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The trend and evolution of training in volleyball: A bibliometric analysis of the last five years

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ABSTRACT

Background Problems: The main focus on improving the performance of volleyball players and teams is through training that covers various aspects. **Research Objectives:** This study aims to analyse and explain trends and developments in the scientific literature regarding volleyball training over the past five years while identifying the most frequently featured training concepts, methods, and techniques in bibliometric studies in the field over the same period. **Methods:** Publication records between 2019 and 2023 were extracted from Scopus and the Web of Science, after which the bibliographic data set was administered using ScientoPy and VOSviewer. A term search was conducted with the keywords “training” OR “exercise” OR “practice” AND “volleyball”. **Findings and Results:** Results showed a total of 1.105 papers were published over the past five years, with 2022 recording the highest number of articles. The *International Journal of Environmental Research and Public Health* was the most prolific source, with 45 papers, and Clemente, F. M., was the most published author. The United States was the leading contributor in this research domain with 137 papers. The most frequently highlighted training concepts, methods, and techniques in this topic included vertical jumps, biomechanics, body composition, muscle strength, power, endurance training, injury prevention, agility, balance, and countermovement jumps. **Conclusion:** The results of this study emphasise the importance of developing training-related knowledge in volleyball. For future research contributions and recommendations, some things that can be taken into consideration are increased interdisciplinary studies, more applied research, use of technology in training, focus on health and injury prevention, comparative studies between countries, and research related to youth training in volleyball. This research provided a strong foundation for further development in understanding and optimising the training of volleyball players in the future.

Keywords: Training; volleyball; review; bibliometric



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INTRODUCTION

The sport of volleyball has become a global phenomenon that attracts players, coaches, and researchers in an effort to improve the performance of volleyball athletes. It is a game that demands teamwork and complex individual skills (Liu, 2023; Yang, 2023). Since its invention in 1895, volleyball has been a competitive sport that continues to adapt to the development of technology and science (Zhang, 2020). Therefore, understanding the trends and evolution in volleyball training in the context of science and technology is crucial, especially in the face of increasingly fierce competition and the desire to achieve the best performance.

Training has a central role in honing skills and preparing athletes for competition (Yang, 2023). The main focus on improving the performance of volleyball players and teams is training that covers various aspects. This includes serving, passing, attacking, and defence techniques (Issa & El-Tayeb, 2017; Rajidin et al., 2022). In addition, training includes the development of physical strength, endurance, and flexibility that are important in the complex movements of volleyball (Iermakov et al., 2022). Mental aspects are also highly relevant, helping athletes manage competitive pressure, improve focus, and develop mental resilience (Beattie et al., 2019; Musa et al., 2021). Deeply understanding volleyball training is key to achieving maximum performance in this sport.

In recent years, research in the field of volleyball training has grown rapidly, with a significant number of scientific publications on this topic (Akazawa et al., 2019; Guo, 2021; Pereira et al., 2015). Bibliometric research has proven to be a very useful tool in understanding trends and evolution in scientific literature, as exemplified by the works of (Matcharashvili et al., 2014; Memon et al., 2020). By analysing publication and citation trends, leading authors, institutions, countries, and keywords, bibliometric analysis provides insight into the current state of research and helps researchers avoid duplication of efforts (Perdima et al., 2022a; Perdima et al., 2022b). Therefore, consequently, the growth of scientific investigations makes this scope a subject of interest in bibliometric studies.

Research in the field of volleyball training is generally empirical (Kutáč et al., 2020; Xu & Liu, 2021), literature review (Closs et al., 2020; da Silva Pereira et al., 2017; Machado et al., 2018; Oliveira et al., 2020; Silva et al., 2019; Villarejo-García et al., 2023), and meta-analysis (Ramírez-Campillo et al., 2020, 2021; Suárez et al., 2020). However, so far, the scientific literature specifically examining the trends and evolution of volleyball training through a bibliometric approach is limited, and there is only one study conducted by (da Silva Lima et al., 2023). The study was limited to the last decade (2012–2022) and only focused on discussing match analysis in indoor and beach volleyball. Therefore, this knowledge gap is an important reason why this study needs to be conducted.

