

Research Hotspots and Trend Analysis of Electroacupuncture Treatment of Depression Based on Bibliometrics

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Abstract

Based on CiteSpace, VOSviewer, and R language bibliometric package Bibliometric, a visual analysis of literature related to electroacupuncture treatment of depression is conducted, summarizing and summarizing the research hotspots and trends in this field, in order to assist in the future development of related fields. Using 1029 articles from CNKI and Web of Science databases from January 1, 2003 to September 25, 2023 as data, CiteSpace, VOSviewer, and R language bibliometric package Bibliometric were used to conduct co-occurrence analysis and graph drawing on countries, authors, research institutions, and keywords. In the past 20 years, the research on the treatment of depression with electroacupuncture has fluctuated, showing a trend of stable Chinese publications reaching a high level, while English publications show an overall long-term rising trend with minor inter-year fluctuations. China has the largest number of publications and has the closest cooperation with other countries. Compared with English literature, the author cooperation network in Chinese literature is more scattered, with “academic connections” being dominant compared to “geographical connections”, and the core author’s publication time is mainly before 2018. At the same time, close cooperation among various institutions needs to be carried out. In the literature, keywords related to mechanisms have emerged significantly and frequently in recent years. The research on the relevant mechanisms of electroacupuncture treatment for depression

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has become a current research hotspot. There is still room for development in clinical safety related research; Relevant researchers and institutions should strengthen cross institutional and cross regional cooperation, and promote the internationalization of research in related fields.

Keywords

Electroacupuncture, Depression, Bibliometrics, Visual Analysis

1. Introduction

Depression is a prevalent psychological disorder in modern society. Relevant data indicate that the persistent and increasingly severe global depression crisis remains unresolved, with approximately 4.7% of adults worldwide suffering from depression; in China, the lifetime prevalence of depressive disorders among adults reaches 6.8% (Herrman et al., 2022). Currently, antidepressant medication is the primary treatment modality for depression and has demonstrated certain efficacy. However, less than 40% of patients achieve remission after initial treatment in clinical settings, and limitations such as significant adverse reactions, strong drug dependence, and high recurrence rates following discontinuation persist (Goodwin & Stein, 2021; Malhi et al., 2026). Consistent with previous meta-analyses of electroacupuncture for depression, electroacupuncture (EA), can alleviate depressive symptoms and improve cognitive impairment compared with single antidepressant treatment (Zhao et al., 2026; Zhou et al., 2022). Furthermore, compared with traditional acupuncture, EA not only retains the advantages of conventional needling but also integrates the physiological effects of electrical stimulation. Moreover, EA enables the control of stimulation intensity through specific electrical frequencies, thereby enhancing the therapeutic efficacy of acupuncture (Wen et al., 2021).

Currently, the field of EA treatment for depression is developing robustly with an abundance of literature; however, systematic reviews of research hotspots and trends remain scarce, hindering researchers from comprehensively grasping the development of this field. Bibliometrics is a statistical and quantitative method used to analyze the academic impact and characteristics of scientific output, thereby facilitating a more comprehensive analysis of relationships within a specific research domain (Chen et al., 2015). CiteSpace and VOSviewer are bibliometric information visualization software developed using Java, capable of extracting information such as publication year, journal, author, and keywords from the literature and generating relevant maps to evaluate research directions and hotspots in the field (Chen et al., 2021b). R language is an emerging computer language that offers advantages of comprehensiveness, convenience, and rapidity when applied to bibliometric research (Aria & Cuccurullo, 2017).

Therefore, grounded in the current research background of EA treatment for

depression, this study integrates CiteSpace 6.2.R4, VOSviewer software, and the R bibliometric package Bibliometrix to conduct data statistics and visualization analysis of relevant domestic and international research literature. The aim is to summarize past research content, delineate future research hotspots and trends, and facilitate researchers' command of relevant studies in this field, ultimately contributing to the advancement of EA treatment for depression.

2. Materials and Methods

2.1. Database Retrieval

This study primarily utilized the China National Knowledge Infrastructure (CNKI) and the Web of Science (WOS) Core Collection as data sources to retrieve literature related to EA treatment for depression.

