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Global research hotspots and trends of Buyang huanwu decoction

A visual analysis of the literature based on CiteSpace

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Abstract

Background: Buyang huanwu decoction (BYHWD) has shown significant clinical efficacy in the treatment of several diseases, particularly stroke. However, bibliometric research has not been comprehensive.

Methods: BYHWD articles were collected from literature databases published from January 1, 1915, to March 31, 2024, including the China National Knowledge Infrastructure, Weipu, Wanfang, Pubmed, Scopus, and Web of Science Core Collection. Knowledge network graphs of annual publication volume, authors, institutions, countries, keywords, and references were constructed.

Results: Nine thousand two hundred thirty-eight Chinese literature and 559 English articles published between 1915 and 2024 showed an overall upward trend. The countries, institutions, journals, and authors with the highest output were China, Hunan University of Chinese Medicine, Guangzhou University of Chinese Medicine, Guangxian Cai, and Changqing Deng, respectively. Research teams outside China were located at Daejeon University, Gachon University, Aga Khan University, Yale University, etc. The results of keyword co-occurrence and burst analysis included clinical applications, animal experiments, action mechanisms, clinical efficacy, and safety evaluations based on systematic reviews and meta-analyses. Literature co-citation analysis revealed that BYHWD was highly correlated with neuroprotection and reduction of cerebral ischemia/reperfusion injury.

Conclusion: Both Chinese and English literature have shown overall growth trend since 1984 and 1989, respectively. Clinical applications, pharmacological effects, mechanisms, active ingredients, evaluation of clinical efficacy and safety, modified BYHWD, methods, and biological techniques may be hotspots and focus of future research on BYHWD. Hotspot analytical methods and biological techniques include systematic reviews, meta-analyses, data mining, network pharmacology, and molecular docking. Future valuable research fields may include studies on neuroprotection, anti-inflammatory activity, ischemic stroke, bioactive compounds, and their underlying mechanisms.

Abbreviations: BC = betweenness centrality, BYHWD = Buyang huanwu decoction, CNKI = China National Knowledge Infrastructure, F = frequency, TCM = traditional Chinese Medicine, WOSCC = Web of Science Core Collection.

Keywords: BYHWD, CiteSpace, hotspot, Stroke, trend, visualization analysis

1. Introduction

Buyang huanwu decoction (BYHWD), which originated from Wang Qingren "Yi Lin Gai Cuo," has significant clinical efficacy in the treatment of diseases including stroke,[1,2] cerebral infarction,[3] cerebral ischemia,[4] and vascular injury.[5] Combination therapies can effectively improve the therapeutic effects in several diseases, such as poststroke hemiplegia[6] and cerebral infarction.[7] Mechanisms of action of BYHWD have been discovered, including anti-inflammation, reduction of neural function damage, and promotion of angiogenesis.[8,9] The related signaling pathways were Caveolin1-VEGF,[10]

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The datasets generated during and/or analyzed during the current study are publicly available.

This visual analysis was comprehensively analyzed in the existing literature. All sources and data cited and referenced in the paper have been clarified with respect to the contributions of the original authors. No new human or animal subjects were included in this study. Therefore, this study did not require approval from the institutional review board or the ethics committee.

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S1P/S1PR1/PI3K/Akt,[11] NF-κB/p38,[12] MAPK signaling[13] and other pathways. In addition, active compounds, such as alkaloids and glycosides,[14] have been discovered in BYHWD. However, these literature reports lacked a comprehensive evaluation of research on BYHWD, especially analysis of English-language literature. This is why the research situation at home and abroad is unclear, which is not conducive to in-depth research and development. Interestingly, we can understand cooperation and exchange at home and abroad through a bibliometric analysis of English literature. New research ideas and the guiding ideology of BYHWD can be found, especially in Western medicine. This potential value will be explored under the guidance of the ideology of integrated traditional Chinese and Western medicine.