This study offers a unique contribution with a bibliometric approach to analysing the recent scientific literature on volleyball training. This assists us in identifying trends that may not have been seen before and provide deep insight into the development of knowledge in this field. More so, a better understanding of these trends has significant urgency for helping players and coaches develop more effective training strategies. Within this framework, the main research question is: (i) What are the trends and evolution in the scientific literature on volleyball training over the past five years? (ii) What concepts, methods, and training techniques are most frequently highlighted in bibliometric studies within the field of volleyball over the same period?. The purpose of this study is to answer these questions by analysing recent publications related to volleyball training, identifying any knowledge gaps that may exist, and outlining the implications of the results of this study for players, coaches, and future researchers.

METHOD

We conducted full searches of the popular Scopus and Web of Science (WoS) databases to find high-quality, globally-focused scientific research. Then, we combined the two sets of data (Abdullah, 2021; Santamaria-Granados et al., 2021; Sweileh, 2020; Yang et al., 2021). The search design for Scopus and WoS article metadata is shown in Figure 1. On November 4, 2023, a term search was conducted in the Scopus and WoS databases to retrieve article metadata for which the search strings were “training” OR “exercise” OR “practice” AND “volleyball”. Preliminary search results show that studies on training in volleyball totaled 1609 papers. Furthermore, the researchers filtered the document types, which were limited to journal articles and proceedings

articles, and the search was also limited to English-language documents. Finally, 1480 articles were identified (2019–2023): 680 from the WoS and 800 from Scopus.

The bibliographic datasets were pre-processed using ScientoPy (Daharis et al., 2023; Ruiz-Rosero et al., 2019). After which VOSviewer (Perdima et al., 2022b; Van Eck & Waltman, 2019) was employed to build co-occurrence maps of the volleyball training-related terms. From the ScientoPy results, 375 duplicated documents were found, consisting of the WoS database (1 document) and Scopus (374 documents), so the number of papers after removing duplicates is 1105. The major contributors (author, university, and source name) were then mapped, and keyword occurrence analysis was used to determine the publication trends, from which the most prominent themes or topics were identified. This bibliometric review is based on the selection strategy and research protocol adapted from the PRISMA flow diagram (Shamseer et al., 2015), as shown in Figure 1.

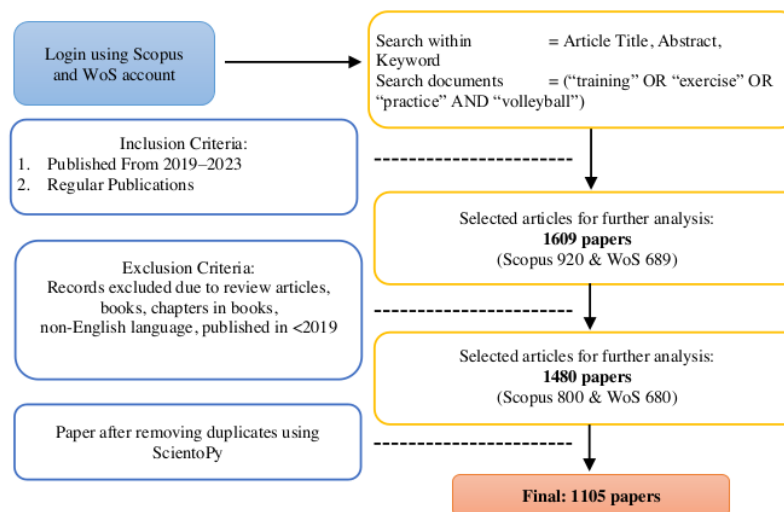


Figure 1. Search Design for Scopus and WoS Article Metadata

RESULTS AND DISCUSSION

1. What are the trends and evolutions in the scientific literature on volleyball training over the past five years?

a. Publication Trends

The annual distribution data showed a significant upward trend in volleyball training research over the past five-year period. In 2019, there were 143 papers related to this topic, and the number continued to increase consistently until it reached 275 papers in 2022. 2022 was the year with the highest number of publications over the observed period. This may indicate that the topic of coaching in the sport of volleyball is gaining more and more attention from researchers and sports practitioners. Despite the significant increase from 2019 to 2022, there was a decrease in the number of publications in 2023 (191 papers). This could be due to various factors, such as the impact of the COVID-19 pandemic or a change in research focus within the scientific community. Despite the decrease in 2023, the data reflects that training in the sport of volleyball has become an increasingly important and interesting research topic for the scientific community over the past five-year period.