2.2. Retrieval Strategy

The CNKI database retrieval strategy was: SU = (“抑郁” + “郁证” + “抑郁综合征” + “抑郁症” + “神经官能性抑郁症” + “忧郁症” + “单相抑郁症” + “抑郁性神经症” + “内源性抑郁症” + “内因性抑郁症” + “抑郁综合征” + “CUMS” + “慢性不可预知刺激”) * (“电针” + “电针疗法” + “脉冲电针疗法” + “电针疗法” + “电热针疗法” + “福尔电针疗法” + “穴位电刺激”). The WOS Core Collection retrieval strategy was: TS = (depression OR depressive disorder OR Chronic unpredictable mild stress OR CUMS OR Poststroke depression OR postnatal depression OR Climacteric depression OR menopause depression OR adolescent depression) AND TS = (electroacupuncture OR Electroacupuncture EA OR Electroacupuncture therapy). The retrieval period spanned from January 2003 to September 2023, based on the publication date.

2.3. Literature Inclusion and Exclusion Criteria

2.3.1. Inclusion Criteria

Publications with complete bibliographic records, including essential information such as publication date, author(s), title, abstract, keywords, and research affiliations.

2.3.2. Exclusion Criteria

1) Duplicate publications; 2) publications whose research topics were irrelevant to the present study; 3) publications not in the form of journal articles, such as conference proceedings, reports, scientific and technological achievements, technical standards, and patents.

2.4. Data Extraction

Two researchers independently reviewed the literature and cross-checked their selections. Chinese and English publications were included according to the inclusion and exclusion criteria. Any disagreements were resolved through discussion with a third researcher. The screened Chinese publications were exported as

text files in RefWorks format, named “download_***” for subsequent use. The screened English publications were exported in the “Full Record and Cited References” format within “Plain Text File” for subsequent use. All retrieval, screening, and export procedures were completed within one day.

2.5. Visualization Analysis Methods

Data were imported into Cite Space 6.2.R4. The time span was set to 2003-2023, with “Years Per Slice” set to 1. Node types were set to author, institution, and keyword, respectively. For institutional co-occurrence, the g-index (k) was set to 10, Top N was set to 4, and other parameters remained at system defaults to generate maps. For keyword co-occurrence, the g-index (k) was set to 10, with other parameters remaining at system defaults to generate keyword co-occurrence, clustering, and burstness maps.

Data were imported into VOSviewer 1.6.18. The full counting method was selected, and the minimum number of documents was set to 2. “Co-authorship” was selected under “Type of analysis” and “Documents” was selected under “Weights” to construct author collaboration network maps and author collaboration timeline network maps weighted by publication count for both CNKI and WOS databases.

The exported .txt files were compressed into .zip format and imported into the Bibliometrix bibliometric analysis web interface running in the R language environment. The “Country Collaboration” function in the sidebar was selected to analyze the imported literature. The bibliometric parameters including g-index (k = 10), Top N = 4 (CiteSpace), and minimum documents = 2 (VOSviewer) were selected based on standard bibliometric mapping practices recommended by Chen’s classic CiteSpace methodological framework and the official VOSviewer tutorial for medical literature analysis. The g-index k = 10 balances the visibility of core collaborative nodes without overloading networks with low-impact institutions/authors; Top N = 4 limits institution co-occurrence maps to high-frequency institutions to avoid visual clutter. The threshold of minimum documents = 2 excludes one-off isolated publications, which are widely adopted in acupuncture bibliometric studies to filter noise. A simple sensitivity test was performed: adjusting k from 8 to 12 and minimum documents from 1 to 3 did not alter the core clustering structure of author/institution networks, confirming the robustness of selected parameters (Chen et al., 2015).

3. Results

3.1. Literature Retrieval Process and Results

A preliminary search of the selected databases was conducted according to the search strategies for publications from January 1, 2003, to September 25, 2023. A total of 1469 publications were retrieved from the Chinese database and 455 from the English database, yielding 1924 publications. After screening, 881 valid Chinese publications and 148 valid English publications were obtained. The literature screening flowchart and results are presented in **Figure 1**.