In the era of big data, research topics in the important part of the information science domain have been changed to scientometric indicators, citation analysis, scientific collaboration, and information behavior. Scientific evaluation indicators, altmetrics, science mapping and visualization, bibliometrics, citation analysis, and scientific collaboration have appeared in the knowledge base of information science research.[15] Scientometrics/bibliometrics have become important tools for assessing and analyzing the applications of scientists' output, inter-university collaboration, and the impact of state-owned science funds on national research and development performance and educational efficiency.[16] For example, Habermas scientific production was evaluated using bibliometrics.[17] A comprehensive analysis of funded scientometric and bibliometric research from 2011 to 2021 was conducted using scientometrics.[18] CiteSpace, Vosviewer, Gephi, and other bibliometric tools were used for visual analysis. CiteSpace was designed by Chaomei Chen and has been widely used for data analysis and visualization of authors, institutions, countries, keywords, journals, and citations.[19] Compared to other tools, it can provide more information about the set of features, burst nodes, high betweenness centrality, highly cited references, and other metrics.[20] CiteSpace was used to analyze annual publication patterns, citation structures, leading nations, and literature co-citation networks in healthcare research. Current research hotspots, active research areas, and technological trends have been explored in more depth. After the COVID-19 outbreak, COVID-19 detection and influenza viruses have become active research hotspots. Deep learning, machine learning, artificial intelligence, biosensor technology, and medical technology have been observed as leading technologies.[21] In the IoT-enabled healthcare field, IoT-enabled technologies were used not only to successfully combat the COVID-19 pandemic but also to improve traditional healthcare systems. Proactive supply risk management strategies, decentralized contact tracing applications, smart social distancing, and quarantine have been research hotspots.[22] Blockchain technology, remote monitoring, 5G technology, etc, have been technological trends.[23]

In traditional Chinese Medicine (TCM) research, bibliometrics have been widely used for the analysis of publishing activities of TCM, Chinese herbal medicine, acupuncture, etc.[24] CiteSpace provides data visualization that can effectively present the current status and trends of research, such as visualization analysis of epilepsy and circadian rhythms.[25] To fully understand the clinical application value and mechanism of BYHWD, we conducted a comprehensive search of literature databases, including China National Knowledge Infrastructure (CNKI), Weipu, Wanfang, PubMed, Scopus, and Web of Science Core Collection (WOSCC). Key areas of the literature were summarized through an analysis of collaborating author networks, collaborating institutions, keyword co-occurrence, and others. We attempted to answer the following questions: (1) What are the global hotspots of BYHWD research? (2) What are the most valuable future research fields for BYHWD?

2. Materials and methods

2.1. Data sources

We used the CNKI, Weipu, Wanfang, PubMed, Scopus, and WOSCC databases as the data sources. "BYHWD" was used as the main subject and searched from January 1, 1915, to March 31, 2024, in CNKI, Weipu, Wanfang, Pubmed, Scopus, and WOSCC search. After removing duplicates and eliminating conference papers, newspapers, and academic achievements, 9238 valid Chinese literature and 559 valid English literature were finally adopted.

2.2. Visualization analysis

CiteSpace 6.2.R4 software was used to perform literature data formatting and visualization analysis. The annual publication volume and citations, literature type, country distribution, and language were analyzed using Microsoft Excel 2016.

Based on CiteSpace, we conducted a collaboration network analysis of authors, institutions, and countries; co-occurrence and clustering analysis of keywords; and co-citation analysis of the literature. The nodes indicate author, institution, country, and other topics on the visual map. Their sizes are consistent with the frequency size. Betweenness centrality represents the measurement of a central vertex based on the shortest paths in a networks.[16] The nodes with a betweenness centrality > 0.1 are regarded as crucial nodes.[19] The link lines between nodes indicate the relationships between different topics. The burst intensity of references was detected to evaluate the clustering effect using the module value (Q) and the average contour value (S). $Q > 0.3$ indicates a significant clustering structure, and $S > 0.5$ indicates a significant and reasonable clustering result.[19] Keyword burst detection analysis was used to identify emergent keywords and hotspots. Keyword burst detection analysis was used to identify fast-growing topic keywords and emerging areas.

In this study, the time span was set between 1915 and 2024, with a time slice of 5 years. The cosine algorithm was selected to calculate the association strength of the network node, and the time slice threshold was set at 50. Pathfinder network scaling and pruning of the sliced networks were used to modify and cut the network. Yearly publication volumes, authors, institutions, keywords, and co-citation literature maps were constructed. A comprehensive analysis of the map was conducted to understand the research hotspots and development trends of BYHWD.

