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Article

Evolution of the Documents Related to the Study of Taekwondo Sports Performance: A Bibliometric Review

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Abstract: Taekwondo is a Korean martial art, combat sport, and Olympic discipline. Taekwondo competition is characterized as an individual sport (1X1), single elimination tournament and repechage system. The aim goal of this study is brought of a bibliometric review regarding the item's "taekwondo" and "performance", through identified and published manuscripts on the Web of Science (WOS) database by December 31, 2022. The bibliometric analysis was used to analyze a data set of 460 WOS-indexed manuscripts published between 1992 and 2022. Descriptive analysis, citation, authorships, countries, institutionals, and keywords co-occurrence analyses were conducted into Taekwondo sports performance. The manuscripts founded in the WOS database are inserted on the categories: "Sports Science" (n = 229), "Hospitality Leisure Sport Tourism" (n = 48), and "Physiology" (n = 32). The authors Kazemi et al. (2006), Matsushigue et al. (2009), and Paillard (2017) are the must published and cited researchers. The countries with high number of published manuscripts with the objective of this study are Brazil (n = 83), South Korea (n = 57), and Spain (n = 52). We found also, five collaboration networks between authors and institutions, found a gap of the thematic relevant researchers. The authors should have highlighted Franchini, E., (n = 42), and Falco, C., (n = 20). It is recommended to carry out multidimensional research on Taekwondo sports performance with the aim of establishing collaborations within groups, institutions, and countries. In this way, the productivity, effectiveness, and quality of research would be increased, as well as international collaboration networks.

Keywords: bibliometric; analysis; skills; sport; individual

1. Introduction

Taekwondo is an ancient Korean martial art without weapons and sport combat [1], its goal is strengthening the body, mind, and spirit, through self-defense practice. Besides, it helps to integrate development, and even to obtain better inclusion and quality of life [2,3]. Equally, it is recognized as an international sport modality, and it is practiced all over the world by kids, young people, and adults [4]. A Taekwondo competition is characterized by three two-minute rounds, and one minute rest between rounds [5]. The athlete performs fantastic and spectacular kick techniques. Likewise, there are a panoply of kick varieties (Chagi), in the Taekwondo system, such as: An-chagi, Ap-chagi, Bakat-chagi, Bandal-chagi, Dollyo-chagi, Furyo-chagi, Miro-chagi, Nako-chagi, Neryo-chagi, Dwit-chagi, Yop-chagi, Mondollyo Furyo-chagi y Mondollyo Nako-chagi, Mondollyo Yop-chagi, Mondollyo Dwit-chagi, etc. [6–8]. That's why complex technical processes are used, and the kick technique can be performed dynamically, with powerful acrobatic, jumping and explosive movements [9]. Therefore, in Taekwondo, where the athlete fights against an opponent, the technical and tactical control is required, as well as recognizing the opponent's qualities to win the fight [9].

In scientific literature, there is a wide variety of studies related to Taekwondo. For instance: body mass characterization [10–12], physical capabilities [13], main physiological adjustments during competition [14], and effects of Taekwondo practice on the health and well-being of practitioners [15,16]. There are also investigations related to the level of motivation during training periods [17,18], and comparison studies between boxing and Taekwondo [19]. Also, papers related to the benefits of using video in Taekwondo learning processes [20–22], and sensors for sportswear [23]. There are studies related to the most common sports injuries in Taekwondo practitioners [24–26]. Thus, a wide variety of investigations into Taekwondo.

Theoretical studies on Taekwondo are focused on specific themes, and papers related to sports performance indicators in Taekwondo are scarce [7,27] and emerging. Thus, in a short time it has gained popularity as a concept

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among sports professional researchers [28]. Understanding sports performance indicators as a method of recording data and analyzing the sports context [29], with the purpose of giving optimal quantitative and qualitative feedback, as well as providing relevant data on the sport analyzed [30]. Also, the main objective is to identify strengths that can be developed in training, and weaknesses that can be improved before the competition [31,32].

In this way, and due to the importance of evaluating and identifying performance in different sports modalities, to implement improvements in skills, and specific techniques to each discipline, the objective of this work is to analyze the evolution of the documents related to the study of performance in Taekwondo, from its origins to the present (2022).

Materials and Methods

2.1. Study Design

The present study is a predominantly theoretical study [33], to analyze the evolution of documents related to performance analysis in Taekwondo through a literature bibliometric review, based on past events. Therefore, it is classified as an *ex post facto retrospective* study [34]. Likewise, by analyzing the evolution of manuscripts related to the researched topic, it will allow researchers to know the state-of-the-art regarding a specific topic and identify future underdeveloped lines of research [35]. Furthermore, considering the main objective of the study, a review of the literature has been developed, based on a systematic and bibliometric analysis of the data obtained [36].

2.2. Data extraction

To search for manuscripts, the Web of Science (WOS) database was used, since it is one of the databases which is most used and with a great deal of impact for the preparation of bibliometric reviews [35,37]. Likewise, the WOS database presents the largest number of indexed documents [38]. For data extraction, the guidelines, and laws of bibliometrics have been taken [39]. Therefore, this database allows extracting information from the manuscripts related to Title, Summary, Keywords, Author(s), Collaborating Institutions and Countries. Also, it will allow the authors to analyze and identify the influence, and relationship with the scientific field, as well as its growth in the number of publications [40].

On the other hand, a phases series proposed by Arksey and O'Malley have been used [41]: a) identify and establish the research question and objectives; b) identify the most relevant studies related to the research topic; c) select the most relevant studies taking into account the established inclusion criteria; d) extract the data to prepare the figures, and identify the relationships established between them, and; e) identify, summarize and establish the main findings obtained after carrying out the study.

2.3. Search strategy

The keywords "Performance" and "Taekwondo" were used to search and identify the manuscripts, by using the "topic" filter. This fact will allow to select those documents that present the key terms in the Title, Summary and Keywords, identifying manuscripts with great relevance and relationship with the selected topic. Furthermore, with the objective of identifying the greatest number of documents related to the research topic, the search was carried out by two of the investigators (VHB and JMG). Subsequently, the results were reviewed and corroborated by a third and fourth researcher (SJI and JLS). In this way, bias in the results is reduced. After this analysis step, a total of 533 documents were identified, 73 were eliminated for not meeting the inclusion criteria. The final sample of the study was made up of a total of 460 documents (Figure 1).

2.3.1. Inclusion criteria

For the inclusion of documents in the bibliometric analysis, these had to meet a series of established inclusion criteria established at the beginning of the research by the authors: 1) the documents had to be related to Taekwondo performance analysis; 2) be written in Spanish, English, or Portuguese, or, failing that, present the possibility of being translated into English; 3) the full text or summary be available for analysis, and; 4) be published before December 31, 2022, once the year 2023 has not yet been completed. For this reason, studies related to Taekwondo from the year 2023 are not included in the analysis.

