

# Research on Water Strength Training in Swimming Training Based on Knowledge Map

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**Abstract:** Strength is the foundation of sports and is the basis of all physical qualities and sports. In the field of sports, the research on strength training is one of the research hotspots that have attracted wide attention at home and abroad. With the help of Cite Space V visual analysis software, this paper takes CNKI's core journal articles on water strength training from 2009 to 2018 as the research object. Based on the analysis of 1058 related documents and data, a visual knowledge map was drawn, and a visual analysis was made on the number of papers published, research hot spots and frontier trends, scientific research institutions, high-yield authors, etc. of the water strength training research in Chinese swimming training in the past 10 years. Around the knowledge map, the research process, hot spots and main institutions of water strength training in Chinese swimming training are sorted out. Through the use of visual tools, the knowledge map of water strength training in swimming training is drawn.

## 1. Introduction

Strength training in swimming is a very key link. At present, there are many problems in strength training of Chinese swimmers. The innovation and optimization of technical methods in the daily training process of swimming sports are also constantly highlighting the impact value on the final result acquisition status of swimming competitions [1]. Chinese swimming researchers are very sure that there are problems in strength training in Chinese swimming development. At present, no reasonable solution has been found. For strength training problems, scientific research should be used to promote training, and through scientific research, Chinese swimming training methods should be systematically improved [2]. With the introduction of water strength training theory into Chinese competitive sports training in swimming training, it has been adopted by most coaches in China and has achieved good competitive results. However, in swimming training in our country, the effect on trunk is still not very obvious [3].

Based on scientific knowledge mapping method, visual exploration of strength training research at home and abroad can sort out numerous literatures at home and abroad accurately, effectively and objectively. With the help of CiteSpace visualization software, it can be mapped into an intuitive mapping that is easy for experts and scholars to understand and accept, avoiding the limitations of traditional research methods, and has certain scientific and innovative value. This paper uses the index data of relevant research documents collected in CNKI database and the visual analysis tool Citespace to intuitively present the development trend and evolution path of water strength training research in swimming training, hoping to supplement the water strength training research in swimming training in China.

## 2. Data Source

The data of this study come from CNKI database of CNKI. In the process of data collection and retrieval, accuracy and validity are very important in information visualization analysis. How to set the retrieval expression so that the retrieval results include all the domestic research swimming training results is the first issue to be considered. Through the retrieval of CNKI literature database website and the reference of university library materials combined with the author's professional knowledge, the collected materials are systematically collated and analyzed to lay a good theoretical

foundation for the development of strength training research in this paper. Combined with the research purpose of this paper, aiming at reflecting the core content of water strength training in swimming training, according to this definition, the data that meet the research needs were queried (see Table 1).

Table 1 List of Data Sources for This Study

Content	
Data source	CNKI database
Retrieval type	Theme = “Core Strength” or “Core Training” or “Core Strength Training” and theme = “Training” or “Sports”
Time span	2009-2018
Document type	All periodicals
Retrieval time	2018
Refining results	1058 journal articles

### 3. Research Method

#### 3.1 Expert Investigation Method

The determination of literature retrieval strategy is related to the comprehensiveness and accuracy of literature collection and the objectivity of research results. It is a very important link. Through consulting tutors and some experts in the domestic sports field, the retrieval strategy has been formulated.

#### 3.2 Bibliometrics

Bibliometrics is a method that uses statistical methods to make statistical analysis on the characteristics of relevant documents and uses data to describe or explain the data characteristics and change laws of documents, thus revealing the characteristics and laws of documents [4].

#### 3.3 Visual Analysis

Cite Space V visualization tool is used to analyze the visual knowledge map of the collected documents in the field of water strength training in swimming training, which can visually display the most advanced and latest research hotspots in this field in the form of visual map. This paper discusses the structure and attribute characteristics of strength training research networks at home and abroad through the analysis of the individual attributes of the network such as the point degree centrality and the intermediate centrality of the relationships in the knowledge network, as well as the overall attributes of the network such as small group research and condensed subgroup. In this study, sample data are imported into Cite Space knowledge map software system, which is based on JAVA platform and has the most powerful function, and visual knowledge maps (mainly including information of published articles, keywords, authors and institutions) are produced. Statistical analysis of data information in different dimensions is carried out to understand the evolution and development of water strength training in swimming training, so as to more objectively reveal the development and trend of “water strength training in swimming training” in recent 10 years in China.

### 4. Results and Discussion

#### 4.1 Temporal and Spatial Analysis of Literature on Water Strength Training in Swimming Training

In the past ten years, the number of articles on swimming research has averaged 37, with more than 45 articles published in 2009, 2010, 2012 and 2014. Only by planning scientific training methods can the abilities of management teams, coaches and athletes be brought into full play and the best training results be achieved. As can be seen from fig. 1, the number of articles issued for domestic physical fitness training research shows an overall upward trend. according to the change

trend of the number of articles issued, since 2010, the overall number of articles issued has shown a year-on-year increasing trend, but the increasing trend is also relatively slow, with ups and downs. The reason may be influenced by the scientific research environment, economic conditions, information dissemination and other factors at that time.



