

Analysis on the Research Progress of Internationalization of Traditional Chinese Medicine Based on Data Mining

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Abstract—Objective By analyzing the research hotspots and future development trends of the internationalization of Chinese medicine, it provides a reference for the development quality of the internationalization of Chinese medicine and promotes the internationalization of the Chinese medicine industry. Method In this paper, CNKI was used as the retrieval database and TCM internationalization was taken as the retrieval topic. A total of 407 related literatures were retrieved. In the retrieval results, manual screening was conducted to exclude repeatedly published literatures and irrelevant literatures such as reports and conference notices. Cite Space III software literature was used to analyze the data, and the results were obtained by literature metrology method and collinear analysis method. Results Keyword collinear network involves 430 keywords and generates 507 keyword interactions with a total of 430 nodes and 507 wires. The key words with high frequency are "internationalization", "modernization of traditional Chinese medicine", "industry of traditional Chinese medicine", "enterprise of traditional Chinese medicine" and so on. Conclusion The number of publications in this field fluctuates, forming a small-scale author cooperation network, and the research field of keywords is more concentrated. Government departments should integrate the resources of the traditional Chinese medicine industry, increase resource input and policy support and scholars should study the internationalization of traditional Chinese medicine in depth and from multiple perspectives, increase research innovations, and break the boundaries between research institutions to strengthen cooperation and exchanges in this field.

Index Terms—Cite space, Data mining, Internationalization of traditional Chinese medicine, Visual analysis

I. INTRODUCTION

Chinese medicine has a long history of thousands of years and has an indispensable position in China's health care system [1]. The internationalization of traditional Chinese medicine means that traditional Chinese medicine is widely recognized and used in other countries in the world, both officially and unofficially. It is highly valued and equal to western medicine [2]. Since the reform and opening up in 1978, China's economy has developed at a relatively rapid pace. In 2001, with China's accession to the World Trade Organization (WTO), traditional Chinese medicine was recognized and accepted by more and more countries in the world because of its unique properties, such as less toxic and side effects, lower costs, and better curative effects [3].

The proposal of the "Belt and Road" initiative in 2013 ushered in a new historical opportunity for the Chinese medicine industry to move towards internationalization [4]. In 2015, Professor Tu Yi won the Nobel Prize, and continued the modernization and internationalization of traditional Chinese medicine [5]. In 2019, President Xi Jinping made important instructions on the work of traditional Chinese medicine, emphasizing the acceleration of the modernization and industrialization of traditional Chinese medicine, and the promotion of traditional Chinese medicine to the world. In addition, due to the increasing number of people suffering from chronic diseases and drug-borne diseases, people are paying more and more attention to the "return to nature" diagnosis and treatment technology and traditional Chinese medicine. Development creates opportunities [6]. This study sorts out the research hotspots and future development trends of the internationalization of Chinese medicine in China in order to provide a certain reference for the development direction and quality of Chinese medicine internationalization in China.

II. MATERIALS AND METHODS

A. Research Object

This article uses China Knowledge Network (CNKI) as the main document database. The search is performed by setting the search formula "theme = Chinese medicine internationalization or title = Chinese medicine internationalization". The search scope is set to all documents and the search time is set to 1997. As of 2019, a total of 407 related literatures have been retrieved (the retrieval time is November 30, 2019). Manual search was performed in the search results to exclude duplicate publications and irrelevant documents such as reports and conference notices. A total of 233 research articles related to the internationalization of Chinese medicine were included in this analysis.

Use Cite Space III to visually analyze the document data retrieved from China national knowledge internet. The time is set to "From 1997 to 2019", the time slice is 1, the connection strength is "Cosine", and the range is selected to "Within Slices", the default value is (C, CC, CCV) = (2, 2, 20), (4, 3, 20), (3, 3, 20). The trimming items are selected as the minimum spanning tree and the pruning sliced networks.

