



Analysis of Hotspots and Contents of Foreign Adolescent Swimming Research

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Abstract. By using Citespace, this paper made a metrological analysis and visualization analysis of 941 papers about foreign adolescent swimming from 2000 to 2021. The data was downloaded from SCIE and SSCI of web of science. Conclusions: (1) The papers showed an upward trend, with a peak in the number of papers in 2020. (2) Scholars from 96 countries published papers on adolescent swimming in important international journals. The United States published the largest number of papers, followed by Australia. Canada and the United Kingdom ranked third. (3) The research of adolescent swimming showed the characteristics of multi-disciplinary integration, involving multiple disciplines such as physical education, psychology, and neuroscience. (4) The research was carried out with the main purpose of improving performance, focusing on behavior, health, injury, risk and so on. The impact of swimming on the health of adolescents will still be a research hotspot in the future.

Keywords: Adolescent swimming · Research hotspot · Citespace V

1 Introduction

Swimming that plays an important role in improving the cardiovascular system, improving cardiopulmonary function, and shaping the body, attracts considerable attention. An increasing number of people are therefore participating in swimming, including adolescent. With the penetration of science technology and advanced theories in sports, adolescent swimming technology and theoretical system in China have been continuously improved, and the research on adolescent swimming has attracted more and more attention from scholars. In recent years, lots of scholars have conducted meaningful explorations on adolescent swimming research in China. By setting the theme as “adolescent swimming” and the time as “2020–2021” in China Knowledge Network, 320 related papers were retrieved. These papers involve the training methods of adolescent swimming physical, the impact of swimming on youth health, the training of adolescent swimming talents, and the analysis of adolescent swimming techniques, etc., which have greatly promoted the development of youth swimming research in China. Under the comprehensive background that modern sports theories are more inclined to

Table 1. Sources of data

content	
Data Sources	SCIE and SSCI (Web of Science™)
Subject terms = (teenager* OR adolescent* OR youth*) and (swimming OR front crawl swimming OR freestyle OR breaststroke OR butterfly OR backstroke)	
Literature published time from 2000-01-01 to 2021-12-14	
Literature type	Article
Language	English
Results	941 papers

the integration of multidisciplinary research, the research on adolescent swimming in China should keep pace with the times and make up for shortcomings. By analyzing the research of adolescent swimming in foreign countries, the scholars can learn advanced research concepts and methods in time. The knowledge maps show the development trends and hotspots of scientific knowledge in a certain research field in the form of visual images. Thus, by using the Citespace V tool which can make knowledge maps, this paper took the papers of youth swimming that downloaded from SCIE and SSCI in the core collection database of web of science™ as the research object. By sorting out the hotspots and development trends of foreign youth swimming research, the author try to provide a reference for the theoretical system of youth swimming research in China.

2 Data Sources and Research Methods

2.1 Data Sources

It can be seen from the data in Table 1 that, the data was collected from SCIE and SSCI in the core database of web of science™. In order to ensure the comprehensiveness and accuracy of the data, this paper set TS = (teenager* OR adolescent* OR youth*) AND TS = (swimming OR front crawl swimming OR freestyle OR breaststroke OR butterfly OR backstroke). The papers retrieved from 2000 to 2021 year were used as the research object. The literature type was set as “Article”, while the language type was “English”. The search time of data was November 26, 2021.

2.2 Research Methods

In this study, Citespace V based on JAVA platform was used to analyze the knowledge map of 941 papers, and describe the hotspots and development trends of foreign youth swimming research. Citespace V is a visualization software developed by Professor Chen Chaomei. This software visually displays complex relationships such as the network structure and derivative changes between disciplinary knowledge groups in a graphical way, which is beneficial for scholars to discover the knowledge of the disciplinary field, structure, and research frontier.