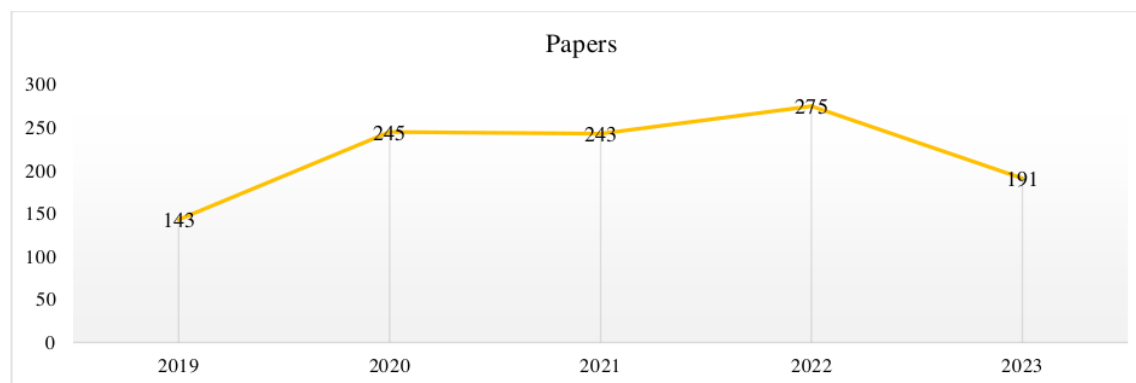


Figure 2. Trends in Training Publications in Volleyball (2019–2023)

b. Sources

In this bibliometric study, we identified 1,105 research publications related to coaching in volleyball from the Scopus and WoS databases. This research was spread across 401 sources, consisting of journals and conference proceedings. The key points in this analysis are contained in Table 1, which details the top 10 journals with the highest number of publications in the field of coaching volleyball. The most prolific journal was the “International Journal of Environmental Research and Public Health” with a contribution of 45 papers, demonstrating the important role this journal plays in highlighting this topic in the scientific literature. The second most productive journal was the “Journal of Physical Education and Sport” with 41 papers, and the third journal was the “Journal of Strength and Conditioning Research” with 34 papers. This analysis also highlights the diversity of sources where training research in volleyball is published, covering a wide range of aspects, from physical to psychological. The identification of these key sources provides important insights for researchers and practitioners alike and offers a solid basis to further explore this topic in a bibliometric context, as well as opportunities for collaboration and further research in the sport of volleyball.

Table 1. The 10 Most Productive Sources

Pos	Source Title	Total	AGR	ADY	PDLY	hIndex
1	International Journal of Environmental Research and Public Health	45	-5.5	11.5	51.1	10
2	Journal of Physical Education and Sport	41	-1.0	8.0	39.0	6
3	Journal of Strength and Conditioning Research	34	-0.5	6.5	38.2	12
4	Revista Brasileira De Medicina Do Esporte	31	6.5	10.5	67.7	3
5	Journal of Human Sport and Exercise	25	0.0	1.5	12.0	5
6	Revista Iberoamericana De Psicologia Del Ejercicio Y El Deporte	22	2.0	9.5	86.4	0
7	International Journal of Human Movement and Sports Sciences	19	-3.5	4.0	42.1	3
8	Frontiers in Psychology	18	-3.0	1.5	16.7	6
9	Applied Sciences-Basel	17	-1.0	4.0	47.1	5
10	Journal of Sports Medicine and Physical Fitness	15	-0.5	3.0	40.0	4

c. Authors

In this bibliometric study, we identified a total of 2,584 authors who have contributed to the training research literature in volleyball. In the author's analysis, several individuals stood out in terms of their contributions. Clemente, F. M., leads in the number of publications with 11 papers, demonstrating his focus and dedication to enriching the scientific literature on training in volleyball. This is followed by Barriel, G. P., and Garcia de Alcaraz, A., who have each contributed nine papers. The strong contributions of these authors reflect the importance of their role in developing knowledge in volleyball training. This author analysis provides important insights into the individuals who have played a role in the scientific literature on coaching in volleyball and can provide a basis for the assessment of individual contributions, identification of research trends, and potential collaboration opportunities within this scientific discipline. Furthermore, it also helps to appreciate the role of the most prolific authors in furthering our understanding of the sport of volleyball and

provides a basis for continued research within this field. Further explanation and visual representation of these findings can be seen in Figure 3.

