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Research trends in sports sciences in Indonesia: A bibliometric analysis

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Abstract*:* This study presents a comprehensive bibliometric analysis of research trends in the field of sport science in Indonesia. Using a bibliometric approach, 128 relevant articles were collected, consisting of articles published in journals, written in English, and originating from Indonesia. This research focuses on analysing publication patterns and trends, with particular emphasis on publication year, affiliated institutions, and leading authors in the field of sport science. The analysis showed that 2020 was the year with the highest number of publications, indicating an increased interest and dedication to sport science research in Indonesia during that period. Among the various educational institutions contributing to this field, Universitas Negeri Yogyakarta emerged as the leading campus with the highest number of publications, demonstrating its important role in advancing sport-related studies. Additionally, the study identified "Journal of Physics: Conference Series" as the dominant source of documents, signalling its significance in disseminating sports science research in Indonesia. To shed light on the prolific contributors, this study examined authorship patterns. In particular, three authors, Novita Sari Harahap, Yulingga Nanda Hanief, and Ahmad Nasrulloh, emerged as the most prolific in the sport science domain, with each of them writing four documents in the form of articles. Their notable contributions demonstrate their expertise and dedication to advancing knowledge in the field of sports science. In conclusion, while the current landscape of sport science research in Indonesia shows promise and progress, there are still limitations and areas for improvement. By addressing these challenges and embracing innovative research agendas, the field can continue to develop and flourish, ultimately contributing to the advancement of sport science knowledge and practice on both a local and global scale.

Keywords: Bibliometric; sports sciences; scopus; Indonesia

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INTRODUCTION

The development of sports science in Indonesia has witnessed significant progress in recent years, as evidenced by a bibliometric analysis conducted by Yunus and Hanief (2022), revealing an increase in scientific production in sports medicine. The University of Indonesia has emerged as a prominent contributor to sports medicine research, with Andri Maruli Tua Lubis being one of the most productive authors in this domain. Moreover, international collaboration has played a crucial role in advancing sports science, as highlighted in the Wang et al. (2015) study, which showed a rapid increase in international collaboration in sport science publications. European countries, particularly Nordic countries, have demonstrated outstanding performance as partners in international collaboration. Regarding the sports system, a comparative study between Indonesia and China's achievement sports systems aims to improve the quality and competence of sports by identifying differences and similarities between the two countries (Prasetya, 2021).

The development of sports in Indonesia is not only a platform to improve the quality of human resources but also the main foundation for shaping a strong national character. Along with that, sports science also plays a crucial role in enriching and improving overall sports competence in Indonesia. However, behind the glittering achievements, challenges that hinder the development of sport science in Indonesia also need to be addressed. Adi and Fathoni (2020) highlighted the need to maximise online and offline learning in sports schools, where specialised sports classes not only pursue sporting achievements but also prioritise academic achievement (Ardian et al., 2019). The establishment of sports schools has made a significant contribution to providing education for student-athletes, but it still requires in-depth study and strong collaboration between teachers and students to develop more effective learning models. On the other hand, the implementation of the role of nutritionists as part of the sports personnel in athlete development centres in Indonesia still requires more serious attention (Penggalih et al., 2021). Last but not least, gender issues in sport, especially in sports dominated by male athletes, pose significant challenges due to various factors such as physical changes, the dominant culture of masculinity, and family demands that sometimes limit the potential of female athletes to develop (Berliana et al., 2021).

