



Review article

Mapping of Petanque Sports Research Trends for the period 2011-2024: A Bibliometric Analysis in the Scopus Database

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Abstract

Objectives. This study aimed to conduct a bibliometric analysis of the trend of petanque sports from 2011 to 2024 in the Scopus database. The research focused on productivity assessment, publication type, journal ranking, frequency of publishing, number of citations, study area focus, keywords, and co-authorship.

Materials and methods. This study was carried out using a bibliometric method. The research stages comprised (1) searching for articles using the Boolean “Petanque” AND “petanque in sport”, (2) inquiry with inclusion criteria of e-books, short reports, conferences, original articles, literature reviews in English, French, and Spanish from 2011 to 2024, (3) filtering 34 articles, (4) eliminating 19 articles, leaving 15 articles that were considered worthy, (5) re-filtering and producing the same number, namely 15 articles, and (6) deciding 15 final data articles. Data collection and analysis techniques used were Mendeley, VOSviewer, and Excel.

Results. In terms of productivity, 3 (20.00 %) documents were identified from 2011, 2021, and 2024; the most common type of document was original articles, with a total of 13 (86.67 %); the most journal rankings were in quartile 3 and 4 (30.00 %); the journals most frequently publishing research on petanque included the Journal of Physical Education and Sport, Ethnologie Francaise, Concurrences, and the International Journal of Human Movement and Sports Sciences, and Retos, each of which had 2 (13,00 %) documents; while the largest number of citations was from Pelana et al, with 26 citations. The majority of studies focused on physical, technical, and biomechanical aspects. The most commonly appearing keywords included performance, athlete, performance characteristic, sport, optimum group performance, and psychological training plan. Regarding collaboration, 14 researchers were found to be cooperating on the same research topic.

Conclusions. Petanque sports studies still require better research productivity and innovation to improve information and knowledge.

Keywords: bibliometric analysis, research trends, petanque sport, Scopus database.

Introduction

Petanque sports have emerged as competitive sports in Indonesia. This can be noticed in competition activities as petanque sports compete at regional and national levels. Petanque sports involve throwing iron and wood balls by the rules set (Soemardiawan & Yundarwati, 2024). Technically, the sport of petanque is divided into two categories: aiming and shooting techniques (Soemardiawan & Yundarwati,

2024). In this case, there are two types of throwing, namely shooting and pointing (Soemardiawan & Yundarwati, 2024). When we consider, petanque sports are dominating in body motions and physical activities such as physical, technical, and biomechanical aspects, and so forth. Other aspects such as psychological, aesthetic, and multidisciplinary considerations are required to provide information and generate new science regarding petanque sports.

Furthermore, as an academic, the authors were encouraged to perform further research on the sport of petanque through field investigations and document analysis in the form of relevant articles. Field observations show that the increase and excitement for the sport of

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petanque is positive, while document analysis in the form of relevant articles leads the author to conclude that articles about the sport of petanque are still not optimal. In this case, it is known that several articles that have been published in several databases are only limited to conducting analyses such as pointing motion analysis (Bustomi & Hidayah, 2020), petanque sports management survey (Hervi et al., 2021), development of a model for android-based petanque (Wulandari & Wibowo, 2022), and the effect of training with the obstacle method on pointing (Al bhaikhaqy, Risanggih et al., 2022). While some of these publications are prominent in the literature on training method analysis and testing, other studies, such as the mapping of research patterns in petanque sports studies using bibliometric analysis, have not received as much attention.

Recently, the publication style for manuscript writing has expanded beyond original research and literature reviews. Academics, on the other hand, are eager to do research using a bibliometric analysis model. In terms of data search and filtering, bibliometric research is equivalent to a literature review. The difference is that a literature review shows the essence and meaning of data, whereas bibliometrics reveals the bibliography of a specific field of study, including research productivity, collaboration patterns, often appearing keywords, and so on (Donthu et al., 2022)

Therefore, how does it relate to the sport of petanque? Undoubtedly, it is quite relevant. At first sight, it appears that research into petanque is already underway. However, is it only limited to discussing testing a training model and doing analysis and correlation? Of course, it is not the only instance when bibliometric analysis is required in the study of petanque. Given that prior studies have primarily focused on original research, academics have conducted very few systematic literature reviews and bibliometric analyses.

According to studies, bibliometric analysis is useful for synthesizing vast amounts of bibliographic data to interpret study performance and intellectual structure (Donthu et al., 2022). Knowledge in the field can be found objectively using bibliometric analysis, which describes field conditions as well as social patterns that support knowledge in the field and map knowledge gaps in the field (Lim, 2024). From another perspective, bibliometric analysis seeks to undertake objective assessments and reports on the productivity of research impacts (Lim, 2024), as well as to determine the scope and scope of research and biases that have not before been observed in research (Lim, 2024).

In this context, the authors perceive a gap in bibliometric research analysis in petanque sports, indicating that such analysis is required to give information and mapping of current research trends. As a result, the goal of this work is to map petanque sports trends from 2011 to 2024 using bibliometric analysis in the Scopus database. The author focuses on the Scopus Elsevier database since it is the most trusted source of bibliometric data for international research and also provides systematically examined knowledge about many fields (Tennant, 2020).

