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EDUCAÇÃO FÍSICA - BACHARELADO**

FRANCISCO BRUNO FORTE ROCHA

**STATUS OF THE RESEARCH IN VOLLEYBALL AND BEACH VOLLEYBALL
FROM MATCH ANALYSIS: A BIBLIOMETRIC ANALYSIS.**

FORTALEZA

2021

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BANCA EXAMINADORA

Prof. Dr. Alexandre Igor Araripe Medeiros (Orientador)
Universidade Federal do Ceará

Prof. Dr. Gilmário Ricarte Batista
Universidade Federal da Paraíba

Prof. Dr. Antonio Garcia-De-Alcaraz
Universidade de Almería

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Abstract

Although this type of literature has been used in several fields of research beyond sports, as far as we know, this article is the first bibliometric study in this field of research. We conduct a bibliometric analysis of the scientific production related in volleyball and beach volleyball from match analysis in Scopus and Web of Science Core Collection. The current state of research on Match Analysis has grown considerably in the last decade (2010-2020), both modalities. The journals that have most publication was the *International Journal of Performance Analysis in Sport* and *Journal of Physical Education and Sport* and *Journal of Human Kinetics*. The most productive countries were Spain and Portugal. The most productive institutions were University of Alicante and University of Porto. Palao J.M. and Garcia-De-Alcaraz are the most productive authors. We hope that this study will provide valuable information about the current state of scientific production in MA in Volleyball and Beach Volleyball.

Resumo

Embora esse tipo de literatura tenha sido utilizado em diversos campos de pesquisa além do esporte, até onde sabemos, este artigo é o primeiro estudo bibliométrico nessa área de pesquisa. Realizamos uma análise bibliométrica da produção científica relacionada ao voleibol e vôlei de praia a partir de análises de partidas no Scopus e Web of Science Core Collection. O estado atual da pesquisa em Match Analysis cresceu consideravelmente na última década (2010-2020), ambas as modalidades. Os periódicos que mais publicaram foram o International Journal of Performance Analysis in Sport e Journal of Physical Education and Sport e Journal of Human Kinetics. Os países mais produtivos foram Espanha e Portugal. As instituições mais produtivas foram a Universidade de Alicante e a Universidade do Porto. Palao J.M. e Garcia-De-Alcaraz são os autores mais produtivos. Esperamos que este estudo forneça informações valiosas sobre o estado atual da produção científica em MA no Voleibol e Voleibol de Praia.

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Status of the research in Volleyball and Beach Volleyball from Match Analysis: a Bibliometric Analysis.

Vanessa da Silva Lima¹, Francisco Bruno Forte Rocha², Iara Bezerra Diniz¹, Antonio Garcia-De-Alcaraz³, Alexandre Igor Araripe Medeiros², Gilmário Ricarte Batista⁴

¹Ceara State University, Ceara, Brazil

²Federal University of Ceara, Ceara, Brazil

³University of Almería, Almeria, Spain

⁴Federal University of Paraiba, Paraiba, Brazil

1. Introduction

Volleyball and beach volleyball are among the most practiced sports in the world and have figured in competitive scenarios for some decades. In this context, scientific investigations that focus on sports performance are on the rise, especially from match analysis (MEDEIROS et al. 2014; FERNANDEZ-ECHEVERRIA et al. 2017).

Match analysis has assumed an important role in sport sciences (HUGHES & FRANKS, 2004), as it allowed the analysis of performance indicators related to the main events of the game (MCGARRY, 2009; WRIGHT, ATKINS & JONES, 2012), configuring itself as a promising area of scientific investigation.

Researchers from different areas have used bibliometric studies to obtain a global view of research fields and the evolution of a particular area. (ELLEGAARD, 2018; MEMON et al., 2020; IBÁÑEZ, GIL & CHENOLL, 2021). Thus, a bibliometric analysis of published studies related to volleyball and beach volleyball from the analysis of the game will allow us to identify research trends, including contributions produced by authors, countries, institutions, journal (WALLIN, 2005; VAN RAAN, 2014), among other relevant information for the scientific development of the modality in the last decades. Additionally, the analysis can also help researchers to find appropriate strategies and decision making for achieving the highest scientific effect.

In relation to academic literature in sports modalities, there are several bibliometric studies, such as Badminton (BLANCA-TORRES et al. 2020),

Handball (IBÁÑEZ, GIL, CHENOLL, 2021), Basketball (MACIEL et al. 2019), Female football (ADÁN et al 2020), Soccer (GARCIA-ANGULO, ORTEGA, 2015). Nevertheless, there is a gap in bibliometric studies regarding Volleyball and Beach Volleyball (BV). Although this type of literature has already been used in several fields of research beyond sports (ZANJIRCHI et al., 2019; VELOUTSOU & MAFE, 2020), as far as we know, this article is the first bibliometric study in this field of research.