The development of sports science in Indonesia showcases encouraging progress in various aspects, including scientific production, international collaboration, and the recognition of sports as a strategic tool for national development. Despite the challenges faced, the concerted efforts in addressing limitations and gender issues contribute to the continued growth and improvement of sports science in the country. This study aims to determine the development of research related to sport science by Indonesian authors, in terms of the distribution of bibliometric maps and research trends using the Scopus Database. Bibliometric analysis is considered effective in providing data sets that can be used to improve research quality (Nandiyanto & Al Husaeni, 2022; Supriyadi et al., 2023; Supriyadi et al., 2023). The bibliometric map has a distribution that is displayed consisting of the type of publication, the topic area studied, the country of origin of the researcher, the journal where the publication was published and the language used (Hamidah et al., 2020). However, in this study, the bibliometric distribution used was the year of publication, the relevant author, the source of the publication, the type of publication, the area of research topic, the country of origin of the researcher, and the journal where the publication was published and the campus of the publication of the author.

Previous studies have examined the development of research in sport science globally or in specific regions such as South America, China, Russia, and Chile (Al Husaeni, 2023; Andrade et al., 2013; Bilgiç & Işın, 2023; Hongyou et al., 2023; Khatra et al., 2021; Ma et al., 2021; Millet et al., 2021; Pérez-Gutiérrez et al., 2016; Smolina et al., 2020; Xianliang & Hongying, 2012; Zhang, 2017). However, this study uniquely focuses on Indonesia. By conducting bibliometric analyses specific to Indonesia, this study offers insights into the research landscape, trends, and patterns in the domain of sport science in Indonesia. This adds valuable context and depth to the understanding of sport science research globally, allowing for comparisons and differences with other regions. In addition, this study fills a gap in the literature by highlighting the unique characteristics and developments of sport science research in Indonesia, which may have been missed or under-addressed in previous bibliometric analyses. This new perspective not only enriches the scholarly discourse but also provides practical implications for policymakers, researchers, and practitioners who want to advance sport science in Indonesia.

In this context, the urgency and objectives of the study are related to an in-depth understanding of the development of sport science in Indonesia through bibliometric analysis. This understanding is important to provide a comprehensive view of the research trends, topic focus, international collaboration, and scholarly contributions made by Indonesian authors in this field. By identifying these patterns, this research can help identify areas that require further attention, direct future development in sport science, and strengthen collaboration between researchers and institutions at home and abroad. Research questions that arise include how scientific production compares across years, what is the distribution of authors and their institutional affiliations, what are the main topics of interest, and how international collaboration networks evolve over time. By answering these questions, this research is expected to provide valuable insights for academics, practitioners, and policymakers in understanding and promoting the development of sport science in Indonesia.

METHODS

We searched the Scopus database for a list of articles. The search was conducted on January 2, 2024. The keywords used were "sport science" OR "exercise science" OR "sport medicine" OR "kinesiology" OR "applied sport science" OR "biomechanics and exercise physiology" OR "sport performance and training science" by filtering the type of paper article, Indonesian language, and English language in the title, keywords, and abstract features of the Scopus search with the number of articles obtained (128 articles). We used published articles, regardless of their year of publication. Articles that had been collected and were eligible for analysis in this study were then entered into Microsoft Excel software and saved in Comma-Separated Values (*.csv) and (*.ris) formats (Supriyadi, 2022a, 2022b; Supriyadi et al., 2023; Supriyadi et al., 2023).

RESULT AND DISCUSSION

Result

Research trends in the field of sports science in Indonesia show that there was one publication in 2011, followed by one publication in 2012. The number of publications increased significantly to 2019 (13 articles), until 2020 (26 articles), and then in 2021 it fell back to 23 articles, until 2022 (16 articles), and finally in 2023 it increased again to 24 articles. Figure 1 shows a positive trend in sport science research by Indonesian authors, with interest and contributions steadily increasing over the years.