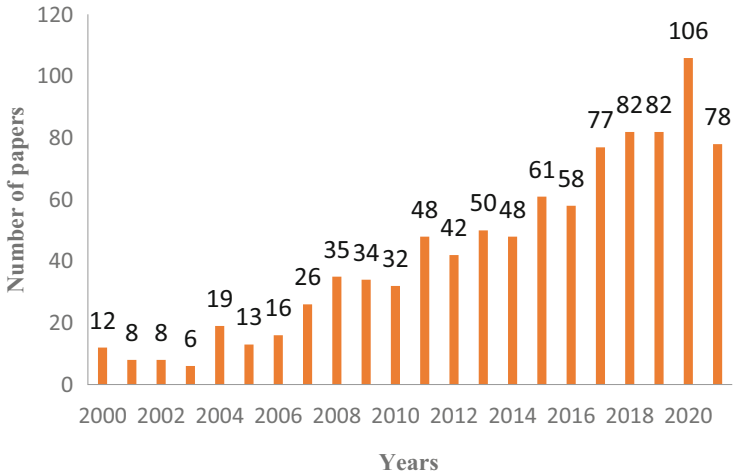


Fig. 1. Number of published papers on research of foreign adolescent swimming

3 Results and Discussions

3.1 Analysis of Annual Number of Published Papers

Academia's attention to a research over a period of time can be expressed in terms of annual number of published papers [10]. As can be seen from Fig. 1, the papers researched in this paper are on the rise as a whole, indicating that the research on youth swimming received a great number of attention from scholars. And scholars made more in-depth research in this field. According to the famous Place's curve principle [7], the number of published papers in research of foreign youth swimming will increase in a certain index in the future, and the content of the research will be more in-depth. The number of published papers in 2020 reached 106, accounting for 11.25% of the total numbers, which could be affiliated with the Tokyo Olympics. The holding of the Olympics can not only attract the public to watch high-level competitive competitions, but also promote the research of youth swimming.

3.2 Analysis of the Center Countries

The parameters were set in the Citespace V software. Time slicing was set from 2000 year to 2021 year. This study cut one slice in every one year. The node types was set as "Country". The threshold item was choose "top N 50 per slice", that is, the 50 items with the highest frequency in each time slice were selected to obtain the distribution map of countries on foreign adolescent swimming, showed in Fig. 2. Among them, each circle (node) represents a country, and the size of the circle shows the publication of papers, while the purple ring on the outermost layer of the circle indicates the centrality of the papers, and the width of the ring is proportional to the centrality [6].

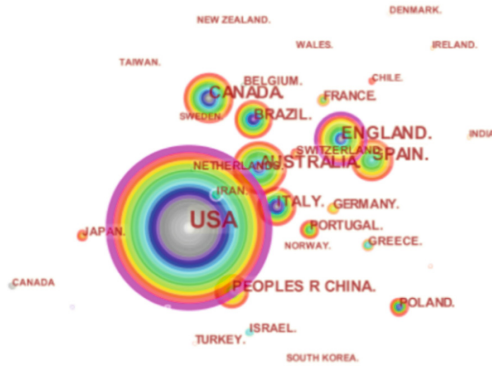


Fig. 2. Distribution map of countries on foreign adolescent swimming

The papers researched in this study comes from 96 countries. According to Fig. 2 and Table 2, it can be seen that the United States had the largest number of published papers, reaching 279 papers, accounting for 26.65% of the total papers. A study reported that if the number of scientific researches in a country accounts for more than 25% of the world's total in a period of time, this country can be called the world science center [4]. Therefore, the United States should be called the world science center for youth swimming research. Australia ranked second with 72 papers, accounting for 7.65% of the total numbers. Canada and the United Kingdom ranked third with 69 papers. China ranked seventh, which showed that the research horizon in China was relatively backward compared with developed countries. In terms of centrality, the United States had the highest centrality at 0.34, followed by the United Kingdom (0.12). Australia (0.9) and Spain (0.9) ranked third. The United States had the largest number of published papers on youth swimming research, indicating that the United States paid more attention to youth swimming. Although the number of published papers in the United Kingdom, Australia and Spain were lacked, the centrality was high, demonstrating that the papers published in these countries had a greater influence on youth swimming research. The number of published papers in China made some progress, but the centrality was only 0.01, which considers that Chinese scholars were restricted from publishing relevant research in international journals, because the native language is not English and the development of the subject is immature, etc.

3.3 Analysis of Main Categories

With the development of swimming in the world, its comprehensive value has changed accordingly, and the research of youth swimming in sport has attracted great attention from scholars. The parameters were set in the Citespace V, in which Time Slicing was from 2000 to 2021, and “category” was set as the Node Types. In addition, the author cut one slice every one year. The Threshold item was choose “top N 50 per slice”, and finally the category distribution map of youth swimming research was acquired, showed in Fig. 3. As can be seen from Fig. 3 and Table 3, youth swimming research formed an interdisciplinary linkage pattern, establishing links with neuroscience, psychology,

Table 2. Center countries in number of published papers

No	Countries	Number of published papers	Percentage of total (%)
1	USA	279	29.649
2	AUSTRALIA	72	7.651
3	CANADA	69	7.333
3	ENGLAND	69	7.333
4	SPAIN	66	7.014
5	BRAZIL	60	6.376
6	ITALY	50	5.313
7	PEOPLES R CHINA	48	5.101
8	FRANCE	34	3.613
9	GERMANY	29	3.082

**Fig. 3.** Distribution map of main category

behavioral science, pharmacology, and psychiatry, to create a new field of swimming research. There were ten key nodes involved in the youth swimming research. Among them, sports science had the highest centrality at 0.2, followed by neurology (0.12). Neuroscience (0.09), psychology (0.11) and behavioral science (0.09) ranked behind respectively.