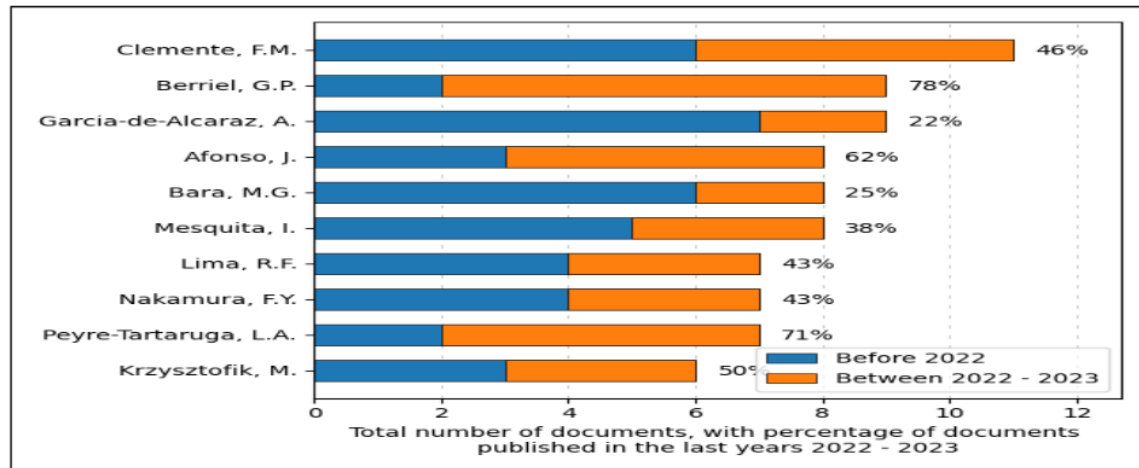


Figure 3. Top 10 Author in Several Publication

d. Country

In analysing author affiliations by country, we gained an important understanding of the distribution of training research in volleyball at a global level. The results, as reflected in Figure 5, highlight some key findings. The United States was the leader in research contributions with 137 papers, indicating the key role of the United States in the development of understanding of training in volleyball. This was followed by China with 121 papers, indicating a strong interest in this research in that country. Brazil, Spain, and Italy also had significant contributions, with 116, 92, and 81 papers, respectively. In addition, analysis of the years 2022–2023 revealed the dominance of China, producing over 50% of all papers published on coaching in volleyball, reflecting significant growth in research contributions from China over the period. These findings provide a rich understanding of the role of specific countries in the development of knowledge on coaching in volleyball and provide a solid basis for cross-border cooperation and knowledge exchange at a global level. Furthermore, these results highlight the importance of international cooperation and collaboration in developing an understanding of coaching in volleyball at a global level.

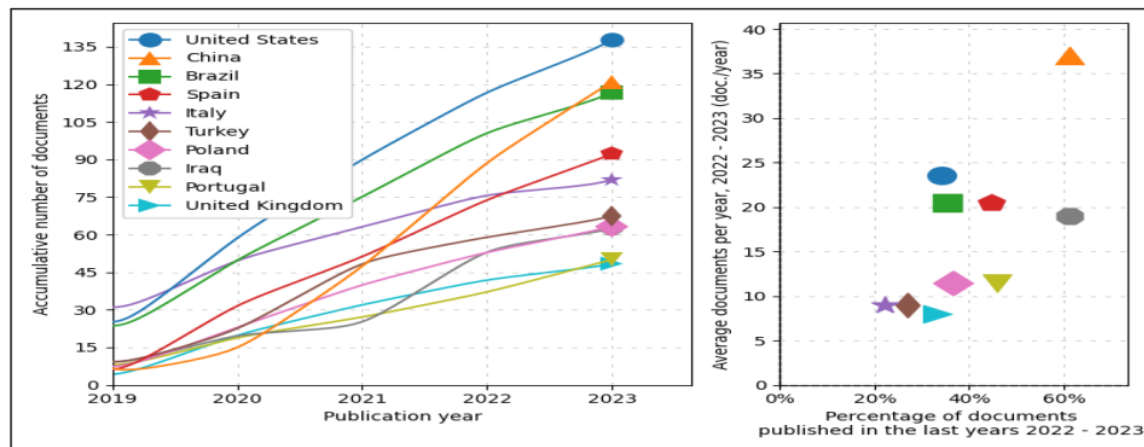


Figure 4. 10 Countries That Published Papers on Training in Volleyball

studies within the field of volleyball over the same period?

