

Visualization Analysis of Chinese Traditional Exercise in Preventing and Treating Chronic Obstructive Pulmonary Disease Based on CiteSpace

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Abstract

Objective: Analyze the research status, hot spots and development trends of traditional Chinese exercises in the prevention and treatment of chronic obstructive pulmonary disease (COPD) in recent 15 years based on CiteSpace software and provide some reference for subsequent related research. **Methods:** The China National Knowledge Infrastructure (CNKI) was used to retrieve the relevant literature and periodicals in recent 15 years. CiteSpace software was employed to conduct a visual analysis of authors, institutions and keywords, and its internal meaning was interpreted in combination with corresponding maps. **Results:** A total of 229 articles were included. The number of published articles increased year by year, indicating that the research heat of traditional exercises to prevent and treat chronic obstructive pulmonary disease has gradually increased in recent 15 years. There are 248 research scholars, represented by Jinxiu Chen and Zhenwei Wang, and 209 research institutions, represented by Fujian University of Traditional Chinese Medicine and Yueyang Hospital of Integrated Traditional Chinese and Western Medicine affiliated to Shanghai University of Traditional Chinese Medicine. The cooperation within institutions is relatively close, while the cooperation between institutions is not tightly connected and the research is relatively scattered. Keyword visualization shows 254 nodes and 628 connection lines, among which there are 10 keywords with frequency greater than 10 times and centrality greater than 0.1, and a total of 14 clusters and 10 emergent words, suggesting that the traditional methods more used in COPD prevention and treatment are Wujinxi, Liuzijue, Baduanjin and Tai Ji Chuan, among which Liuzijue and Tai Ji Chuan are particularly prominent. The evaluation criteria of curative effect are mainly sports endurance, quality of life and lung function, taking both objective and subjective indicators into account. **Conclusion:** With conducting a visual analysis of related literature in CNKI by CiteSpace, the general situation of the research on the prevention and treatment of chronic obstructive pulmonary disease by traditional martial arts is intuitively displayed, the cooperative relationship between researchers and institutions is initially revealed, as well as the research frontiers, hotspots and research trends of traditional martial arts prevention and treatment of chronic obstructive pulmonary disease are roughly understood, which provides a certain direction and reference for further research.

Keywords

CiteSpace
Traditional Chinese exercise
Chronic obstructive
pulmonary disease
Visualization analysis

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1. Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive disease limited by persistent irreversible airflow, which is related to the abnormal inflammatory reaction of harmful gases or particles ^[1]. As the main chronic disease in the world, COPD has become the third leading cause of death in global, which main clinical manifestations are cough, expectoration, shortness of breath or dyspnea, decreased exercise endurance and even the daily activities can not be completed alone, thus seriously affects the quality of life ^[2]. In traditional Chinese medicine, COPD belongs to the category of lung distension, which is caused by chronic lung deficiency and endogenous phlegm, resulting in lung qi failing to converge and fullness, resulting in cough and wheezing, and the disease is often aggravated because of reinfecting exogenous pathogens. American Thoracic Society (ATS) and European Respiratory Society (ERS) advocate the use of lung rehabilitation in COPD patients, which includes exercise training, patient education, social psychological support and so on, in order to help COPD patients improve their physical and psychological state and maintain a long-term healthy lifestyle ^[3,4].

Sports training includes endurance training, resistance/strength training, flexibility training, respiratory muscle training and so on. Various sports methods can be adopted, such as swimming, running, cycling and breathing exercises. However, as most COPD patients are elderly people, they may not be able to tolerate high-intensity exercise, resulting in excessive muscle energy consumption and respiratory frequency disorder, which weakens their exercise ability. In COPD patients, there is limited evidence about the optimal intensity of exercise training. It is still unclear who benefits more from high-intensity exercise training or low-intensity exercise ^[5]. While some studies have pointed out that COPD patients can benefit from both high-intensity and low-intensity exercise ^[6,7]. The Metabolic Equivalent of Task (MET) index of traditional exercises is between 1.5 and 2.6, and the maximum cardiac output accounts for 43–49% of the predicted value, which is classified as low-intensity exercise ^[8].