The purpose of this bibliometric analysis is to examine (1) productivity analysis, types of published articles, and journal rankings, (2) publication popularity by looking at the number of citations and the focus of petanque research studies, (3) keyword trends that frequently appear, and (4) co-authorship patterns. It is expected that this study will

provide further information and insight, as well as increase publication output, particularly in petanque sports.

Materials and Methods

Study Participants and Organization

Bibliometrics is a problem-solving method employed in this study (Belfiore et al., 2020; Kussainova et al., 2023). This study stage included (1) a data search using the Scopus database with the Boolean analysis “Petanque” AND “Petanque in sport”. The authors employ the Scopus database since the existing data considerations are complete and reliable after thorough screening (Bornmann et al., 2013). Stage (2) investigated data from 2011 to 2024, using research as inclusion criteria in the form of e-books, brief reports, conferences, and original articles in English, French, and Spanish. Articles that do not match the requirements are removed as exclusion criteria. In stage 3, the authors screen eligible data. In this stage, the authors obtain preliminary data from the Scopus database spanning 2011 to 2024, totaling 34 articles. Furthermore, in stage (4), the authors screen the articles, discarding 19 that do not meet the requirements and leaving 15 that do. In stage (5), the authors conduct a more thorough and rigorous re-screening, resulting in 15 articles that meet the criteria. In stage (6), the authors select 15 articles to proceed to the bibliometric analysis stage. To clarify, the authors present a diagram to establish the stages of data collection as follows:

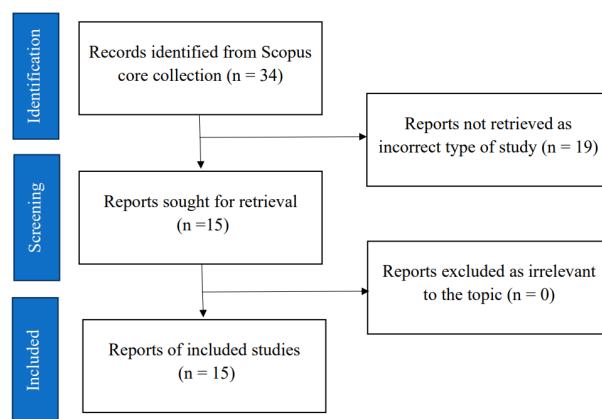


Fig. 1. Research flow diagram with inclusion and exclusion criteria

Data Analysis Technique

The data was gathered by document analysis with the Scopus database. The Mendeley desktop application, Vosviewer (Chen et al., 2022; Nugraha et al., 2023), and the Excel application to calculate the percentage are used to aid in the data analysis technique (Akhiruyanto et al., 2022; Yudhistira et al., 2023). The bibliometric analysis research focuses on (1) the analysis of productivity, publication type, ranking, and journals that frequently publish research on petanque; (2) analysis of popular articles based on the number of citations and focus of petanque research studies; (3) analysis of keyword trends that frequently appear in

petanque sports research; (4) analysis of co-authorship trends that frequently collaborate on petanque sports research; and (5) analysis of future difficulties and potential for petanque sports research.

Results

The results of the bibliometric analysis mapping are presented in tables and diagrams, namely (1) productivity analysis, publication type, journal ranking, (2) number of citations and focus of petanque sport studies, (3) analysis of frequently appearing keyword trends, and (4) analysis of co-authorship that frequently collaborates. To make things clear, the data results are presented as follows:

Table 1. Results of the analysis of Petanque Sports Research Productivity

No	Document	Amount	Percentage
1	2011	3	20.00
2	2012	0	0.00
3	2013	2	13.33
4	2014	0	0.00
5	2015	0	0.00
6	2016	1	6.67
7	2017	2	13.33
8	2018	0	0.00
9	2019	0	0.00
10	2020	0	0.00
11	2021	3	20.00
12	2022	1	6.67
13	2023	0	0.00
14	2024	3	20.00
Total amount		15	100



Fig. 2. Publication productivity diagram

Table 1 shows that the analysis of research productivity on petanque sports in 2011 was 3 (20.00 %), in 2012 it was 0 (0.00 %), in 2013 it was 2 (13.33 %), in 2014 it was 0 (0.00 %), in 2015 it was 0 (0.00 %), in 2016 it was 1 (6.67 %), in 2017 it was 2 (13.33 %), in 2018 it was 0 (0.00 %), in 2020 it was 0 (0.00 %), in 2021 it was 3 (20.00 %), in 2022 it was 1 (6.67 %), in 2023 it was 0 (0.00 %), and in 2024 it was 3 (20.00 %). The analysis findings show that publication productivity is still very low, as seen from the number of documents in the

form of articles, which is only 3 documents at most. This is expected to continue in 2024, and it is hoped that the number of publications regarding petanque sports will rise. The following rising diagram presents it more clearly (fig. 2).