From the results of the bibliometric analysis, we identified ten author keywords that consistently appear in the training research literature in volleyball, which can be seen in Figure 6. Each keyword reflects an important aspect of knowledge development and player performance in this sport. Keywords such as “Vertical Jump” emphasise the importance of vertical jumping ability in various aspects of the game, including attacks and blocks. “Biomechanics” emphasises the role of biomechanical analysis in the understanding of technique and player performance. The concept of “Body Composition” highlights the relationship between body composition and athlete performance. In addition, “Muscle Strength” and “Power” show that research often emphasises improving muscle strength and power as key elements in the training of volleyball players. “Resistance Training” emphasises the importance of training with weights in achieving these goals. Research also often looks at “Injury Prevention” as a key focus, given the risk of injury in this sport. “Agility” and “Balance” are important aspects of the game, and training techniques are often discussed in the literature. Finally, “Countermovement Jump” reflects attention to jumping techniques in the game. This analysis provides a rich insight into the concepts, methods, and techniques that dominate research in volleyball training and will assist coaches and researchers in designing more effective training programmes as well as fostering knowledge development within the sport.

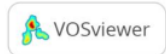


Figure 5. Network Visualisation Map of Authors' Keywords

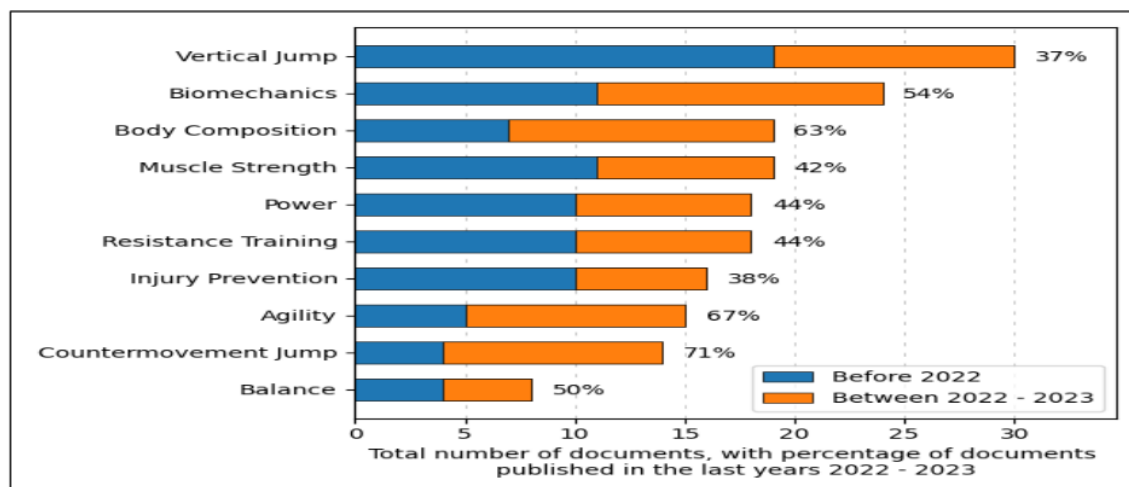


Figure 6. Top 10 Author Keywords

The main objective of this study is to analyse and explain trends and developments in the scientific literature on volleyball training over the past five years. In addition, we sought to identify the training concepts, methods and techniques most frequently emphasised in bibliometric studies in the field over the same period. The annual distribution data showed a significant upward trend in volleyball training research over the last five-year period, with 2022 being the year with the highest number of publications in the observation period. This indicates the increasing interest of sport researchers and practitioners in the topic of coaching in volleyball. This is consistent with the opinion of [Bartel and Bricknell \(2016\)](#) and [Xu et al. \(2022\)](#) who mentioned that the high number of publications indicates the increasing interest of researchers and practitioners.