There are many kinds of traditional exercises, among which Tai Ji Chuan is the representative. In addition, in 2003, China's State Sports General Administration

introduced four fitness exercises, including Wuqinxi, Baduanjin, Liuzijue and Yijinjing. Therefore, the traditional techniques mentioned in this paper include Wuqinxi, Baduanjin, Liuzijue, Yijinjing and Tai Ji Chuan. As a safe exercise therapy to prevent and treat COPD, traditional exercises have gradually attracted the attention of researchers in recent years.

CiteSpace is a visual software developed by Professor Chaomei Chen, a computer and information science major at Drexel University in the United States, based on JAVA environment ^[9]. It can analyze the data of scientific literature in a certain field to get valuable information, so as to find its internal laws, and can transform text information into visual maps to show the current situation and hot spots of research intuitively. In this study, CiteSpace 5.8.1R software was used to conduct co-occurrence and cluster analysis on the annual number of articles, authors, institutions and key words related to the prevention and treatment of COPD by traditional methods, and draw a visual map, which can intuitively show the development process and research hotspots of traditional methods in the past 15 years, and has certain reference significance for subsequent research ^[10].

2. Data and methods

2.1. Data sources

The CNKI database was used for advanced search, and the search criteria box selected the theme. The search query includes the following terms: (Wuqinxi OR Baduanjin OR Yijinjing OR Liuzijue OR Tai Ji Chuan) AND (Chronic Obstructive Pulmonary Disease). The publication time was set to January 1, 2006 and August 22, 2021 to search Chinese documents. A total of 246 documents were retrieved, and 229 documents were included after manually excluding documents such as conferences and scientific and technological achievements.

2.2. Data transformation

The selected literature in the “Reworks” format was exported, save it to a file, and then name it “download_***”. We utilize the Import/Export function of CiteSpace to perform data conversion.

2.3. Research method

The data were analyzed by using the visualization software CiteSpace 5.8.1R developed by Professor Chaomei Chen, majoring in computer and information science at Drexel University in the United States. Specific Parameter settings: the time interval was 2006–2021. The author, institution and keyword are selected as node types, and the whole atlas is simplified by clipping, and the visual atlas is drawn and analyzed respectively.

3. Results

3.1. Annual publication volume

The published amount of the included documents was analyzed, as shown in **Figure 1**, in which the statistical time of published amount in 2021 is from January 1, 2021 to August 20, 2021. In the past 15 years, the distribution of the annual number of articles has shown two stages, with a steady growth period from 2006 to 2014, during which the number of articles has increased year by year, with an average of 4.9 articles per year. 2015–2021 is a stable period, with an average of 26.5 articles published annually. In 2019, the number of articles published was the highest (38 articles), and in recent 10 years, the number of articles published was 204, accounting for 89% of the total number of articles published, indicating that the recent 10 years was the peak of the research on the prevention and treatment of COPD by traditional methods, which attracted the attention of relevant researchers.

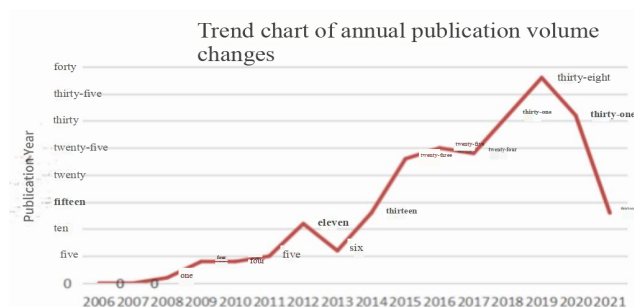


Figure 1. The trend chart of the change of the number of articles published in the prevention and treatment of chronic obstructive pulmonary disease by traditional exercises from 2006 to 2021.