Table 2. Results of an analysis of publishing types, ranks, and journals that frequently publish articles on the sport of petanque

	No	Document	Amount	Percentage
Publication Type	1	Book	1	6.67
	2	Original article	13	86.67
	3	Literature review	1	6.67
	4	Proceedings	0	0.00
Total amount			15	100
	No	Quartile	Amount	Percentage
Ranking journal	1	Quartile 1	2	20.00
	2	Quartile 2	2	20.00
	3	Quartile 3	3	30.00
	4	Quartile 4	3	30.00
Total amount			10	100
	No	Journal	Amount	Percentage
Journals that frequently publish	1	Physical Education Theory and Methodology	1	6.67
	2	Journal of Physical Education and Sport	2	13.33
	3	Ethnologie Francaise	2	13.33
	4	Concurrences	2	13.33
	5	International Journal of Human Movement and Sports Sciences	2	13.33
	6	Retos	2	13.33
	7	New York State Folklife Reader: Diverse Voices	1	6.67
	8	Voices - Journal of New York Folklore	1	6.67
	9	Revista de Psicologia del Deporte	1	6.67
	10	Engineering Failure Analysis	1	6.67
Total amount			15	100

According to Table 2, the bibliometric analysis of the type of book publishing is 1 (6.67 %), 13 (86.67 %) original articles, 1 (6.67 %) literature reviews, and 0 (0.00 %) proceedings. Therefore, it means that original articles are the most common type of publishing, with literature reviews, books, and proceedings remaining relatively rare. Although original articles continue to dominate, there is a need for more publications, particularly in the Scopus database.

According to Table 2, the bibliometric study of journal rankings shows that quartile 1 is 2 (20.00 %), quartile 2 is 2 (20.00 %), quartile 3 is 3 (30.00 %), and quartile 4 is 3.

In this case, the most dominant publications are in quartiles 3 and 4, although publication productivity in journals in quartiles 1 through 4 is still required, given that there is very little productivity discussing petanque sports, particularly in Scopus-indexed journals.

Based on Table 2, the bibliometric analysis of journals that often publish research on petanque are the journal Physical Education Theory and Methodology with 1 (6.67%) article,

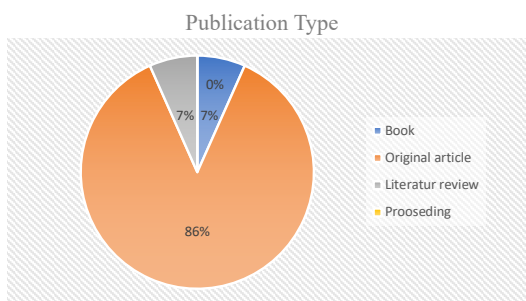


Fig. 3. Publication type diagram

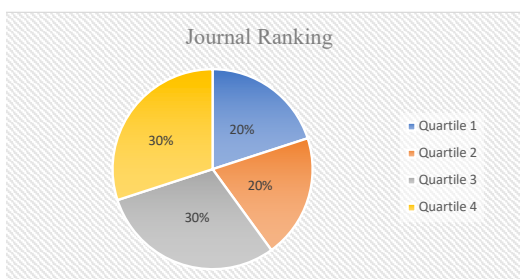


Fig. 4. Journal ranking diagram

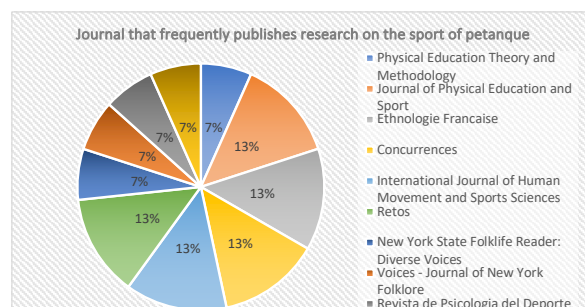


Fig. 5. Journal that frequently publishes research on the sport of petanque

Journal of Physical Education and Sport with 2 (13.33%) articles, Ethnologie Francaise with 2 (13.33%) articles, Concurrences with 2 (13.33%) articles, International Journal of Human Movement and Sports Sciences with 2 (13.33%) articles, Journal Retos with 2 (13.33%) articles, New York State Folklife Reader: Diverse Voices with 1 (6.67%) article, Voices - Journal of New York Folklore with 1 (6.67%) article, Revista de Psicologia del Deporte with 1 (6.67%) article, and Engineering Failure Analysis with 1 (6.67%) article. Based on this study, these journals are still looking for more interesting papers concerning the sport of petanque. This is because there are still few publications regarding petanque sports, demonstrating that there is still room for them in these journals. To facilitate data interpretation, the authors present this analysis in the diagram below (fig. 3-5).

Based on Table 3, the authors examined 9 prominent articles with the most citations and concentrated on the field of study in petanque sports. The results of the analysis found that research from Pelana et al entitled "The Effect of Arms

Table 3. Analysis of 9 popular articles and focus of study areas

No	Article Title	Author's name	Number of Citations	The focus of the study area
1	The effect of arm length and endurance, and self-confidence on petanque shooting	Pelana et al. (2021)	26	Physical and psychological aspects of sports
2	The effect of an accuracy training program on petanque shooting results	Phytanza et al. (2022)	24	Skill aspects
3	The correlation between muscle endurance and arm length with petanque shooting accuracy	Setiakarnawijaya et al. (2021)	13	Physical and technical aspects
4	Mechanisms causing petanque ball explosions	Loser et al. (2011)	12	Engineering
5	The effect of self-talk on petanque shooting accuracy	Rizal et al. (2021)	5	Psychological and skill aspects
6	Kinematic motion analysis of petanque pointing and shooting techniques	Al Ardha et al. (2024)	3	Sports biomechanics
7	Android-based training program application for petanque sports	Hidayah et al. (2024)	2	Sports technology
8	Biomechanical analysis of throwing aura in petanque: a literature review study	Helmi et al. (2024)	1	Sports biomechanics
9	Finding optimal performance using a psychological training plan	Hernandez et al. (2011)	1	Sports psychology