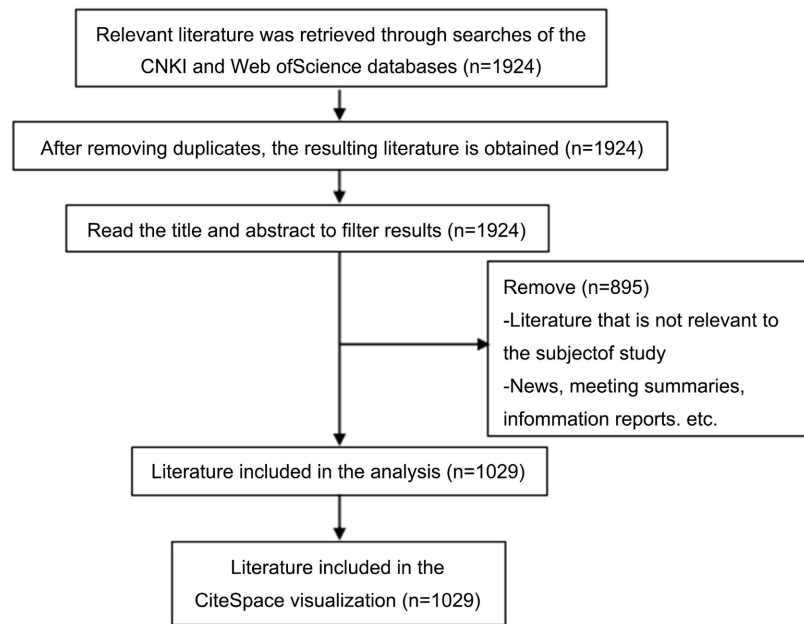


Figure 1. Literature screening flowchart.

3.2. Annual Publication Volume Trends

Analysis of the annual publication volume over the past 20 years revealed that the average annual number of Chinese publications related to EA treatment for depression was approximately 42. From 2003 to 2014, the overall trend showed a fluctuating upward pattern, with peak publication volumes of approximately 60 articles in 2014, 2016, and 2017. Thereafter, the annual publication volume remained generally stable at around 50 articles, as detailed in **Figure 2**. The average annual number of English publications related to EA treatment for depression was approximately 7, exhibiting an overall upward trend. The largest increase occurred between 2018 and 2019, with the publication volume peaking at 21 articles in 2021. Combined analysis of Chinese and English publication volumes indicates that over the past 20 years, the number of publications on EA treatment for depression has fluctuated, exhibiting a trend of Chinese publications stabilizing at a high level and English publications increasing year by year. Although English publications demonstrate a general upward trajectory across 2003–2023, minor declines occurred during 2016–2017 and 2021–2022, which may be attributed to periodic fluctuations in research output and delayed publication cycles of clinical trials.

3.3. Analysis of International Collaboration

The included English literature was analyzed using the Bibliometrix package in the R environment. As shown in **Figure 3**, research in the field of EA treatment for depression is currently predominantly conducted in China. Although China has collaborations with other countries such as the United States and the United Kingdom, the collaboration networks formed are relatively sparse and the collaborative relationships are not close.

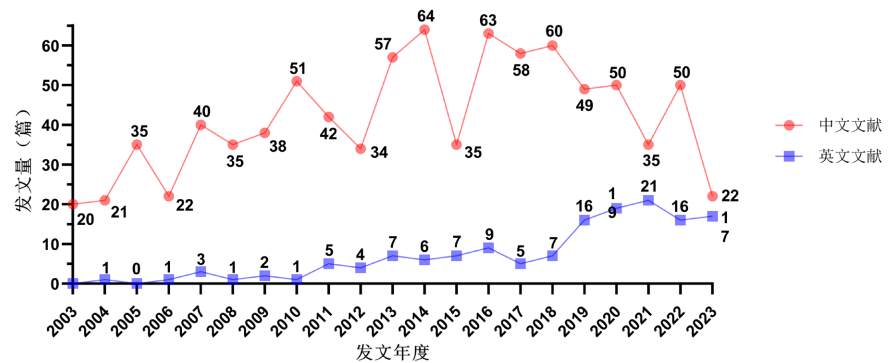


Figure 2. Annual publication trend chart of literature on electroacupuncture therapy for depression over the past 20 years.

Country Collaboration Map

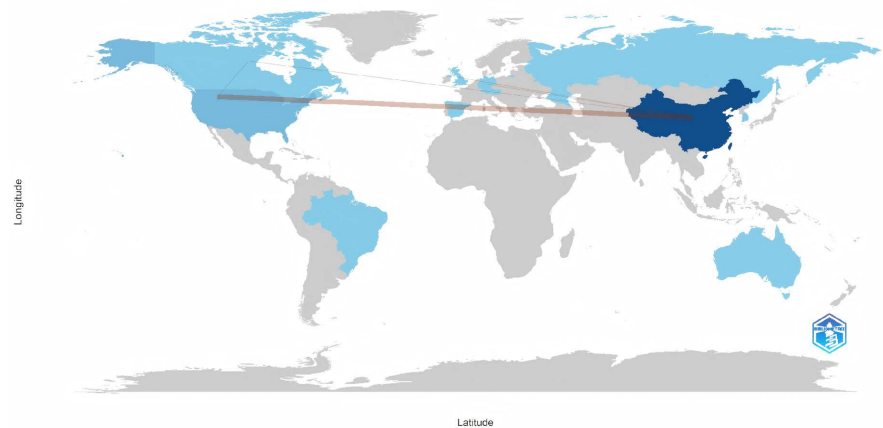


Figure 3. National cooperation relationship network diagram.