3.2. Author analysis

There are 248 nodes and 317 lines in the co-occurrence

spectrum of authors. In the co-operation spectrum, each node is an author, the font size of the author's name corresponds to the number of articles published, and the thickness of the lines between nodes corresponds to the strength of the cooperative relationship between authors. As shown in **Figure 2**, a total of 248 authors were included for analysis, and six research cooperation teams were formed, mainly including Jinxiu Chen, Zhenwei Wang, Fubing Yang, Haihua Wang, Xin Yan and Tairong Liu. Among them, Zhenwei Wang (10 articles), Jinxiu Chen (9 articles) and Peilan Yang (8 articles) are the top three (as shown in **Figure 3**).

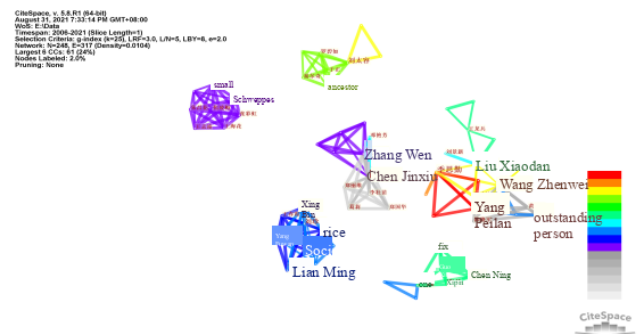


Figure 2. Author's cooperation relationship diagram.

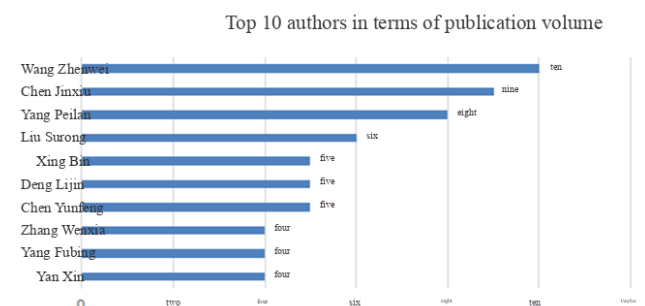


Figure 3. Top 10 authors of published articles.

3.3. Institutional analysis

As shown in **Figure 4**, it is a visual atlas analysis of institutional cooperation for the included criteria, and the nodes of the same research institution are merged, such as Fujian College of Traditional Chinese Medicine and Fujian University of Traditional Chinese Medicine, Chengdu University of Traditional Chinese Medicine and Clinical Medical College of Chengdu University of Traditional Chinese Medicine. There are 209 nodes and 163 connections, suggesting that there are 209 institutions, and little cooperation among them (density = 0.0075). Five close cooperation networks have been

formed, namely Fujian University of Traditional Chinese Medicine, Chengdu University of Traditional Chinese Medicine, Nanjing University of Traditional Chinese Medicine, Yueyang Hospital of Integrated Chinese and Western Medicine affiliated to Shanghai University of Traditional Chinese Medicine, and Sports Rehabilitation Research Center of Wuhan Institute of Physical Education. The main research positions include Fujian, Nanjing, Chengdu and Wuhan. Among them, Fujian University of Traditional Chinese Medicine (14 papers, accounting for 6% of the total number of papers) has the largest number of papers, and the top three are Fujian University of Traditional Chinese Medicine, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine affiliated to Shanghai University of Traditional Chinese Medicine and Chengdu University of Traditional Chinese Medicine (refer **Figure 5**).

