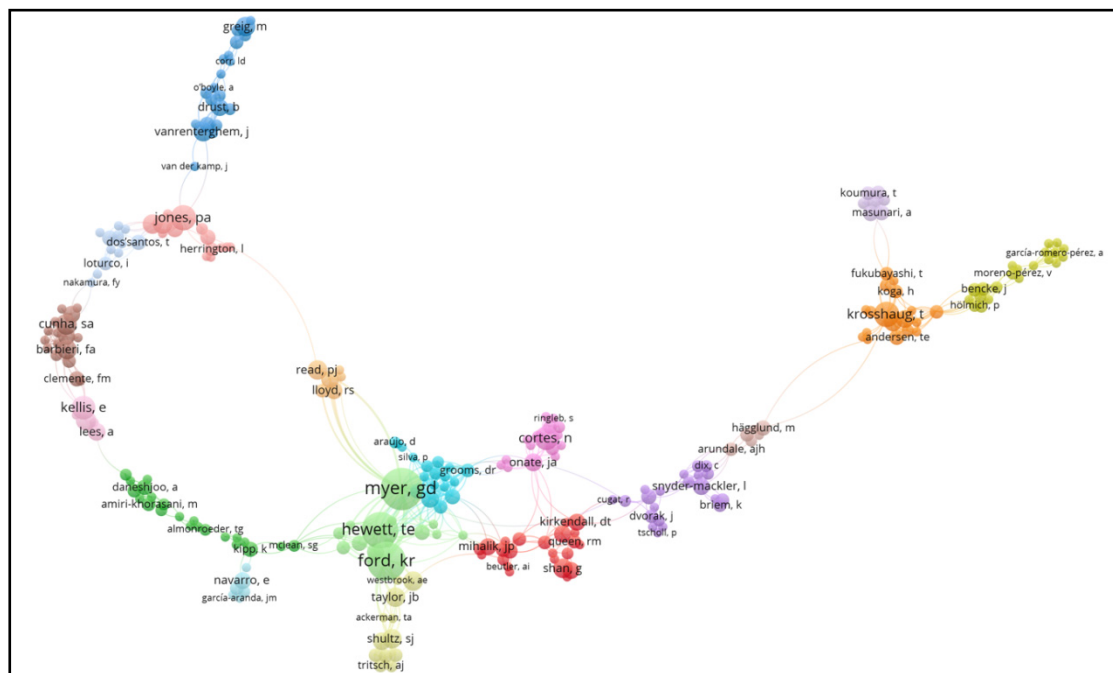


Figure 4. Co-authorship analysis with authors as the unit of analysis.

Table 2. The top 20 universities in partnerships based on total link strength.

N	Organization
1	Rocky Mountain University of Health Professions, Provo, UT, United States
2	Sports Medicine Biodynamics Center, Human Performance Laboratory, Cincinnati, OH, United States
3	Cincinnati Children’s Hospital Medical Center, Cincinnati, OH, United States
4	Micheli Center for Sports Injury Prevention, Waltham, MA, United States
5	Sport Performance Research Institute, New Zealand (sprinz), AUT university, Auckland, New Zealand
6	Division of Biostatistics and Epidemiology, Cincinnati Children’s Hospital Medical Center, Cincinnati, OH, United States
7	Departments of Orthopedic Surgery, Biomedical Engineering, and Rehabilitation Sciences, University of Cincinnati, Cincinnati, OH, United States
8	Department of Pediatrics, College of Medicine, University of Cincinnati, Cincinnati, OH, United States
9	Department of Environmental Health, University of Cincinnati, Cincinnati, OH, United States
10	Department of Orthopedics, University of Pennsylvania, Philadelphia, PA, United States
11	Athlete Health and Performance Research Centre, Aspetar Orthopedic and Sports Medicine Hospital, Doha, Qatar
12	Department of Exercise and Sport Science, Curriculum in Human Movement Science, University of North Carolina, Chapel Hill, NC, United States
13	Department of Exercise and Sport Science, Injury Prevention Research Center, University of North Carolina, Chapel Hill, NC, United States
14	Injury Prevention Research Center, Department of Epidemiology, University of North Carolina, Chapel Hill, NC, United States
15	University of North Carolina at Chapel Hill, 209 Fetzer Gymnasium, Chapel Hill, NC 27599, South Road, United States
16	Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway
17	Department of Physical Therapy, High Point University, High Point, NC, United States
18	Department of Mechanical and Materials Engineering, Queen’s University, Kingston, Ont., Canada
19	Department of Surgery, Division of Orthopedics, Dalhousie University, Halifax, NS, Canada
20	School of Biomedical Engineering, Dalhousie University, Halifax, NS, Canada

