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Adapted Sport: A Bibliometric Analysis
Deporte Adaptado: Un Análisis Bibliométrico

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Abstract. Adapted sports (AS) allows the physical activity level to increase in groups such as people with disabilities, pregnant women, children and older people. AS modifies conventional sports' formal structure to make them accessible. This study aimed to analyse the trend followed by the annual publications on this topic and identify the most productive and cited authors, journals, and countries with the highest number of publications, the most cited documents and the most used keywords. The search was conducted in the Web of Science (WoS) and traditional bibliometric laws were applied. A total of 398 documents were identified. The annual publications followed an exponential growth trend (R^2=89.5%). "Influence of Adapted Sport on Quality of Life: Perceptions of Athletes with Cerebral Palsy" was the most cited document. The categories of most interest to researchers were Sports Science and Rehabilitation. The journal with the higher number of publications was Retos-Nuevas Tendencias en Educación Física, Deportes y Recreación. The USA had the highest number of published documents (122 documents) and citations (973), leading extensive research networks worldwide. A total of 1270 authors have published on this topic, using "adapted sport", "adaptive sport", "disability, and "physical activity" as the most used keywords. Makhov (12 documents) was the most prolific co-author, and Lundberg was the most cited.
Keywords: Adaptive Sport; Modified Sport; Disability; Physical Activity; Exercise.

Resumen. El deporte adaptado (DA) permite aumentar el nivel de actividad física en colectivos como las personas con discapacidad, las embarazadas, los niños y las personas mayores. El DA modifica la estructura formal de los deportes convencionales para hacerlos accesibles. Este estudio pretendía analizar la tendencia seguida por las publicaciones anuales sobre este tema e identificar los autores, revistas y países más productivos y citados, con mayor número de publicaciones, los documentos más citados y las palabras clave más utilizadas. La búsqueda se realizó en la Web of Science (WoS) y se aplicaron las leyes bibliométricas tradicionales. Se identificaron un total de 398 documentos. Las publicaciones anuales siguieron una tendencia de crecimiento exponencial (R^2=89,5%). "Influence of Adapted Sport on Quality of Life: Perceptions of Athletes with Cerebral Palsy" fue el documento más citado. Las categorías de mayor interés para los investigadores fueron Ciencias del Deporte y Rehabilitación. La revista con mayor número de publicaciones fue Retos-Nuevas Tendencias en Educación Física, Deportes y Recreación. EE.UU. tuvo el mayor número de documentos publicados (122 documentos) y de citas (973), liderando amplias redes de investigación en todo el mundo. Un total de 1270 autores han publicado sobre este tema, utilizando "deporte adaptado", "deporte adaptativo", "discapacidad" y "actividad física" como las palabras clave más utilizadas. Makhov (12 documentos) fue el coautor más prolífico, y Lundberg el más citado.
Palabras claves: Deporte Adaptado; Deporte Modificado; Discapacidad; Actividad Física; Ejercicio Físico

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Introduction

About one to five billion people live with some form of physical, sensory, mental or intellectual disability, with 80% of these people residing in low- and middle-income countries (Martin et al., 2021). This population tends to have sedentary lifestyles; people with disabilities are twice as likely to have a sedentary lifestyle compared to those without disabilities (Ramsden et al., 2023). This fact results in an increased risk of obesity, metabolic disorders, impaired overall health, increased social isolation, lower contribution to the workforce and decreased quality of life (Diaz et al., 2019). They also face the possibility of experiencing additional disorders, such as depression (Prince et al., 2007). People with disabilities generally experience lower levels of health compared to those without disabilities (Bright et al., 2018). As such, people with disabilities face an underlying health problem that creates greater health care demands (Bright et al., 2018). Thus, they find themselves confronting a variety of significant challenges and obstacles in their day-to-day lives (Di Palma et al., 2016).

People with disabilities perform less Physical Activity (PA) than the general population (Buffart et al., 2008; Maher et al., 2007), although the PA recommendations of the World Health Organization (WHO) are the same (Bull et al., 2020). In this sense, people with disabilities should also try to lead an active life within their possible limitations (Bartlo & Klein, 2011; Diaz et al., 2019; Khoo et al., 2022), as there is evidence that PA improves the physical, psychological and social well-being of people with physical disabilities, as well as increases their integration, quality of life and their health, both physical and mental (Blauwet & Willick, 2012; Bloemen et al., 2015; Groff et al., 2009; King et al., 2003; Taylor et al., 2004; van der Slot et al., 2007).