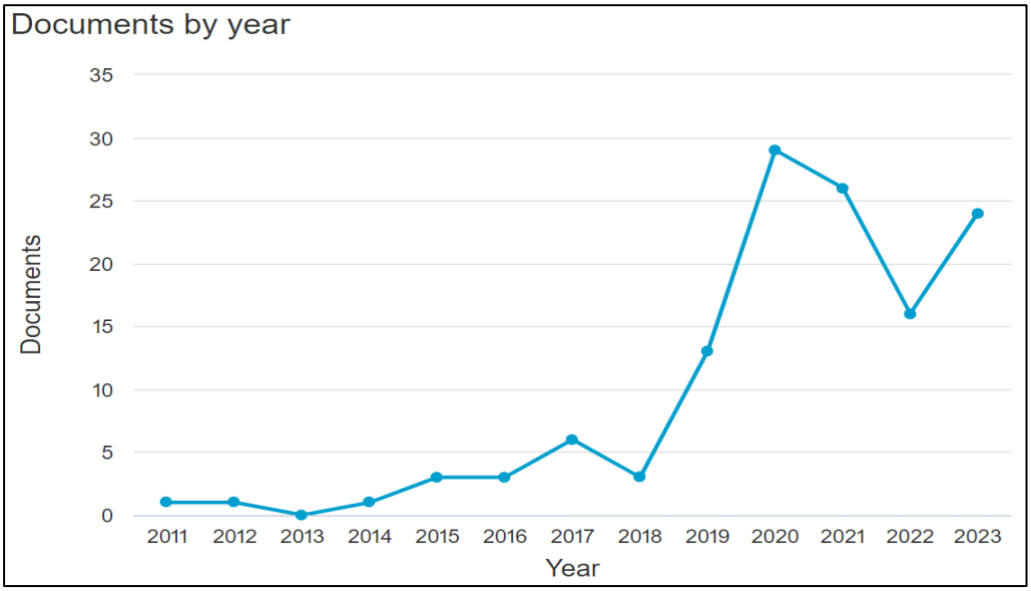


Figure 1. Annually Publications of Sport Science from Indonesian Author

Table 1 provides a valuable insight into the sources of publications in the field of sports science from Indonesian authors. Topping the list is the "Journal of Physics: Conference Series," with a considerable number of publications, namely 23 articles. Next is the "International Journal of Human

Movement and Sports Sciences," with 16 articles. This journal seems to be the second-popular platform for Indonesian researchers from 2020 until now to share their findings and progress in the field of sports science. However, based on information from https://beallslist.net/, the publisher of this journal, "Horizon Research Publishing," has the potential to become a predatory journal. "Journal of Physical Education and Sport" is the third most popular source with 11 articles. In addition, several other sources have contributed two to three articles each. This table reveals the richness and diversity of sport science research produced by Indonesian authors. It shows the presence of reputable journals and publications that have been a channel to disseminate their findings. The contributions cover a broad spectrum of topics, demonstrating the multidisciplinary nature of sports science research in Indonesia. This not only signifies the growing interest in the field but also reflects the country's efforts to advance and contribute to global knowledge in sports science.

Table 1. Sources of Publications of Sport Science from Indonesian Author

Source Title	Frequency
Journal of Physics: Conference Series	23
International Journal of Human Movement and Sports Sciences	16
Journal of Physical Education and Sport	11
International Journal of Education in Mathematics, Science and Technology	3
Physical Education Theory and Methodology	3
AIP Conference Proceedings	2
BMJ Open	2
Gazzetta Medica Italiana Archivio per le Scienze Mediche	2
Heliyon	2
Indonesian Journal of Applied Linguistics	2
Journal of Sports Science and Medicine	2
Man in India	2
Retos	2
Sport Mont	2

Table 2 provides valuable insights into 10 Indonesian authors who have made significant contributions to the field of sports science through their publications. Their prolific research output demonstrates their dedication and commitment to advancing knowledge in this field, and as a result, these authors have emerged as important figures in the sport science research community in Indonesia. The most contributing author in this field is Novita Sari Harahap, who has published an impressive six articles in the field of sports science. Following close behind is Yulingga Nanda Hanief, who has contributed five articles. In addition, there are several authors who have written four and three articles, respectively, in the field of sports science. Table 2 also presents information on the top 10 Indonesian authors who have contributed publications in the field of sports science and their affiliations. These authors' research covers a wide range of topics related to sport, physical activity, and athletic performance, reflecting the diverse interests and expertise within the Indonesian sport science research community.