In the second case, we used as a limitation that there should be at least 2 documents and 100 citations for each organization. Table 2 shows the top 20 organizations in total link strength, which shows the total strength of a university’s connections with other universities. A high total link strength means that the university has many and strong collaborative links with other universities, indicating high collaboration and possibly high influence in the research field. From the table, it can be seen that the universities of the United States and Canada are the ones with the most collaborations.

4.2.2. Co-Citation Analysis

A co-citation analysis was conducted using sources (Figure 5) and authors (Figure 6) as the unit of analysis. In the first case, where the limit was set to at least 100 citations per source, journals with many connections have greater influence and significance in the field, as they are frequently cited together in scientific papers. This indicates that the articles published in these journals are fundamental and widely used by the scientific community. For example, the “American Journal of Sports Medicine” holds a central position with many connections, showing that it is one of the most frequently cited journals in the field of soccer biomechanics. Other important journals include the “Journal of Sports Sciences” and the “British Journal of Sports Medicine”, which also show many connections. The clustering of journals using different colors highlights different research directions or specializations within the field of biomechanics. For example, journals in red may focus more on clinical applications, while those in green may concentrate on more theoretical or basic research.

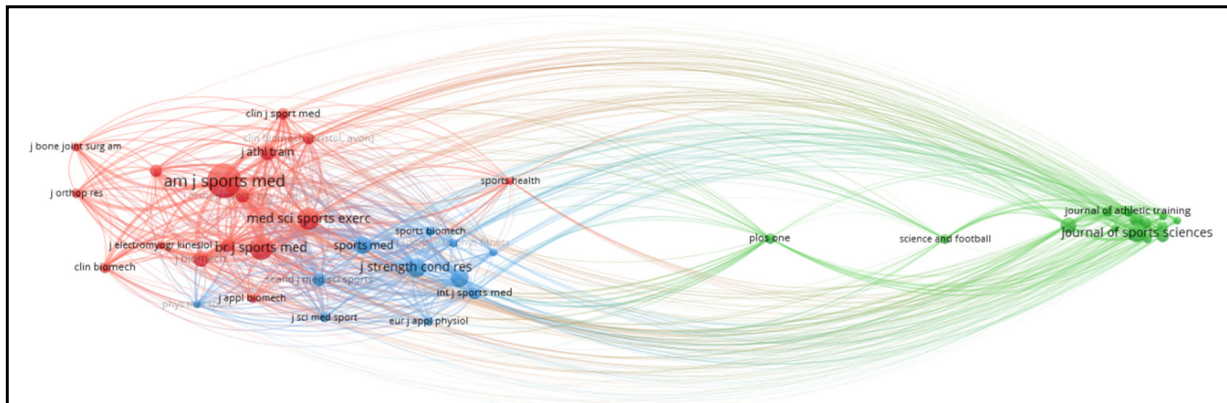


Figure 5. Co-citation analysis using sources as the unit of analysis.