Length and Endurance and Self-Confidence on Petanque Shooting” received 26 citations (Pelana et al., 2021). Second, research from Phytanza et al entitled “The Effect of Accuracy Training Programs on Petanque Shooting Results” received 24 citations (Phytanza et al., 2022). The third study from Setiakarnawijaya et al entitled “The Relationship between Muscle Endurance and Arm Length with Petanque Shooting Accuracy” received 13 citations (Setiakarnawijaya et al., 2021). Fourth, research from Loser et al entitled “Mechanism Causing Petanque Ball Explosion” received 12 citations (Loser et al., 2011). The fifth study is from Rizal et al entitled “The Effect of Self-Talk on Petanque Shooting Accuracy” which received 5 citations (Rizal et al., 2021). The sixth study comes from Al Ardha et al entitled “Kinematic motion analysis of petanque pointing and shooting techniques” which received 3 citations (Al Ardha et al., 2024). The seventh study is a study by Hidayah et al entitled “Android-Based Training Program Application for Petanque Sports” and received 2 citations (Hidayah et al., 2024). The eighth is a study by Helmi et al entitled “Biomechanical Analysis of Throwing Aura in Petanque: Literature Review Study” which received 1 citation (Helmi et al., 2024). The ninth is a study by Gonzalez et al entitled “Finding Optimal Performance with Psychological Training Plans” which received 1 citation (Hernandez & De Los Fayos Ruiz, 2011).

Furthermore, the primary focus of petanque research is on petanque sports performance as evaluated through the lens of physical aspects, skills, sports biomechanics, sports psychology, and engineering. The data indicate that research on the popularity of petanque is still limited, as indicated by the low number of citations. The majority of petanque studies focus on physical aspects, methods, sports biomechanics, and sports psychology. Although extensive research has been undertaken on the subject, further in-depth investigation is required. More fields of study, such as engineering and sports technology, are also required in petanque, and more sports sectors are still being developed to provide academics with knowledge and insight.

Table 4. Analysis of frequently appearing keyword trends

Label	Number of Keywords	Keywords
Cluster 1/Network visualization in red	3	Sport, optimum group performance, and physiological training plan
Cluster 2/Network visualization in green	3	Performance, athlete, and performance characteristics

Based on Table 4, the authors used the VOSviewer application to trace keywords that frequently appear in petanque sports studies, applying the minimum number of occurrences of a term, which is 1. This research revealed that 133 keywords met the criterion. The authors then performed a keyword selection in which if the keywords obtained were only 1, the authors deleted them to retain only the most keywords, which were performance, athlete, performance characteristic, sport, optimum group performance, and psychological training plan.

Based on Table 5, the authors analyzed to trace the co-authorship that frequently collaborates in petanque research with the VOSviewer application by using the minimal

Table 5. Trends in frequently collaborative co-authorship

Label	Number of Collaborations	Author
Cluster 1/ Network visualization in red	14	Lourenco, Phytanza, Irawan, Widodo, Widiyono, Hadiatmo, Saleh, Sutopo, Burhaein, Indriawan, Azizah, Susanto, Demrici, Parmadi

number of occurrences of a phrase, which is 1. The findings of this analysis revealed that 117 met the threshold, and the author found 14 co-authors who frequently perform research on petanque sports. They are Lourenco, Phytanza, Irawan, Widodo, Widiyono, Hadiatmo, Saleh, Sutopo, Burhaein, Indriawan, Azizah, Susanto, Dermrici, and Parmadi. To clarify, the VOSviewer analysis image shows the following:

Discussion

Petanque is a relatively new competitive sport. This is common in regional and national competitions. This motivated the authors to do a bibliometric analysis study. Although the evolution of petanque sport through observation and observation demonstrates its presence in the world of sports, the analysis offered in this paper is still required to deepen understanding and information. Previous studies have primarily focused on correlational research, surveys, experiments, and designing a training program, but bibliometric analysis to map the trend of petanque sports research received little attention. As far as the authors are aware, no one has undertaken a bibliometric analysis of petanque sport. As a result, this is the first study to highlight the need for urgency in petanque sport research. To be more specific, the author did a bibliometric analysis with the main difficulties that will be addressed in the discussion section below as follows:

RQ1: How are the productivity, publication type, ranking, and journals that frequently publish petanque sports research developing between 2011 and 2024?

The outcomes of the highest research productivity on petanque are 3 (20.00%) documents included in the Scopus database in 2011, 2021, and 2024. Furthermore, there were two (13.00%) documents in 2013 and 2017, and only 1 (6.67%) in 2016 and 2022. Aside from these years, there was no petanque research (0.00%). This demonstrates that study on the sport of petanque is severely limited from year to year. Research productivity indicates that a topic is in high demand for research when the need for research is critical. As a result, research on the sport of petanque has not been in great demand to be included in the Scopus database. This permits the introduction of the sport of petanque to be described as suboptimal, or experts and academics participating in the sport of petanque have not given much thought to undertaking study on the sport of petanque. Although it may be claimed to be still going on in 2024, only three articles have been published in the Scopus database, which suggests that until the end of the year, research on petanque sports will be less significant than when one is

published in the Scopus database. As a result, academics must raise awareness to improve the output of petanque-related research that can be included in the Scopus database.