Table 2. Most Relevance Indonesian Authors of Sport Science

Author Name	Frequency	University
Novita Sari Harahap	6	Universitas Negeri Medan
Yulingga Nanda Hanief	5	Universitas Negeri Malang
Ahmad Nasrulloh	4	Universitas Negeri Yogyakarta
Agus Rusdiana	4	Universitas Pendidikan Indonesia
Nurul Ihsan	4	Universitas Negeri Padang
Anton Komaini	4	Universitas Negeri Padang
Ilham	4	Universitas Negeri Padang
Rika Nailuvar Sinaga	4	Universitas Negeri Medan
Hastria Effendi	3	Universitas Negeri Padang
Erwin Setyo Kriswanto	3	Universitas Negeri Yogyakarta

Table 3 presents the most cited publications in the field of sports science authored by Indonesian researchers. Notably, Sukendro et al.'s paper, titled "Using an extended Technology Acceptance Model to understand students' use of e-learning during COVID-19: Indonesian Sport Science Education Context," stands out with 138 citations, emphasising its significance in examining e-learning adoption during the pandemic, specifically within Indonesia's sport science education. Additionally, Juwono I.D. and Szabo A.'s exploration of "100 Cases of Exercise Addiction" sheds light on a rarely identified dysfunction, garnering 22 citations. Following closely, Duffield R. et al.'s research on "Field-based pre-cooling for on-court tennis conditioning training in the heat" delves into pre-cooling strategies for tennis training in hot conditions, with 14 citations. These papers underscore the profound impact of Indonesian researchers on global sports science discourse.

The advancement of sports science in Indonesia is evident through increasing scientific output in sports medicine, particularly led by the University of Indonesia. Collaborations with European nations, notably Nordic countries, have played a pivotal role in propelling sports science forward. Prasetya's comparative study between Indonesia and China's achievement sports systems aims to bolster sports quality and competence by dissecting similarities and differences between the two countries, ultimately shaping Indonesia's sporting landscape. Nevertheless, challenges persist in the development of sports science in Indonesia. Adi and Fathoni advocate for maximising online and offline learning in sports schools, utilising private facilities, and addressing gender disparities in sports, particularly in traditionally masculine domains. Despite these hurdles, Indonesia's sports science continues to make strides, driven by scientific output, international partnerships, and the recognition of sports as a catalyst for national progress.

Table 3. Most Cited Document of Publications Sport Science from Indonesian Authors

Authors and Year	Title	Cited by
(Sukendro et al., 2020)	Using an extended Technology Acceptance Model to understand students' use of e-learning during Covid-19: Indonesian sport science education context	138
(Juwono & Szabo, 2021)	100 Cases of Exercise Addiction: More Evidence for a Widely Researched but Rarely Identified Dysfunction	22
(Duffield et al., 2011)	Field-based pre-cooling for on-court tennis conditioning training in the heat	14
(Syahruddin et al., 2021)	Students' acceptance to distance learning during Covid-19: the role of geographical areas among Indonesian sports science students	7
(Majid & Fauzi, 2021)	The effect of sprint training on vertical jump height of female youth volleyball players	6
(Karakauki et al., 2021)	The effect of small game exercise on freestyle swimming speed: A case study of Halu Oleo university sport science student	5
(Yoshida et al., 2019)	Comparison of radiation risk perception and knowledge of radiation between Indonesian and Japanese dental students	5
(Riza et al., 2018)	Determining strategies on playing badminton using the Knuth-Morris-Pratt algorithm	5
(Nuryadin & Hindawan, 2019)	Impulse measurement and analysis using a smartphone accelerometer	5
(Gultom et al., 2022)	Profile of Student Physical Fitness Level of Sports Science Study Program: Relationship between Nutrition Status and Learning Achievement during COVID-19 Pandemic	4