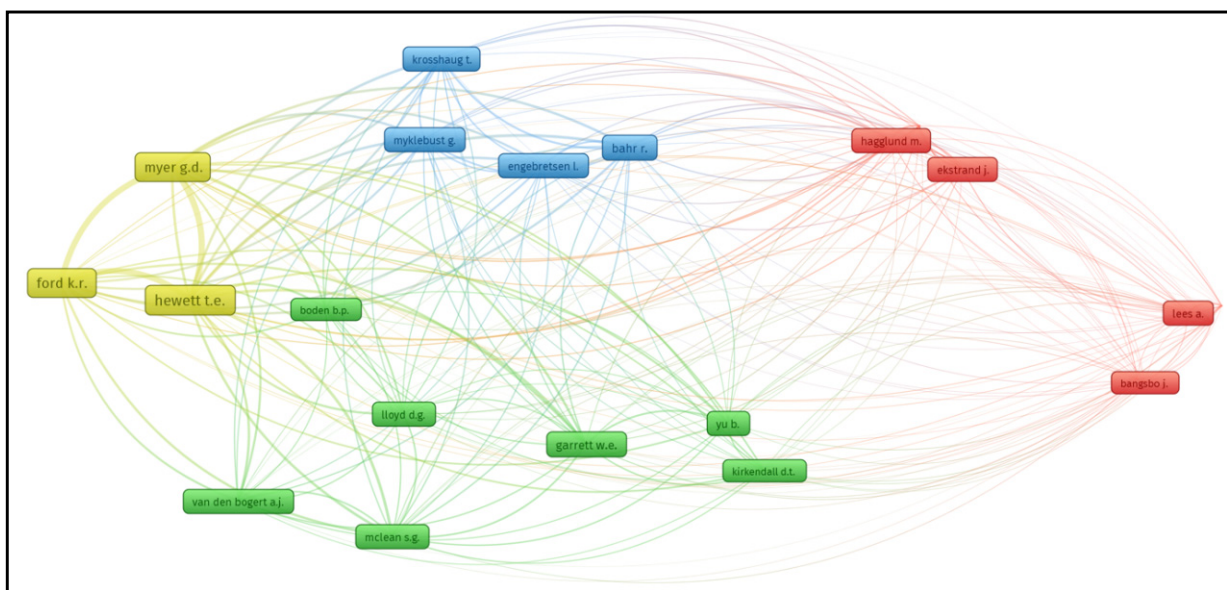


Figure 6. Co-citation analysis using authors as the unit of analysis.

In the second case, where the limit was set to at least 200 citations per author, the presence of groups of authors with common connections indicates the research teams across or schools of thought that collaborate closely and produce documents that are co-cited by other documents. For example, the group in blue represents a specific research team focusing on particular issues in soccer biomechanics. Additionally, authors like “Myer, GD” and “Hewett, TE” are central figures in the network, with many connections, indicating that their works are frequently cited and have significant influence in the field.

4.2.3. Bibliographic Coupling Analysis

We performed bibliographic coupling analysis using the documents as the unit of analysis (Figure 7). The articles by Hewett, et al. [67] and Hewett, et al. [68] are central in the network with many connections, which shows these are leading articles in the field of soccer biomechanics with significant influence and are widely used as a basis for further research. Articles with increased connections have a greater influence in the field, as they are more frequently cited in scientific papers. This highlights the importance of collaboration and networking in scientific research. The different clusters of articles formed in various colors indicate different research directions or topics. For example, articles in red might focus on specific injury topics, while those in blue might concentrate on movement analysis.

