



REVIEW ARTICLE

Championing Olympic Excellence: A Bibliometric Analysis of Biomechanics Impacting Tennis Performance on the World Stage

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Abstract

Objectives. The study aims to comprehensively analyze the existing literature on the relationship between biomechanics and tennis performance, with a particular focus on enhancing Olympic accomplishment.

Materials and methods. Scopus was used to search three fields in each record: (1) Author's name, (2) Journal Name where the paper was published, (3) Total citations. Bibliometric analysis was employed as a component of the analysis. To obtain a comprehensive and accurate understanding, the data was analyzed and interpreted using several methods of data triangulation. VOSviewer software was applied to generate distance-based co-occurrence maps for bibliometric analysis and synthesis. The terms extracted from keywords, titles, and abstracts were categorized and organized based on their level of interconnectedness. The keywords "Biomechanics" and "tennis performance" are commonly employed in the study, and their meanings are often interpreted in different settings. The search yielded 240 papers and 6137 citations, which were used in the study conducted between 2000 and 2024.

Results. The study's findings identified "key authors, countries, and subject areas" contributing to the field of biomechanics research in tennis, emphasizing interdisciplinary collaboration and future research directions.

Conclusions. In conclusion, the study provides a foundation for continued research and innovation in championing Olympic excellence through biomechanics research in tennis.

Keywords: biomechanics, tennis performance, Olympics, bibliometric analysis, VosViewer.

Introduction

To attain Olympic excellence in tennis, it is necessary to thoroughly comprehend the biomechanical elements that impact performance at worldwide levels (Martin et.al., 2021). Although tennis players aim to achieve their highest level of physical fitness and technical proficiency, there still needs to be more knowledge regarding the specific biomechanical processes that contribute to optimal performance (Lambrich & Muehlbauer, 2023). These factors impede coaches, players, and sports researchers from fully exploiting the capabilities of biomechanics to optimize tennis performance at the highest levels (Papageorgiou, 2021). Hence, it is imperative to thoroughly examine and promote the importance of biomechanics in enhancing tennis performance at

worldwide levels, thereby contributing to the progress of Olympic excellence in tennis (Zhu, 2017).

The impact of biomechanics on tennis performance at the world level, especially in promoting Olympic excellence, is significant (Ferrandez et.al., 2021). Biomechanics, the scientific discipline that investigates the mechanical properties and behaviors of living beings, is essential for comprehending and enhancing the actions executed by tennis players (Brocherie & Dinu, 2022). Biomechanics offers useful insights for enhancing technique, power, and effectiveness on the court by analyzing the forces, angles, and kinematics associated with each stroke (Touzard et.al., 2019).

At the pinnacle of competition, even small modifications in a player's biomechanics can have a substantial impact on their performance (Wood et.al., 2023). Biomechanical analysis assists tennis players in optimizing their strokes for increased speed, precision, and consistency across several aspects of their game, such as the serve, forehand, backhand, and volley (Pardiwala et.al., 2020). Understanding the ideal

racket angle and contact point for a serve can result in faster serves with enhanced accuracy, providing players with a competitive advantage over their opponents (Li et.al., 2023).

In addition, biomechanics plays a crucial role in identifying possible injury hazards and assisting in the development of methods to prevent injuries (Hayes et. al., 2023). Through the examination of the biomechanics of motions, coaches, and sports scientists can create training programs that reduce bodily strain and enhance performance (Yu et. al., 2018). In the sport of tennis, which is physically demanding and intensive, injuries caused by repetitive movements and overexertion are common (Suprunenko, 2021). This makes it even more crucial to devote attention to this concern.

In the worldwide arena of Olympic competition, the incorporation of biomechanics into training programs and coaching methods is becoming more prevalent (Brito et al., 2023). Olympic winners utilize biomechanical data to precisely refine their technique, optimize their physical fitness, and strategically plan their gameplay in order to surpass their opponents (Pluim et al., 2023). Consequently, sportsmen demonstrate extraordinary accomplishments on the tennis court, shattering records, and mesmerizing spectators with their agility and talent (Fletcher et al., 2021).