For these reasons, Adapted Physical Activity (AFA) was born, which encompasses any form of movement, physical exercise or sport that focuses in particular on the needs and of people with limited conditions due to any cause (DePauw & Doll-Tepper, 1989). It encompasses several areas, including physical education, sport, recreation, dance and creative arts, nutrition, medicine and rehabilitation (Hutzler & Sherrill, 2007).

Within AFA, it is important to highlight that adapted sport (AS) encompasses all those sports modalities that meet the needs of people with some form of limitation. This

may be because specific adaptations and modifications have been made to facilitate their practice, or because the structure of the sport itself allows their participation (Hernández, 2000; Reina, 2010). The documented beginnings of these sports activities date back to 1944, in an attempt to make hospital life more pleasant and improve social integration (Aquilino, 1998). Since then, this concept has evolved, creating competitive sports (Tweedy & Howe, 2010). In 2012 it was confirmed that AS is a movement in continuous growth (Blauwet & Willick, 2012; Shapiro et al., 2012). AS is understood as a sport modality that is adapted to the group of people with disabilities or special health conditions (Reina, 2010). It is a form of sport practice in which the rules are modified to facilitate the learning of basic motor skills and abilities (Buszard et al., 2020). Adaptations, such as varying the space and/or time, even modifying or substituting the size/format of the implement or mobile, are made according to the characteristics of the population participating (Buszard et al., 2020; Diaz et al., 2019). These modifications are usually strategies to encourage increased participation in order to acquire more motor and mental skills (Buszard et al., 2020; Di Palma et al., 2016; Yazicioglu et al., 2012), in addition to allowing the inclusion of different populations with physical, intellectual or sensory disabilities (Alvis-Gómez & Neira-Tolosa, 2013). Mainly, if we attend to the classification of the Olympics, there are three major groups of AS: the Paralympic Games for physical, visual and intellectual disabilities, the Special Olympics more focused on intellectual disabilities and the Olympics for hearing limitations (Pérez et al., 2012). However, this classification has had negative effects on the participation of people with significant disabilities in elite sport competitions (DePauw & Gavron, 2005). Now, the trend is for high-level AS to be integrated into their respective sports federations, no longer depending organically on a multisport federation that encompasses a specific group of disabilities (Pérez et al., 2012).

In addition, AS can be extrapolated to various populations that do not have any disability, such as the group of elderly (Bishop et al., 2010; Jenkin et al., 2017; Paterson et al., 2007; Sirven & Debrand, 2008), pregnant women (Newton & May, 2017) or for children without disabilities (Devís & Sánchez, 1996; Etxebeste et al., 2014; Read & Devis, 1990). In this sense, one of the main objectives is to promote inclusion and equal opportunities for all people, regardless of their limitations. Among the benefits of practicing AS, we can highlight the improvement of mood (Campbell, 1995; Campbell & Jones, 1994; Greenwood & Dzewaltowski, 1990; Muraki et al., 2000; Santiago & Coyle, 2004), greater movement skills (Greenwood & Dzewaltowski, 1990; Muraki et al., 2000; Santiago & Coyle, 2004; Taylor et al., 2004), reduced depression and tension (Campbell, 1995; Campbell & Jones, 1994; Greenwood & Dzewaltowski, 1990), and improved health perception (Campbell, 1995; Campbell & Jones, 1994; Greenwood & Dzewaltowski, 1990; Muraki et al., 2000; Santiago & Coyle, 2004; Taylor et al., 2004; van der Slot et al., 2007). In short, it can be stated that AS tends to increase the percentage of PA practice in a large part of the population (Santiago & Coyle, 2004; Yazicioglu et al., 2012).

Likewise, in secondary education it allows promoting equal opportunities (Robles-Rodríguez et al., 2017), it also allows developing other values such as awareness, responsibility and empathy (Abellán, 2015). However, it should be noted that AS for people with disabilities do not receive sufficient support from public entities and their research is currently very scarce (Jenkin et al., 2017). The same is true for research on the psychology of AS (Hernández-Beltrán et al., 2022). For example, in Spain there are few validated and adequate awareness programs (Felipe-Rello et al., 2020). These programs, of PA and sports, can help the practical training of teaching staff or other types of professionals in the field of physical education, as well as favor inclusion (Felipe-Rello et al., 2020). It is important to continue improving and implementing programs that promote inclusive physical education with the aim of increasing students' motivation and, consequently, their commitment to PA (Pérez-Tejero et al., 2022). Likewise, these groups face episodes of discrimination and negative stereotypes within the sports field (Martin et al., 2016), while a possible solution would be to apply AS (Di Palma et al., 2016; Santiago & Coyle, 2004; Yazicioglu et al., 2012), achieving improvements in their state of life at both rehabilitative and integrative and normalizing levels (Aquilino, 1998). In this same line, sports integration should appear whose main purpose is to adapt a specific sport modality to be able to manage and organize competitions for athletes with disabilities (Pérez-Tejero et al., 2013).