3. Results

3.1. Annual publication volume analysis

The amount of Chinese and English literature has generally been increasing. The earliest Chinese-language research was conducted by Zhang (1984).[26] The English-language literature first appeared in 1989, with a significant increase in publication volume after 2006 (Fig. 1). This indicates that research on BYHWD has attracted attention from researchers worldwide, possibly because of its significant therapeutic effects on stroke.[27]

3.2. Collaborating author analysis

Two network diagrams were built with authors as network nodes for the period from 1915 to 2024. The Chinese author collaboration network had 645 nodes, 657 links, and a density of 0.0032. Based on frequency (F) and betweenness centrality (BC), the authors were Guangxian Cai (F = 55, BC = 0.01), Jiping Zhang (F = 49, BC = 0.00), Fuyuan He (F = 46, BC = 0.01), etc. Collaboration between different author teams was less frequent. The English author collaboration network had 342 nodes, 623 links, and a density of 0.0107. The authors,

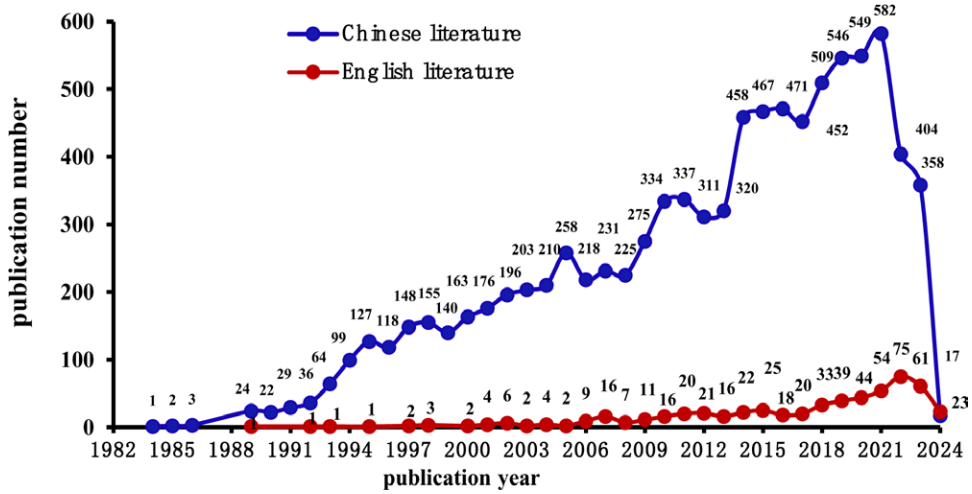

Figure 1. Annual distribution of publications in research field of BYHWD. BYHWD = Buyang huanwu decoction.

based on F and BC, were Changqing Deng (F = 18, BC = 0.13), Tao Tang (F = 16, BC = 0.02), Fuyuan He (F = 16, BC = 0.06), etc. Cooperation between the author teams was compact. The authors' analyses are presented in Figure S1, Supplemental Digital Content, http://links.lww.com/MD/N870.

3.3. Collaborating institution analysis

In the co-institutional network of Chinese and English literature, the Chinese research institution network was depicted with 517 nodes, 261 links, and a density of 0.002. There were 394 research institutions, including Hunan University of Chinese Medicine (BC = 0.05), Shandong University of Chinese Medicine (BC = 0.01), and Heilongjiang University of Chinese Medicine (BC = 0.01). Collaboration among different institutions was less frequent. The collaboration network of English document-issuing institutions had 108 nodes, 121 links, and an overall density of 0.0209. There were 105 research institutions, including Hunan University of Chinese Medicine (BC = 0.2), Guangzhou University of Chinese Medicine (BC = 0.06), and Beijing University of Chinese Medicine (BC = 0.08). Some research teams outside China were located at Daejeon University, Gachon University, Aga Khan University, and Yale University. The results are shown in Figure S2, Supplemental Digital Content, http://links.lww.com/MD/N870 and Table S1, Supplemental Digital Content, http://links.lww.com/MD/N870.

3.4. Country of publication analysis

The cooperation network of countries in the English literature consisted of 18 nodes and 18 links, with an overall density of 0.1176. Countries with a large number of published articles were China, South Korea, the United States, Australia, and other 6 countries. Except for South Korea, all other countries, such as the United States, have direct connections with China. Countries with more than 2 publications were China (220), South Korea (7), the United States (4), Australia (3), and Pakistan (3), with intermediation centrality scores of 0.43, 0.00, 0.12, 0.05, and 0.00, respectively. The colors of the links show that collaborations among China, Brazil, Mexico, and Spain have increased in the past 5 years. The results are presented in Figure S3, Supplemental Digital Content, http://links.lww.com/MD/N870.