Biomechanics plays a crucial role in tennis performance at the global level, particularly in the quest for Olympic success. Its significance cannot be exaggerated (Yeadon & Pain, 2023). By employing biomechanical analysis and implementation, athletes can enhance their abilities, minimize the risk of injuries, and attain unprecedented levels of success, thereby establishing themselves as champions in the realm of tennis (Deng et al., 2022).

Bibliometric analysis, a method that employs quantitative techniques to examine a large amount of published research in a specific field (Donthu et al., 2021; Mukherjee et.al., 2022), can be utilized as a rigorous approach to increase the objectivity of the study. The study aims to provide a concise overview of research trends, serving as a guide for future research endeavors. Therefore, the study aims to review and provide an overview of Biomechanics Impacting Tennis Performance on the World Stage research published in top-tier journals using bibliometric analysis, contributing seminal insights to the following research questions (RQs):

- Which author and journals have published the most number of studies on the subjects of biomechanics and tennis performance?
- Which papers on the subject of biomechanics and tennis performance have received the most number of citations?
- What are the leading keywords in papers about the fields of biomechanics and tennis performance?
- Which countries display strong collaboration networks in the field of biomechanics and tennis performance?

The purpose of the study is to thoroughly examine the current body of literature on the relationship between biomechanics and tennis performance, specifically with an emphasis on promoting Olympic success. The study aims to utilize bibliometric analysis with VosViewer to determine the authors and journals that have published the highest number of articles on biomechanics and tennis performance. The study will help to identify the primary contributors to the discipline. Moreover, the study will identify the publications

that have garnered the highest number of citations, so highlighting the most prominent works in the field. The study will uncover the main subjects and areas of concentration in the fields of biomechanics and tennis performance by finding prominent keywords in the literature. Moreover, the study investigates the collaboration networks among countries, providing insights into robust connections and possible opportunities for cooperation. This bibliometric analysis offers significant insights to researchers, coaches, and athletes aiming to improve tennis performance at the Olympic level. It contributes to the progress of sports science and the pursuit of Olympic excellence.

Material and Methods

The study implies that researchers prioritize the most relevant papers pertaining to their investigation on “Championing Olympic Excellence: A Bibliometric Analysis of Biomechanics Impacting Tennis Performance on the World Stage”. The Scopus database was selected as a reputable source for retrieving citation data due to the importance of understanding the function of biomechanics in tennis play. Understanding the principles of biomechanics is one of the primary goals. This is essential because the terms “Biomechanics” and “tennis performance” are commonly used yet can be understood differently depending on the circumstances. The search produced 240 papers and 6137 citations, which were used in the study conducted from 2000 to 2024. This extensive dataset serves as a strong basis for assessing the influence of biomechanics on tennis performance at the global level. Figure 1 illustrated below shows the flow of information during different phases of a systemic screening process.

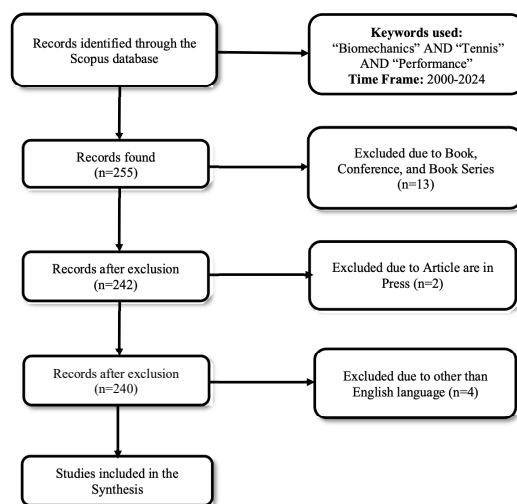


Fig. 1. Visual representation of the flow of information through the different phases of a systemic screening process. Source: Self-prepared by Author