Furthermore, original articles are the most often published kind, accounting for 13 documents (86.67%), followed by literature reviews and books, which account for 1 (6.67%). However, proceedings have shown no interest in being published in Scopus proceedings. This demonstrates that there is still a lack of publishing in books, literature reviews, and proceedings, leaving many options for publication in these sources. Although the number of original articles has increased to 13 (86.67%), productivity still needs to be improved. It is intriguing that secondary data analysis, such as literature reviews, is still underutilized in petanque sports studies, as is the author's research on bibliometric analysis, no one has been interested in analyzing it in more depth. To the authors' knowledge, this is the first time a bibliometric study of petanque sport has been published in a journal.

The analysis of the Scopus database journal ranking shows that research in petanque sports is frequently published in Scopus-indexed journals, with quartiles 1 and 2 totaling 2 (20.00%) documents and quartiles 3 and 4 totaling 3 (30.00%) documents. The smaller the quartile, the better, therefore it is expected that study on petanque sports will enter quartiles 1 and 2, where an in-depth examination is required to show problems both empirically and theoretically. The research goal must also be consistent with the problem to be considered for Scopus journal quartiles 1 and 2.

The journals that publish the most publications about petanque are the Journal of Physical Education and Sport, Ethnologie Française, Concurrences, International Journal of Human Movement and Sports Sciences, and Retos, each with 2 (13.33%) articles. This indicates that not many studies on petanque sports have been examined by other Scopus-indexed publications. The productivity of researchers who are nonetheless unenthusiastic about publishing their findings is a possible contributing factor. This productivity refers to the performance of an expert or academic who is motivated to provide knowledge and information to gain new scientific knowledge.

One of the factors influencing research output in petanque sports studies is that scientists are still not sufficiently focused on doing in-depth investigations and analyses. Furthermore, limited time and resources, as well as an intention to provide the most recent information, particularly in petanque sports, contribute to low research output in the field. This is consistent with prior research, which found that organizational characteristics and the researcher's conditions influence the determinants of a researcher's performance (Abramo et al., 2017). These factors have an impact on individual resources, available time, level of skill, and reputation, all of which are important in determining research productivity (Abramo et al., 2017). The decrease in productivity is due to researchers' continued focus on performing independent or solo research, which is frequently associated with delayed publication production. This is related to researchers' understanding of the value of research collaboration (Uddin et al., 2012). Specifically, research collaboration has an impact on enhancing article production, which can lead to more citations and publications (Bidault & Hildebrand, 2014; Ductor, 2016;

Li et al., 2013). Naturally, the authors support the idea that research collaboration will result in a considerable increase in the number of articles published in petanque sports studies. A further in-depth examination will be provided in the RQ4 co-authorship analysis for petanque sports research collaboration.

RQ2: What are the most cited popular articles and the focus of research studies on petanque sports between 2011 and 2024?

The authors discovered nine documents with the most citations after conducting a bibliometric study to trace popular articles. The first rank that received the most citations was the research by Pelana et al with 26 citations (Pelana et al., 2021), the second was the research by Phytanza et al with 24 citations (Phytanza et al., 2022), the third most was the research by Setiakarnawijaya et al with 13 citations (Setiakarnawijaya et al., 2021), the fourth was the research by Loser et al with 12 citations (Loser et al., 2011), the fifth was the research by Rizal et al with 5 citations (Rizal et al., 2021), the sixth was the research by Al Ardha et al with 3 citations (Al Ardha et al., 2024), the seventh was the research by Hidayah et al with 2 citations (Hidayah et al., 2024), the eighth was the research by Helmi with 2 citations (Helmi et al., 2024), and the ninth was a study by Hernandez with 1 citation (Hernandez & DeLosFayosRuiz, 2011). However, Ronzano, Feschet, Wachsmann, et al.'s research has not earned any citations (Feschet, 2011, 2013b, 2013a, 2016; Wachsmann & Zacharie, 2017). The subject of study in petanque sports is primarily concerned with performance, including physical aspects, skill aspects, sports psychology aspects, and sports biomechanics, followed by sports technology and engineering.

As a result, articles that add to science and serve as references for other studies are distinguished by the number of citations, which facilitates the transmission of knowledge. The most often mentioned articles are 24 to 26, with the primary focus on physical elements such as arm strength and length, as well as technical features such as shooting accuracy and biomechanical analysis. This demonstrates that, on a theoretical level, petanque sports emphasize and focus on physical aspects, but it does not rule out the potential that psychological aspects, sports technology, and other research require improvement. Sports science evolves through the marriage of diverse sciences, resulting in a new paradigm.