Because more research is needed in the field of AS, it is necessary to establish a starting point for future research. Therefore, a proper bibliometric study is necessary to provide objective data on current publications. Bibliometric studies provide a statistical or quantitative description of a bibliography related to a topic (Nicholas & Ritchie, 1978). This information is highly useful when locating leading authors, research groups and institutions involved in the topic to ease the establishment of partnerships and new lines of collaboration (Flores-Fernández et al., 2018). One of the most interesting quantitative data in the scientific field is the number of citations (Rosmarakis et al., 2005), which is used as a parameter to measure the impact of this research (Moed, 2009). Thus, the bibliometric study aim is to analyze the scientific interest and evolution of a given field of knowledge, evaluating the annual publications, the prolific co-authors and the most important institutions and countries involved, or the most cited articles.

Although there was three previous bibliometrics, they either dealt with more specific topics or did not cover publications from their origins (Special Olympics, Disability Sport and AS from 2001 to 2020) (Khoo et al., 2018, 2022; Liu et al., 2022), not fully applied the traditional laws of bibliometrics, characterized by its systematicity and its

broad search strategy. The present study is the first to address published scientific articles on AS with a broad search strategy, providing a panoramic view of the state of the art in the AS field. Moreover, the main objectives of this study were 1) to analyze the exponential growth of annual publications on AS; 2) to highlight the most relevant journals; 3) to identify the prolific and prominent co-authors; 4) to know which country has the most publications and 5) to group the most used keywords.

Materials and Methods

A bibliometric analysis based on the bibliometrics traditional laws was used. The Web of Science (WoS) Core Collection was the data source chosen to obtain the set of articles. An advanced search was performed using the following search vector: (ti=("adaptive sport*") or ti=("inclusive sport*") or ti=("adapted sport*") or ti=("modified sport*") or ti=("walking soccer") or ti=("walking football") or ti=("walking basketball") or ti=("walking rugby") or ti=("walking netball") or ti=("walking handball") or ti=("walking hockey") or ti=("walking sport") or ti=("walking tennis") or ti=("walking cricket") or ti=("walking hockey") or ak=("adaptive sport*") or ak=("inclusive sport*") or ak=("adapted sport*") or ak=("modified sport*") or ak=("walking soccer") or ak=("walking football") or ak=("walking basketball") or ak=("walking rugby") or ak=("walking netball") or ak=("walking handball") or ak=("walking hockey") or ak=("walking sport") or ak=("walking tennis") or ak=("walking cricket") or ak=("walking hockey") or ab=("adaptive sport*") or ab=("inclusive sport*") or ab=("adapted sport*") or ab=("modified sport*") or ab=("walking soccer") or ab=("walking football") or ab=("walking basketball") or ab=("walking rugby") or ab=("walking netball") or ab=("walking handball") or ab=("walking hockey") or ab=("walking sport") or ab=("walking tennis") or ab=("walking cricket") or ab=("walking hockey")); limiting the search to articles and reviews of articles published in journals indexed in the following WoS Editions: Science Citation Index (WoS-SCI), Social Science Citation Index (WoS-SSCI) and Emerging Sources Citation Index (ESCI). A total of 520 documents were obtained, discarding 122 documents: 16, for not meeting the search terms; and 122, for not being of interest for this study. The remaining 398 documents were extracted from the WoS on 29 October 2022 in xlsx format and plain text without formatting. Under the inclusion criteria, two authors (P.-C. and D.-Z.) evaluated the titles and abstracts.

The annual publications trend was analyzed verifying its adjustment to an exponential growth ratio (R^2), applying DeSolla Price's exponential growth law (Dobrov et al., 1979; Price, 1976). A descriptive analysis was performed on the WoS Categories in which the documents were related, using the WoS Analyze Results. Bradford's law of concentration was applied to the journals to identify the most productive and most cited journals in the set of documents analyzed (Desai et al., 2018; Morse & Leimkuhler, 1979a; Venable et al., 2014, 2016). Lotka's law was used to highlight the most productive co-authors, being identified as the prolific co-authors (Lotka, 1926), applying the Hirsch index (h-index) (Gallois, 2013) on the prolific co-authors to identify the most cited prolific co-authors (co-authors with the highest number of citations among the most productive). A descriptive analysis of co-authored countries/regions was performed. The most cited documents were selected applying the h-index, taking as the most cited articles, the h documents with h or more citations (Contreras-Barraza et al., 2021; Gallois, 2013), matching the co-authors of the most cited papers with the prolific co-authors, identified prominent co-authors (prolific co-authors with at least one paper among the most cited papers) (Sainaghi et al., 2018). A descriptive analysis of the author's keywords was performed creating a thesaurus with approximate terms and applying Zipf's law to highlight the most frequently used terms (Zipf, 2013). Data were processed with the VOSviewer software (Centre for Science and Technology Studies, Leiden University, The Netherlands), using the fractionalization analysis to create co-authorship plots for authors and countries/regions and co-occurrence plots for author keywords (Contreras-Barraza et al., 2021).