The PRISMA model in Figure 1 provides a structured and transparent overview of the screening process for identifying relevant studies. Initially, 255 records were identified through the Scopus database using specific keywords related to “Biomechanics,” “Tennis,” and “Performance” within the timeframe of 2000-2024. From this initial set, 13 records were excluded as they were from book, conference, or book series

Table 1. Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Keywords	Records conferring the relationship between biomechanics and tennis performance	Records excluded in which variables have no relation
Type of Literature	Journals, Review Articles	Book series, book, chapter in book
Language	English	Other than English
Timeframe	Concerning 2000-2024	<2000
Paper Stage	Final stage	Excluded that are on the running stage

publications, and an additional 2 records were excluded because they were articles in press, not yet published. After applying these exclusion criteria, 242 records remained. Subsequently, four records were further excluded due to being in languages other than English, resulting in a total of 240 records. Finally, 236 studies were included in the synthesis, meeting the criteria for relevance and forming the basis for analysis. Overall, the PRISMA model illustrates how the initial pool of records is progressively refined to select studies for synthesis and analysis, ensuring a systematic and rigorous approach to literature review.

Scopus was used to search three fields in each record: (1) Author's name, (2) Journal Name where the paper was published, (3) Total citations. Bibliometric analysis was utilized as a component of the analysis. In order to obtain a comprehensive and accurate understanding, the data was analyzed and interpreted utilizing several methods of data triangulation. VOSviewer software was utilized to generate distance-based co-occurrence maps for bibliometric analysis and synthesis. The terms extracted from keywords, titles, and abstracts were categorized and organized based on their level of interconnectedness (Van Eck & Waltman, 2010).

The supplementary Table 1 provides a comprehensive overview of the criteria used to select papers for the study on the biomechanics that impact tennis play. The inclusion requirements in the "Criterion" column require that records establish the relationship between biomechanics and tennis performance. This ensures that only papers that are directly pertinent to the study topic are incorporated. Conversely, the exclusion criteria specify that records are eliminated if variables are unrelated to the issue. This process aids in eliminating unnecessary papers that may not provide any valuable insights into the investigation. The literature type

considered includes journals and review articles, which are known for their rigorous and concentrated approach toward specific issues. Excluding book series, individual books, and book chapters are necessary as they may lack the necessary depth or relevance required for the study.

Only publications written in English are included in the study, as the researchers performing the study are proficient in English. Papers written in languages other than English are not included because they may present language barriers. The study encompasses a timeframe from 2000 to 2024, which allows for the inclusion of recent research while also catching a substantial volume of relevant literature. Papers published prior to 2000 are removed due to the potential insufficient relevance to current trends or breakthroughs in the subject. Finally, papers that are in the final stage are included, while those that are in the running stage are excluded. This guarantees that only research that has been finished and evaluated by experts is taken into account for the analysis.

Citation Analysis

The study "Championing Olympic Excellence: A Bibliometric Analysis of Biomechanics Impacting Tennis Performance on the World "Stage" offers general research statistics, including the "number of papers published each year, the most referenced documents, the significant authors, the prominent journals, and the leading countries in the field".

Table 2 above presents a summary of citations, specifically focusing on the top 10 most often cited publications on the subject. The information provided above serves as the foundation for a thorough analysis of the impact of biomechanics on tennis performance and the difficulties encountered by tennis players at the global level.