Fig.1 Trend Chart of Literature Changes in Research Directions of Core Strength Training in China from 2008 to 2018

Since 2009, a large number of related achievements on water strength training in swimming training have emerged in our country. The number of articles published in “ordinary periodicals” has increased rapidly, reaching 180 articles in 2016. Although the number of “core journals” has increased slightly, the growth value basically tends to be stable. In 2011, the World Swimming Championships will be held and the London Olympics will be held in 2012. A series of competitive swimming will drive the rapid development of practical swimming. In 2012, not only will there be an upsurge of research on swimming competition rules, techniques and tactics, and training methods in China. From the linear regression curve, it can be seen that the number of articles published on the related researches on physical fitness training in China is still increasing in the future, which indicates that the academic circles are paying more and more attention to the related researches on physical fitness training.

## 4.2 Hot Spot Analysis of Key Words in Water Strength Training

### 4.2.1 Co-Occurrence Analysis of Key Words in Water Strength Training

With CiteSpaceV, the network node is determined as the key word selection cluster view. Since 2009, the focus in the research field of water strength training in China has mainly focused on the core area and core stability of water strength training in swimming training. Institutional cooperation has always been an important research issue in scientometrics, and the interactive relationship between institutional cooperation and the output of scientific literature has not received enough attention and research. As one of the concentrated features of Chinese scientific papers, institutional concentration features. Among them, the holistic view refers to the overall cognitive ability of the training process, while the detailed view is expressed in the execution of the training process. However, Yin Jun, a scholar, stated in his research that the improvement of training level can reduce the influence of physical quality to a certain extent, that is, reduce the influence of physical quality on training results. According to statistics, the top ten journals are all sports journals with 315 articles, accounting for 82% of the total. Water strength training and strength training in swimming training. Scholars further elaborated that core training is a comprehensive training method for training trunk waist abdominal muscle group and spinal muscle group, and a more optimized training mode is carried out in combination with strength, sensitivity, balance, flexibility and proprioception of core muscle. [5] Compared with the phenomenon of regional concentration and discipline concentration, the institutional cooperation for strength training and research in China is mostly the cooperation between institutions of higher learning, limited by scientific research equipment, geographical distance, institutional resources and other conditions, and generally takes the form of strong-strong cooperation and strong-weak cooperation.

### **4.2.2 Hot Spot Analysis of Key Words in Water Strength Training**

In order to further explore the hot spot changes of related literatures in the field of water strength training research in China from 2009 to 2018, the time zone view presentation function of Cite Space V keyword clustering is used [6]. The signature agencies of research papers related to strength training in domestic core journals, the cooperative relationship between the connected representative agencies, and the isolated node representative agencies did not participate in scientific research cooperation or did not reach the set threshold. Selecting “institutions” as the node type, and then running the software, a corresponding knowledge map can be obtained, from which it can be found that the research institutions with more than 10 articles mainly focus on sports training theory research institutions, and nearly 20 of them have more than 10 articles. Key words are accurate induction of the full text and important indicators of information measurement research. Key words can reflect the research hotspots and development trends. After 2007, keywords such as “badminton”, “tennis”, “track and field events” and “core area” began to emerge, indicating that at this stage, Chinese research on water strength training has entered a rapid development stage, with a linear increase in the amount of literature. The high-frequency keywords are mainly “competitive sports”, “physical fitness” and “strength training”. The reason may be that there are differences in research directions among institutions, or the geographical distance is relatively long and the cooperation cost is relatively high. However, judging from the structure of the whole network, the cooperation within the institution or between the two institutions is dominant, and the multi-agency cross-regional cooperation still needs to be strengthened.

### **4.3 Analysis of High Yield Authors in Water Strength Training**

In Cite Space V and Node Types for parameter setting: Select Author, Links: Select Cosine, Selection Criteria: top50 Per Slice (indicating the author who extracted the top 50 data of each time slice to generate the final network, i.e. the number of articles posted to P50 during the period 1992-2017), other parameter setting methods are similar to the previous analysis [7]. The analysis found that the authors of domestic strength training research have a relatively frequent communication network as a whole, and many high-yield authors have published cooperation results. Combined with the sparse analysis of institutional cooperation maps, it further proves that intra-institutional cooperation is the dominant mode of scientific research cooperation in the field of domestic strength training research. These documents contain 504 authors with 1,029 links between them, which shows that researchers in the field of physical training have close cooperation. Setting “readers” as the node type and running the software, 45 authors and 136 authors' nodes were selected to form a co-occurrence visual knowledge map of representative figures, and at the same time, authors with more than 10 articles were selected as representative figures. The cooperative knowledge map of high-yield authors shows a highly discrete and coexisting distribution rule. There are 440 authors in this field, but the cooperation between authors is only 240 times, and the vast majority of researchers are in the state of individual combat. The reason may be that geography, region, resources, research direction and other conditions limit their scientific research cooperation. There are three modes of scientific research cooperation in the network: ring chart, straight line chart and pairwise cooperation chart. Independent authors still account for a considerable proportion [8].