The research was spread across 401 sources, including journals and conference proceedings. The most prolific journal in terms of contributions was the [International Journal of Environmental Research and Public Health](#). The analysis also underlines the diversity of sources from which volleyball training research is published, covering a wide range of aspects, from physical to psychological. The identification of these key sources provides important insights for researchers and practitioners and creates a strong basis to further explore this topic in a bibliometric context ([Zhang et al., 2023](#)), as well as opportunities for further collaboration and research. The source analysis also confirmed that in academia, the reputation of particular journals and conferences can have a major impact on the recognition and number of citations for research ([Zhang et al., 2019](#)). The main purpose of scientific journals is to present high-quality scientific data and share information with the research community as well as the general public ([Pujalte, 2020](#); [Rajendra & Santosh, 2021](#)). Therefore, researchers should wisely choose publication venues for their research to ensure that their work can achieve greater impact and make a significant contribution to the development of the discipline in question.

In this bibliometric study, we also identified authors who have contributed to the training research literature in the field of volleyball. In the author's analysis, several individuals stood out in terms of their contributions. Clemente, F. M., led in the number of publications with 11 papers, demonstrating his focus and dedication to enriching the scientific literature on volleyball training. The strong contributions of these authors reflect the importance of their role in knowledge development ([Somisetti, 2022](#)). This author analysis provides important insights into the individuals who have played a role in the scientific literature on volleyball training and can provide a basis for assessing individual contributions, identifying research trends, as well as potential collaboration opportunities within the discipline. It also helps to appreciate the role of the most prolific authors in furthering our understanding of the sport of volleyball and creates a basis for continued research within this field.

When analysing author affiliations by country, we gained important insights into the distribution of volleyball training research globally. The United States led the way in research contributions with 137 papers, demonstrating the key role of the United States in the development of understanding about volleyball training. These findings provide a rich understanding of the role of specific countries in knowledge development and create a strong basis for cross-border cooperation and knowledge exchange at the global level (Guan & Chen, 2012). Furthermore, these results highlight the importance of international cooperation and collaboration in developing an understanding of volleyball training.

Furthermore, in reviewing the training concepts, methods, and techniques most frequently highlighted in these studies, some of the concepts that received attention include “Vertical Jump”, which emphasises the importance of vertical jumping ability in various aspects of the game, such as attacks and blocks (Chaturvedi et al., 2023; Sotiropoulos et al., 2023; Yildiz et al., 2023). “Biomechanics” highlights the role of biomechanical analysis in the understanding of technique and player performance (Idrees et al., 2022; Sudds et al., 2023). The concept of “body composition” highlights the relationship between body composition and athlete performance (Pavlović et al., 2022; Sieroń et al., 2023). In addition, “muscle strength” and “power” show that research often emphasises improving muscle strength and power as key elements in the training of volleyball players (Berriel et al., 2022; Da Cunha et al., 2020). “Resistance Training” emphasises the importance of training with weights to achieve these goals (Cai & Wang, 2022; Hammami et al., 2022). Research also often considers “injury prevention” as a key focus, given the risks associated with injuries in this sport (Al-Attar et al., 2022; Ling et al., 2022). Author keywords can make it easier for future readers and researchers to identify critical ideas and arguments in the article.

CONCLUSION

In this study, trends and developments in the scientific literature related to volleyball training over the past five years were analysed. The results showed that the field experienced significant growth, with over a thousand papers published, peaking in 2022. The *International Journal of Environmental Research and Public Health* was the most prolific source, while Clemente, F. M., was the most influential author, and the United States served as a major contributor to the research. In terms of training concepts, methods, and techniques, we find that aspects such as vertical jumps, biomechanics, body composition, muscle strength, power, endurance training, injury prevention, agility, balance, and countermovement jumps are frequently emphasised in the scientific literature.

This analysis has limitations in terms of the availability of literature that only covers the period from 2019 to 2023, so there is the potential that recent developments in this field have not been included in the analysis. In addition, the databases used are limited to Scopus and WoS. As a recommendation for the future, future research can focus more on research in the context of the concepts, methods, and training techniques in volleyball that have been proposed. Furthermore, it is also necessary to continue similar bibliometric analyses for other sports training fields to broaden cross-disciplinary insights and understanding. The contribution of this study is that it provides a comprehensive view of the dominant trends and foci in the scientific literature on volleyball training. The results of this study have the potential to be an important foundation for further developments in understanding and implementing effective training practices in the context of volleyball, with the aim of improving player and team performance in the future.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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