B. Research Methods

Bibliometric method is a quantitative research method [7], which uses mathematical and statistical methods to describe and predict the research hotspots and development status of a field, so as to study the external characteristics of scientific literature [8]. The co-word analysis method includes the analysis of the frequency of the topic words or the collinear frequency [9], which mainly counts the number of occurrences of the same word or noun phrase in the same document, based on which the clustered analysis of the words studied, To get the closeness of the relationship between words, so as to analyze the structural changes of the discipline or theme they represent [10]. Cite Space is a software for data visualization analysis, which can plot the analyzed data into a knowledge map, which visually shows the hotspots and development directions of a research field [11]. This article uses bibliometrics and co-word analysis, and uses the visual analysis tool Cite Space III to analyze high-yielding authors, frequency analysis of research institutions, frequency analysis of keywords, and time analysis of keywords.

III. RESEARCH RESULTS

A. Analysis of High-yielding Authors Research Institution

When analyzing high-yielding authors and their cooperation networks, it was found that of the 233 journal articles related to the internationalization of Chinese medicine, a total of 378 authors were involved, with an average volume of 1.6 posts per article. There were 51 authors with 2 or more papers, among which Xiong Jixia (7), Jia Qian (6), Guo Zhixin and Wang Yitao (5), Zhang Dong and Li Jinliang (4); Finally, Yang Yue, Sun Lihua, Xiao Xiaohe, Sun Yuanyuan, Xu Wanqiang, Guo Dean, Wang Guangping, Du Yanyan, Wu Yungao, Cao Cai, Jia Wei, and Chen Feng (3 articles). A cluster analysis of the authors of the study revealed that there were five groups forming a network of cooperative relationships. The authors are based on Xiong Jixia, mainly studying the research on the international trade trend of the "Belt and Road" of Chinese medicine resources based on the perspective of imports to encourage internationalization. The author, focusing on Jia Qian, mainly studies the problems and countermeasures of internationalization of Chinese medicine; Guo Zhixin is the core author, whose main research content is to explore the road of internationalization of Chinese medicine from the source; Wang Yitao is the core author, whose main research content is the patent licensing and the strategy development of the internationalization of Chinese medicine; the last group of main research content is the new situation New strategy: R & D and international development of new Chinese medicine and health products.

It can be seen from Table I that in the field of Chinese medicine internationalization, the research institutions with higher frequency and representativeness are Nanjing University of Traditional Chinese Medicine, China

Institute of Science and Technology Information, School of Business Administration, Shenyang Pharmaceutical University, and Tianjin University Medical Sciences and 12 research institutes, including the Technical College. It can be seen that the research institutions are mainly concentrated in the pharmacy and management colleges and pharmaceutical institutes of various medical institutions, indicating that universities and institutes of medicine are the main research forces in this field. Divided by region, research institutions are mainly located in Beijing, Tianjin, Shenyang, Nanjing and other places. The economic levels of the above regions are relatively high, colleges and universities are clustered, and the pharmaceutical industry is developing well. There is a certain relationship between the level of development in the medical field. In addition, research institutions are scattered, with fewer core research teams, and fewer collaborations between colleges, pharmaceutical companies, and medical institutions.

TABLE I.
FREQUENCY TABLE OF CHINESE MEDICINE INTERNATIONALIZATION INSTITUTIONS

Serial number	Frequency	Mechanism	Years
1	7	School of Economics and Management, Nanjing University of Chinese Medicine	2005
2	6	Nanjing University of Chinese Medicine	2002
3	6	China Institute of Science and Technology Information	1999
4	6	School of Business Administration, Shenyang Pharmaceutical University	2002
5	5	School of Pharmaceutical Science and Technology, Tianjin University	2002
6	4	School of Medicine and Business, Guangdong Pharmaceutical University	2007
7	3	School of Public Management, Huazhong University of Science and Technology	2004
8	3	Chinese Medical Research Institute of University of Macau	2007
9	3	China Chamber of Commerce for Import and Export of Medicines and Health Products	2005
10	3	New Drug Evaluation Center of State Drug Administration	2001
11	3	Guangdong Pharmaceutical College	2002
12	3	School of Humanities, Harbin Engineering University	2011