Results

A total of 520 documents were obtained, discarding 122 documents (16 for not meeting the search terms and 122 for not covering the study's scope. The remaining 398 documents were extracted from the WoS on 29 October 2022 in xlsx format and plain text without formatting.

398 documents, including 363 articles and 35 reviews, published from 1994 to 2022 were highlighted. The first paper published on the subject was "Balance and Stabilization Capability of Paraplegic Wheelchair Athletes" (Bernard et al., 1994). No continuity in annual publications was found until 2005. From the latter to 2021, the annual publications to an exponential growth rate trend (Figure 1). At the moment of the search, 51 papers already were published in 2022.

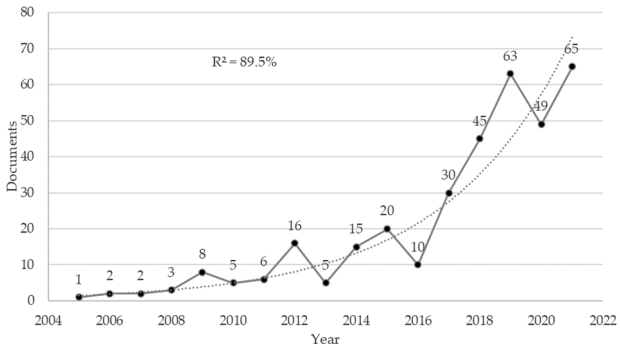

Figure 1. Adapted Sports Annual publications trend.

Found documents were related to 57 WoS categories. Sport Sciences (121), Rehabilitation (102), Hospitality

Leisure Sport Tourism (67), Education Educational Research (33), Public Environmental Occupational Health (27), Psychology Applied (18), Multidisciplinary Sciences (14), Psychology Multidisciplinary (14), Health Care Sciences Services (12), Pedriatics (12) and Sociology (11) were the subject categories with the most related papers.

Moreover, 81 journals with a publication range between 1 and 15 documents. The most prolific journal was Retos-Nuevas Tendencial en Educación Física, Deportes y Recreación (15 documents). According to the number of documents, Bradford's Core was composed of 13 journals that accumulated 34.2% of the documents (Table 1). The journals distribution according to Bradford's zones was: Core (13 journals, 136 documents, 34.2% of the total documents), Zone I (55 journals, 149 documents, 37.4%) and Zone II (113 journals, 113 documents, 28.4%); this distribution was adjusted to Bradford's theoretical series with an error of -0.7%.

Table 1.
Bradford's Core journals according to the published number of documents.

Bradford's Zone	Journals	JIF	JCR	Doc.	%Doc.	%Acc.	%O.A.
Core	Retos-Nuevas Tendencias en Educación Física, Deportes y Recreación	n.a.	n.a	15	3.8%	3.8%	15.9%
	Journal of Human Sport and Exercise	n.a.	n.a	14	3.5%	7.3%	72.8%
	Disability and Rehabilitation	2.439	Q2	13	3.3%	10.6%	15.3%
	Palaestra	n.a.	n.a	13	3.3%	13.8%	0.0%
	Therapeutic Recreation Journal	n.a.	n.a	13	3.3%	17.1%	0.0%
	PM&R	2.218	Q2	12	3.0%	20.1%	4.1%
	Research Journal of Pharmaceutical Biological and Chemical Sciences	n.a.	n.a	12	3.0%	23.1%	n.a.
	Adapted Physical Activity Quarterly	2.741	Q2	9	2.3%	25.4%	0.0%
	International Journal of Environmental Research and Public Health	4.614	Q1	9	2.3%	27.6%	96.1%
	Disability and Health Journal	4.615	Q1	7	1.8%	29.4%	5.8%
	Sports Medicine and Arthroscopy Review	2.617	Q3	7	1.8%	31.2%	0.0%
	American Journal of Physical Medicine & Rehabilitation	3.412	Q1	6	1.5%	32.7%	2.8%
	Revista de Psicología del Deporte	0.936	Q4	6	1.5%	34.2%	0.0%

JCR (Journal Citation Reports Quartile); JIF (Journal Impact Factor); Doc (Documents); %Doc (Percentage of total documents published); %Acc (Accumulated percentage of total number of documents published); %OA (Percentage of documents in Open Access); n.a. (Not applicable).