Furthermore, the quantity of citations is frequently used to determine the study's popularity. The amount of studies that examine the topic and theme, or even make significant contributions to the execution of sports, demonstrates the study's appeal. According to past research, the number of times our scientific publications are mentioned indicates an overall scientific effect on the global academic community (Vieira & Gomes, 2010). The quantity of citations is thought to be associated with scientific quality and can be used to assess a researcher's academic achievement at an institution or department (Vieira & Gomes, 2010). Another study found that the popularity of articles with the most citations is influenced by three criteria (Tahamtan et al., 2016). The first factor includes the relevance of the article, the quality of the article, the interest and novelty of the participants,

the characteristics of the topic and focus of the study, the research method, the type of document, the research design, the characteristics of the description of the results and discussion, the images and attachments of the article used, the interesting title and abstract, the type of references used, the number and length of the article, the age of the article, the initial citation and the speed of citation, the visibility and ease of access of the article (Tahamtan et al., 2016). The second factor is the impact of the journal, the language of the journal, the scope of the journal, and the type of publication (Tahamtan et al., 2016). The third factor includes the number of authors, the track record of the authors, the academic ranking of the authors, self-citations, the collaboration of the authors in various studies, gender, age, race, the productivity of the author's publications, institutions and organizational features, as well as funding (Tahamtan et al., 2016).

Certainly, the authors are quite aware of the factors influencing the amount of citations listed above. However, in the study of petanque sports research, the authors' analysis discovered that citations have not been able to be numerous because, among other criteria, the number of publications on petanque sports, particularly in the Scopus database, is still not adequate. As a result, when it comes to impact and citations, it is undoubtedly required to boost the productivity of research published in Scopus-indexed journals. However, the lack of citations in petanque sports studies can be caused by a very basic thing: the urgency expressed in earlier studies cannot be considered to be particularly essential in real implementation.

RQ3: What is the trend of keywords that frequently appear in petanque sports research between 2011 and 2024?

The findings of bibliometric analysis using the VOSviewer application revealed a pattern of keywords that are frequently used in petanque sports studies. The authors

applied the pattern of the minimum number of occurrences of a term is one, so the authors found 133 that meet the threshold. The authors then selected keywords by deleting irrelevant keywords and discovered keywords such as performance, athlete, performance characteristic, sport, optimum group performance, and psychological training plan.

In general, the word "sport" appears frequently, followed by the keywords performance, athlete and performance characteristics, optimal group performance, and physiological training plan. This suggests that the keywords that frequently occur are well-known in petanque sports studies. This keyword grouping is related to relevancy, demonstrating a correlation between several topics of study (Giannakos et al., 2020). To clarify, the authors depict it in the VOSviewer analysis graphic below as follows:

RQ4: What is the trend of co-authorship in petanque sports research collaboration between 2011 and 2024?

The results of bibliometric analysis using the VOSviewer application with co-authorship search to conduct research collaboration patterns in petanque sports studies revealed a very complex collaboration pattern in which authors who frequently conduct collaborative research on petanque sports are Lourenco, Phytanza, Irawan, Widodo, Widiyono, Hadiatmo, Saleh, Sutopo, Burhaein, Indriawan, Azizah, Susanto, Demrici, and Parmadi. For better understanding, the following is how the VOSviewer analysis visualizes it:

In general, collaboration trends seek to map issues that will subsequently be addressed and solutions sought, as well as identify organizations and academics that are working together on joint research projects. This is consistent with earlier research showing that research collaboration improves research productivity, which will be especially significant when authors work on international levels. On a global scale,