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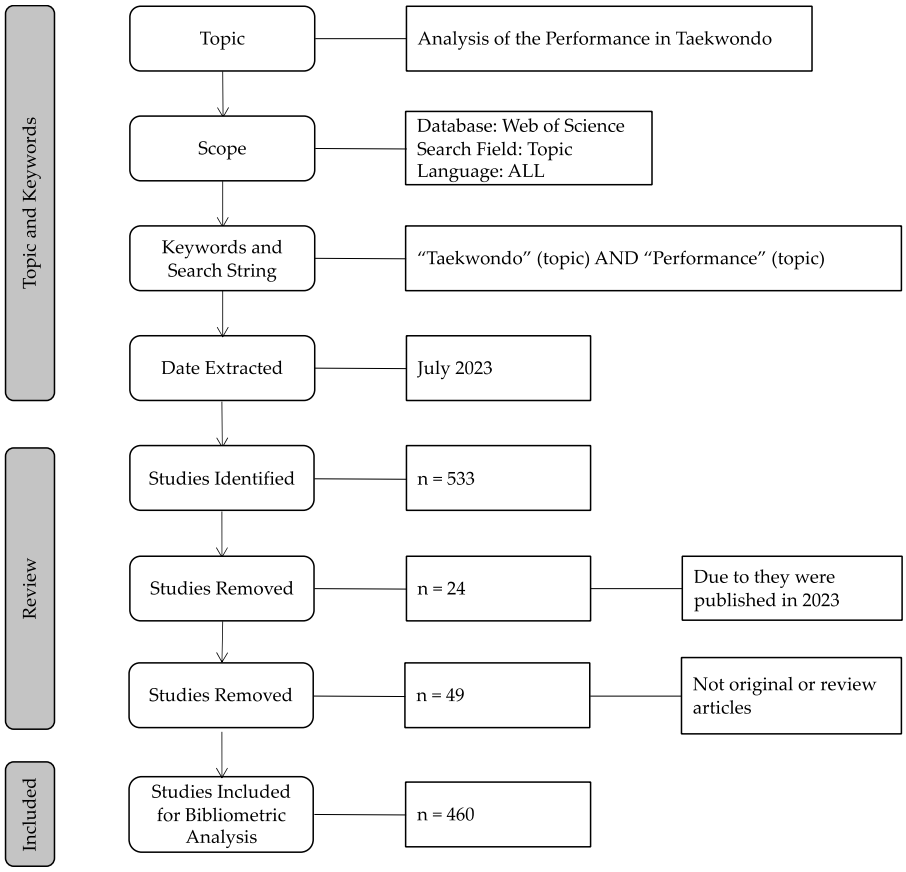

Figure 1. PRIMA flow diagram by identification, screening, eligibility and included sources process.

2.4. Data analysis

For data extraction and subsequent analysis, the main laws of bibliometrics have been take as reference [42,43]. For data analysis, the following established laws have been used: Law of Price, Lotka [44], and Zipt [45]. Also, to carry out the analysis of the manuscripts, the metadata of the studies were downloaded in two formats, Plain text, and Excel. Subsequently, by using VOSViewer (Center for Science and Technology Studies, Netherlands), and Microsoft Excel (2006 version: Microsoft Corporation, Redmond, WA, USA), the visualization and data analysis processes were carried out. In the VOSViewer application, a fragmentation analysis was used with a value of 3 for attraction and -3 for repulsion.

Results

3.1. Number of publications evolution

After the analysis of the study sample, it is shown as the first study related to the research topic, published in 1992, and analyzed the influence of competitive anxiety on the performance of athletes [46]. In 1995, the second article was published, with the purpose of analyzing the influence of the presence of injuries prior to the competition, being an influential factor in the control and regulation of athletes and coaches [47].

After making these publications, no continuity is identified in the publication of studies until 2004, being the year in which a minimum of one article is published to date. From 2004 to nowadays, the sample is divided into those documents published between 2004 to 2013 (n = 83), and since 2013 to the present date (n = 275), presenting an increase of 90.7% in the number of publications. Furthermore, the years 2021 and 2022 are the periods with the highest number of publications (n = 66) (Figure 2).

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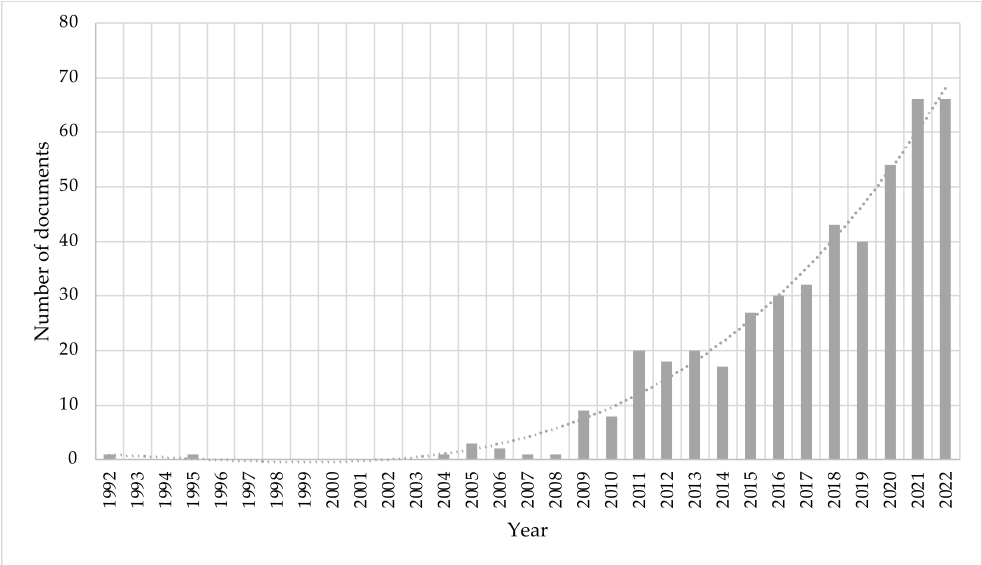

Figure 2. Evolution of the number of documents.

3.2. WOS Category

Table 1 shows the results related to the categories established by the WOS. It is also observed that the most predominant category is "*Sports Science*", with a total of 229 documents, corresponding to almost 50% of the selected sample. Behind her, and with a considerably smaller number, are "*Hospitality Leisure Sport Tourism*" (n = 48), and "Physiology" (n = 32). Thus, the authors focus their interests on areas related to Sports Sciences, whose objective is the analysis of performance, and the factors that thereby influence.

Table 1. Distribution of documents based on WOS category.