3.4. Co-Occurrence Analysis of Author Collaboration Networks

Analysis of the included literature using VOSviewer revealed that the Chinese publications involved 1779 authors, of whom 1305 (73.36%) published only one article. The English publications involved 862 authors, of whom 719 (83.41%) published only one article. The proportion of low-productivity authors exceeded the 60% threshold defined by Lotka's Law (Sun & Zhang, 2012). The number of core authors was calculated using Price's Law formula: $M = 0.749 \times (N_{\max})^{1/2}$, where M represents the minimum number of publications and $N_{\max}$ represents the publication count of the most prolific author in the dataset. Authors with publication counts exceeding M were defined as "core authors" (Zhang et al., 2020; Price & Zhang, 1984). In CNKI, $M_{\max} = 48$, $N \approx 5$; 72 authors published more than five articles, accounting for 4.05%. In WOS, $M_{\max} = 12$, $N \approx 3$; 59 authors published three or more articles, accounting for 6.84%. These findings indicate that the research authors in both CNKI and WOS databases are numerous and dispersed, forming a core author-driven team development model. Researchers in this field may strengthen collaboration in the future to conduct more in-depth and sustained studies.

3.4.1. Analysis by the Lead Author

Table 1 and **Table 2** list the top 10 authors by publication volume in EA treatment for depression research in the CNKI and WOS databases, respectively. The publication volume of scholars in CNKI was significantly higher than that of scholars in WOS. In CNKI, the top three authors by publication volume were Tu Ya (48 articles), Li Zhigang (28 articles), and Ren Lu (17 articles), with their combined publications accounting for 10.5% of the total. In WOS, the top three authors were Huang, Yong (12 articles), Lao, Lixing (12 articles), and Xu, Shifen (11 articles), with their combined publications accounting for 23.6% of the total. These core authors have made outstanding contributions to EA research on depression.

Table 1. Publication count scale for authors of Chinese literature on electroacupuncture therapy for depression.

Rank	Author	Number of Articles	Country	Institution	Percent (%)
1	图娅	48	中国	北京中医药大学	5.4%
2	李志刚	28	中国	北京中医药大学	3.2%
3	任路	17	中国	辽宁中医药大学	1.9%
4	赛音朝克图	17	中国	内蒙古国际蒙医医院	1.9%
5	徐世芬	16	中国	上海中医药大学附属上海市中医医院	1.8%
6	史榕苻	15	中国	中日友好医院	1.7%
7	王玲玲	15	中国	常州市第一人民医院	1.7%
8	卢峻	14	中国	北京中医药大学	1.6%
9	姚海江	14	中国	首都医科大学	1.6%
10	秦丽娜	14	中国	北京中医药大学第三附属医院	1.6%

Table 2. Scale for the number of publications by authors of English literature on electroacupuncture treatment for depression.

Rank	Author	Number of Articles	Country	Institution	Percent (%)
1	huang, yong	12	中国	南方医科大学	8.1%
2	lao, lixing	12	中国香港	香港大学	8.1%
3	xu, shifen	11	中国	上海市中医药大学附属市中医医院	7.4%
4	qu, shanshan	8	中国	南方医科大学	5.4%
5	yu, jin	8	中国	复旦大学	5.4%
6	zhang, zhinan	8	中国	南方医科大学	5.4%
7	cai, wa	7	中国	上海中医药大学	4.7%
8	tu, ya	7	中国	北京中医药大学	4.7%
9	yin, xuan	7	中国	上海市中医药大学附属市中医医院	4.7%
10	zhang, zhang-jin	7	中国香港	香港大学	4.7%

Furthermore, the core authors in this field are all of Chinese nationality. The majority of the top 10 authors in CNKI are based in northern China, whereas the majority of the top 10 authors in WOS are based in southern China. This suggests that geographical factors may exert an influence, resulting in limited collaboration between scholars from northern and southern China.