Table 2. Citation analysis of different authors

Sr. No.	Authors	Source/journal	Total Citations
1.	Liao and Masters (2001)	Journal of Sports Sciences	263
2.	Lees (2003)	Journal of Sports Sciences	228
3.	Schack and Mechsner (2006)	Neuroscience Letters	161
4.	Palut and Zanone (2005)	Journal of Sports Sciences	126
5.	Huys, Cañal-Bruland, Hagemann, Beek, Smeeton, and Williams (2009)	Journal of Motor Behavior	124
6.	Girard, Micallef, and Millet (2005)	Medicine and Science in Sports and Exercise	116
7.	Bahamonde (2000)	Journal of Sports Sciences	115
8.	Kibler, Wilkes, and Sciascia (2013)	Clinics in Sports Medicine	115
9.	Rumball, Lebrun, Di Ciacca, and Orlando (2005)	Sports Medicine	112
10.	Mark Williams, Huys, Cañal-Bruland, and Hagemann (2009)	Human Movement Science	109

An analysis of author citations provides valuable insights into the main subjects and issues discussed in the field of biomechanics that impact tennis performance. Author-based evaluation offers initial insights into the possible impacts on the study field. The study conducted by Liao and Masters (2001) has received 263 citations in the Journal of Sports Sciences. The study conducted two experiments to investigate the idea that learning by analogy activates characteristics of an implicit mode of motor learning. A study conducted by Lees (2003) that examined the recent advancements in the utilization of scientific principles in racket sports has garnered considerable interest. The paper was published in the Journal of Sports Sciences and included 228 citations. The paper "Representation of motor skills in human long-term memory" by Schack & Mechsner (2006) had 161 citations as reported in Neuroscience Letters.

Palut and Zanone (2005) conducted a study in which they utilized self-organization theories and dynamical system models to examine the collective behavior of tennis players. Their research garnered 126 citations in the Journal of Sports Sciences. In their study, Huys et al. (2009) investigated the significance of local dynamical information in predicting the direction of tennis shots. Their research garnered 124 citations in the Journal of Motor Behavior. Girard et al. (2005) published a scholarly study titled "Lower-limb Activity during the Power Serve in Tennis: effects of Performance Level" in the journal Medicine and Science in Sports and Exercise and has been cited 116 times. Bahamonde (2000) highlighted the significance of "Changes in angular momentum during the tennis serve," which has received 115 citations in the Journal of Sports Sciences.

Kibler et al. (2013) published a scholarly study titled "Mechanics and Pathomechanics in the Overhead Athlete" in the journal Clinics in Sports Medicine. The publication has received 115 citations. A study conducted by Rumball et al. (2005) examined the prevalent injuries documented in the literature, specifically focusing on musculoskeletal issues in the lower back, ribcage, shoulder, wrist, and knee. The study was published along with 112 citations in the field of Sports Medicine. The manuscript, authored by Williams et.al. (2009), investigates the mechanisms involved in anticipating groundstrokes in tennis. This is done by manipulating the dynamic information given at various body regions, including the racket. The study has garnered 109 citations in the journal Human Movement Science. The analysis offers initial insights into the most impactful research and probable avenues for future studies in the subject of biomechanics in tennis performance at the global level.

Yearly Publication

The chart in Figure 2 illustrates the total number of publications on biomechanics and tennis performance that have been indexed in Scopus from the year 2000 to 2024. Between 2000 and 2004, the total number of publications is rather limited, with an annual publication count ranging from 2 to 7 pieces. This indicates a narrow concentration on the subject matter in this timeframe.

Between 2005 and 2014, the number of publications varied but remained consistently low, with an annual range of 5 to 13 papers. This suggests a gradual albeit moderate rise in study interest regarding the relationship between

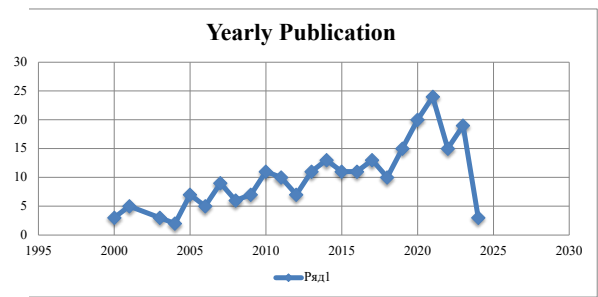


Fig. 2. The number of total publications on biomechanics and tennis performance indexed in Scopus 2000-2024

biomechanics and tennis performance. In 2015, there was a little increase in the number of publications, with 11 papers. This was followed by a consistent pattern in the subsequent years, with an average of 10 to 15 papers being published annually. In 2021, there is a notable increase in research efforts in biomechanics and tennis performance, as evidenced by the peak in publishing with 24 papers.