3.4 Hotspots Analysis of Foreign Youth Swimming Research

By visually analyzing the high-frequency keywords of foreign youth swimming research from 2000 to 2021, the authors clearly and accurately recognize the hot-spots in the foreign youth swimming research field. All of 941 papers were imported into the CiteSpace V software. The hotspot network knowledge map (Fig. 4) and high-frequency keyword list (Table 4) in the field of foreign youth swimming research were obtained, which indicates that “adolescent” has the highest frequency because it was the research subject.

Table 3. Statistics about centrality and frequency of the categories

No	Categories	Frequency	Centrality
1	SPORT SCIENCES	246	0.2
2	NEUROLOGY	227	0.12
3	NEUROSCIENCES	209	0.09
4	PSYCHOLOGY	92	0.11
5	BEHAVIORAL SCIENCES)	92	0.09
6	PHARMACOLOGY & PHARMACY	82	0.05
7	PSYCHIATRY	75	0.06
8	ENDOCRINOLOGY & METABOLISM	74	0.13
9	PEDIATRICS	73	0.35
10	PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH	70	0.35

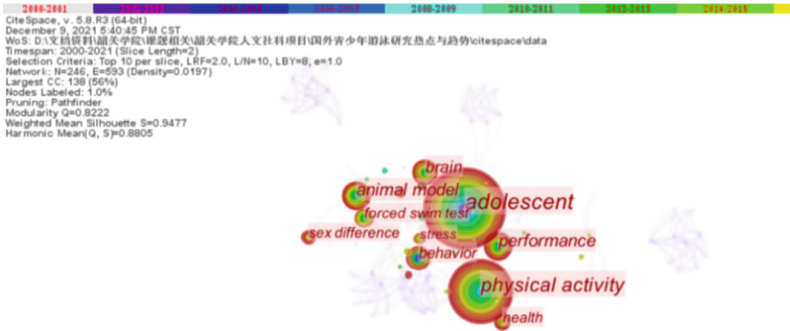


Fig. 4. Co-occurrence network map of keywords

The purpose of youth swimming research was to improve competitive performance. The hotspots of this research focused on behavior, health, sports injury, sports risk, etc. Resistance test method, animal experiment method and comparative study were the research methods commonly used by authors [1–3, 5, 8, 9]. The impact of swimming on the health of adolescents attracted the attention of scholars, and it will still be a research hotspot in the future. The future research content in the field of adolescent swimming will be more extensive and in-depth.

Table 4. High-frequency and high-centrality of keywords

No	High-frequency keywords		High-centrality keywords	
	Keywords	Frequency	Keywords	Centrality
1	Adolescent	243	Behavior	0.22
2	physical activity	159	Adolescent	0.18
3	Performance	68	body composition	0.14
4	animal model	68	Risk	0.12
5	Brain	60	Injury	0.10
6	Behavior	52	Health	0.08
7	Health	35	Association	0.08
8	forced swim test	34	bone mineral density	0.08
9	sex difference	29	Motivation	0.07
10	Stress	26	Performance	0.06

4 Conclusions

In order to comprehend the relevant research trends intuitively and the research hotspots, this paper used the method of scientometrics and information visualization. The conclusions are as follows:

- (1) Scholars from 96 countries published papers on adolescent swimming in important international journals. The United States published the largest number of papers, followed by Australia. Canada and the United Kingdom ranked third. The published papers showed an upward trend, with a peak in the number of publishing papers in 2020.
- (2) The research of adolescent swimming showed the characteristics of multi-disciplinary integration, involving multiple disciplines such as physical education, psychology, and neuroscience.
- (3) The research is carried out with the main purpose of improving performance, focusing on behavior, health, injury, risk and so on. The impact of swimming on the health of adolescents will still be a research hotspot in the future.

Acknowledgements. Funded by the project of school-level humanities and social sciences research of Shaoguan university (Project Number: SY2020SK08).

Funded by the project of the 22nd batch of education and teaching reform research of Shaoguan University (Project Number: SYJY20211152).

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