3.5. Keywords co-occurrence analysis

As shown in Table 1 and Figure 2, the keyword co-occurrence network of Chinese literature consisted of 621 nodes, 1339 links, and an overall density of 0.007. A total of 610 keywords from 9238 articles mainly focused on clinical diseases, dialectical treatment, single herbs, chemical components, and molecular mechanisms. The keyword co-occurrence network of English literature consisted of 209 nodes, 598 links, and an overall density of 0.0275. A total of 186 keywords from 559 articles mainly focused on pharmacological effects and mechanisms of action.

3.6. Keyword clustering analysis

Keyword clustering analyses of Chinese and English literature were performed to obtain cluster labels using the LLR algorithm. A Chinese literature network map consisting of 621 nodes and 1339 connections, with a density of 0.007, is shown in Figure S4A, Supplemental Digital Content, http://links.lww.com/MD/N870. The network map had a modularity Q of 0.5783 (>0.3) and mean silhouette of 0.781 (>0.7), indicating effective clustering.[19] The cluster details are listed in Table S2, Supplemental Digital Content, http://links.lww.com/MD/N870, including the LLR labels of the clusters, size, and silhouette value. The order of Chinese literature clusters from largest to smallest was cerebral ischemia (75), cerebral ischemic stroke (57), and astragali radix (46), etc. Their fields include many research subjects, such as disease models, clinical curative effects, clinical applications, addition and subtraction therapy, neurological function, system evaluation, medication rule, replenishing qi and activating blood, safety, clinical observation, astragaloside IV, review, signal pathway, and rats. A timeline visualization of keywords in Chinese literature is shown in Figure S5A, Supplemental Digital Content, http://links.lww.com/MD/N870. The time spans of #0, #1, #2, #3, #6, #7, #8, #9, and #10 were relatively long, indicating that cerebral ischemia, cerebral infarction, astragali radix, wang qingren, stroke, data mining, coronary heart disease, diabetes, and cerebral hemorrhage are closely related to the study of BYHWD, which are hot spots in the Chinese literature.

An English literature network map consisting of 209 nodes and 598 connections, with a density of 0.0275, is shown in Figure S4B, Supplemental Digital Content, http://links.lww.com/MD/N870. The network map had a modularity Q of 0.6041 (>0.3) and mean silhouette of 0.8238 (>0.7), indicating effective clustering.[19] The cluster details are listed in Table S2, Supplemental Digital Content, http://links.lww.com/MD/N870, including the LLR labels of the clusters, size, and silhouette value. English literature clusters were arranged in order from large to small, including mechanisms (28), vascular endothelial growth factor receptor-2 (26), cerebral ischemia/reperfusion (25), and sciatic nerve (22). Many research subjects are involved in the field of these clusters,

Table 1

Top 10 keywords with high frequency of BYHWD research.

Chinese keyword	Frequency (F)	Betweenness centrality	English literature's keyword	Frequency (F)	Betweenness centrality
Cerebral infarction	720	0.04	Buyang huanwu decoction	151	0.04
Acupuncture	440	0.03	Traditional Chinese medicine	60	0.05
Stroke	390	0.05	Expression	33	0.09
Clinical curative effect	274	0.02	Stroke	31	0.05
Curative effect	258	0.02	Ischemic stroke	29	0.01
Qi deficiency and blood stasis	255	0.08	Injury	25	0.12
Cerebral stroke	223	0.05	Cell	22	0.07
Neurological function	206	0.04	Cerebral ischemia	21	0.03
Rat	180	0.11	Activation	20	0.03
Cerebral ischemia	171	0.10	Rats	19	0.02

BYHWD = Buyang huanwu decoction.