Nevertheless, in the years 2022 and 2023, the quantity of publications experiences a minor reduction to 15 and 19 papers respectively, suggesting a possible stabilization or tiny fall in research production compared to the preceding year. By 2024, there are merely three articles, suggesting that either the trend observed in prior years persists or it is too early in the year to obtain a comprehensive overview of scientific production. In general, the data indicates an increasing fascination in the field of biomechanics and study on tennis performance for the last twenty years, however, there have been variations in the amount of research conducted from year to year.

Top Authors

The graphical data in Figure 3 represents the top authors and the number of documents they have published in the field.

The above table 3 presents the Top authors and the number of documents they have published in the field. Reid, M. is at the top of the list with 27 articles, demonstrating a noteworthy impact on tennis performance through their considerable contributions to the scientific research of biomechanics. Whiteside, D. has published 13 papers, demonstrating a significant amount of research output. Gu, Y., Martin, C., Bideau, B., Baker, J.S., Elliott, B., Iino, Y., Kulpa, R., and Rogowski, I. have a smaller number of

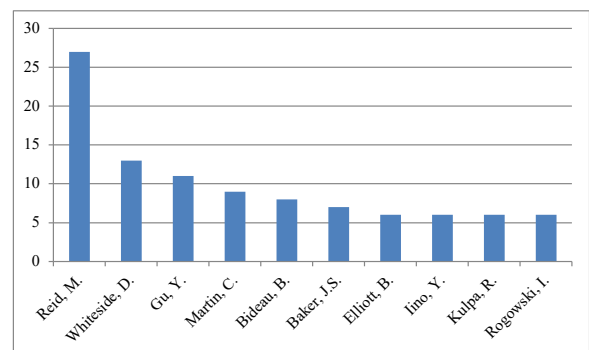


Fig. 3. Top authors and the number of documents they have published in the field

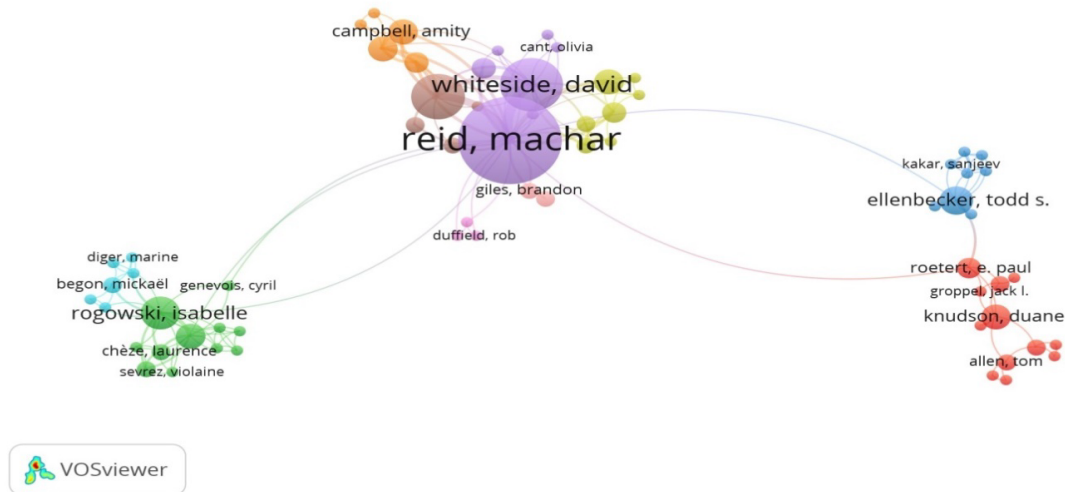


Fig. 4. Co-authorship between Authors

publications but still make a significant impact in the area, with 6 to 11 articles each.