Therefore, the aim of this study was to carry out a bibliometric analysis of the scientific production related in volleyball and beach volleyball from match analysis. The results of this study will provide an in-depth overview of the current state of the literature, trends in the area studied and provide guidance for future research.

2. Method

2.1 Database and search strategy

Data were extracted from two databases: Scopus and Web of Science Core Collection (WoS). Both databases have a large collection of journals and are widely used in various research (LIU, AVELLO, 2021; KHOO, LI, ANSARI, 2018; LASTELLA, MEMON, VICENT, 2020).

The use of two databases in this study aimed to provide more robust results, allowing a broad search to identify different research related to the topic (DE, OLIVEIRA et al. 2019). Scopus was used it addresses high quality of results, in addition to including complete bibliometric data (ZANJIRCHI, ABRISHAMI, JALILIAN, 2019). Similarly, Web of Science is a digital database widely used in bibliometric research, which also can provide high-quality literature in several areas (DIEM, WOLTER, 2013).

Before determining this initial research strategy, we conducted some searches using the title-abstract- keywords or topic or all fields for both sports. However, different strategies have led to a significant number of false positive results for Volleyball and false negative results for Beach Volleyball, which means that many studies obtained were not relevant to our main target content in volleyball were present and relevant studies in beach volleyball were absent.

Therefore, the search was conducted through all fields (WoS) and title-abstract-keywords (Scopus). We use two keywords “Beach Volleyball” or “Volleyball” associated, using the “AND”, with the keywords that represent concept analysis of the game, such as "game analysis" OR "notational analysis" OR "match analysis" OR "performance analysis" OR "performance indicators" OR "technical analysis" OR "tactical analysis" OR "video analysis". The search terms used were obtained from specific research and systematic review developed by Medeiros et al. (2014). Our search does not have a low-time frame limit.

This study does not involve human subjects, and therefore, did not require ethics approval.

2.2 Identifications of the documents in our search collection, screening and eligibility

Once the initial strategy was defined, the research was carried out in the two databases on April 27th for Beach Volleyball and May 9th for Volleyball in the year 2021, with 286 publications in beach volleyball and 443 in volleyball being identified. Our search does not have a low-time frame limit.

Following this, records were removed before screening for type of source and document (Review articles, conference paper, book, book chapter, conference proceeding and errata papers), only papers published in journals were included. For screening, 234 articles were found in BV and 354 in Volleyball. Then, we performed a manual review of the titles, abstracts, and full text, if necessary, aiming to exclude articles in languages other than English, method unrelated to the theme (does not use game match analysis as a methodology) and Sitting Volleyball papers.

After the analysis of duplicates, 29 articles of BV and 106 from Volleyball were included in bibliometric analysis. All methodological steps of the research were performed by two independent researchers (B.F and I.B.D) and later evaluated by a third researcher (V.S.L) whenever there was uncertainty or dispute between the two researchers regarding the paper eligibility. The overall search strategy employed in the current study is shown in Figure 1 and 2.