Figure 2 delves into the top 10 Indonesian authors in the field of sports science, providing important insights into the research domain. Among these authors, Universitas Negeri Yogyakarta stands out as the leader with 24 sport science articles. This sizable number underscores the university's significant role in advancing sports science research. The high frequency of publications from Universitas Negeri Yogyakarta suggests a robust research culture, well-established infrastructure, and a cadre of skilled researchers dedicated to sport science. In second place, Universitas Negeri Padang boasts 17 articles, further demonstrating active involvement in contributing to the academic discourse in sport science. Following closely, Universitas Negeri Medan secures third place with 16 articles, indicating noteworthy research outcomes in the field.

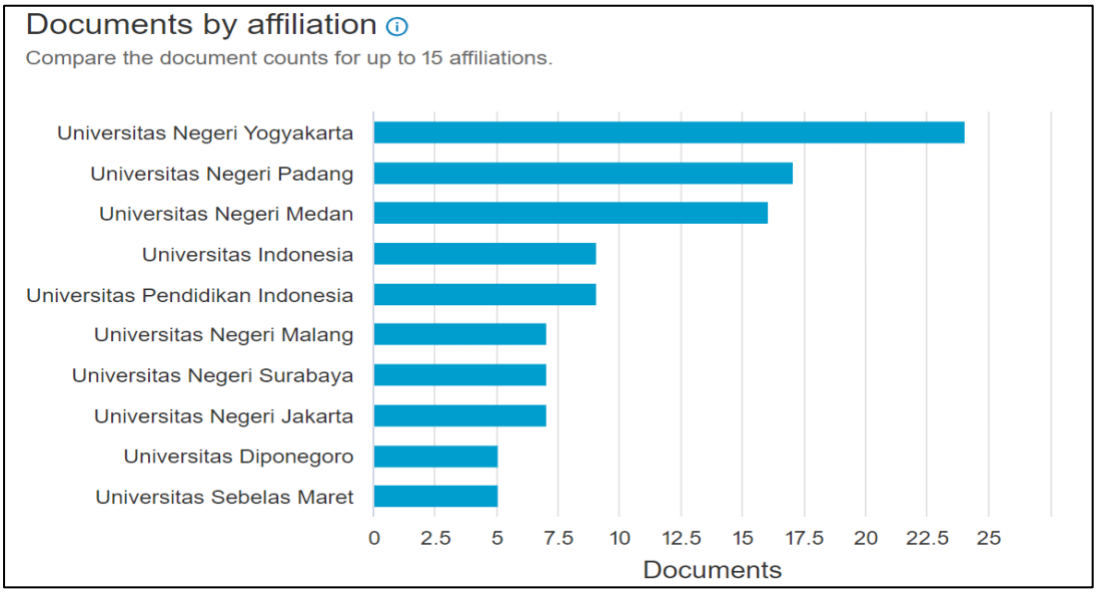


Figure 3. Top 10 Publications Sources of Sport Science from Indonesian Author

Discussion

The research trends in sports science within Indonesia, as evidenced by the data presented, indicate a promising trajectory. Starting with minimal publications in 2011 and 2012, there has been a notable surge in scholarly output, particularly from 2019 to 2020, followed by a slight dip in 2021 before a resurgence in 2023. This pattern reflects a growing interest and engagement in sports science research among Indonesian scholars over the years, with 2020 marking a significant peak in publication activity.

Table 1 sheds light on the sources of these publications, showcasing a diverse array of journals that have been instrumental in disseminating research findings. While the "Journal of Physics: Conference Series" emerges as the primary platform for Indonesian authors, concerns regarding the credibility of some publishing entities, such as "Horizon Research Publishing," underscore the importance of discernment in selecting publication outlets. Nevertheless, the presence of reputable journals like the "International Journal of Human Movement and Sports Sciences" and the "Journal of Physical Education and Sport" underscores the quality and breadth of research contributions from Indonesian scholars.