The cluster diagram depicted in Figure 4 indicates that the authors have been actively involved in researching biomechanics and tennis performance, thereby making significant contributions to the existing knowledge in this field. Their work is likely to encompass a wide range of biomechanical elements, such as the analysis of techniques, prevention of injuries, optimization of equipment, and enhancement of performance in the sport of tennis. Their combined endeavors have probably played a significant role in the progress and understanding of how biomechanics impacts tennis performance, leading to valuable insights and developments in the discipline.

Subject Area Analysis

Figure 5 represents the allocation of research papers in different fields of study pertaining to the influence of biomechanics on tennis performance. The subject areas of Medicine and Health Professions have the highest occurrence, with 180 and 143 documents respectively. This suggests a notable emphasis on the medical and health-related elements of biomechanics in tennis, encompassing injury prevention, rehabilitation, and athlete health management.

The fields of Biochemistry, Genetics, and Molecular Biology are represented by 38 documents, indicating a significant focus on the molecular factors that drive biomechanical processes in tennis play. The areas of Psychology, Engineering, and Neuroscience have a lower number of documents, specifically 21, 19, and 18 respectively. These subject areas likely investigate elements such as cognitive readiness, equipment engineering, and neurological systems implicated in tennis performance.

The fields of Multidisciplinary, Computer Science, and Social Sciences all contain a relatively small number of documents, suggesting that scholars from different disciplines are contributing to the study of biomechanics in tennis from different angles. The field of Environmental Science has the lowest number of documents, specifically 10, indicating a relatively lower emphasis on studying the impact of environmental conditions on tennis biomechanics compared to other topic areas.

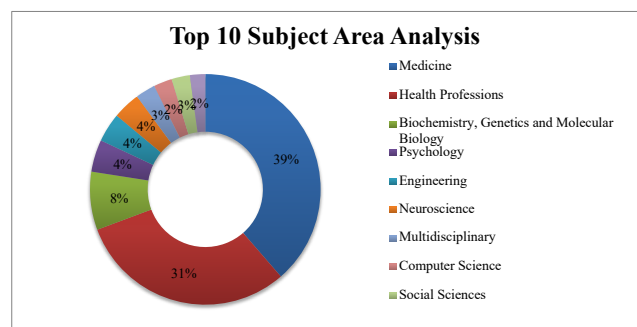


Fig. 5. Distribution of documentation in various subject areas

Overall, the data demonstrates that biomechanics research in tennis is interdisciplinary, including multiple domains to provide a thorough understanding of performance determinants and possible solutions.

Country Analysis

The data in Figure 6 represents the top countries and regions in research collaboration related to biomechanics and tennis performance from 2000 to 2024.

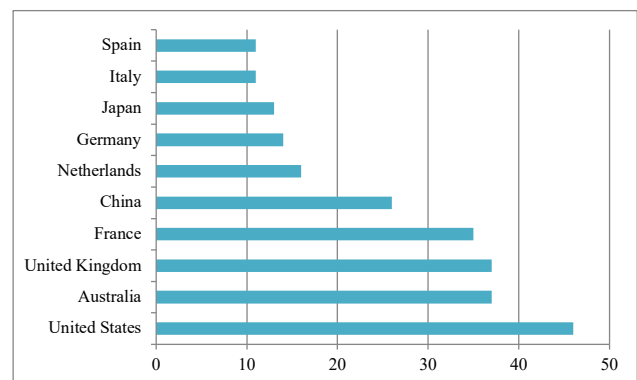


Fig. 6. Top countries and regions in research on documents

performance, with contributions from multiple countries across the globe.