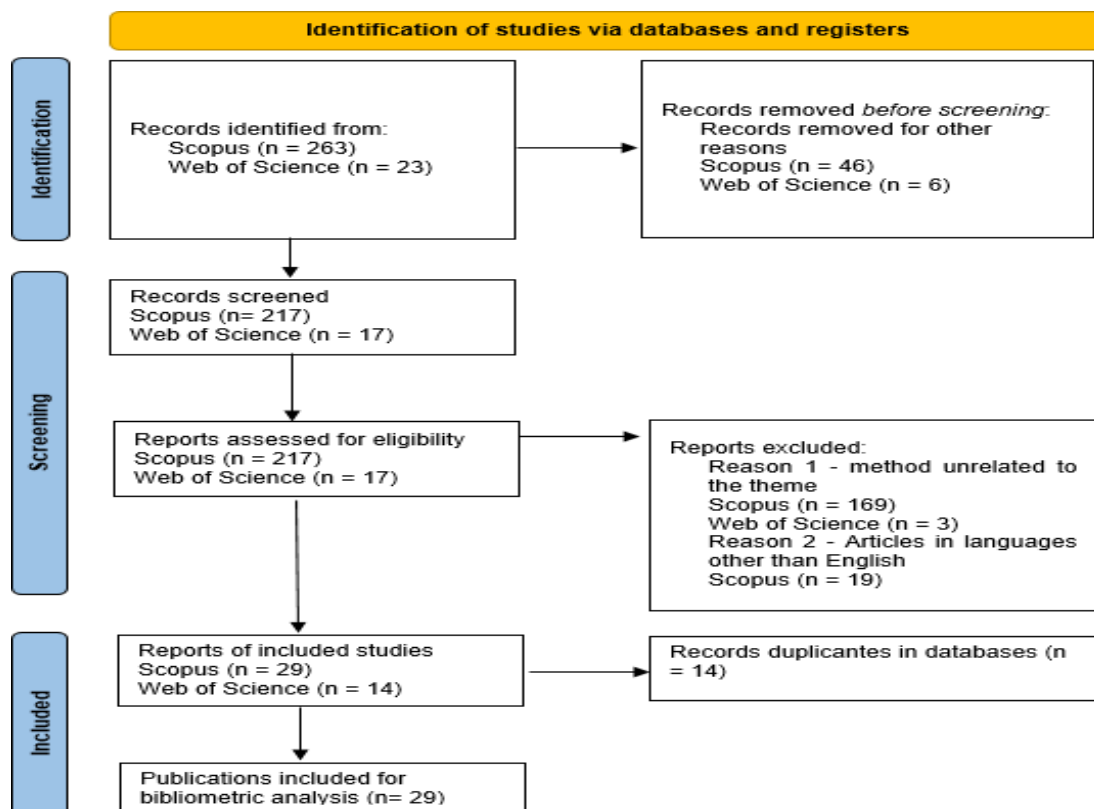


Figure 1. Flow diagram for research strategy and article selection for bibliometric study in Beach Volleyball Design is adapted from flow diagrams proposed by Page et al., 2021

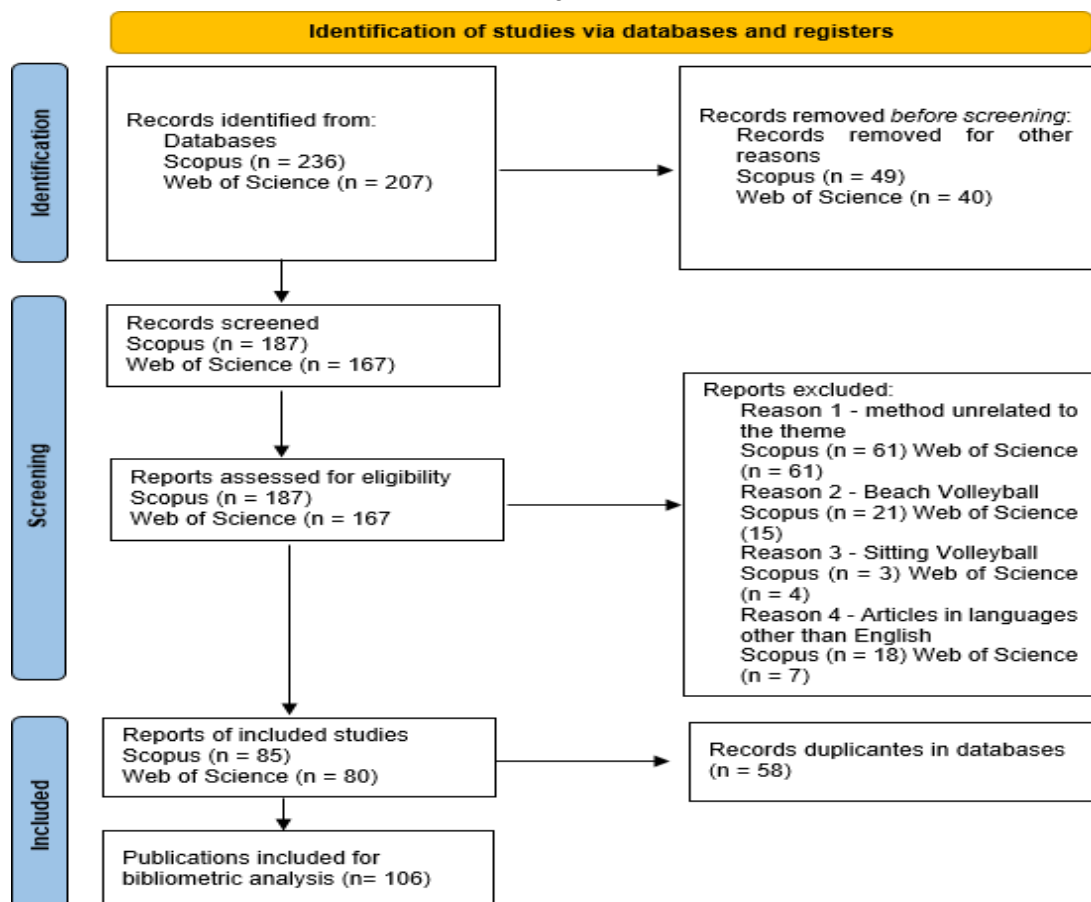


Figure 2. Flow diagram for research strategy and article selection for bibliometric study in Volleyball Design is adapted from flow diagrams proposed by Page et al., 2021

2.3 Analysis of bibliometric data

The variables analyzed for the bibliometric study were: the number of articles published per year, top 5 most productive and influential authors (according to publication number and h-index), journals (publication number and journal impact factor), countries (publication number and citations) and institutions (publication number and citations), and top 10 most cited papers (number of citations).