WOS Category	Documents	% of 460
Sport Sciences	229	49.78
Hospitality Leisure Sport Tourism	48	10.43
Physiology	32	6.95
Nutrition Dietetics	27	5.87
Public Environmental Occupational Health	23	5.00
Environmental Sciences	18	3.91
Rehabilitation	18	3.91
Medicine General Internal	15	3.26
Multidisciplinary Sciences	14	3.04
Psychology Experimental	14	3.04

3.3. Publication journal

Considering the journal in charge of publishing the articles, it is noted as "Archives of Budo", has the largest number (n = 61). Also, the impact Factor of the journal has been identified based on the score awarded by the Journal Citation Reports for the year 2022. It is observed that the journals with an impact index greater than 3 are: "*Plos One*" with 11 published documents, "*International Journal of Sports Physiology and Performance*" with 9 documents, and "*Journal of Strength and Conditioning Research*", with a total of 23 studies (Table 2).

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Table 2. Most relevant journals by published manuscripts.

Publication title	Doc's	% of 460	IF*	Editorial
Archives of Budo	31	6.73	2.1	Int Scientific Information, Inc
Journal of Strength and Conditioning Research	23	5.00	3.2	Lippincott Williams & Wilkins
Ido Movement for Culture Journal of Martial and Anthropology	22	4.8	N/A	Idokan Poland Assoc.
International Journal of Environmental Research and Public Health	18	3.91	N/A	Mdpi
Perceptual and Motor Skills	12	2.60	1.6	Sage Publications Inc
Plos One	11	2.39	3.7	Public Library Science
International Journal of Sports Physiology and Performance	9	1.95	3.3	Human Kinetics Publ Inc
Journal of Sports Medicine and Physical Fitness	9	1.95	1.7	Edizioni Minerva Medica
Revista de Artes Marciales Asiáticas	9	1.95	N/A	Universidad de León
Journal of Exercise Rehabilitation	8	1.73	1.9	Korean Soc Exercise Rehabilitation

*IF – Impact Factor of Journal Citation Reports 2022; Doc's - Documents

3.4. Most cited documents

Table 3 shows the most Top 10 cited documents in relation to the study of sports performance in Taekwondo. In addition, the journal in which it has been published is identified, as well as the average number of citations per year from its publication to the present (time cited in the WOS). It can be seen how the study prepared by Kazemi et al. [48], it is the one that has received the greatest number of citations since its publication (2006).

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Table 3. High-cited documents, authors, journal, and average per year.

Title	Authors	Journal	Year of publication	Total of citations	Average per year
A profile of Olympic Taekwondo competitors	Kazemi et al. [48]	Journal Of Sports Science and Medicine	2006	114	6,33
Taekwondo: Physiological Responses and Match Analysis	Matsushigue et al. [49]	Journal Of Strength and Conditioning Research	2009	108	7,2
Plasticity of the postural function to sport and/or motor experience	Paillard [50]	Neuroscience And Biobehavioral Reviews	2017	104	14,86
Fitness profile of elite Croatian female taekwondo athletes	Markovic et al. [51]	Collegium Antropologicum	2005	100	5,26
Physiological Responses and Perceived Exertion During International Taekwondo Competition	Bridge et al. [52]	International Journal of Sports Physiology and Performance	2009	96	6,4
A Review of Time-Motion Analysis and Combat Development in Mixed Martial Arts Matches at Regional Level Tournaments	Del Vecchio et al. [53]	Perceptual And Motor Skills	2011	91	7
Practices of Weight Regulation Among Elite Athletes in Combat Sports: A Matter of Mental Advantage?	Pettersson et al. [54]	Journal of Athletic Training	2013	78	7,09
Stress-related hormonal and psychological changes to official youth Taekwondo competitions	Chiodo et al. [55]	Scandinavian Journal of Medicine & Science in Sports	2011	74	5,69
Making Weight in Combat Sports	Langan-Evans et al. [56]	Strength And Conditioning Journal	2011	70	5,38
Caffeine Reduces Reaction Time and Improves Performance in Simulated-Contest of Taekwondo	Santos et al. [57]	Nutrients	2014	66	6,6

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3.5. H-Index

Figure 3 shows the minimum of documents depends on the H-Index of the sample (n = 40). Therefore, in this study, we can affirm that there is a minimum of 40 documents that present a minimum of 40 citations. After carrying out a thorough analysis of the documents, it is shown that there are a total of 4 documents with a number equal to or greater than 100 citations, with 114, 108, 104 and 100 respectively.

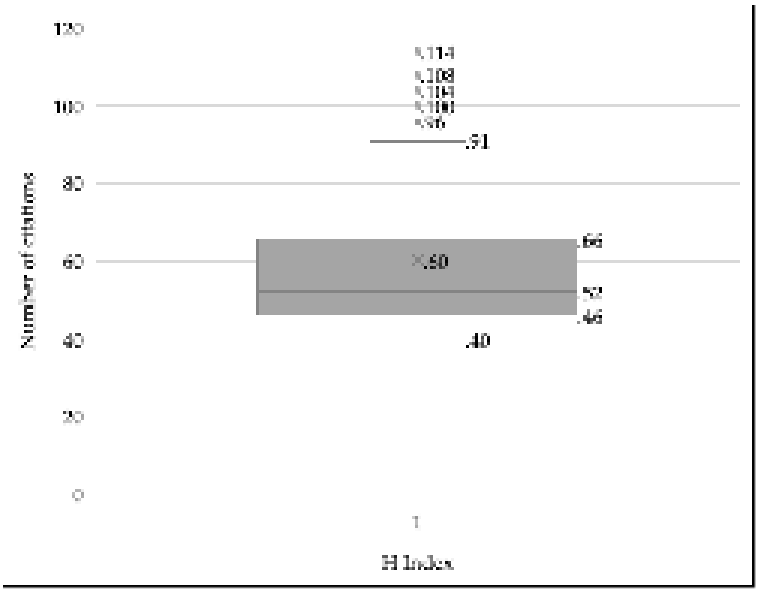

Figure 3. Number of citations depending on the H-Index of the sample.

Below, Figure 4 shows the number of documents and citations received in total, per year. The year of 2021 shows the highest number of citations: 719, with a total of 20 published documents. In contrast, the years after 2020 are the one with the greatest number of documents produced. However, the number of citations decreases considerably.