The contributions of individual authors highlighted in Table 2 underscore the dedication and expertise within the Indonesian sports science research community. With authors like Novita Sari Harahap and Yulingga Nanda Hanief leading the pack with their prolific output, it's evident that these scholars are making significant strides in advancing knowledge within the field. Moreover, the affiliations of these authors across various Indonesian universities reflect a collaborative and interdisciplinary approach to sports science research, contributing to the richness and depth of scholarly inquiry.

Table 3 showcases the impact of Indonesian researchers on the global discourse of sports science through their highly cited publications. Notable works, such as Sukendro et al.'s (2020) examination of e-learning adoption during the COVID-19 pandemic and Juwono and Szabo's (2021) exploration of exercise addiction, underscore the relevance and significance of Indonesian scholarship in addressing contemporary issues within the field. Additionally, collaborations with international partners and the dissemination of findings through reputable journals contribute to Indonesia's growing reputation as a hub for sports science research and innovation.

While the research trends in sports science within Indonesia display a promising trajectory, it's essential to acknowledge certain limitations inherent in the current landscape. One notable constraint is the uneven distribution of research output across different years, with fluctuations observed in publication numbers over time. This inconsistency may pose challenges in maintaining sustained momentum for research activities and could potentially hinder the continuous advancement of knowledge in the field. Additionally, the reliance on certain publishing outlets, some of which may have

questionable credibility, raises concerns regarding the rigor and integrity of the research disseminated, highlighting the need for greater scrutiny in selecting publication venues.

Moving forward, there are several areas of research that warrant attention and exploration to further enrich the field of sports science in Indonesia. Firstly, there is a need for more in-depth studies focusing on the practical application of theoretical frameworks and concepts within real-world sporting contexts. By bridging the gap between theory and practice, researchers can contribute valuable insights into optimising training methodologies, enhancing athlete performance, and promoting overall well-being in sports. Furthermore, investigations into emerging trends and technologies, such as the integration of digital platforms in sports education and training, can offer novel avenues for advancing the field and addressing contemporary challenges.

Moreover, efforts should be directed towards fostering greater collaboration and knowledge exchange among researchers, institutions, and stakeholders within the sports science community. Collaborative initiatives, both domestically and internationally, can facilitate the sharing of resources, expertise, and best practices, thereby enhancing the quality and impact of research outcomes (Cheng et al., 2021; Kigenyi et al., 2022). Additionally, interdisciplinary approaches that integrate perspectives from diverse fields, such as medicine, psychology, and engineering, can yield comprehensive solutions to complex issues in sports science (Elisabeth Hausken-Sutter et al., 2022). By embracing a holistic and inclusive approach to research, the field can achieve greater depth and breadth in addressing the multifaceted aspects of sports and physical activity.

In conclusion, while the current landscape of sports science research in Indonesia shows promise and progress, there remain inherent limitations and areas for improvement. By addressing these challenges and embracing innovative research agendas, the field can continue to evolve and thrive, ultimately contributing to the advancement of sports science knowledge and practice on both local and global scales. Through concerted efforts, collaboration, and interdisciplinary inquiry, researchers can pave the way for a more robust and impactful future for sports science in Indonesia.

CONCLUSSION

The data presented reveals a positive trend in sport science research by Indonesian authors, with a consistent increase in publications over the years. Various sources, including prominent journals, have contributed to the rich and diverse landscape of sport science research in Indonesia, spanning across multidisciplinary topics. The top 10 authors and their works showcase the country's commitment to advancing knowledge in the field. Despite challenges, such as limited teaching hours and gender issues in sports, Indonesia's sports science development has shown encouraging progress, with international collaborations playing a vital role. Universitas Negeri Yogyakarta emerges as a leading institution with substantial research output, followed closely by other universities actively contributing to the field. This collective effort positions Indonesia to continue making valuable contributions to the global sports science community.

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