Additionally, bibliometric mapping was also conducted. We used VOSviewer software to present the relation of co-authorship between countries.

3. Results

3.1 Evolution of the number of articles published by year

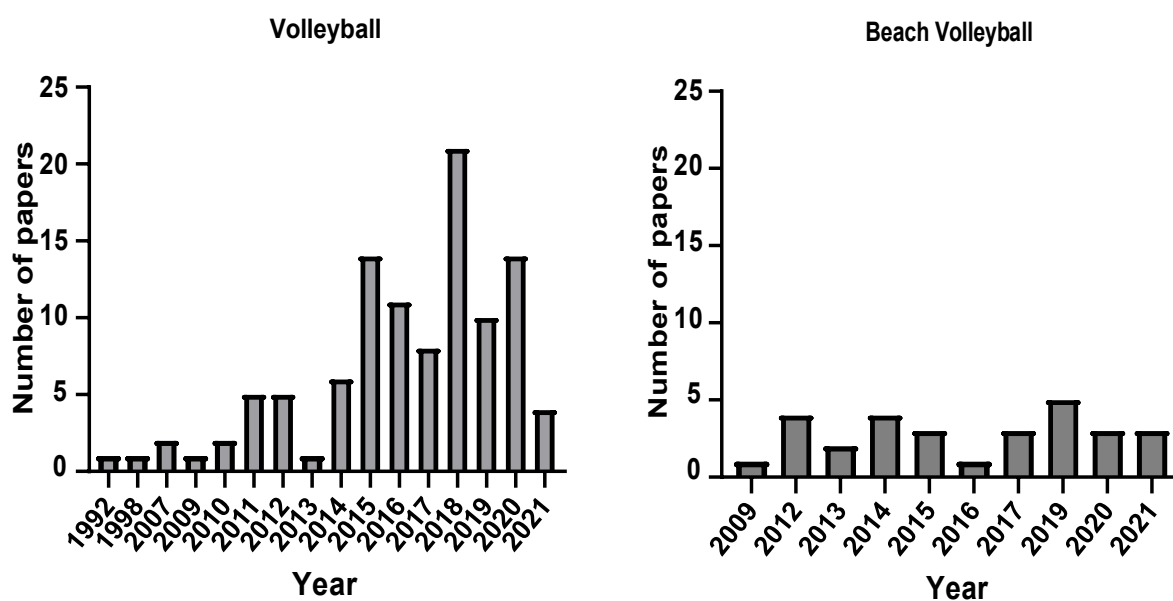


Figure 3-A/B. Evolution of the number of articles published by year in Volleyball and Beach Volleyball

*The years that had no publication were removed.

The first article in MA on BV was published in 2009, with no publication in the next two years. However, the following years showed an increase in scientific production in this area, with emphasis on the years 2019 as the most productive year with 5 publications (17.2%), 2014 and 2012 both with 4 publications (13.8%). The average publication was 2.2 articles per year

Regarding Volleyball, the first publication on MA was carried out in 1992, after that, some years passed until the second publication (1998), and only after 2011 that this theme had an increase in academic production. The highlight years were 2018 being the year with the largest number of publication with 21 articles (19.6%), 2020 and 2015 both with 14 articles published (13%). It is important to point out that, despite the fact that the first publication was carried out in 1992, it was only after almost two decades that the theme began to be more deeply studied (2011), with a publication average of 9 articles per year.

3.2 Most productive and influential journals

Table 1. Top 5 most productive and influential journals

	Journals	Articles	Number of citations	Journal Impact Factor	JIF - 5 years
Beach Volleyball	International Journal of Performance Analysis in Sport	4	32	1.950	2.337
	Journal of Physical Education and Sport	4	11	--	--
	Journal of Sports Science and Medicine	3	17	2.988	3.195
	Journal of Human Sport and Exercise	2	14	0.44	n/a
	Frontiers in Psychology	2	4	2.990	3.620
Volleyball	International Journal of Performance Analysis in Sport	24	299	1.950	2.337
	Journal of Human Kinetics	11	73	2.380	2.448
	Montenegrin Journal of Sports Science and Medicine	8	61	0.67	--
	Kinesiology	7	190	1.452	1.994
	Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte	6	14	1.406	1.600

In total, 18 journals published the included papers of BV, and the top 5 journals published 17 (58.6%) of the total number of papers. *International Journal of Performance Analysis in Sport* and *Journal of Physical Education and Sport* where ranked first with 8 (27.5%) papers each. In the top 5 five journals, three of them have the *Journal Impact Factor* above one, with *Frontiers in Psychology* having the highest impact factor (2.990), and the JIF-5 years (3.620).