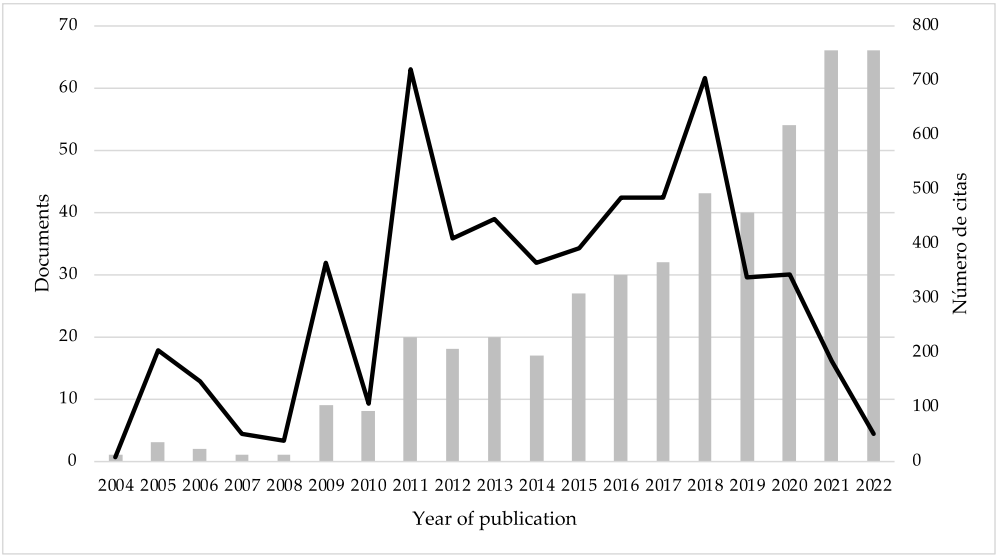

Figure 4. Numbers of documents and citation evolution in Taekwondo sports performance.

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3.6. Publications by countries

After the extracting procedure of the countries that have contributed to preparation of the documents, there is a total of 62 regions of the 35 countries present a minimum of 3 documents, and 20 countries present a minimum of 7 documents produced. For the analysis of co-authorship of the countries, all of them have been included (n = 62). Only 51 of them have a connection. Beyond that, it is observed that Brazil (n = 83), South Korea (n = 57), and Spain (n = 52) are the countries with the highest number of publications. Taking the number of citations received as a reference, Brazil, Italy, and England have the highest number, with 1264, 622 and 604, respectively. Spain is identified in fourth place with a total of 589 citations (Figure 5).

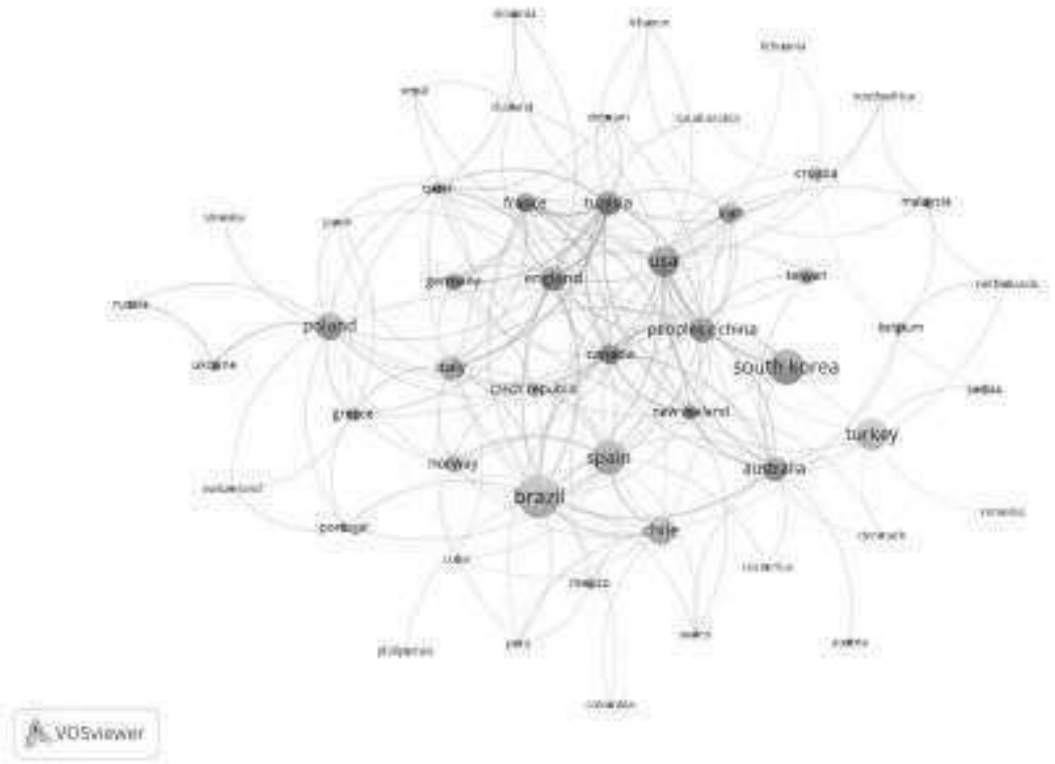

Figure 5. Co-authorships of countries based on number of documents.

Figure 5 also identifies the Co-authorships of countries map, by using the VOSviewer, seven cluster representing the network between the countries. The size of the bubbles indicates the co-authorships frequency. Light blue cluster leadership by Brazil indicates most published documents related to the Taekwondo sports performance, followed by blue the cluster leadership by South Korea, and the orange cluster represents the network lead by Spain.

Figure 6 shows the existing relationships between the collaborating countries, depending on the temporality of the publication of the documents. Once again, the blue cluster, leadership by Brazil, is the biggest, but in nowadays the yellow cluster (such as Japan, Nepal, Thailand, Lithuania, Peru, and Cuba) are the countries with the largest number of studies published in a temporal perspective. Studies published in these temporal co-authorships of the countries cluster highlighted that these countries are, nowadays, interested in the topic of this study.