3.4.2. Author Collaboration Analysis

VOSviewer was used to generate author collaboration network maps (**Figure 4**) and author collaboration timeline network maps (**Figure 5**) weighted by publication count for both Chinese and English literature. The CNKI map displayed 167 nodes and 897 links, while the WOS map displayed 93 nodes and 464 links.

1) Analysis of Author Collaboration Teams

In **Figure 4**, different colors represent different team clusters. As illustrated, the author collaboration network map for CNKI contained eight clusters, exhibiting a state of “partial concentration with overall dispersion.” The largest team was the collaboration team centered around Tu Ya, followed by the team centered around Li Zhigang. Research between these two major core teams was relatively independent, and the scale of collaboration was also relatively small. The author collaboration map for WOS contained six clusters, with four major core research teams initially formed: the collaboration team centered around Huang, Yong; the team centered around Lao, Lixing; the team centered around Tu, Ya; and the team centered around Yu, Jin. There was a certain degree of collaboration among the major teams, with relatively close connections. In summary, compared with the WOS literature, the author collaboration network in CNKI was more scattered, with academic mentorship relationships (“Xueyuan”) playing a more dominant role than geographical relationships (“Diyuan”).

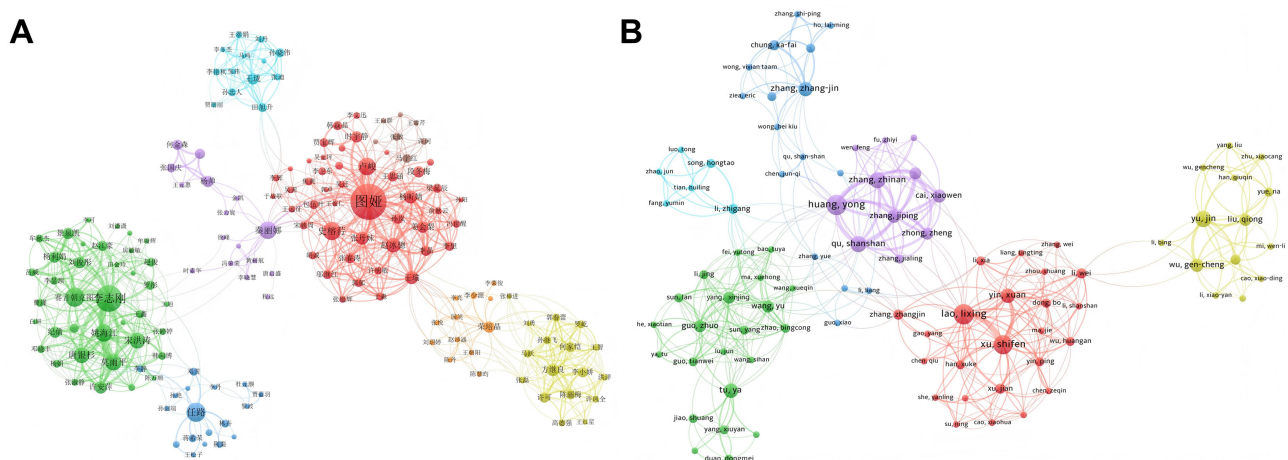


Figure 4. Collaborative author map of Chinese and English literature on electroacupuncture therapy for depression. (A) Collaboration network of authors in Chinese literature; (B) Collaboration network of authors in English literature.

2) Analysis of Author Publication Timeline

The author publication timeline can reveal emerging collaborative teams, facil-

itating scholars in better identifying hotspots and potential collaborators in the corresponding field (Xiao et al., 2011). Based on the author collaboration network map (Figure 4), selecting the Overlay Visualization option generated the author publication timeline map (Figure 5).