Regarding the number of citations accumulated by the documents published on the subject in each of the journals, Bradford's Core was composed of four journals: Disability and Health Journal (7 documents, 210 citations, 8.9% of the total citations), Disability and Rehabilitation (13 documents, 205 citations, 8.7%), Therapeutic Recreation Journal (13 documents, 189 citations, 8.0%) and Research Journal of Pharmaceutical Biological and Chemical Science" (12 documents, 149 citations, 6.3%). The journals distribution in Bradford's zones according to the number of citations was: Core (4 journals, 45 documents, 32.1% of total citations), Zone I (15 journals, 70 documents, 33.7%) and Zone II (162 journals, 283 documents, 34.3%).

The manuscripts were published by 1270 co-authors. By applying Lotka's law to the set of co-authors, it was estimated that the prolific co-authors should be the 36 with the highest number of publications (square root of 1270) (Lotka, 1926); 28 co-authors with 5 or more manuscripts and 37 co-authors with 4 or more, the latter being considered the most prolific co-authors. Figures 2 and S1 show the 36 prolific co-authors and their publication networks.

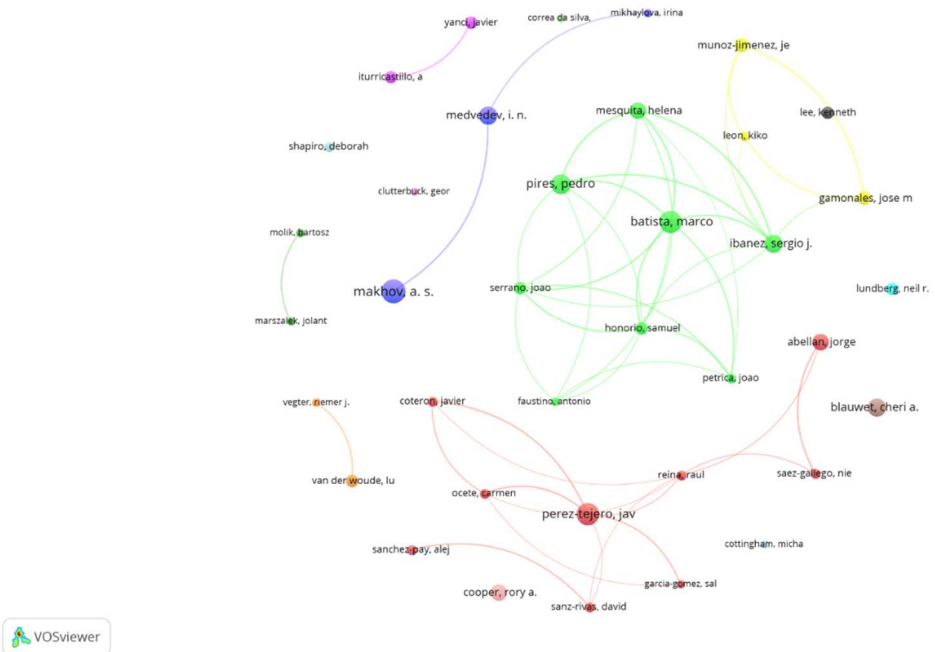

Figure 2. Most prolific co-authors (analysis: fractionalization; attraction: 9; repulsion: -1; node size: documents; colour: clusters).

Applying the h-index to the prolific co-authors, 19 co-authors were found with 19 or more cumulative citations in their papers on AS, these are the most cited prolific co-authors (Table 2). Among the prolific co-authors, there were six prominent co-authors with four or more published papers, and at least one of them was among the most cited papers. These prominent co-authors were N. Lundberg with six papers and four of them among the most cited (WOS:000263569800009; WOS:000442906400002; WOS:000296211100003; WOS:000442875700001); D. Shapiro with five papers and two of the most cited (WOS:000283232849000003; WOS:000345524400006); Pérez-Tejero with 11 papers and one among the most cited (WOS: 000210441400027); R. Cooper with eight papers and one of the most cited (WOS:000363482900006); G. L. Clutterbuck with four papers and one of the most cited (WOS:000465208200002), and M. Cottingham with four papers and one among the most cited (WOS:000367886000004).