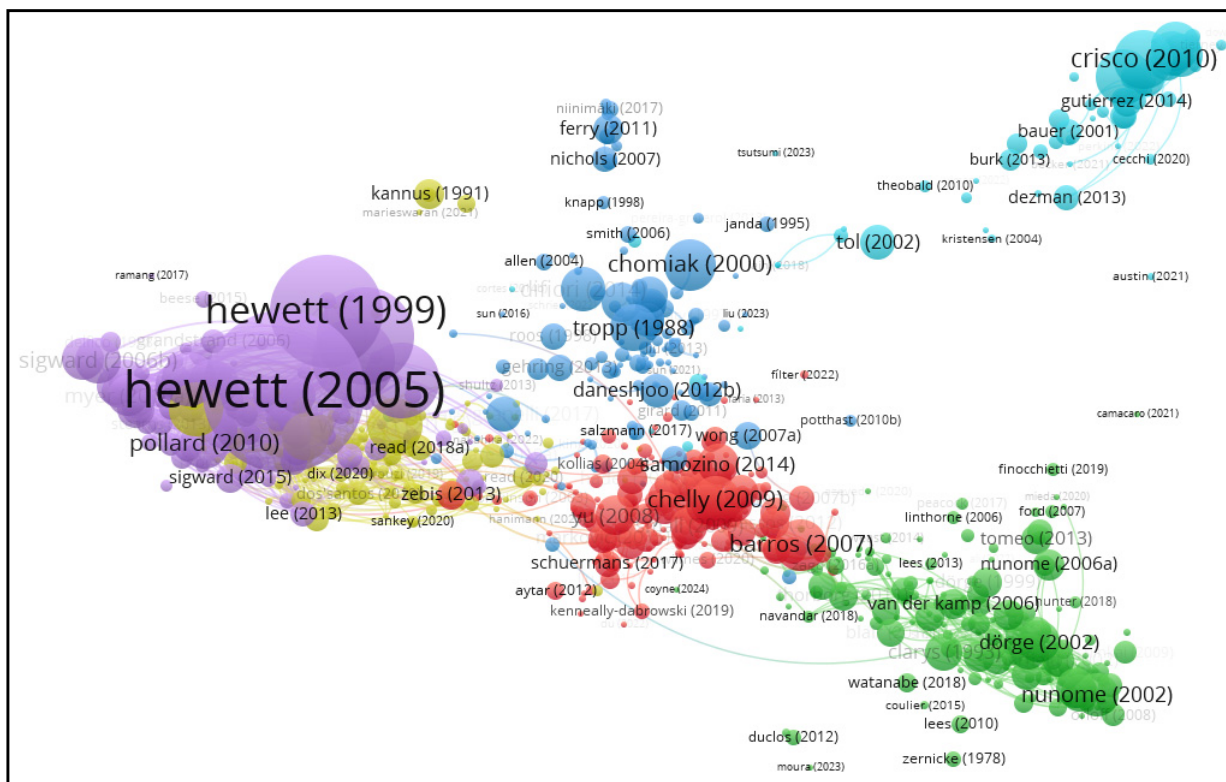


Figure 7. Bibliographic coupling using documents as a unit of analysis.

4.3. Clustering

From the co-occurrence analysis of author keywords in publications of soccer biomechanics, seven clusters emerged. Only keywords that appeared at least five times were taken into account. Table 3 shows the keywords and the corresponding name provided for each cluster. Each cluster provides valuable insights into different aspects of soccer biomechanics, reflecting the multifaceted nature of the field and the importance of a comprehensive approach to understanding and improving soccer performance. In particular:

Cluster 1 focuses on the physical aspects of soccer performance and the prevention of injuries. Key topics include muscle strength, force production, and physiological factors that influence performance. The inclusion of keywords like “ACL reconstruction”, “knee injury”, and “prevention” highlights the emphasis on understanding and reduction of injury risks, particularly in the knee. The presence of “youth sports” suggests an interest in the developmental aspects of soccer biomechanics, ensuring that young athletes are trained safely and effectively.

Cluster 2 centers on the interaction between footwear, playing surfaces, and injury mechanisms. Keywords such as “cleats”, “artificial turf”, and “traction” indicate a focus on how different surfaces and footwear affect performance and injury risk. Issues like “ankle sprain”, “groin pain”, and “femoroacetabular impingement” suggest a detailed examination of specific injuries related to these interactions. The cluster also includes broader themes of neuromuscular control and perception, which are critical for adapting to different playing conditions.