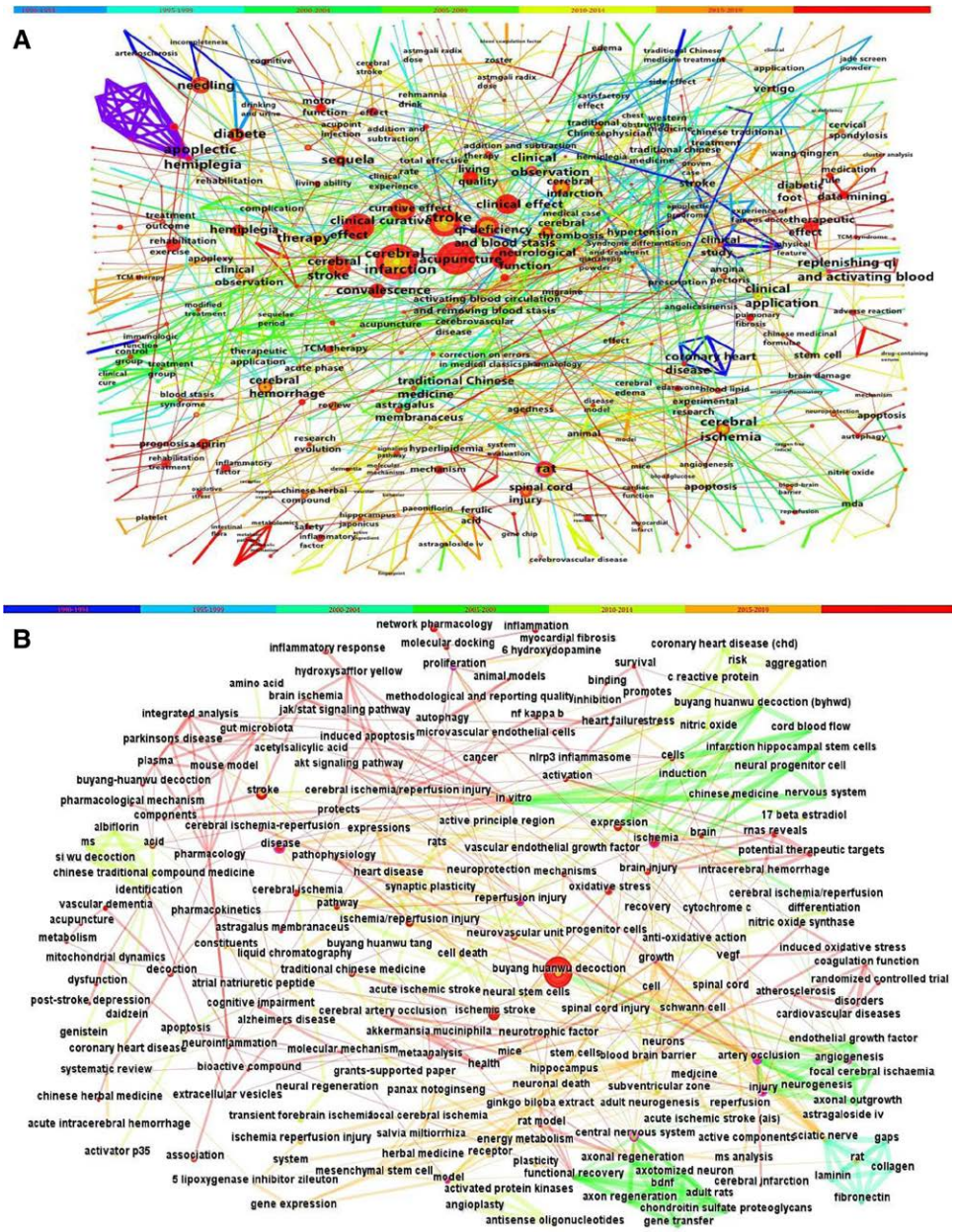

Figure 2. Network map of keywords co-occurrence of BYHWD research. (A) Network map of keywords co-occurrence of Chinese literature. (B) Network map of keywords co-occurrence of English literature. BYHWD = Buyang huanwu decoction.