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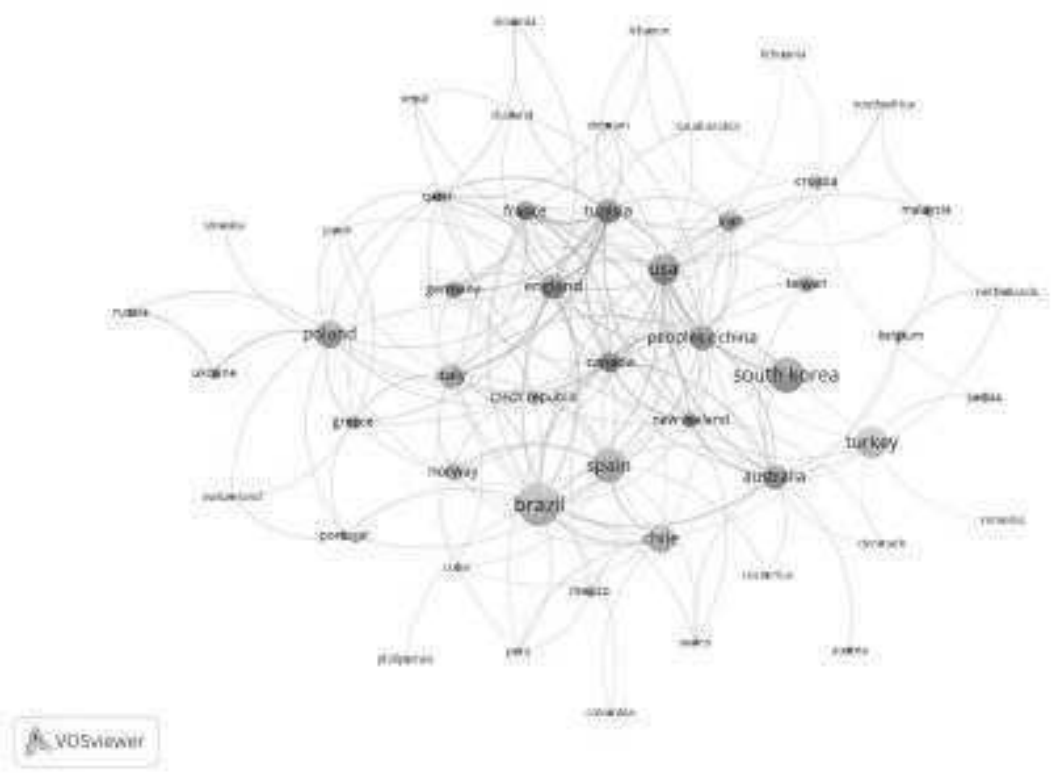

Figure 6. Co-authorships of the countries based on temporality.

3.7. Publications regarding the Organisations

Table 4 shows those institutions that present the greatest number of studies carried out. It is observed that the University of São Paulo (Brazil) is one of the most active in the development of studies related to the analysis of performance in Taekwondo (n = 46).

Table 4. Most prolific institutions in the preparation of documents.

Affiliations	Registers number	% of 460
Universidade de São Paulo	46	10.00
Universidad de Santiago de Chile	21	4.56
Centre National de la Medecine Sciences des Sports	16	3.47
Universidad de Manouba	16	3.47
Universidad de Valencia	15	3.26

In the below Figure 7, a fragmentation analysis has been carried out (attraction: 3 and Repulsion: -3), to know the co-authorship of the identified organizations. In the first instance, a total of 728 institutions have been identified, of which only 46 present a minimum of 5 documents. With the objective of identifying the relationships between those most prolific institutions, a total of 31 have been included, those that presented a minimum of 6 documents, of which only 24 have related each other.

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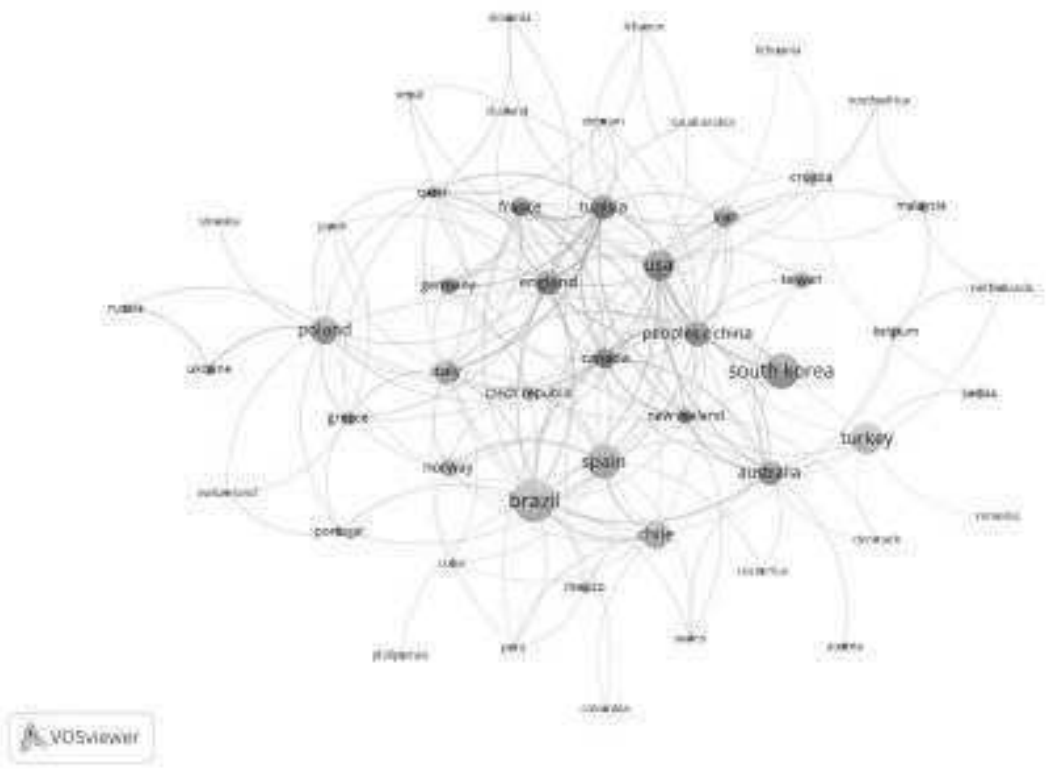

Figure 7. Co-authorship of the organizations depending on the number of documents.

The co-work map, regarding the organizations analysis, was generated in VOSviewer revealed five top cluster institutions involved in Taekwondo sports performance studies from 1992 to 2022.

The biggest bubbles organizations are *Universidade de São Paulo* (Brazil)(green cluster), followed by *Universidad de Santiago de Chile* (Chile)(red cluster), then *Universidad de Valencia* (Spain)(yellow cluster), then Manouba University (Tunis)(blue cluster), and finally Liverpool John Moores University (England)(purple cluster).

3.8. Network between authors

Of the total selected network authors (n = 1485), only 62 have been included in the analysis, since it is the closest value to 38, square root of 1485. In this manner, the most prolific authors of the research topic have been selected. In addition, those authors who presented a minimum of 4 completed documents have been included.

Figure 8 illustrates the network map by using the VOSviewer showing six cluster acts with the most prolific authors and their co-authorships analysis. Leaderships by the Franchini, E. (red cluster), then Falco, C. (purple cluster), Chaouachi, A. (green cluster), Capranica, L. (yellow cluster), Oergui, I. (blue cluster), and Miarka, B. (light blue cluster).