B. Keywords Frequency Analysis

In the keyword frequency distribution table (see Table 2), there are 14 keywords with a frequency greater than or equal to 8, among which there are 11 with a frequency of 10 or more. Centrality can judge the importance of the node, and the centrality ≥ 0.1 indicates that the keyword has a pivotal role in the network. It can be seen that the frequency and centrality have a certain correlation. The higher the keyword frequency, the stronger the centrality. Among keywords with frequency greater than or equal to 10, the centrality of keywords such as internationalization,

modernization of traditional Chinese medicine, internationalization of traditional Chinese medicine, traditional Chinese medicine industry, traditional Chinese medicine products, and compound Danshen dripping pills is greater than or equal to 0.1, which plays a very good hub in the collinear network effect. In addition, from the perspective of the chronological distribution, most of the keywords with higher frequencies appeared in the period from 1997 to 2003, indicating that scholars have done more research on the internationalization of Chinese medicine during this period, which is the same as China officially joined the world in 2001. The World Trade Organization (WTO) marks that China's industry has entered a new stage in its historical opening up. Many scholars at that time mainly studied how to push Chinese medicine products or Chinese medicine companies to the international market, and to operate in the quality of Chinese medicine products and Chinese medicine companies. Do in-depth research on management and import and export of Chinese medicine.

TABLE II.
FREQUENCY TABLE OF CHINESE MEDICINE INTERNATIONALIZATION
KEYWORDS

Serial number	Frequency	Centrality	Key words	years
1	62	0.2	Globalization	2002
2	34	0.41	Chinese medicine modernization	1997
3	34	0.21	Internationalization of Chinese Medicine	2000
4	32	0.15	Chinese medicine industry	2000
5	17	0.09	Chinese Medicine Enterprise	1998
6	16	0.17	Chinese medicine products	1999
7	15	0.06	Compound Danshen Dripping Pills	1998
8	13	0.22	Chinese medicine export	2002
9	11	0.04	Chinese herbal medicine	1999
10	10	0.03	North America	1999
11	10	0.1	United States of America	1999

C. Keywords Time-domain Atlas Analysis

The starting time of the internationalization of Chinese medicine studied in this article was in 1997, and the first keyword that appeared was modernization of Chinese medicine. From 1998 to 1999, the main research objects of scholars were Chinese medicine companies, international markets, international operations, FDA, Chinese herbal medicines, and proprietary Chinese medicines. From 2001 to 2002, the most frequent keyword appeared was the internationalization of traditional Chinese medicine. During this period, scholars' research on the internationalization of traditional Chinese medicine entered a deeper and broader scope. It was mainly combined with international management and management to study plant extraction. Foreign trade, foreign exchange earning, and talent training models, which are related to the background of China's entry into the World Trade Organization (WTO). From 2003 to

2008, around the internationalization of Chinese medicine, keywords such as quality standards, export value, standard currency, foreign trade, and protection of Chinese medicine intellectual property rights appeared. From 2009 to the present, technical barriers, industry-university-research, evidence-based medicine, the Belt and Road Initiative, big data, collaborative development, dual first-class, new plant drug development, and pioneering power have emerged around the internationalization of Chinese medicine. The combination of policies will gradually promote the research on the internationalization of Chinese medicine in the context of policies.

IV. CONCLUSIONS

A. Research Volume Fluctuates

The research on the internationalization of Chinese medicine in China has been increasing year by year from 1997 to 2003. From 2004 to 2012, the overall number of papers issued was relatively high. From 2013 to 2019, the number of papers issued fluctuated first and then increased. It is speculated that the number of papers will increase in the future. trend. The overall volume of papers and related research in this field is relatively small, and the research started late. It is suggested that relevant departments should invest more resources in this research field. Research scholars should continue to pay attention to the research dynamics in this field. On the premise of constantly summing up previous research results, invest more energy to think about research and give their own views. And ideas, while increasing the number of studies, improve the quality of the research.