Table 2.
Most cited prolific co-authors.

Name	Main affiliation / Country-Regions	Documents	Citations
Makhov, A. S.	Russian State Social University / Russia	12	129
Pérez-Tejero, J.	Polytechnic University of Madrid / Spain	11	79
Blauwet, C. A.	Harvard Medical School / USA	9	51
Medvedev, I.	Russian State Social University / Russia	9	28
Abellan, J.	University of Castilla-La Mancha / Spain	8	34
Cooper, R. A.	University of Pittsburgh / USA	8	77
Iturricastillo, A.	University of Basque Country / Spain	6	20
Lundberg, N. R.	Brigham Young University / USA	6	268
Van der Woude, L. H.	University of Groningen / Netherlands	6	32
Yanci, J.	University of Basque Country / Spain	6	20
Coteron, J.	Polytechnic University of Madrid / Spain	5	34
Ocete, C.	Comillas Pontifical University / Spain	5	63
Reina, R.	Miguel Hernandez University of Elche / Spain	5	36
Saez-Gallego, N.	University of Castilla-La Mancha / Spain	5	23
Shapiro, D. R.	Georgia State University / USA	5	121
Clutterbuck, G. L.	The University of Queensland / Australia	4	40
Cottingham, M.	University of Houston / USA	4	47
Marszalek, J.	Jozef Pilsudski University Physical Education / Poland	4	26
Molik, B.	Jozef Pilsudski University Physical Education / Poland	4	37

Figure 3 shows the co-authoring countries and the collaboration networks between them. The USA was the country with the highest number of published documents (131 documents), the highest number of accumulated citations (973 citations) and the highest number of co-collaborations with other countries (15 links), as well as the center of the most productive cluster. Spain was the second leading country, with a high number of documents (77) and citations (257). This country is the center of another large production network and has links with 13 countries. Other highlighted countries were Brazil (30 documents), third in production; The Netherlands (175 citations), third in citations; and England (14 links), the second in the number of countries in collaboration.

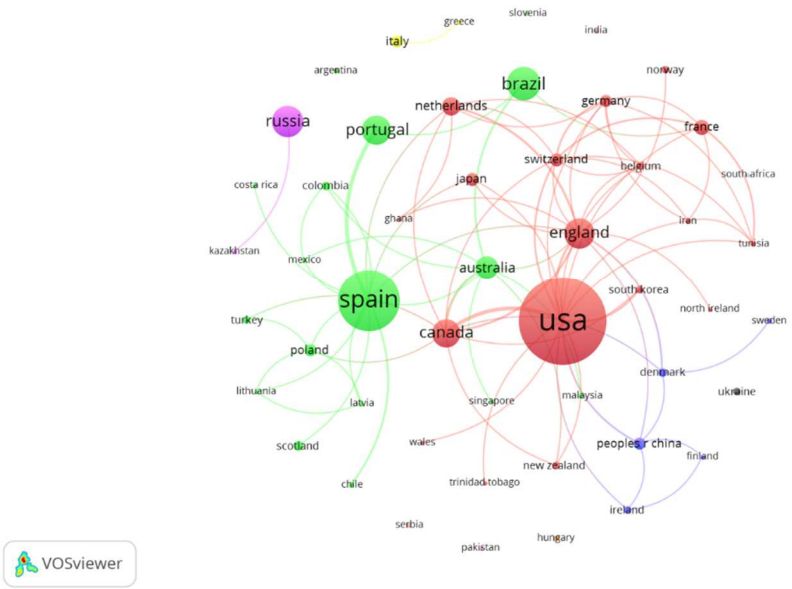

Figure 3. Countries/Regions relationships (analysis: fractionalization; attraction: 9; repulsion: -1; node size: documents; colour: clusters).

Twenty-three papers with 25 or more citations were highlighted; Table S1 shows the 23 most cited papers. The three papers with the most citations were: "Influence of Adapted Sport on Quality of Life: Perceptions of Athletes with Cerebral Palsy" (89 citations) (Groff et al., 2009), "Influence of Adapted Sports on Quality of Life and Life Satisfaction in Sport Participants and Non-Sport Participants with Physical Disabilities" (81 citations) (Yazicioglu et al., 2012), and "Factors associated with Physical Activity in Children and Adolescents with a Physical Disability: A Systematic Review" (74 citations) (Bloemen et al., 2015).