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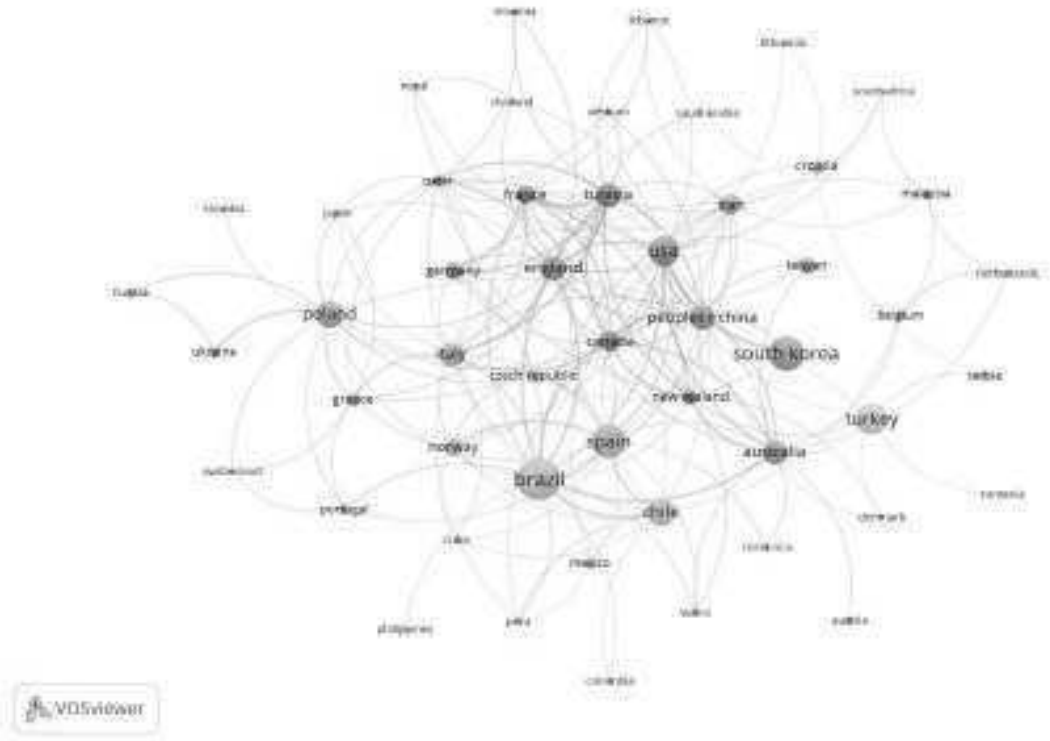

Figure 8. Most prolific authors and their co-authorships.

Table 5 shows the top 10 cluster study authors with the highest number of documents produced, as well as the H-Index of each of them, extracted from the researcher profile of the WOS database. It should be noted that the authors Franchini, E., and Chaouai, A., present an H-Index much higher than the others with a value of 50 and 49, respectively. Followed by Capranica, L., who present values of 40 H-Index. This being a value that expresses the level of significance which they present within the scientific community.

Table 5. Highly numbers of paper and H-Index by authors.

Authors	N	H-Index
Franchini, E.	42	50
Falco, C.	20	14
Herrera-Valenzuela, T.	18	11
Valdés-Vadilla, P.	14	11
Estevan, I.	13	17
Da Silva Santos, J.F.	13	5
Chaouachi, A.	11	49
Capranica, L.	10	40
Chiodo, S.	8	9
Song, J.K.	8	10

3.9. Keywords used by authors

In relation to the keywords used by the authors in their different studies, a total of 1128 keywords have been identified, of which only 40 terms had a minimum occurrence of 5. It is observed that the co-work analysis identified the most frequently used by the authors are "taekwondo" (n = 110), "martial arts" (n = 94), "combat sports" (n = 58), "performance" (n = 33), and "athletes" (n = 18) (Figure 9). The findings suggested that the sports performance information system and taekwondo

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keywords appear in every analysis linked by other sports (e.g., judo, karate, boxing, and wrestling) and in a generical point analyse "combat sport". Also, in relationship with the keywords co-occurrence analyses by balance, isokinetic strength, postural control, vertical jump, and training

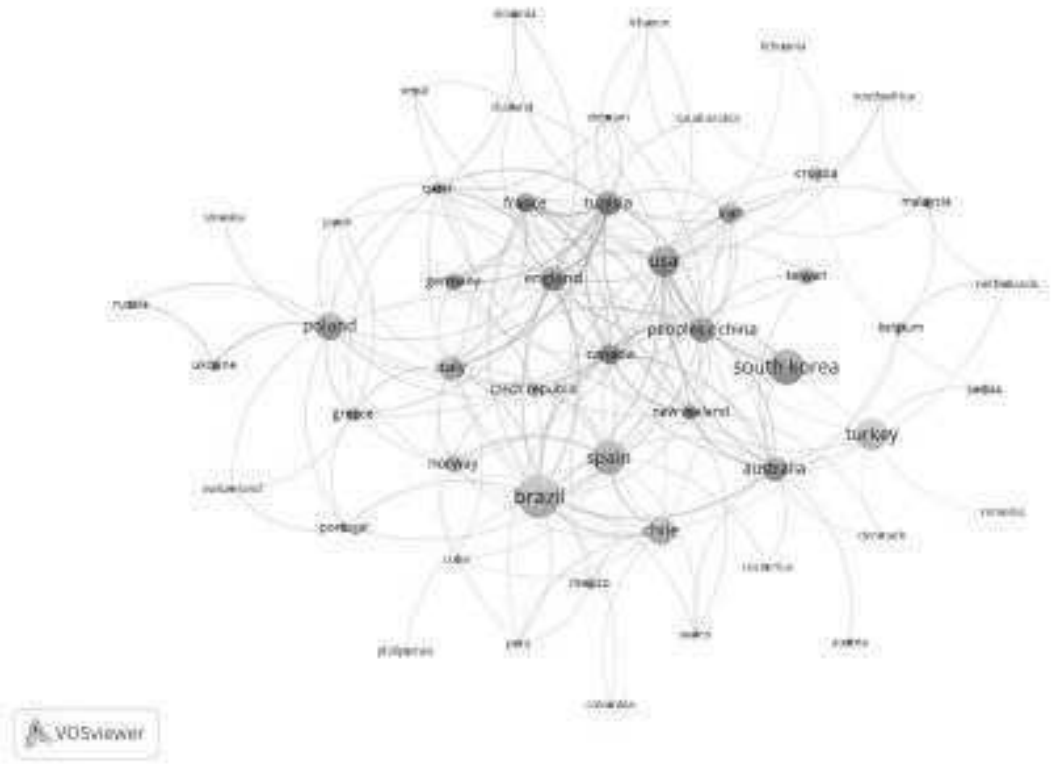

Figure 9. Most used keywords.

On the opposite, depending on the temporality (Figure 10), the keywords map shows a clear trend in the use of terms focused on the analysis of factors that influence the performance of athletes such as "stress", "fatigue" or "reaction time".

The last step, a temporal keywords analysis map was generated in VOSviewer. According to the bubble map results, the keyword "combat sports" information system is related with the cluster "sports", and "elite athletes". These findings confirm that the recent published works are connected to Taekwondo sports performance and psychological issue. These is the focus and recent interesting topic for majority of the authors and co-authors.