### **4.4 Analysis of Scientific Research Institutions for Water Strength Training**

#### **4.4.1 Analysis of Cooperation between Scientific Research Institutions**

Co-occurrence analysis of scientific research institutions can directly show the distribution of the main strength and influence of Chinese water strength training research. From the horizontal, we can clearly find the characteristics of its changes over the years, grasp the development law, judge its development period and guide its future development. From the vertical point of view, we can combine the overall system in the field of strength training research, compare various perspectives, find its strong and weak areas, and put forward guiding suggestions. The number of documents gathered in a certain time zone is directly proportional to its influence. The node connection between time zones indicates the inheritance of the research, which helps to control the knowledge

evolution and document update and their mutual influence in the time dimension, and helps to intuitively understand the layout characteristics of keywords in different time zones [9]. Scientific research institutions show obvious centralized-discrete atlas, and the cooperation between these high-yield research institutions is very close. Among them, Beijing Sports University has the largest node, and the cooperation between the Capital Sports Institute, Wuhan Sports Institute, Shenyang Sports Institute and Beijing Sports University forms the largest cooperation network diagram. Horizontally, the physical quality, physical training and muscle group are gradually declining, and longitudinally, they are also relatively low, which should cause experts to attach great importance to them, find out the causes and offer suggestions for the overall development of strength training.

#### 4.4.2 Analysis on the Number of Articles Published by Scientific Research Institutions and Their Research Fields

In the analysis of high-yield scientific research institutions, the first one is Beijing Sports University, which has published up to 66 articles in the field of water strength training. The second place was Wuhan Institute of Physical Education, which published 35 papers. The third place is Shanghai Institute of Physical Education, which has published 20 papers (Table 2). Static analysis of domestic strength training research focus is based on the number of word frequencies, reflecting the key content of the research field. It can macroscopically grasp the overall framework of domestic strength training research, but it is still unable to reveal the relationship between words, the evolution track between words and so on, and the conclusion inevitably has shortcomings.

Table 2 List of High-Yield Research Institutions and Research Contents from 2009 to 2018

Serial number	Unit	Number of posts issued	Hot words
1	Beijing sports university	66	Core stability, competitive sports, physical education, swimming, gymnastics, etc.
2	Wuhan institute of physical education	35	Competitive sports, basketball, canoeing, sports dance, aerobics, etc.
3	shanghai university of sport	20	Core stability, core muscles, competitive sports, strength training
4	Capital institute of physical education	18	Training methods, diving, basketball, martial arts, etc
5	Shaanxi Normal University	13	General strength, stability, aerobics, basketball, volleyball
6	Nanjing institute of physical education	8	Synchronized swimming, diving, taekwondo, sports dance

Swimming as a “competitive sport” only has such high attention. The competitive and ornamental nature of swimming competition highly stimulates the enthusiasm of the public. The research on competitive swimming not only meets the needs of the public culture, but also provides theoretical basis for the improvement of Chinese swimming competitive strength. In order to objectively and directly count the institutions and units engaged in research related to water strength training, the knowledge map and list have been merged, for example, Beijing Sports University and Beijing Sports University Science Research Center are one unit. The development of training kinematics has a great influence on the direction and orientation of social development in our country, so the research on water strength training in swimming training should be continuously strengthened.

## 5. Conclusion

The research field of aquatic strength training is currently in a period of vigorous development. Since 2009, the number of published articles has basically increased in a straight line, but the quality of published articles needs to be further improved. We pay attention to the combination of theory and practice in every step and apply the core training theory to our actual training work. The water strength training theory in swimming training is the most advanced training method at present and can solve many strength problems in swimming training. In the analysis of high-frequency

authors and research institutions in this paper, it is not difficult to find that the communication and cooperation between research teams in the field of water power training and research in China is not enough. Its network map shows that there are not many connections between team nodes, and this cluster group is relatively scattered except for scholars with far-reaching influence in this field. Water strength training in swimming training in our country has experienced more than ten years of development. Although a theoretical system of sports training with Chinese characteristics has been established, this system needs to be improved because it is still in the exploratory stage. Therefore, it is necessary to speed up the research in this field and further supplement and perfect our sports training system.

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