By applying Zipf's law to the 897 author keywords, the 28 most used were high-lighted. Figure 4 shows the 28 most used keywords and the four thematic groups they formed among themselves. The first thematic group was formed around the AS concept, together with others such as sports, athletes, or Paralympics, among others (red cluster). The second was formed around the concept AS, together with terms such as rehabilitation, cerebral palsy, spinal cord injury or quality of life, among others (blue cluster). The third group was formed around the Disability concept together with others such as inclusion, paralympic sport, inclusive sport, or physical education (green cluster). Finally, there was another thematic group formed around the PA concept, together with exercise, football, well-being, or health (yellow cluster).

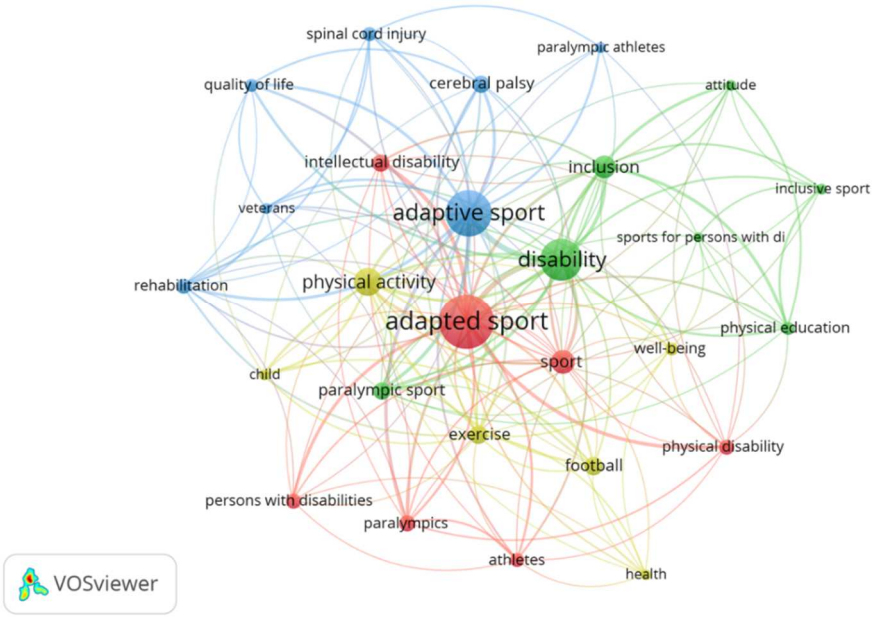

Figure 4. Most used co-author's keywords (analysis: fractionalization; attraction: 8; repulsion: -2; node size: occurrences).

Discussion

One of the main findings of this study is the growing interest in the subject of study since an exponential growth of publications on AS was observed from 2005 to 2021 (R^2: 89.5%). These results could confirm that AS is in continuous growth (Blauwet & Willick, 2012; Di Palma et al., 2016). This growth is in line with the other three bibliometric studies (Khoo et al., 2018, 2022; Liu et al., 2022) Three previous bibliometric studies related to AS were found (Khoo et al., 2018, 2022; Liu et al., 2022): the first one focused on the top 50 most cited articles on sports for people with disabilities, covering from 1980 to 2017 (Khoo et al., 2018). The second one focused more on the 50 most cited Special Sports and Paralympics from 1978 to 2022 (Khoo et al., 2022). The third covered AS from 2001 to 2020 (Liu et al., 2022). However, these three studies did not fully apply the traditional laws of bibliometrics, not calculating the determination coefficient, Bradford's zone (Morse & Leimkuhler, 1979b), nor Lotka's law (Lotka, 1926), and did not including the h-index and Zipf's law (Bulick, 1978). Khoo noted that most of the papers were published in the last ten years (53.7%), especially between 2019 and 2022 (Khoo et al., 2022).

The most predominant categories were Sport Sciences (121 documents) and Rehabilitation (102 documents). In line with these results, Liu (Liu et al., 2022) highlighted Sports Sciences (653 documents) and Rehabilitation (368 documents) as the most important categories. The interest in AS for Sports Sciences, the increased interest could be due to the increase in Paralympic sports participation (Blauwet & Willick, 2012). Moreover, the most cited article deals with how AS can improve the quality of life of elderly elite athletes (Groff et al., 2009). Furthermore, Rehabilitation is another increasingly important category (Liu et al., 2022), being related to publications on training and competition in the field of sports recovery after injuries, such as shoulder pain in wheelchair athletes (Mason et al., 2018; Soo Hoo, 2019). These findings are in line with the seven main categories described by DePauw (DePauw, 1986). However, Rehabilitation and Sports Injuries were not included in this study, Khoo (Khoo et al., 2018) found as predominant categories Training and its effects, in line with Liu et al. (Liu et al., 2022) and ours, and the Sociology and

Psychology.