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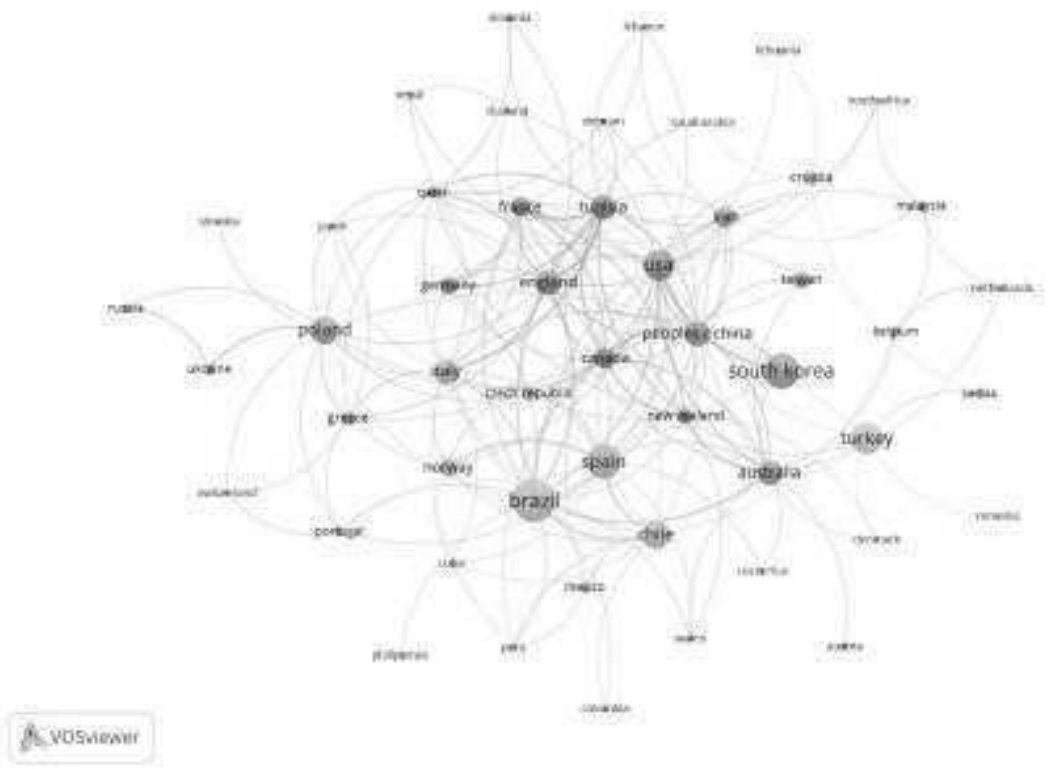

Figure 10. Keywords depending on temporality.

4. Discussion

The main objective of the present theoretical study was to carry out a comprehensive analysis of the manuscripts related to sports performance in Taekwondo through the development of a bibliometric review. The results show the existence of 460 WOS-indexed manuscripts included in this bibliometric review and related to the topic under study between 1992 and 2022. Almost 50% of the documents are related to the WOS category: "Sports Science" (n = 229). Furthermore, the largest number of manuscripts are published in the journal "Archives of Budo" (n = 31). Likewise, publications related to sports performance in Taekwondo from 2013 to nowadays present an increase of 90.7%. Therefore, bibliometric reviews allow us to obtain a global and effective perspective in relation to the object of study [58,59]. Furthermore, the present work is postulated as the first English-speaking bibliometric review related to sports performance in Taekwondo.

The results related to the evolution in the number of publications show that the first published document related to Taekwondo sports performance occurred in the year of 1992 and analyzed the influence of competitive anxiety on sports performance [46]. Currently, sports performance indicators related to psychology are focused on behaviors and psychological processes in the sports context [60]. Besides, the first line of research in psychology and sports performance in Taekwondo is still valid today. Regarding the second published article, which analyzes Taekwondo athlete injuries before competition [47], it is an emerging field of research, since any type of injury that occurs before, during or after training or competition can influence the sports performance of athletes. On the other hand, research related to sports performance in Taekwondo from 2013 to the present (n = 375), presenting an increase of 90.7% in the number of publications because of the boom in the field of Sports Sciences, and the need to innovate in studies. Likewise, the authors of this manuscript are expanding the knowledge related to the object of study, and it is a variant of systematic literature reviews [61]. It can also serve as a starting point and complement for research. In relation to the WOS categories, the main categories are: "Sports Science" (n = 229), "Hospitality Leisure Sport Tourism" (n = 48), and "Physiology" (n = 32). The first three categories add up to 67.16% of published

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documents. In the scientific literature, there are no manuscripts that corroborate the results obtained. Regarding the publication magazine, "Archives of Budo", is presented with the highest number (n = 61; FI=2.1). However, the journals with an impact index greater than 3 are: "Plos One" (n = 11; FI=3.7), International Journal of Sports Physiology and Performance (n = 9; FI=3.3), and "Journal of Strength and Conditioning Research" (n = 23; FI=3.2). Therefore, researchers focus their interests on areas related to Sports Sciences, with the aim of analyzing sports performance in Taekwondo, allowing to create a performance profile, which must be present in the sporting activity to achieve performance and can be used to predict the future of sporting activities [62]. The bibliometric review related to Taekwondo sports performance allows us to determine which are the main categories where researchers publish. The results related to the most cited documents show how the study prepared by Kazemi et al. [48], it is the manuscript that has received the highest number of citations since its publication (2006). The study carried out by Paillar [50], is the document that has received a total of 14.86 citations per year since its publication (2014). In addition, they are recent and interesting studies for Taekwondo coaches and athletes, since they allow the profiles of the Olympic Champions and other competitors who participated in the Sydney 2000 Olympic Games to be identified, as well as knowing the effects of caffeine on reaction time during a specific Taekwondo task and Sports Performance during a simulated competition. The others TOP 10 documents allow us to determine the time structure and physiological response during competitions between winners and losers [49]. The study by Markovic et al. [51], allows us to know the physical condition profile of elite Taekwondo Croatian athletes, determines what physical, and physiological [52], and motor performance characteristics differences between the winners and losers. On the other hand, there is a study that compares different martial arts such as Judo, Wrestling, Karate and Taekwondo with the purpose of quantifying the effort-pause relationship and identifying the number of actions performed per round in each sport modality analyzed [53]. Besides, there is a great diversity of studies related to Taekwondo as sports and Olympic discipline. That's why it is recommended to carry out multidisciplinary research to increase the quality of the work.