B. Research forms a small-scale author collaboration network

In the research field of internationalization of Chinese medicine, high-yielding authors include Xiong Jixia, Jia Qian, Guo Zhixin, and Wang Yitao, etc. The research results are rich, forming a small-scale core author group. In terms of research related to the internationalization of Chinese medicine, the research units that have contributed greatly include the School of Economics and Management of Nanjing University of Traditional Chinese Medicine, the China Institute of Science and Technology Information, the School of Business Administration of Shenyang Pharmaceutical University, and the School of Pharmaceutical Science and Technology of Tianjin University. Concentrated in the Institute of Pharmacy, the School of Management and the College of Pharmacy of various institutions of higher learning, the research power is scattered, and there is less cooperation between research institutions. It is suggested that relevant departments should invest more resources in this research field. Research scholars should continue to pay attention to the research dynamics in this field. On the premise of constantly summing up previous research results, invest more energy to think about research and give their own views and ideas, while increasing the number of studies, improve the quality of the research.

C. Keyword research areas are more concentrated

The analysis results show that the keywords are mainly divided into four categories, which are keywords related to traditional Chinese medicine products, production of traditional Chinese medicine, trade in traditional Chinese medicine products, and management of traditional Chinese medicine products. Most of the research on the internationalization of traditional Chinese medicine has focused on the perspective of traditional Chinese medicine and its economic management. It is suggested that the research on the internationalization of Chinese medicine should be strengthened, the research area should be expanded, and the research should be carried out from multiple angles. Relevant research institutions should break the boundaries between regions and majors, conduct academic exchanges and discussions, find different research directions, and optimize research results. It is suggested that scholars can strengthen the depth of research in traditional Chinese medicine products, international standards, intellectual property protection, and international marketing strategies by adding innovation points and technical points, combining the research of internationalization of traditional Chinese medicine with international and domestic policies and hot technology of the times, The combination of technologies such as blockchain, cloud, big data, and the Internet of Things with the construction of a Chinese medicine platform promotes the rapid development of the Chinese medicine industry, thereby enhancing the competitiveness of Chinese medicine in the international market.

REFERENCES

- [1] W. Guangping, "Analysis of influencing factors in the internationalization process of Chinese medicine industry." *Productivity Research*, vol. 10, pp. 118-120, 2009.
- [2] S. Lihua, Y. Yue, D. Li, S. Gangqiang, and H. Taikang, "Research on the problems and countermeasures of internationalization of Chinese medicine." *Chinese Traditional and Herbal Drugs*, vol.35 (11), pp. 1201-1204, 2004.
- [3] Wu. Wansheng. "Opportunities and challenges of Chinese medicine internationalization." *Cooperative Economy and Science and Technology*, vol. 11, pp. 83-84, 2015.
- [4] S. Ying, and Z. Xiaoyan, "Research on the Internationalization Development Strategy of Chinese Medicine Industry." *Economic Research Review*, vol. 09, pp. 38-39, 2019.
- [5] C. Kaixian, "Enlightenment of Professor Tu Yan's Nobel Prize and Development of Integrated Traditional Chinese and Western Medicine." *China Journal of Integrated Traditional Chinese and Western Medicine*, vol. 37 (2), pp. 143-144. 2017.
- [6] G. Zhixin, Z. Libin, J. Jianlan, L. Mingyan, and Y Yingjin, "Current Situation and Countermeasures of Chinese Medicine Internationalization." *Chinese Traditional and Herbal Drugs*, vol. 34 (2), pp. 97-100, 106, 2003.
- [7] Z. Liang, and M. Xianxue, "Comparative Study of Bibliometric Method and Content Analysis Method." *Library Work and Research*, vol. 06, pp. 64-66, 2013.
- [8] Z. Wenhui, "A Comparative Study of Bibliometric Method and Content Analysis Method." *Journal of Information*, vol. 05, pp. 31-33, 2006.
- [9] Y. Chunlei, and L. Fuhai, "Research on improvement of subject topic evolution method based on co-word analysis." *Information Theory and Practice* vol. 35 (03), pp. 79-82, 2012.
- [10] C. Jiewang, and G. Chunxia. "Basic principles of co-word analysis and EXCEL implementation." *Information Science*, vol. 29 (06), pp. 931-934, 2011.
- [11] D. Bei, S. Yanhui, F. Lian, and X. Yujun, "A Visual Analysis of the Research Status in the Field of Citation Analysis in China—A Knowledge Map Analysis Based on the Number of Papers, Authors and Topics." *Journal of Information*, vol. 30 (06), pp. 91-97, 2011.