In relation to Volleyball, a total of 35 journals published the included papers. The top 5 journals were responsible for 56 (52.8%) of these papers. *International Journal of Performance Analysis in Sport* and *Journal of Human*

Kinetics were ranked in first and second, with 24 (22.6%) and 11 (10.3%) papers, respectively. Regarding the *Journal Impact Factor*, *Journal of Human Kinetics* has the highest impact factor (2.380), and the JIF-5 years (2.448), with all the other journals having a impact factor above 1.4, the exception is the *Montenegrin Journal of Sports Science and Medicine* (0.67).

3.3 Highly productive countries

Table 2. Top 5 most productive countries.

	Countries	Papers (%)	Citations	CPP
Beach Volleyball	Spain	12 (41.3)	85	7
	Germany	4 (13.7)	6	1.5
	Austria	2 (6.8)	47	24
	Portugal	2 (6.8)	27	14
	Brazil	2 (6.8)	9	4.5
Volleyball	Spain	34 (32)	208	6
	Portugal	33 (31.1)	674	20.4
	Brazil	12 (11.3)	112	9.3
	Greece	9 (8.4)	74	8
	Germany	3 (2.8)	54	18

CPP = citations per paper.

Table 2 shows that, in BV, the top 5 countries participated in 22 (%) articles. Spain was the most productive country with 12 publications, followed by Germany with 4 publications. Regarding the number of citations, Spain also ranks first with 85 citations and 7 citations per paper, followed by Austria with 47 citations and 24 citations per paper. Almost all countries in the top 5 list are from Europe, with the exception of Brazil (South America).

With regard to Volleyball, a total of 91 articles were published with the participation of the top 5 countries. Spain was also the most productive country, followed by Portugal, with 34 and 33 publications, respectively. On the other hand, Portugal has the highest number of citations with 674 citations and 20.4 citations per paper, followed by Spain with 208 citations and 6 citations per paper. Similarly, to BV, almost all countries in the top 5 are from Europe, with Brazil, again, being the exception.

3.4 Most productive institutions

Table 3. Top 5 most productive institutions.

	Affiliation	Country	Papers (%)	Citations	CPP
Beach Volleyball	University of Alicante	Spain	6 (20.6)	24	4
	University of Murcia	Spain	4 (13.7)	43	10.7
	Technical University of Munich	Germany	3 (10.3)	5	1.6
	University of Porto	Portugal	2 (6.8)	27	13.5
	University of Graz	Austria	2 (6.8)	47	23.5
Volleyball	University of Porto	Portugal	20 (18.8)	529	26.4
	University of Extremadura	Spain	10 (9.4)	53	5.3
	University of Athens	Greece	9 (8.4)	74	8.2
	University of Trás-os-Montes and Alto Douro	Portugal	8 (7.5)	120	15
	University of Granada	Spain	8 (7.5)	45	5.6

CPP = citations per paper.

Table 3 shows that University of Alicante was the most productive institution in BV with 6 publications, followed by University of Murcia with 4 publications, both Spanish institutions. Taking into account the number of citations, the University of Graz came first place with 47 citations, and University of Murcia the second with 43.

Regarding the Volleyball, University of Porto was the most productive institution with 20 papers, followed by University of Extremadura with 10 papers. In relation to the number of citations, University of Porto also ranked first place with 529, and University of Trás-os-Montes and Alto Douro the second with 120.

3.5 Most productive authors

Table 4. Top 5 most productive authors.

	Author	Affiliation	Papers (%)	Citations	CPP	h-index*
Beach Volleyball	Palao, J.M.	University of Murcia / University of Winsconsin-Parkside	6 (20.6)	24	4	16
	Jimenez-Olmedo, J.M.	University of Alicante	4 (13.7)	43	10.7	7
	Medeiros, A.I.A.	Federal University of Ceara / University of Porto	3 (10.3)	5	1.6	2
	Wenninger, S.	Technical University of Munich	2 (6.8)	27	13.5	2
	Seweryniak, T.	University School of Physical Education in Wroclaw	2 (6.8)	47	23.5	2

Volleyball	Garcia-De-Alcaraz, A.	Polytechnic University of Madrid / University of Almeria	20 (18.8)	529	26.4	7
	Drikos, S.	University of Athens / Gazi University	10 (9.4)	53	5.3	4
	Marcelino, R.	University of Trás-os-Montes and Alto Douro / University of Porto	9 (8.4)	74	8.2	13
	Costa, G.	Federal University of Goiás	8 (7.5)	120	15	4
	González-Silva, J.	University of Extremadura	8 (7.5)	45	5.6	4

*related to the author, not only for their papers in MA

In terms of the number of articles published, the most influential author in the BV was Palao J.M. with 5 publications, followed by Jimenez-Olmedo J.M. and Medeiros A.I.A., with 4 and 3 publications respectively. The author with more citations are also Palao J.M. with 43, and second Medeiros A.I.A. with 35.