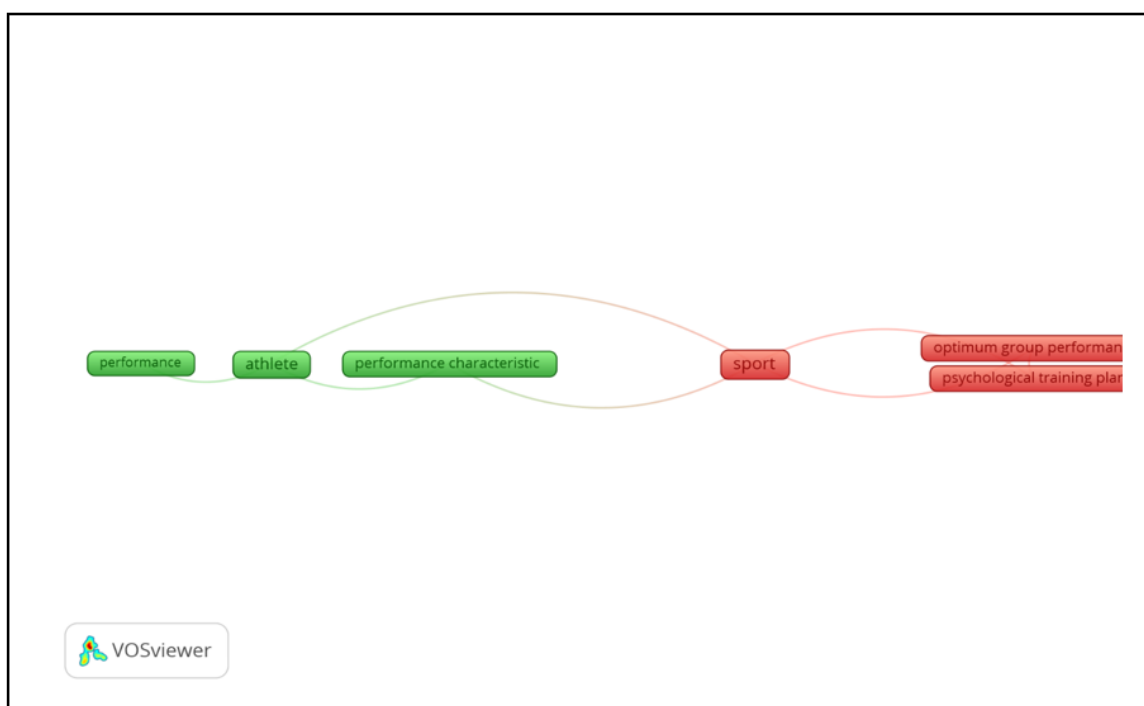


Fig. 6. Results of a network visualization study of commonly occurring keywords

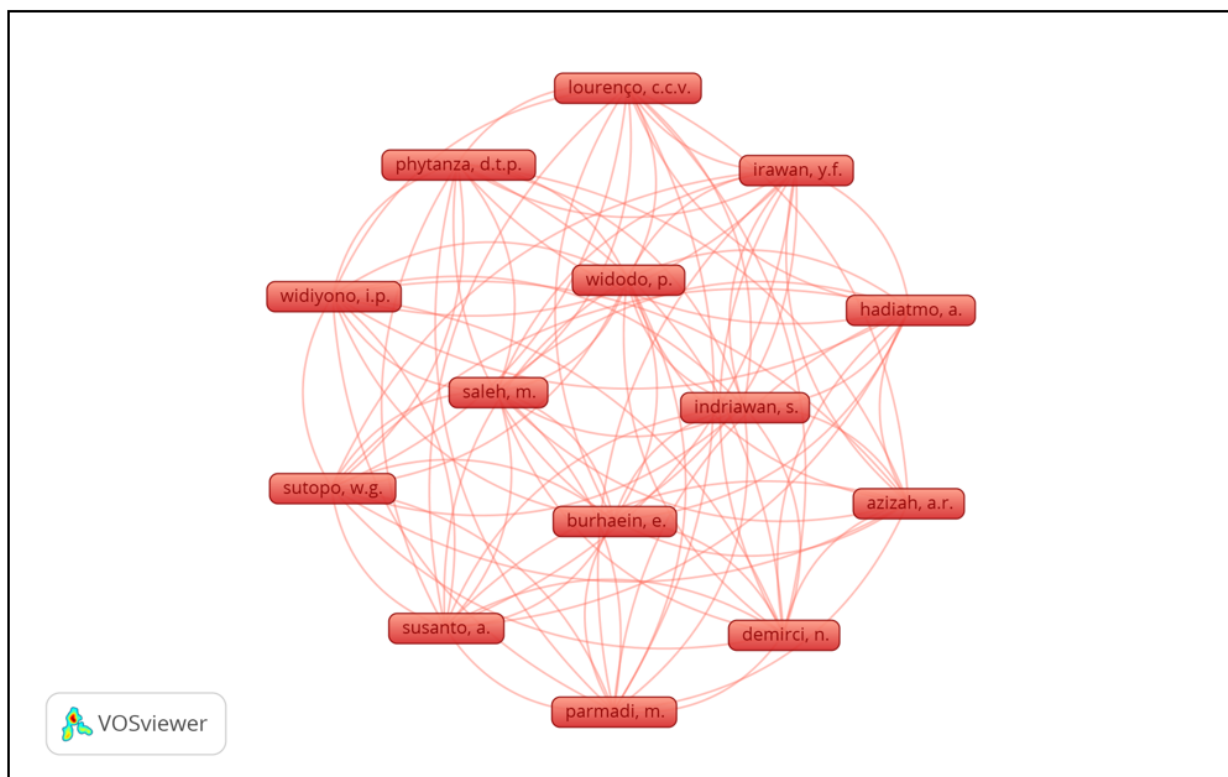


Fig. 7. Results of network visualization analysis of frequent collaboration co-authorship

diverse patterns of issue-solving will emerge with varying perspectives, resulting in variances in research and scientific advancement (Abramo et al., 2017). Adequate resources, motivation, and individual competency all influence publication and citation production, leading researchers to perform collaborative research more effectively (Abramo et al., 2017).

According to the authors, research collaboration allows single researchers to be aided by a team in managing research more successfully and efficiently. For example, a work can be separated into sections focusing on the introduction, technique, results and discussion, abstract and conclusion, editing, and submission. Teamwork is required to build a solid cooperative. The more problems are split to be answered, the more viewpoints there will be in the research, resulting in two to three subjects of study rather than just one.

In line with past studies, collaborative research tries to bridge and overcome the limitations of unresolved research (Abramo et al., 2017). In this context, the authors observe that there has been little collaborative research between international institutions on petanque sports; hence, the author only discovered regional collaborations. This study requires special attention to improve relations not only in petanque sports but also in many sectors of sports science studies so that future research can be even more dazzling and make valuable contributions.

RQ5: What are the problems and potentials in petanque sports research in the future?

This bibliometric analysis is useful for more than just identifying research trends and results. However, using bibliometric analysis, the authors can identify research issues

that have not been and will be revealed. This problem has been outlined in the description above, but it is specifically explained in this section, namely about (1) research productivity. The productivity of special research that is included in the Scopus database is undoubtedly very low, which is possible because researchers have not been able to optimally reveal problems in detail to be used as rationalization material for problems. The problem in the study is the most significant component since it will make the research flow clear and easier to address by identifying the approach and how to perform it correctly. Previous studies in the study of petanque sports have described problems based on the perspective at the time of field observation, which is surely less accurate when employed as a research topic. This is undoubtedly one of the reasons why research on petanque has not been able to become part of the Scopus database to its full potential.