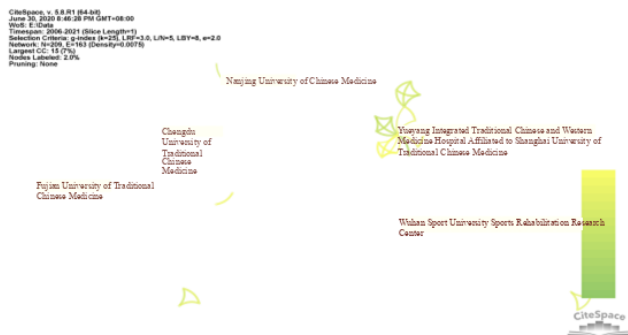


Figure 4. Institutional cooperation diagram.

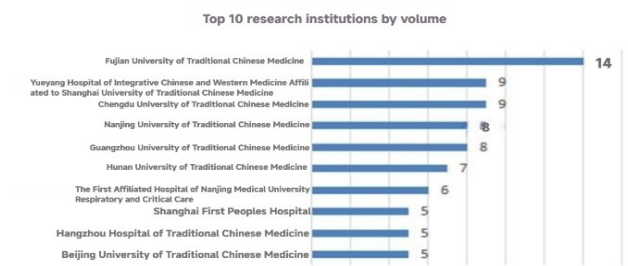


Figure 5. Top 10 research institutions with published papers.

3.4. Keywords analysis

Keywords were selected as nodes to generate the keyword analysis map depicted in **Figure 6**, **7** and **Table 1**.



Figure 6. Keyword co-occurrence diagram.

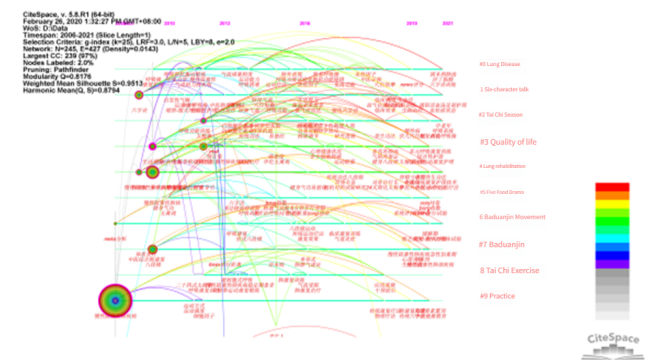


Figure 7. Keyword time zone line chart.

Table 1. Keywords with frequency > 10 and centrality > 0.1

Number	Keyword	Age	Frequency	Centrality
1	COPD	2006	197	0.51
2	Stable phase of COPD	2009	61	0.26
3	Baduanjin	2009	56	0.17
4	Liuzijue	2008	50	0.38
5	Pulmonary function	2012	50	0.10
6	Lung rehabilitation	2008	47	0.29
7	Quality of life	2009	39	0.68
8	Tai chi chuan	2012	29	0.46
9	Exercise endurance	2006	23	0.25
10	Wuqinxi	2010	12	0.30

3.4.1. Co-occurrence analysis

By analyzing the key words, we can get the key research content and direction in this field [11]. Through the analysis of the literature, it is known that there are keywords with the same or similar meanings but different expressions, such as COPD and chronic obstructive pulmonary disease, survival quality and quality of life, which are merged and unified to ensure the accuracy of the results.

As can be seen from **Figure 6**, the visualized graph of keyword co-occurrence includes a total of 254 nodes and 628 connections, with relatively tight connections between nodes. Where the betweenness centrality is greater than 0.1, it indicates that this node occupies an important position in the graph and is more likely to have a significant impact. The purple border around the edge of the tree ring represents the strength of the betweenness centrality, with a thicker border indicating a stronger centrality^[12]. As shown in **Table 1**, there are 10 keywords with a frequency greater than 10 and a centrality greater than 0.1, including chronic obstructive pulmonary disease, stable phase of chronic obstructive pulmonary disease, Baduanjin, lung function, six-character technique, pulmonary rehabilitation, Tai Chi, quality of life, Wuqinxi, and exercise endurance.