In relation to Volleyball, Garcia-De-Alcaraz A. was the author with most publications (9), followed by Drikos S. (7). Regarding the number of citations, Marcelino R. took first place with 246, and Costa G. the second place with 92.

3.6 Top 10 most cited articles

The most cited paper of MA in BV was published in 2009 by Koch C and Tilp M., with 43 citations (until May 2021), and 3.58 average citations per year. The second and third most cited papers were published in 2014 (Medeiros A.I.A et al.) and 2012 (Buscá B. et al.), with 2.42 and 1.77 average citations per year, respectively.

With regard to Volleyball, the paper in first place by Marcelino R., Mesquita I., Sampaio J., has 82 citations, published in 2011 (8.20 average citations per year), followed by the second paper with 64 citations (5.81) published in 2010 by Afonso J. et al., and third most cited paper with 60 citations (6.00) published in 2011 by Castro J., Sousa A., Mesquita I.

Table 5 show the top 10 most cited articles in MA for BV and Volleyball.

Table 5. Top 10 most cited articles.

	Cited by	Authors	Title	Year	Source title	Citations per year
Beach	43	Koch C., Tilp M.	Beach volleyball techniques and tactics: a comparison of male and female playing characteristics	2009	Kinesiology	3.58

	17	Medeiros A., Marcelino R., Mesquita I., Palao J.M.	Physical and temporal characteristics of under 19, under 21 and senior male beach volleyball players	2014	Journal of Sports Science and Medicine	2.42
	16	Buscá B., Moras G., Peña J., Rodríguez-Jiménez S.	The influence of server characteristics on performance in men's and women's high-standard beach volleyball	2012	Journal of Sports Science	1.77
	15	Palao J.M., Valadés D., Ortega E.	Match duration and number of rallies in men's and women's 2000-2010 FIVB world tour beach volleyball	2012	Journal of Human Kinetics	1.66
	14	Palao J.M., Valadés D., Manzanares P., Ortega E.	Physical actions and work-rest time in men's beach volleyball	2014	Motriz	2.00
	10	Medeiros A.I.A., Mesquita I.M., Marcelino R.O., Palao J.M.	Effects of technique, age and player's role on serve and attack efficacy in high level beach volleyball players	2014	International Journal of Performance Analysis in Sport	1.42
	9	Jimenez-Olmedo J.M., Pueo B., Penichet-Tomás, A.	Defensive systems during the men's european university beach volleyball championship	2016	Journal of Physical Education and Sport	1.80
	8	Medeiros A.I.A., Marcelino R., Mesquita I., Palao J.M.	Performance differences between winning and losing under-19, under-21 and senior teams in men's beach volleyball	2017	International Journal of Performance Analysis in Sport	2.00
	8	Palao J.M., López-Martínez A.B., Valadés D., Ortega E.	Physical actions and work-rest time in women's beach volleyball	2015	International Journal of Performance Analysis in Sport	1.33
	8	Jimenez-Olmedo J.M., Penichet-Tomás, A., Saíz-Colomina S., Martínez-Carbonel J.A., Jove-Tossi M.A.	Serve analysis of professional players in beach volleyball	2012	Journal of Human Sport and Exercise	0.88
Volleyball	82	Marcelino R., Mesquita I., Sampaio J.	Effects of quality of opposition and match status on technical and tactical performances in elite volleyball	2011	Journal of Sports Sciences	8.20
	64	Afonso J., Mesquita I., Marcelino R., Silva J.A.	Analysis of the setter's tactical action in high-performance women's volleyball	2010	Kinesiology	5.81
	60	Castro J., Souza A., Mesquita I.	Attack efficacy in volleyball: Elite male teams	2011	Perceptual and Motor Skills	6.00

52	Marcelino R., Sampaio J., Mesquita I.	Attack and serve performances according to the match period and quality of opposition in elite volleyball matches	201 2	Journal of Strength and Conditioning Research	5.77
52	Afonso J., Esteves F., Araújo R., Thomas L., Mesquita I.	Tactical determinants of setting zone in elite men's volleyball	201 2	Journal of Sports Science and Medicine	5.77
51	Marcelino R., Mesquita I., Palao J.M., Sampaio J.	Home advantage in high-level volleyball varies according to set number	200 9	Journal of Sports Science and Medicine	4.25
51	Costa G., Afonso J., Brant E., Mesquita I.	Differences in game patterns between male and female youth volleyball	201 2	Kinesiology	5.66
44	Afonso J., Mesquita I.	Determinants of block cohesiveness and attack efficacy in high-level women's volleyball	201 1	European Journal of Sport Science Research Quarterly	4.40
38	Eom H.J., Schutz R.W.	Transition play in team performance of volleyball: A log-linear analysis	199 2	Exercise and Sport International	2.00
34	Drikos S., Vagenas G.	Multivariate assessment of selected performance indicators in relation to the type and result of a typical set in men's elite volleyball	201 1	Journal of Performance Analysis in Sport	3.40