Co-Occurrence of Keywords

Figure 8 illustrates the clustering of keywords based on their co-occurrence. An extensive analysis of keyword co-occurrence has been conducted to understand the development and progression of research on “The Impact of Biomechanics on Tennis Performance on the World Stage.” In order to carry out a study that is significant, a minimum requirement of five instances for a specific term has been employed. As a consequence, there was a grand total of 154 things out of the overall 1893 keywords. Firstly, the presence of keywords depicted with large circles indicates their frequent usage in scholarly articles on this particular topic. It is evident that the circles representing “biomechanics, physiology, task performance, physical performance, females, reviews, muscle training, psychomotor performance, and muscular strength” phrases are greater compared to the circles representing other categories. Less often occurring keywords include “racket sports, elbow injuries, physical activities, torque, lifespan, aerobic activity, and sports” terminology. In the future, scholars may conduct research using these high-frequency keywords to track present trends or explore new possibilities based on less frequently occurring terms.

Discussion

The objective of the study was to comprehend the research collaboration patterns in the fields of biomechanics and tennis performance between the years 2000 and 2024. The study utilized the Scopus database to identify 240 papers and 6137 citations, creating a comprehensive dataset for analysis. The inclusion criteria were designed to select only pertinent papers, specifically targeting journals and review articles published in English from 2000 to 2024. By conducting citation analysis, it was determined that the most influential authors on this subject are Reid, M., who has published 27 papers, and Whiteside, D., who has published 13 papers.

The citation review emphasized prominent articles, including those authored by Liao and Masters (2001) and Lees (2003), which indicated substantial focus on subjects such as motor learning and the utilization of scientific principles in racket sports. Moreover, the allocation of data across different subject areas demonstrated a significant concentration on Medicine and Health Professions, suggesting a prioritization of athlete health and the prevention of injuries. The investigation also identified the foremost countries in scientific collaboration, with the United States taking the lead, followed by the UK and Australia. In addition, an analysis of keyword co-occurrence revealed significant terms such as biomechanics, physiology, and task performance, indicating areas of focus and prospective avenues for future research. Overall, the study offers useful insights into the interdisciplinary aspects of biomechanics research in tennis and its implications for enhancing athletic performance at the global level.

The objective of our study was to analyze the patterns of research collaboration in the fields of biomechanics and tennis

performance during the past 24 years using bibliometric analysis. Daud et al. (2021) aimed to perform a bibliometric analysis in the field of optimization in sports by examining works published from 2011 to 2020. Ultimately, the study presented an overview of the existing body of literature on the subject of optimization in sports within the past decade. In a similar vein, Safari and colleagues (2022) conducted a study to examine the use of network embedding-based visualization in analyzing data science in sports activities using a large-scale dataset. A total of 805 articles published between 1997 and 2020, written by 3141 authors from 1181 institutions across 60 countries, were collected using WOS using R, Cite Space, and VOS viewer.

The number of papers on elbow pain (EP) in overhead sports is growing. Li et al. (2022) performed a bibliometric analysis to discover the research patterns about EP in overhead sports. The VOSviewer software was used to extract and evaluate several metrics from 455 qualified papers, including author name, article title, publishing journal, keywords, organization, publication country/region, and the sum of times cited. This analysis yielded the primary research results for three aspects. Bibliometrics, scientometrics, and informetrics are disciplines that primarily study the statistical evaluation of science by analyzing publications and citations. There is a diverse range of citation metrics that offer insights into the impact or influence of journals, specific articles, and authors. Dindorf et al. (2022) conducted a bibliometric analysis of highly cited articles in the journal *Sports Biomechanics* to investigate the hypothesis of the publication's excellent reputation among scholars. A systematic search was conducted in three prominent databases, namely Google Scholar, Scopus, and Web of Science, to identify the articles with the highest number of citations published in the field of Sports Biomechanics during the initial fifteen-year period (2002-2016) of its publication.