By analyzing high-frequency keywords and high centrality keywords in the paper and visualizing them, we can identify research hotspots in this field. The application of traditional techniques such as Eight Baduanjin, Liuzijue, Tai Ji Chuan and Wuqinxi has strong research hotspots in improving lung function and quality of life in chronic obstructive pulmonary disease. The timeline graph in **Figure 7** illustrates the differences in clustering across time spans and time points.

3.4.2. Cluster analysis

Keywords are a highly concise summary of a document. The research hotspots in different periods can be reflected by the high-frequency keywords in this period. The cluster diagram can reflect its structural characteristics, important keywords and connections, and can clearly show the theme of this field and its evolution process^[13]. As shown in **Figure 8**, the keywords are clustered by CiteSpace, and 14 clusters are obtained, including #0 lung disease, #1 Liuzijue, #2 Tai Ji Chuan, #3 quality of life, #4 lung rehabilitation, #5 Wuqinxi, #6 Baduanjin movement, #7 Baduanjin movement, #8 Tai Ji Chuan movement, #9 exercise, #10 elderly people, #11 acute exacerbation of chronic obstructive pulmonary disease, #12 CAT score, #13 exercise endurance. The module clustering value Q is 0.8176 (> 0.3) and the contour value is 0.9513 (> 0.7), which shows that the cluster structure is reasonable and the clustering result is credible. Each color block represents a cluster, and the nodes in each

color block belong to the same cluster. Further analysis, as shown in **Table 2**, shows that the contour value of each cluster is greater than 0.7, indicating that the research is mainly concentrated and the clustering results are credible. Among them, the acute exacerbation of #0 lung disease and #11 chronic obstructive pulmonary disease include the stable period and acute exacerbation of COPD. It indicates the traditional lateral reaction method can be applied not only to the stable period of COPD, but also to the acute exacerbation period. #0 lung disease, #1 Liuzijue, #2 Tai Ji Chuan, #3 quality of life, #4 lung rehabilitation, #5 Wuqinxi, #6 Baduanjin movement, #7 Baduanjin, #8 Tai Ji Chuan movement, #9 exercise reflect the concrete application of traditional exercises in chronic obstructive pulmonary disease. #3 quality of life, #12 CAT score and #13 exercise endurance reflect the evaluation criteria of curative effect in traditional manual therapy for chronic obstructive pulmonary disease. Subjective symptoms and corresponding scores can effectively judge the curative effect.

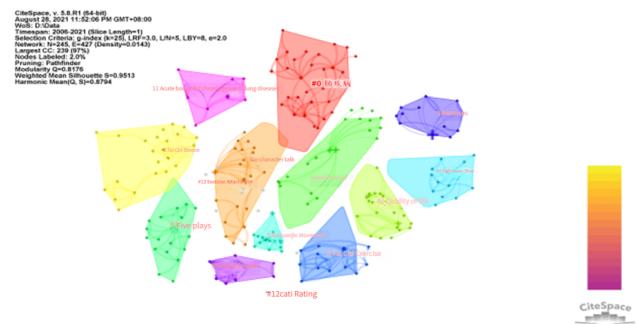


Figure 8. Keyword clustering diagram.

3.4.3. Burst analysis

We can predict the development trend of this field and judge the research hotspots through keyword pop-up analysis. The graph of keyword emergence analysis is shown in **Figure 9**, and a total of 10 emergent words have been obtained. In recent years, the research focus has not lasted long, and the judgment and attention on the degree of dyspnea has gradually shifted from exercise endurance to the study of respiratory mechanics and respiratory muscle strength. From 2006 to 2011, the research methods of Meta-analysis were widely used in this field. The exploration of the specific application of traditional techniques includes the use of Liuzijue, exercise prescription, lip-contraction-abdominal