3.7 Bibliometric Mapping - Co-authorship network between countries

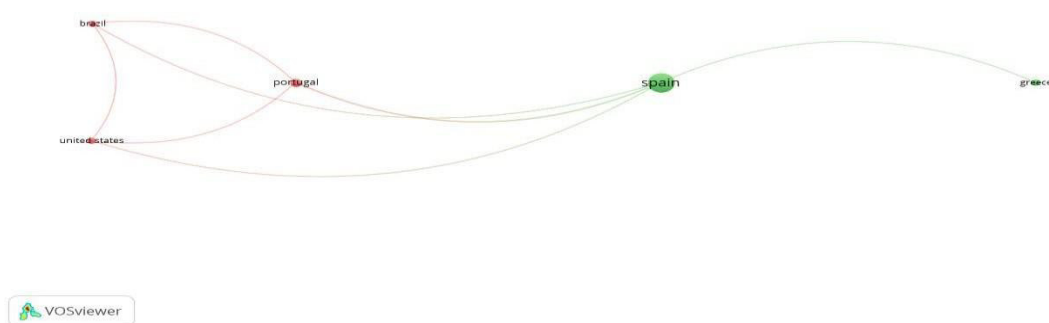


Figure 4. The network visualization map for co-authorship between countries in BV
 Figure 4 shows the network visualization map for co-authorship in BV. The network is composed by 2 clusters relating 5 countries. There was 6 links, with Spain being the central country in this network. The Cluster is 1 composed by Brazil, Portugal and USA, and Cluster 2 by Greece and Spain. The total link

strength shows that Spain (5), Portugal (4) and Brazil (3) have the highest rate of co-authorship.

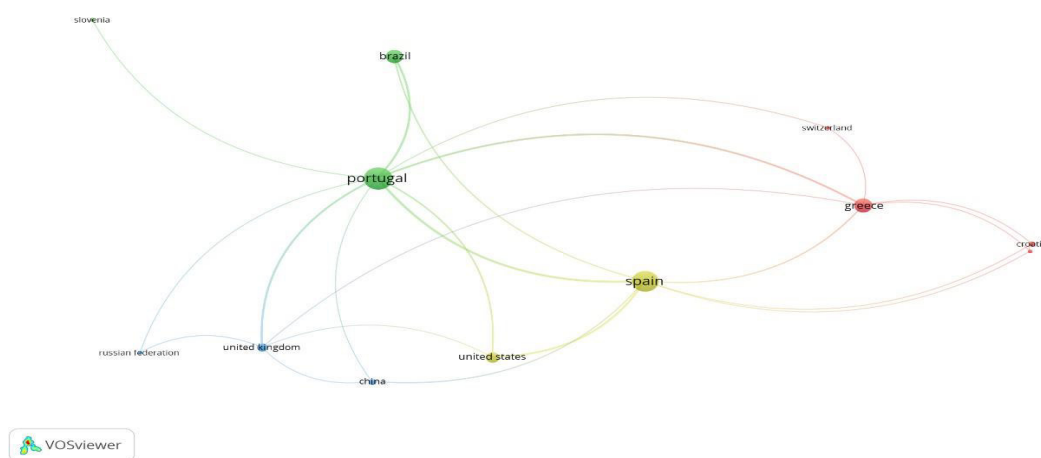


Figure 5. The network visualization map for co-authorship between countries in Volleyball

Figure 5 shows the network visualization map for co-authorship in Volleyball. The network is composed by 2 clusters relating 5 countries. There was 23 links, with Portugal being the central country in this network. The Cluster is 1 composed by Croatia, Greece, Switzerland and Turkey; Cluster 2 by Brazil, Portugal and Slovenia; Cluster 3 by China, Russia, United Kingdom; and Cluster 4 by Spain and USA. The total link strength shows that Portugal (29), Spain (20) and Greece (11) have the highest rate of co-authorship.

4. Discussion

The current study provide new evidence of the scientific production related to MA in BV and Volleyball. Research in the analysis of the game in volleyball began to emerge in the 1990s and in beach volleyball in the 2000s. There is a relative time factor difference in the year the inclusion of both modalities in the Olympic Games and the consequent impact of this fact on the development of modalities and of scientific interest.

In the last 10 years, the number of articles published has more than doubled. In BV, growth was fivefold comparing 2009 to 2019. In this same period, in Volleyball it showed a tenfold increase. Thus, this scenario evolution of publications in the field of scientific development. BV seems to be in a precursor phase, showing a linear growth behavior. In Volleyball, in a scenario composed

of three decades, the exponential growth phase emerges, duplicating studies every decade. Both the precursor and the exponential phases are proposed in Price's Law (Price, 1963) which proposes development of the scientific field goes through four stages: the precursor stage, the exponential growth stage, the consolidation of the body knowledge stage, and the decrease in the production stage. Then, this is promising research field in relation to studies that can still be developed until reaching the consolidation stage.