Cluster 3 is primarily concerned with identifying and reducing injury risks. The frequent appearance of “ACL”, “knee injuries”, and “knee valgus” underscores the significant focus on knee health. The presence of “injury risk”, “risk factors”, and “screening” suggests an emphasis on preventive measures and the early detection of potential issues. The inclusion of “adolescents”, “female”, and “youth” highlights the importance of specialized approaches for different populations within soccer.

Cluster 4 focuses on head injuries and the technology used to monitor and prevent them. Keywords like “brain injury”, “concussion”, “head impact exposure”, and “heading” indicate a strong emphasis on understanding the biomechanics of head impacts in soccer. The use of “accelerometer”, “inertial measurement unit”, and “wearable sensors” reflects the technological advancements employed to measure and analyze these impacts. “Postural control” and “balance” are also critical components, as they influence a player’s sensitivity to head injuries.

Table 3. Categorization of key research themes in soccer biomechanics based on co-occurrence analysis.

Name of Cluster	Items	Keywords
Cluster 1: “Physical Performance and Injury Prevention”	27	ACL reconstruction, adolescent, asymmetry, athletic performance, ball velocity, countermovement jump, electromyography, fatigue, force, force platform, gender, hamstrings, isokinetic, knee injury, landing, muscle strength, peak torque, physiology, power, prevention, reliability, running, soccer, strength, torque, valgus, youth sports
Cluster 2: “Footwear and Surface Interaction”	21	ACL injury, ankle sprain, anticipation, artificial turf, athletic injuries, cleats, femoroacetabular impingement, foot, football, gait, gender differences, groin, groin pain, hip, kick, neuromuscular control, perception, plantar pressure, sports medicine, traction, velocity
Cluster 3: “Injury Risk and Screening”	19	ACL, adolescents, ankle, athletes, change of direction, female, ground reaction forces, injury prevention, injury risk, instep kick, knee, knee injuries, knee valgus, risk factors, screening, sport, stress fracture, youth
Cluster 4: “Head Injuries and Monitoring”	17	Accelerometer, balance, brain injury, concussion, female athletes, head impact exposure, head kinematics, heading, inertial measurement unit, lower extremity, mild traumatic brain injury, mouthpiece, postural control, repetitive head impacts, subconcussion, team sports, wearable sensors
Cluster 5: “Training and Rehabilitation”	16	Ankle injury, athlete, biomechanics, exercise, hamstring, hamstring injury, injury mechanism, jumping, kicking, magnetic resonance imaging, motor control, rehabilitation, sports, sports injury, training, video analysis
Cluster 6: “Performance Metrics and Movement Analysis”	14	Agility, cutting, EMG, ground reaction force, injury, joint moment, kinematics, kinetics, knee joint, sports performance, sprinting, three dimensional, turning, vertical jump
Cluster 7: “Advanced Biomechanical Analysis and Return to Sport”	13	Acceleration, ACL injury prevention, association football, biomechanical phenomena, coordination, deceleration, GPS, knee abduction moment, motion analysis, performance, return to sport, stiffness, technique

Cluster 5 revolves around training and rehabilitation practices. The keywords “rehabilitation”, “training”, “exercise”, and “motor control” suggest a focus on methods to improve performance and recover from injuries. The inclusion of “hamstring injury”, “ankle injury”, and “injury mechanism” highlights the importance of understanding specific injury types and their underlying causes. “Video analysis” and “magnetic resonance imaging (MRI)” are essential tools in both training and rehabilitation, providing detailed insights into movement patterns and injury diagnostics.

Cluster 6 deals with performance metrics and detailed movement analysis. The keywords “agility”, “cutting”, “sprinting”, and “vertical jump” indicate a focus on dynamic movements crucial for soccer performance. “Kinematics” and “kinetics” suggest a detailed analysis of the motion and forces involved in these movements. The frequent mention of “knee joint” and “injury” emphasizes the connection between movement analysis and injury prevention.