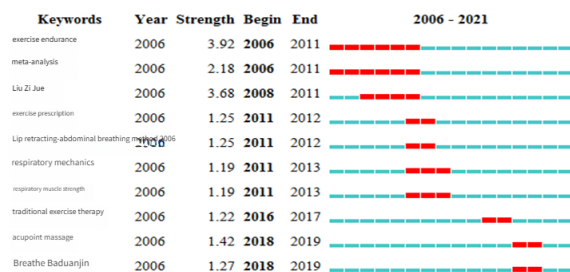
Table 2. Keyword clustering list

Cluster number	Scale	Age	Contour value	Lable(LLR)
#0	32	2015	0.942	Lung disease ($18.45, 1.0 \times 10^{-4}$)
#1	28	2015	0.964	Liuzijue($22.16, 1.0 \times 10^{-4}$)
#2	24	2016	0.946	Tai chi chuan($20.57, 1.0 \times 10^{-4}$)
#3	22	2015	0.936	Quality of life($28.12, 1.0 \times 10^{-4}$)
#4	21	2016	0.973	Lung rehabilitation($31.34, 1.0 \times 10^{-4}$)
#5	18	2015	0.953	Wuqinxi($22.13, 1.0 \times 10^{-4}$)
#6	14	2016	0.924	Baduanjin exercise($18.16, 1.0 \times 10^{-4}$)
#7	14	2015	0.926	Baduanjin($18.09, 1.0 \times 10^{-4}$)
#8	14	2014	0.906	Tai ji chuan movement($14.66, 0.001$)
#9	14	2014	1	exercise($8.18, 0.005$)
#10	11	2015	1	The aged($10.68, 0.005$)
#11	10	2017	0.983	Acute exacerbation of COPD($17.22, 1.0 \times 10^{-4}$)
#12	9	2017	0.957	CAT score($12.47, 0.001$)
#13	8	2017	0.918	Exercise endurance($17.36, 1.0 \times 10^{-4}$)

breathing, acupoint massage and breathing Baduanjin. It can be inferred from the breathing Baduanjin in the pop-up words that it may be more targeted to add breathing coordination while exercising to improve exercise endurance. At the same time, most of the research hotspots are still limited to the clinical efficacy research and literature review research of different traditional methods to prevent and treat COPD, while the mechanism and related experimental research are lesser.

traditional techniques (Wuqinxi, Liuzijue, Yijinjing, Baduanjin and Tai Ji Chuan) in the CNKI nearly 15 years, which intuitively reflects the research status, future research hotspots and development trends of this kind of research.

Judging from the number of papers published each year, the research on the prevention and treatment of COPD with traditional exercises has been increasing year by year since 2008, with an average of more than 4 articles per year, which may be related to the successful hosting of the 2008 Olympic Games, the attention paid to mass sports, and the state and the government vigorously advocating the development of traditional fitness exercises^[14]. From 2015 to 2021, the number of articles published each year was more than 20, and reached the peak in 2019 (38 articles), indicating that the traditional exercises of preventing and treating COPD have been gradually valued. The authors are represented by Zhenwei Wang and Jinxiu Chen (intermediary centrality 0.01), and formed a research team headed by Jinxiu Chen, Zhenwei Wang, Fubing Yang and Haihua Wang. The relationship between teams is close, but the cooperation between teams is not close, and the research is relatively scattered. The number of articles published by high-yield

Top 10 Keywords with the Strongest Citation Bursts**Figure 9.** Keyword pop-up diagram.

4. Discussion

In this paper, CiteSpace is used to visually and bibliometrically analyze the related literatures of the

authors is close. High-yield institutions include Shanghai University of Traditional Chinese Medicine, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine affiliated to Shanghai University of Traditional Chinese Medicine, and Chengdu University of Traditional Chinese Medicine. The University of Traditional Chinese Medicine and its affiliated hospitals are the main research institutions for related research, with an intermediary centrality of 0, indicating that the relationship between authors and institutions is not close, the research is scattered, and there is a lack of communication, which may be related to different research topics and institutional platforms. It is suggested that all institutions can strengthen contact and communication, give play to their own advantages, and provide more powerful clinical services.