In relation to the H-Index, there is a minimum of 40 documents that present a minimum of 40 citations. Only a total of 4 documents presents a number equal to or greater than 100 citations [48–51]. The year 2011 is the year with the highest number of citations, 719 with a total of 20 published documents. However, in the years after 2020, a greater number of documents related to Taekwondo sports performance have been published, but they present a considerably lower number of citations. Taekwondo research has increased considerably in recent years. Therefore, the present bibliometric study reveals the increase in publications related to Taekwondo sports performance, and shows the main journals where researchers publish. It is important that bibliometric research goes beyond reporting the results of the performance analysis and scientific mapping generated by scientific databases (e.g., Web of Science), and software (e.g., CiteSpace, Gephi, Leximancer, and VOSviewer) [42]. It is insufficient to describe the main contributors, (e.g., main authors, institutions, and countries), and the topics (for example, most cited articles and top keywords) in each field. Therefore, bibliometric reviews should be complementary to systematic reviews or meta-analyses. Furthermore, researchers should focus on underexplored topics to increase knowledge.

Results related to Publications considering countries: 35 countries present a minimum of 3 documents and 20 countries show a minimum of 7 documents produced. The countries with the highest number of publications made are Brazil (n = 83), South Korea (n = 57), and Spain (n = 52). On the opposite, the countries with the highest number of citations received are Brazil (n = 1264), Italy (n = 622), and England (n = 604). Currently, the countries with the highest number of publications depending on the temporal perspective are Japan, Nepal, Thailand, Lithuania, Peru, and Cuba. The countries density map shows a bigger spread on the implicate countries. Once again, we found that in scientific literature, there are no studies that corroborate the results obtained. So, the present bibliometric review allows providing relevant information on the topic under investigation, and helps researchers establish new relationships, as well as find more relevant authors and articles [37].

The results related to the Publications regarding the Organizations shows how the *Universidade de São Paulo* is one of the most active in carrying out research related to the analysis of performance

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in Taekwondo (n = 46). The *Universidad de Santiago de Chile* (n = 21), and the *Centre National de la Medecine Sciences des Sports de Cité Khadra* (n = 16), stand out in the production of scientific documents. There is a diversity of Institutions and countries dedicated to research into Taekwondo sport performance. That it is essential for researchers to establish new contacts to design and develop quality research.

In relation to the network between authors, the most relevant researchers based on the number of published documents are Franchini, E. (H-Index=50), Falco, C. (H-Index=14), and Herrera-Valenzuela, T. (H-Index=11). The Top-3 articles on Taekwondo sports performance finding, in accordance with [63], are Kazemi et al. (2006), Matsushigue et al. (2009), and Falco et al. (2009). The authors Franchini, E., (n = 42), and Falco, C., (n = 20) should be highlighted. However, the authors Franchini, E., and Chaouai, A., present a H-Index much higher than the all research with a value of 50 and 49 respectively, and have fewer published manuscripts. It is assumed that it is due to the quality of the papers. Therefore, it is essential to establish relationships with authors from other institutions to improve research [58,59]. These networks of different authors may be interesting for the rest of the researchers to establish future lines of research related to Taekwondo sports performance. Therefore, bibliometric studies offer unique opportunities to contribute to theory and practice [42], as well as meet the main authors on a specific topic. Bibliometric review studies are essential to know who the main researchers are on specific topics. Alike, this document provides a general and exclusive description of Taekwondo sport performance.

Regarding the results related to the Keywords used by the authors, it is shown that the authors most frequently use the follow terms: "taekwondo" (n = 110), "martial arts" (n = 94), "combat sport" (n = 58), "performance" (n = 33), and "athletes" (n = 18). However, depending on the temporal issue, a clear trend is observed in the use of terms focused on the analysis of factors that influence the athlete performance such as "stress", "fatigue", or "reaction time". Keywords results show that related subject to Taekwondo sports performance is directed. "Stress" and "fatigue" is a psychobiological state that impairs sports performance in healthy athletes [64]. The bubble map results reflect that the combat sports information system is an emerging theme on the topic of this paper related to the temporal keywords co-occurrence analysis. And the most recent topics in the WOS database are the cluster "sports" and "elite athletes". This bibliometric review may provide the future readers with a state-of-the-art understanding of the topics, help identify gaps and recognize signal future research [65].

Coaches must work on the psychological aspects of athletes to improve their sports performance. Finally, the results of this bibliometric review allow us to analyze the documents in the WOS-indexed manuscripts database in a general way on research on Taekwondo sports performance. In future papers, this findings results can be used to analyze the temporal dimension and evolution of the academia environment.

5. Limitations

This study has some limitations and must be appointed acknowledge, firstly, the Taekwondo sports performance scope of this bibliometric review is limited to the objective of this paper. The worldwide bibliometric review, researchers tend not to focus on a particular subject of Taekwondo but to provide a Taekwondo as a global trend of sport. This work focusing on the Taekwondo sport performance to provide specific knowledge in accordance with interesting authors. Secondly, the bibliometric review method can't replace other review methods like systematic review and/or meta-analysis approach. Thirdly, this review was conducted only on the articles indexed in the WOS database. This might be a significant limitation because there are several articles published on the KCI – Korean Citation Index, KISS – Korean-Studies Information Service System, and RISS – Research Information Sharing Service, who most of the paper are writing in native language of Korea. A systematic review and meta-analysis of randomized controlled trials shows that on twelve included studies only two (16%) were writing in English (other language than Korean) [66].

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6. Conclusions

To the best of our knowledge, this bibliometric analysis of Taekwondo related to sport and performance is the first paper contribution to understanding the main goal of this study. Using science mapping, exploring, and analyzing by VOSviewer tool the literature provides novel insights and crucial information into Taekwondo sports performance theme.

The results, of this bibliometric review, show the existence of 460 WOS-indexed manuscripts published between 1992 and 2022. The mainly manuscripts found in the WOS categories are: "Sports Science" (n = 229), "Hospitality Leisure Sport Tourism" (n = 48), and "Physiology" (n = 32). The most notable documents related to Taekwondo sports performance, from the authors are: Kazemi et al. (2006), Matsushigue et al. (2009), and Paillard (2017). The authors Franchini, E., (n = 42), and Falco, C., (n = 20) should be highlighted. The countries with the highest number of publications made in line with the main study are Brazil (n = 83), South Korea (n = 57), and Spain (n = 52). There are five collaboration networks between different authors and academia dimension, with an absence of the most relevant researchers about this bibliometric study. It is recommended to carry out multidisciplinary research on Taekwondo Olympic discipline with the purpose of establishing collaborations between groups, institutions, and countries. In this way, the productivity, effectiveness, and quality of research will increase, as well as collaboration networks will be international relationships.

The bibliometric review is relevant and reliable source of knowledge, since it allows to know the main advances in research related to Taekwondo sports performance, and to know the relationships between the authors and main institutions.

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