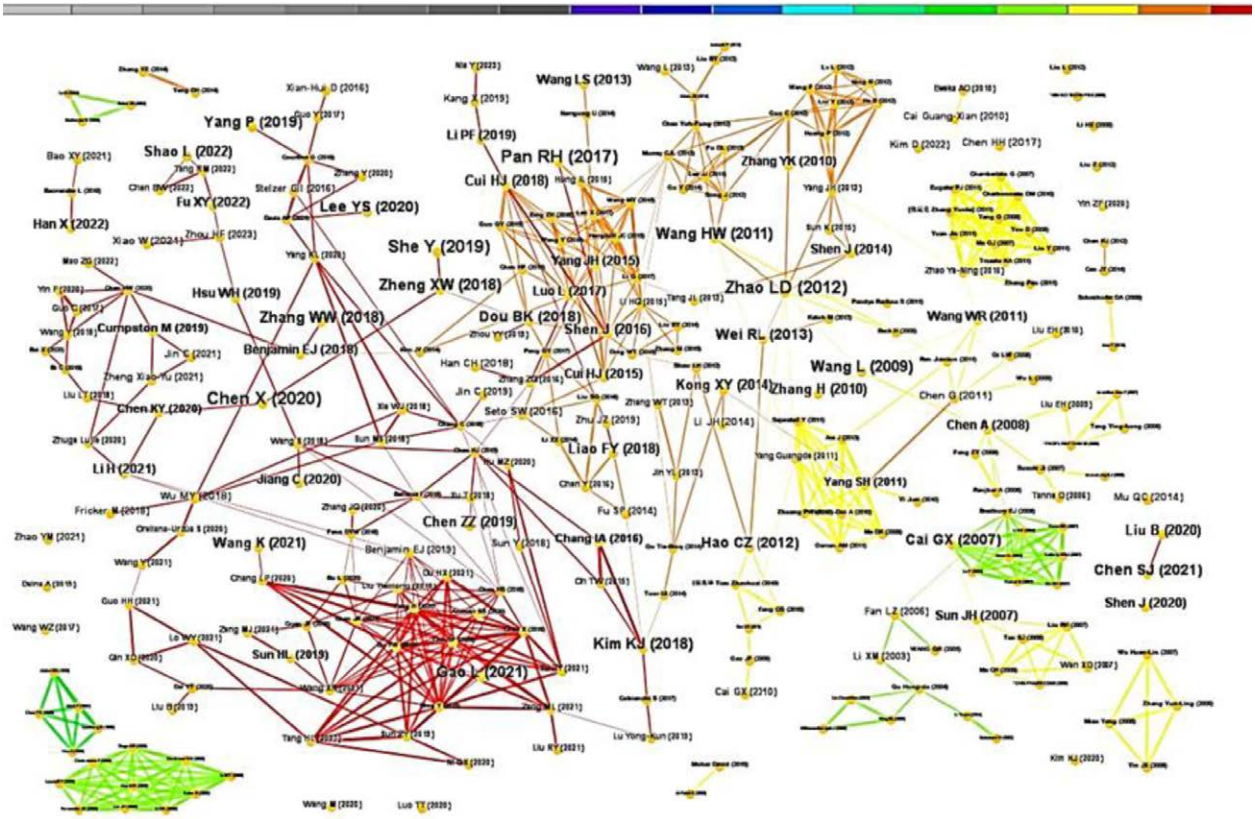

Figure 3. Co-citation network diagram in English literature on BYHWD research. BYHWD = Buyang huanwu decoction.

including network pharmacology, molecular docking, metabolomics, Schwann cells, mitochondrial dynamics, integrated analysis, neural regeneration, neural stem cells, proteomics, coronary heart disease, and HPLC-MS. The Timeline visualization of keywords in the English literature is shown in Figure S5B, Supplemental Digital Content, http://links.lww.com/MD/N870. The interval spans of #0, #2, #3, #4, #5, and #8 were relatively long, indicating that composition and mechanisms related to BYHWD, such as cerebral ischemia/reperfusion, sciatic nerve, bioactive compound, intracerebral hemorrhage, have become hot spots of interest by the authors of the English literature.

3.7. Hotspots analysis

In keyword emergence analysis, there were 25 emergent Chinese keywords with an intensity range of 8.89 to 40.41, while English literature owned 25 emergent keywords with an intensity range of 1.62 to 3.97. Chinese literature focused on the study of clinical treatment, such as TCM therapy, clinical effects, quality of life, hemiplegia, angina pectoris, and data mining, whereas English literature concentrated on experimental researches, including progenitor cells, hippocampus, activation, constituents, pathway, inflammation, network pharmacology, molecular docking, meta-analysis, and others. Common research hotspots include ischemic stroke, cerebral ischemia, rats, mechanisms, and recovery. The latest topics in the Chinese and English literature indicate that data mining, meta-analysis, effect, and mechanism have become global research hotspots. The results are presented in Figure S6, Supplemental Digital Content, http://links.lww.com/MD/N870.

3.8. Literature co-citation analysis

A co-citation network diagram was built by citation analysis of the English literature, which had 281 nodes and 623 links with a density of 0.0158. As shown in Figure 3, 279 English papers published between 1996 and 2024 were co-cited. The most highly cited article was written by Chen et al,[28] which showed that BYHWD had neuroprotective and neurogenesis-promoting effects by activating the PI3K/Akt/Bad and Jak2/Stat3/Cyclin D1 signaling pathways. The second most highly cited paper was written by She et al,[29] which indicated that BYHWD glycosides had neuroprotective effects by inhibiting pyroptosis of neurons after cerebral ischemia/reperfusion injury. The mechanism was relevant to regulation of the classical pyroptosis pathway by NLRP3. The remaining papers were ranked according to their citation frequency. The conclusions are summarized as follows. BYHWD exerted neuroprotective effects through downregulation of the expression of metabotropic glutamate receptor-1 RNA, upregulation of the expression of presynaptic (SYN), postsynaptic (GAP-43) and cytoskeletal (MAP-2) proteins, inhibition of glutamate release, improvement of neurobehavioral deficits,[30,31] etc. Compared with conventional Western medicines, BYHWD had a greater clinical effective rate of neurological deficit and was safer for the treatment of patients with acute ischemic stroke.[32] Therefore, the substantial neuroprotective effects of BYHWD in experimental stroke might be due to the multitarget therapeutic strategy of traditional Chinese medicine.[33]