According to the keyword co-occurrence chart and high-frequency keywords, there are 10 keywords with frequency greater than 10 times and centrality greater than 0.1, including chronic obstructive pulmonary disease, stable period of chronic obstructive pulmonary disease, Baduanjin, lung function, six-character formula, lung rehabilitation, Tai Ji Chuan, quality of life, wuqinxi and exercise endurance. As for the traditional techniques included in this paper, Baduanjin, Liuzijue, Tai Ji Chuan and Wuqinxi are all high-frequency keywords, among which Liuzijue and Tai Ji Chuan are particularly prominent, which may be related to the training effect of Liuzijue on respiratory function and the high popularization rate of Tai Ji Chuan^[15,16]. Only Yijinjing is not a high-frequency keyword, indicating that Yijinjing is less used in COPD prevention and treatment, which may be related to the difficulty in learning Yijinjing and the low popularization rate compared with the other four traditional methods^[17]. Apart from the key words, the high-frequency keywords include lung function, lung rehabilitation, quality of life and exercise endurance, suggesting that traditional exercises can play an important role in the prevention and treatment of COPD as a specific way of lung rehabilitation^[18]. The evaluation criteria of curative effect can be lung function, exercise endurance and quality of life, which have both objective indicators and subjective evaluation, and the ability to judge curative effect is more accurate. But in addition to the evaluation criteria of curative effect, more evaluation

criteria can be adopted, including self-efficacy, muscle function status and balance of COPD patients.

Through keyword clustering and timeline map, it can be found that the main research population in this paper is the elderly, which is related to COPD being one of the main chronic diseases of the elderly. Traditional exercises can be used not only in the stable period of COPD, but also in the acute exacerbation of COPD^[19,20]. Combined with the emergence of key words, we can make a general prediction on the research content, development and future development direction of the literature related to the prevention and treatment of COPD by traditional methods. Through the comprehensive analysis of related maps, it is concluded that the research hotspots are mainly concentrated in the following aspects.

- (1) Meta-analysis of randomized controlled studies of traditional exercises in preventing and treating COPD, so as to obtain more objective and scientific evidence
- (2) Prescribing different exercise prescriptions according to patients' personal conditions
- (3) To study the internal mechanism of traditional exercise in preventing and treating COPD, the main research directions are respiratory mechanics and respiratory muscle strength
- (4) Using traditional techniques and cooperating with respiratory function training
- (5) Exercise combined with breathing and new treatment methods, such as acupoint massage. According to the trend of BURST diagram, it is predicted that there will be more clinical efficacy evaluation, systematic evaluation and internal mechanism research.

To sum up, based on CiteSpace software, this paper makes a visual analysis of the related research literature on the prevention and treatment of COPD by traditional methods in CNKI (Wuqinxi, Liuzijue, Yijinjing, Baduanjin and Tai Ji Chuan), which intuitively shows the general situation of the research on the prevention and treatment of chronic obstructive pulmonary disease by traditional methods, research frontiers and hot spots, and provides a certain direction and reference for further research. It is concluded that the traditional methods that are widely used in the prevention and treatment of COPD are Wuqinxi, Liuzijue, Baduanjin and Tai Ji Chuan,

among which Liuzijue and Tai Ji Chuan are particularly prominent. The evaluation criteria of curative effect are mainly based on exercise endurance, quality of life and lung function, taking both objective and subjective indicators into account.

At present, the role of traditional exercises in the prevention and treatment of COPD has been recognized, which can improve exercise endurance and quality of life,

while large-sample, multicenter, prospective randomized controlled study and in-depth study of its mechanism are still needed. Due to the late start of the related research on the prevention and treatment of chronic obstructive pulmonary disease with traditional methods, the amount of research literature is relatively small, so there are some limitations, so there may be one-sidedness and shortcomings in the analysis results.

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Disclosure statement

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