Lastly, cluster 7 is centered on advanced biomechanical analysis techniques and their application in injury prevention and performance enhancement. Keywords like “GPS”, “motion analysis”, and “biomechanical phenomena” highlight the use of sophisticated tools to monitor and analyze player movements. “Return to sport”, “performance”, and

“technique” indicate a focus on applying biomechanical insights to help athletes recover from injuries and enhance their on-field performance.

5. Discussion

The aim of this study was to conduct a bibliometric analysis of the scientific literature in soccer biomechanics. We used the Scopus database, identifying 951 relevant articles that were analyzed employing bibliometric techniques. Our results show an increasing trend in publications on soccer biomechanics in recent years. This can be explained by the recent advances in technology that have generated several new types of equipment to measure motion and inertial forces during human movement [69]. The fact that both the performance analysis of the citations of the sources and the co-citation analysis using sources as the unit of analysis highlight journals such as the “American Journal of Sports Medicine”, the “Journal of Sports Sciences”, and the “British Journal of Sports Medicine” as having a significant contribution suggests that research on soccer biomechanics is highly valued within the broader context of sports medicine. This is logical because biomechanical factors greatly influence running-related injury risk [70] and are also linked to contact injuries, such as concussions [71].

The co-authorship analysis using organizations as the unit of analysis reveals a notable trend: universities in the United States and Canada dominate the top positions. This may be attributed to several factors, including substantial research funding, well-established research programs, and a strong emphasis on interdisciplinary studies. On the other hand, the results of the co-authorship analysis using authors as the unit of analysis and the bibliographic coupling analysis using the documents as the unit of analysis show the collaborations among scientists. The importance of collaboration and networking in scientific research helps in productivity and the advancement of science [72,73].

Lastly, the clustering results derived from the co-occurrence analysis of author keywords provide a nuanced understanding of the diverse research themes within soccer biomechanics. Each cluster highlights a specific aspect of the field, reflecting its complexity and the necessity for a multifaceted approach. The prominent themes of injury prevention, performance enhancement, and the use of advanced technologies underscore the field’s significance in both academic and practical contexts [74–76]. Future research should continue to explore these themes, fostering interdisciplinary collaborations to advance the understanding and application of soccer biomechanics.

Despite the valuable information provided by this research, it is not without limitations. For example, the utilization of a single database, Scopus, may not capture all relevant publications in the field. Additionally, our analysis was limited by the availability and quality of data, given that some important studies might have been excluded due to database limitations. Future studies could benefit from incorporating data from multiple databases, such as Web of Science and PubMed, to provide a more comprehensive overview of the research field. Moreover, our analysis primarily focused on quantitative metrics, and future research could incorporate qualitative assessments to gain deeper insights into the content and impact of the research.

6. Conclusions

In summary, this study conducted a comprehensive bibliometric analysis of the scientific literature and offered a detailed overview of the existing literature, identifying key trends, influential researchers, and leading institutions. Utilizing VOSviewer software allowed for sophisticated visualization of bibliometric networks, enhancing the interpretation of complex data. The identification of seven distinct clusters provides valuable insights into different aspects of soccer biomechanics, highlighting the field’s complexity and practical relevance. The findings of this study hold significant importance for both the specialized scientific community and the broader public. For researchers, the comprehensive mapping of the literature can guide future studies, fostering interdisciplinary collaborations and advancing the understanding of soccer biomechanics. For practitioners,

including coaches and trainers, the insights gained from this research can be the guide for studying the scientific literature that concerns them with the aim of the development of evidence-based training programs and injury prevention strategies, ultimately enhancing player performance and safety. Overall, this bibliometric analysis underscores the growing interest and significant advancements in soccer biomechanics research, highlighting the importance of interdisciplinary collaborations and the integration of advanced technologies. The insights gained from this study will inform future research directions and support the development of innovative practices in soccer training and rehabilitation.

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