The top10 studies with the highest burst strengths are shown in Figure S7, Supplemental Digital Content, http://links.lww.com/MD/N870. Among them, 6 studies originated from J Ethnopharmacol, 2 studies were from Evid-Based Compl Alt, and 1 study was from Mol Neurobiol and BMC Complem Altern Med. The 3 most highly cited papers came from Mol Neurobiol and J Ethnopharmacol, which indicated that the neuroprotective effect of BYHWD was relevant to activating the PI3K/Akt/Bad and Jak2/Stat3/Cyclin D1 signaling pathways, as well as downregulation of metabotropic glutamate receptor-1 RNA and glutamate release resulting from cerebral ischemia. Its

glycosides may exert neuroprotective effects through regulation of the classical pyroptosis pathway by NLRP3. These representative studies mainly focused on the effects and mechanisms of alleviation and neuroprotection of brain ischemia–reperfusion, including the expression of related factors and targets of action. Some studies still have a large influence, such as the neuroprotective effects[28] and glycosides of BYHWD.[29] Therefore, they can be used as important references in literature.

4. Discussion

4.1. General information

Chinese and English literature research on BYHWD began in 1984 and 1989, respectively, and their numbers have fluctuated and increased until today. The top 3 authors for Chinese and English literature were Guangxian Cai, Jiping Zhang, Fuyuan He, Changqing Deng, Tao Tang, and Fuyuan He. The relationship between authors in English literature was closer than that in Chinese literature. The literature was mainly from China, such as Hunan University of Chinese Medicine. Research institutions outside of China, such as Daejeon University, had few publications and relatively independent research. These indicated that China held a dominant position in this field, with a high academic impact. China had regional cooperative relations with 8 other countries, such as the USA.

According to the co-occurrence network analysis, 610 Chinese literature keywords were concentrated mainly on cerebral stroke, clinical dialectical treatment, clinical effects, and data mining, as well as studies of the mechanisms of action of single herbs and chemical components. A total of 186 English keywords were primarily distributed in pharmacological effects, active ingredients, mechanisms of action, systematic reviews, meta-analyses, network pharmacology, and molecular docking. In summary, cerebral stroke, clinical effects, clinical dialectical treatment, effects, and mechanisms are common hotspots in the Chinese literature. The cited English literature mainly focuses on ischemia/reperfusion injury, protective effects, active ingredients, and mechanisms. The first 10 studies with high burst strength focused on neuroprotective effects, mechanisms of neuroprotection, and alleviation of coronary heart disease. These studies indicate that neuroprotection is a rapidly developing subject that has attracted increasing interests from scholars.

4.2. Hot spots and frontiers

Based on keyword analysis, the important hotspots were identified as follows: (1) Pharmacological effects and mechanisms of BYHWD on cerebral ischemic stroke and other diseases have been found, including promoting neurological function recovery,[34] protective effects on cerebral ischemic stroke,[35] regulation of metabolite production,[36] and others. (2) Several active ingredients were identified in BYHWD, such as amygdalin, paeoniflorin, and astragaloside IV.[37] The glycosides of BYHWD exerted neuroprotective effects by restraining pyroptosis in neurons with cerebral ischemic reperfusion injury.[37] (3) Clinical applications of BYHWD included the treatment of encephalopathy diseases,[38] various vascular diseases,[39] diabetes,[40] spinal cord injury,[41] atherosclerosis,[42] and others. Among them, stroke and other cerebrovascular diseases were the main diseases, especially cerebrovascular diseases with qi deficiency and blood stasis syndrome.[2] BYHWD combined with acupuncture and moxibustion for warming yang had a significant efficacy in the treatment of the convalescent stage of ischemic stroke with qi deficiency and blood stasis syndrome.[43] (4) The clinical efficacy and safety of BYHWD were evaluated through systematic review and meta-analysis. For example, BYHWD was effective and safe in treating spinal cord injury,[41] and it also had fewer adverse reactions than Western medicine in the treatment of poststroke depression and acute cerebral hemorrhage.[44] The combination of BYHWD and Western medicine could ameliorate the rehabilitation effect, living ability, and neurological function of stroke patients.[45] Some suggestions were proposed to improve the evaluation of clinical and experimental studies of BYHWD, such as improvement of the methodological and reporting quality of BYHWD for experimental cerebral ischemia-reperfusion injury.[46] (5) Network pharmacology, molecular docking, and data mining were used to investigate the bioactive components and core functional targets of BYHWD. For example, the bioactive components and targets of BYHWD against atherosclerosis, such as baicalein and AKT 1, were identified by network pharmacology analysis.[42]