Aside from that, research output is influenced by individual competence, research collaboration, funding, and time flexibility. However, when it comes to competence, it is possible to read and reflect on a subject that will be researched using a high level of literacy. Research collaboration can be undertaken by establishing relationships and building a research team so that research efforts can be divided according to sub-field. Funding can also be sought, as many Scopus journals do not charge publication fees. Academics must prioritize their time and make time to write. Problem (2) is related to research collaboration, and while it has been done, it is important to note that international collaboration remains minimal. Research collaboration is critical to improving the quality and reach of foreign research.

Problem (3) is about citations. The huge amount of citations indicates that this research has an impact on knowledge

transmission. However, this is linked to productivity and research collaboration. The more petanque-related articles there are, the more relevant citations will be searched and used as references. In terms of collaboration, more authors advocate that other authors cite published research. Problem (4) concerns the scope of petanque research, which is not restricted to physical characteristics such as biomechanical analysis, arm length, and arm strength, but can also include technical studies, psychology, and the arts.

Future research on petanque sports should include more critical studies and relevant improvements, with the potential to have a real impact on the order of life in the sports community. Furthermore, research on petanque sports needs streaming and ongoing study to increase the productivity of article publications.

Conclusions

Based on the study's findings, the authors came to the following conclusions: the highest research productivity occurred in 2011, 2021, and 2024, totaling 3 documents (20.00%); original articles accounted for 13 (86.67%) of the published research, and the highest journal ranking was quartile 3 and quartile 4 (30.00%); journals that frequently publish petanque research include the *Journal of Physical Education and Sport*, *Ethnologie Francaise*, *Concurrences*, *International Journal of Human Movement and Sports Sciences*, and *Retos*, each with 2 (13.00%) documents, and the research by Pelana et al. had the highest number of citations, namely 26 citations. The focus of most studies is on physical, technical, and biomechanical aspects. Keywords that often appear are performance, athlete, performance characteristic, sport, optimum group performance, and psychological training plan. There are 14 collaborating researchers with the same research topic. The bibliometric analysis indicates that to give the most recent research advances, petanque sports research productivity needs to be optimized. To obtain trustworthy and high-caliber research, articles containing petanque sports studies can also be published in journals with a Scopus index or comparable. Even if this research can be finished, there are still a lot of unexplored things. For example, the analysis in this research is restricted to the Scopus database; the department, institution, and country of origin have not had their research output evaluated. Thus, to gather comprehensive data, additional research must focus on these aspects.

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Conflict of interest

All authors declare no conflict of interest.

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Мапування тенденцій у галузі досліджень спортивних ігор з петанку за період 2011-2024 рр: Бібліометричний аналіз у наукометричній базі даних Scopus

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

Реферат. Стаття: 11 с., 5 табл., 7 рис., 37 джерел.

Мета дослідження. Мета цього дослідження полягала у проведенні бібліометричного аналізу тенденцій у галузі спортивних ігор з петанку з 2011 по 2024 рр. у наукометричній базі даних Scopus. У дослідженні було зосереджено увагу на оцінці продуктивності, типі публікації, рейтингу журналу, частоті публікацій, кількості цитувань, фокусі галузі дослідження, ключових словах та співавторстві.

Матеріали та методи. Для проведення цього дослідження було застосовано бібліометричний метод. Етапи дослідження включали (1) пошук статей за допомогою застосування логічного типу даних «петанк» і «петанк у спорті», (2) запит з критеріями включення електронних книг, стислих звітів, конференцій, оригінальних статей, оглядів літератури англійською, французькою та іспанською мовами з 2011 по 2024 рік, (3) фільтрацію 34 статей, (4) виключення 19 статей, в результаті чого залишилося 15 статей, які були визнані доцільними, (5) повторну фільтрацію і отримання аналогічної кількості, а саме 15 статей, і (6) вибірку 15 статей, які увійшли до остаточного масиву даних. З метою збору та аналізу даних використовувалися програмні засоби Mendeley, VOSviewer та Excel.

Результати. З точки зору продуктивності, було виявлено 3 (20,00 %) документи з 2011, 2021 та 2024 років; найпоширенішим типом документів були оригінальні статті із загальною кількістю 13 (86,67 %); більшість рейтингів журналів були в 3 та 4 квартилях (30,00 %); серед журналів, які найчастіше публікували дослідження з петанку, представлені наступні видання: *Journal of Physical Education and Sport*, *Ethnologie Francaise*, *Concurrences* та *International Journal of Human Movement and Sports Sciences*, а також *Retos*, кожен з яких містив по 2 (13,00 %) документи; тоді як найбільша кількість цитувань належить публікаціям науковця Пелани та ін. (Pelana et al) – 26 цитувань. У більшості досліджень акцентовано увагу на фізичних, технічних та біомеханічних аспектах. Найчастіше зустрічалися такі ключові слова: результативність, спортсмен, характеристика результативності, спорт, оптимальна групова результативність та план психологічної підготовки. Щодо питань співпраці, було встановлено 14 дослідників, які займалися однаковою тематикою досліджень.

Висновки. Дослідження в галузі спортивних ігор з петанку й досі потребують покращення дослідницької продуктивності та інновацій задля підвищення рівня інформованості та знань.

Ключові слова: бібліометричний аналіз, тенденції досліджень, вид спорту петанк, наукометрична база даних Scopus.

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