Regarding keywords, the most important ones were "Adapted Sport", "Adaptive Sport", "Disability" and "Physical Activity", mainly used in Sports Sciences. Moreover, they match with the ones used in the three most cited articles (Bloemen et al., 2015; Groff et al., 2009; Yazicioglu et al., 2012). Liu et al. (Liu et al., 2022) found the most occurrences being "Performance", "Disability", "Exercise" and "People". "Disability" also coincides with our results in contrast to the other words, although "Physical Activity" and "Exercise" have points in common. This fact is repeated with "Performance" and "Sports" as sports can be divided into recreational and competition. This divergence of results between our findings and Liu (Liu et al., 2022) may be due to the absence of data filtering or using a different methodology. The terms "Performance", "Adaptive Sport" and "Adaptive Sport" confirm that the focus of interest has shifted from rehabilitation to competition, although this change in trend was observed as early as 1986 (DePauw, 1986).

American and English journals conform to the majority of Bradford's Core, in line with the above-mentioned previous bibliometrics (Khoo et al., 2018, 2022; Liu et al., 2022). In contrast, the journal with the greatest number of documents is Spanish, Retos-Nuevas Tendencias en Educación Física, Deportes y Recreación. For example, one of its most cited articles proposes an educational intervention to improve the inclusion of disabled students in physical education classes (Ocete et al., 2015). Their authors appear with the most prominent in our data (Table 2). However, there are few researchers studying AS, resulting in a low citation ratio (Larsen & von Ins, 2010).

The most relevant country was the USA, followed by Spain. These results differ from those from the other reviews. The USA was one of the first countries to manage disability and spots in the 1980s (Di Palma et al., 2016). In that decade, the USA, Canada and some European countries impulsed for the first time the management and organization of AS (Di Palma et al., 2016). For this reason, Canada and the United Kingdom could be among the countries with the most publications. Moreover, the modern Paralympic movement was born in the UK (Blauwet & Willick, 2012) and could be the incentive for publications. In the case of the USA, apart from being a country with a larger population and therefore with greater possibilities for study, it was also the driving force behind the Special Olympics in the 1970s (Khoo et al., 2022). Another reason for the USA's prominence could be the large number of athletes participating in the Paralympics (Martin et al., 2021). In this sense, the most cited and prominent co-author is from this region, Lundberg, Neil R., also co-authored the most cited article published in an American journal (Groff et al., 2009).

The practical application of this bibliometric study includes the visualization of the AS trends, helping to provide context to the topic's current situation. Thus, knowing the journals, authors and countries/regions with more interest can help to promote future research and to have better access to relevant information on AS. Specifically, it will identify the most active researchers and institutions in terms of collaboration, analyze co-authorship and co-citation between researchers, and examine international collaborations, helping to identify patterns of collaboration and strengthen scientific networks in the field, and thus being able to be an opportunity to create a system of collaboration and interaction among the researchers.

The bibliographic data were extracted from one database, the WoS, which could be one of the limitations of the study. Another limitation is the incompatibility of the different database sets in comparative terms. This study has focused on AS from a generic point of view; therefore, a future line could be oriented on the bibliometric analysis in different populations and/or fields such as health, education, performance, injury, rehabilitation, or psychology/sociology. In addition, it would be appropriate for future research to complement these results with a systematic review and meta-analysis. Besides, given the findings of this study, it has become evident that this is a subject of growing interest, in which there are many researchers contributing knowledge to the topic. However, it is a developing field with enormous potential to find research opportunities that lead to more social equality, and we can contribute from our area of knowledge.

Conclusions

This review shows the exponential growth trend of publications on AS from 2005 to 2021 (R^2=89.5%). During these years, the countries with the most publications were The USA and Spain. The journal with the higher number of publications was Retos-Nuevas Tendencias en Educación Física, Deportes y Recreación. The USA had the highest number of published documents (122 documents) and citations (973), leading extensive research networks worldwide. A total of 1270 authors have published on this topic, using "adapted sport", "adaptive sport", "disability, and "physical activity" as the most used keywords. The categories of most interest to researchers were Sports Science and Rehabilitation. Makhov (12 documents) was the most prolific co-author, and Lundberg was the most cited.

Therefore, the results obtained highlight the growing impact and interest of researchers in AS and expose the most relevant trends and research topics in this field, as well as the areas that require further attention. Furthermore, the presentation of such results could promote scientific collaboration and support programme and policy evaluation, as these metrics could be a valuable tool for researchers, institutions, and decision-makers in the field of AS.

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