Regarding the most productive journals, As shown in Table 1, the top 5 journals is responsible for more than half of the publications, both in BV and Volleyball. Thus, we can see there is an unequal distribution of papers in the journals, with a large number of papers are found in a small number of journals. This suggests that the field of research was not considered in depth by many journals, suggesting an innovative and youthful nature of the field under study (Bradford, 1934). In addition, the list of journals that are highlighted in the theme can serve for better targeting the search for scientific information by the coaches of both modalities.

Authors from 10 countries and 17 affiliations published in MA for BV. The top 5 countries was responsible for 22 (75.8%) publications. With relation to Volleyball, 15 countries and 32 affiliations participated in publications, with top 5 countries being responsible for 91 (85.8%) publications. In both modalities, the increase in scientific production in the last decade was led by European countries, especially Spain and Portugal. This increase in production may come from the globalization of sport and the increase in financial investment made by governments. The increased investment in sport may be responsible for some aspects such as the increase in the population's sporting practice, international prestige for the nation, in addition to attracting several sports scientists, reinforcing academic development and, consequently, scientific production (GRIX, CARMICHAEL, 2012).

With regard to most productive authors in BV, table 4 shows that the authors ranked the first and second place has a higher number of publications, and a higher h-index. On the other hand, in Volleyball, the author with the most publications is also the most cited, but the third author with the highest number of citations is the one with the highest h-index. The inconsistency in the number of publications, citations and h-index indicate that no academic or academic team

has yet had a decisive influence in the area (LIU, AVELLO, 2021), which is also related to the fact that the area still in the exponential growth stage.

With relation for the most cited articles in BV and Volleyball, results show that the most studied performance indicators were: comparison between genders, player role, physical and temporal characteristics, game duration, type of technique and its relation to effectiveness, and tactical aspects. In relation to Volleyball, the performance indicators were: quality of opposition, tactical and technical actions and their relation to the result, home/away advantage, comparison between genders.

The average of authors in the most cited articles, both for BV and for Volleyball, are 3.7 and 3.2. Results similar to those obtained in other studies in which the average number of authors is between 1 and 4; on the other hand, this may be because it is unusual, in certain fields of knowledge, that authorship being very numerous (BLANCA-TORRES et al. 2020).

Regarding the map of co-authorship between countries, figure 5 and 6 shows a correlation of authorship among few countries, with Spain and Portugal being the countries with the most links. In relation to that, international collaboration in scholarly research, resulting in published articles, has risen at a spectacular rate for three decades. Based on the increase in global competition and exponential technological growth, it has become common for countries to scientifically collaborate with other countries in order to expand their production and innovation in the academic scene. Consequently, countries with a greater number of collaborative linkages are in an advantageous position to improve domestic production capacities and make use of foreign investment in research and innovation (CHEN, ZHANG, FU, 2019).

Although our study provided some insights into the scientific production of MA in BV and Volleyball, there are some limitations to be acknowledged. First, only articles written in English were included; therefore, articles published in other languages were not analyze. This may be a limitation given the possibility of publications in another language. Second, the bibliometric indicators of the present study were taken directly from the Scopus and Web of Science database and, in some cases, there may be inaccuracies (LASTELLA, MEMON, VICENT, 2020). Third, the search was done in Web of Science “all fields” (BV and Volleyball) and Scopus “all fields” for BV and “title-abs-key” for Volleyball. This

could limit the studies found for Volleyball. However, this increases the guarantee that the articles found are link to the topic of interest.

The main strengths of current study was the use of two widely explored databases in sport science (WoS and Scopus); strict selection criteria, with evaluation of titles, abstract and, when necessary, full text, for inclusion; no year limitation for publications, which allows a broad analysis of scientific production in MA for both modalities.

5. Conclusions

The currently used bibliometric indicators summarizes the critical elements and characteristics one should be aware of when evaluating the quantity and quality of scientific output on MA in Volleyball and BV. This research was the first to carry out a bibliometric analysis about the scientific production on MA in Volleyball and BV. The current state of research on MA has grown considerably in the last decade (2010-2020), both modalities. The journals that have most publication was the *International Journal of Performance Analysis in Sport* and *Journal of Physical Education and Sport* and *Journal of Human Kinetics*. The most productive countries were Spain and Portugal. The most productive institutions were University of Alicante and University of Porto. Palao J.M. are most productive and influential author in BV; in Volleyball Garcia-De Alcaraz A. are the most productive and cited author.

We hope that this study will provide valuable information about the current state of scientific production in MA in Volleyball and BV. Furthermore, we hope that researchers and practitioners, aiming to intensify research in the field of MA in both modalities, will use the present data.

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