Conclusions

In conclusion, biomechanics has a substantial impact on shaping tennis performance. Through an in-depth understanding of the body's movement and its interaction with equipment, players can enhance their techniques, strength, and precision on the court. By conducting biomechanical analysis, athletes and coaches may pinpoint specific areas that need development, enhance stroke mechanics, and proactively avoid injuries. The comprehension of biomechanics not only improves tennis performance but also adds to the overall progress of the sport. By integrating biomechanical principles into training and coaching tactics, players may strive to achieve enhanced consistency, efficiency, and effectiveness in their game. The study of biomechanics in tennis offers useful insights that can assist players in maximizing their abilities and attaining success at the global level.

The bibliometric analysis of biomechanics' impact on tennis performance at the global level provides significant insights into the scientific field. The analysis identified the key authors, journals, countries, and subject areas that are making significant contributions to this field. Using VOSviewer software, the study investigated co-authorship networks and keyword co-occurrence to identify significant

trends and areas of interest. The notable representation of countries such as the United States, Australia, and the United Kingdom highlights the worldwide interest in this subject.

Suggestions involve promoting global cooperation to further enhance studies in the field of biomechanics and improve tennis play. Furthermore, advocating for multidisciplinary methodologies, namely in fields like psychology and engineering, has the potential to enhance comprehension of the intricate interplay between biomechanics and athletic prowess. Potential future avenues of exploration could include examining nascent technology, such as wearable sensors and virtual reality, in order to augment training methodologies and optimize player performance. In summary, this study establishes a basis for further investigation and advancement in promoting Olympic greatness in tennis through biomechanics research.

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Conflict of interest

The authors declare no conflict of interest regarding the publication of this research paper.

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Досягнення олімпійської досконалості: Бібліометричний аналіз біомеханіки, що впливає на результативність гри у теніс на світовій арені

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 10 с., 2 табл., 8 рис., 36 джерел.

Мета дослідження. Дослідження спрямоване на проведення комплексного аналізу наявних літературних джерел щодо взаємозв'язку між біомеханікою та результативністю гри у теніс, з певним акцентом на підвищення рівня олімпійських досягнень.

Матеріали та методи. За допомогою наукометричної бази даних Scopus було проведено пошук за трьома параметрами у кожному записі: (1) ім'я автора, (2) назва журналу, в якому опубліковано статтю, (3) загальна кількість цитувань. В якості складової аналізу було застосовано бібліометричний аналіз. Для отримання комплексного і точного розуміння

інформації, було проведено аналіз та інтерпретацію даних з використанням декількох методів їх триангуляції. З метою створення дистанційних мап спільної зустрічальності для бібліометричного аналізу та синтезу було застосовано програмне забезпечення VOSviewer. Терміни, отримані з ключових слів, назв і анотацій, були класифіковані та систематизовані відповідно до рівня їх взаємопов'язаності. У дослідженні часто використовуються ключові слова «біомеханіка» і «результативність гри у теніс», значення яких часто інтерпретуються в різних контекстах. За результатами пошуку було знайдено 240 статей і 6137 посилань, які було використано в дослідженні, проведеному в період між 2000 і 2024 роками.

Результати. Результати дослідження визначили «ключових авторів, країни та предметні області», що сприяють дослідженню в галузі біомеханіки тенісу, підкреслюючи міждисциплінарну співпрацю та напрямки для подальших наукових досліджень.

Висновки. Таким чином, дане дослідження забезпечує основу для подальшого наукового вивчення та інновацій у досягненні олімпійської досконалості шляхом проведення біомеханічних досліджень у тенісі.

Ключові слова: біомеханіка, результативність гри у теніс, Олімпійські ігри, бібліометричний аналіз, VosViewer.

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