In addition, there have been many clinical and experimental studies on modified BYHWD. For example, it ameliorated the prognosis of acute myocardial infarction in patients after percutaneous coronary intervention.[47] It also improved diabetic liver injury by inhibiting oxidative stress in db/db mice.[48]

Based on the above results, we believe that the neuroprotective effect and its mechanism are important points for future research. The effective components and their mechanisms of action will be further researched, and related animal experiments will be more in-depth and innovative. Biological techniques, such as metabolomics, will be widely applied to further elaborate on the function and efficacy of BYHWD. Meta-analysis will emerge as a means of analysis and evaluation. Therefore, neuroprotection and other pharmacological effect, effective components, experimental stroke, mechanism, clinical application, efficacy and safety evaluations, modified BYHWD, analysis method, and biological technique may be valuable research topics in the present and future.

4.3. Limitation

However, there are certain potential limitations in this study. Co-citation analysis was not performed in the Chinese literature. Some literature reports had nonstandard subject headings that were not reflected in topic headings. For example, BYHWD has been included in the heading topic of Chinese herbal medicine or traditional Chinese medicine. In addition, VOSviewer, Gephi, and other bibliometric tools were not used for visual analysis. Articles published between April and September 2024 were not analyzed.

5. Conclusion

In order to find more comprehensive and valuable information, this paper analyzes the literature on BYHWD using CiteSpace. Both Chinese and English literature on BYHWD have been fluctuating and growing. Their subjects focused on clinical applications, pharmacological experiments, the evaluation of clinical efficacy and safety, and literature research. Research hotspots consisted of clinical applications, pharmacological effects, mechanisms, active ingredients, evaluation of clinical efficacy and safety, modified BYHWD, analytical methods, and biological techniques. Among them, the topics of neuroprotection, anti-inflammatory activity, ischemic stroke, bioactive compounds, and mechanisms will be strengthened in the future. Hotspot methods and biological techniques, including systematic reviews, meta-analysis, data mining, network pharmacology, and molecular docking, will be used more in research on BYHWD.

However, these studies still have some inadequacies. First, the combination of experimental research and clinical application should be strengthened. Experimental research on BYHWD has reached the molecular and cellular levels, such as signaling pathways and metabolomics. These studies are seldom combined with clinical applications, which has insufficient clinical application value. To understand the properties and laws of action of BYHWD, drug research and clinical

applications need to be combined to provide a basis for its clinical application. Second, the clinical medicinal value should be explored. Information on applicable syndrome, drug dosage, and preparation of medicinal herbs was sorted according to the basic theory of traditional Chinese medicine. Under the guidance of the theory of TCM dialectical treatment, drug compatibility research has been conducted to improve the curative effect. For example, the effect of modified BYHWD on patients with acute myocardial infarction after percutaneous coronary intervention. Third, the scope of clinical applications should be expanded, which may be a breakthrough point for the new use of old drugs. There have been some reports on the effects and mechanisms of BYHWD in other diseases, such as spinal cord injury. The performance and clinical application of BYHWD require further exploration and safety evaluations. Finally, the exploration of BYHWD should be combined with emerging technologies, such as automation, artificial intelligence, bioinformatics, and multi-group big data, especially nontraditional Chinese medicine research ideas.

In addition, cooperation among countries, institutions, and authors should be strengthened. Thus, extensive cooperation and exchanges should be developed. Innovative research ideas and methods for BYHWD may have occurred.

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Conceptualization: Bowen Li.
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Supervision: Weijuan Gao.
Validation: Maobo Du.
Visualization: Bowen Li.
Writing – original draft: Bowen Li.
Writing – review & editing: Bowen Li, Weijuan Gao.

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