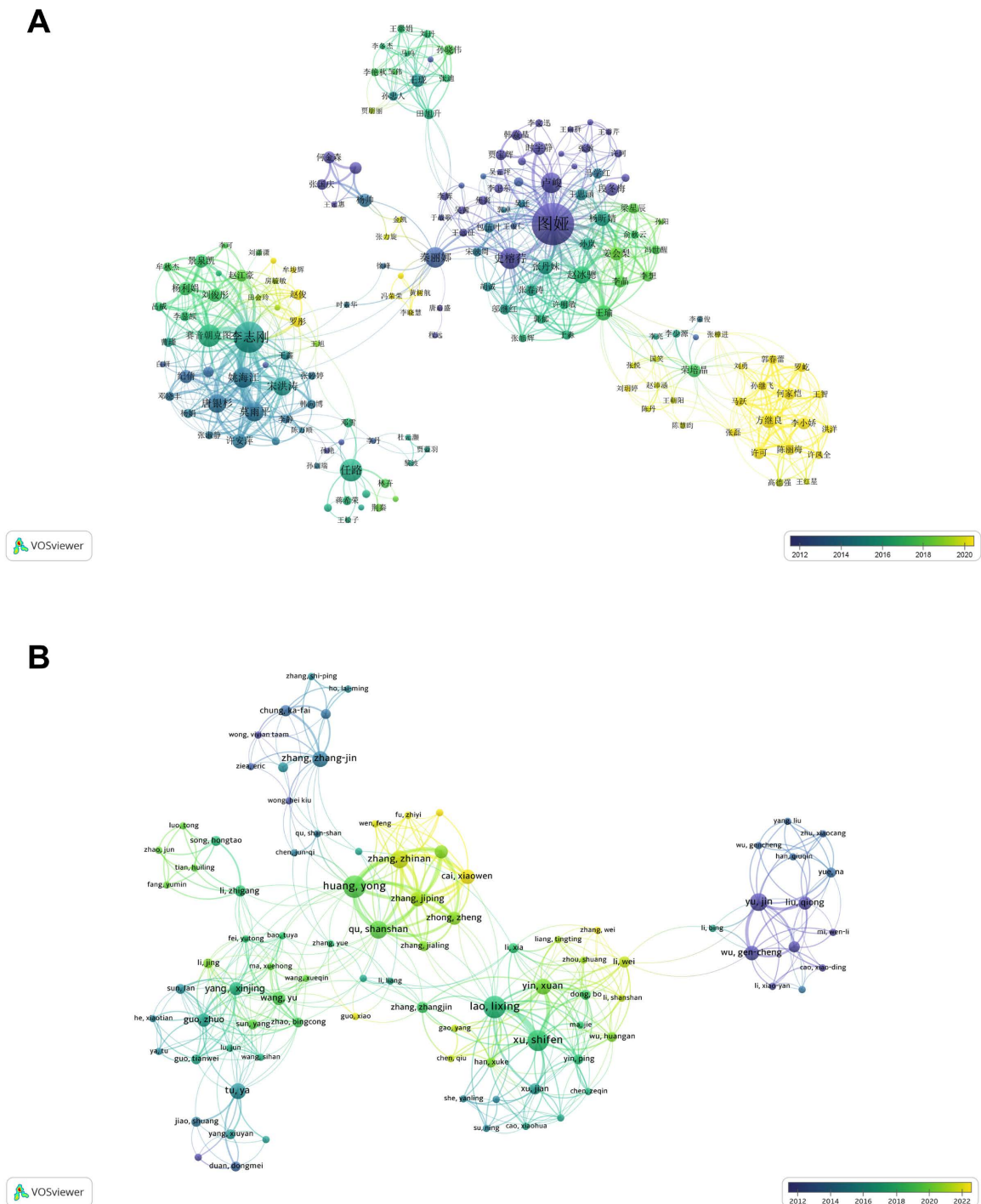


Figure 5. Network diagram illustrating the evolution of publication dates for authors in Chinese and English literature. (A) Network diagram illustrating the evolution of publication timelines for authors in Chinese literature; (B) Network diagram illustrating the evolution of publication timelines for authors in English literature.

In terms of publication timeline, within the two major core collaboration teams in CNKI (Tu Ya's team and Li Zhigang's team), scholars with higher publication counts generally made their first publications before 2018. In contrast, Fang Jiliang's team primarily began publishing after 2020, representing a newly formed academic exchange team in recent years. In WOS, scholars with higher publication counts generally made their first publications before 2018.

3.5. Co-Occurrence Analysis of Institutional Collaboration Networks

For institutional data, only the primary institutional affiliation was included; specific hospital departments and school colleges were removed. Institutions with multiple names were standardized to their most recent names for statistical purposes. After the above reprocessing of the screened data, institutional collaboration network co-occurrence maps for Chinese and English publications were generated separately (Figure 6).

As shown in Figure 6(A), the institutional collaboration network co-occurrence map for Chinese publications contained 290 nodes and 149 links, forming seven major clusters centered around Beijing University of Chinese Medicine, Guangzhou University of Chinese Medicine, Nanjing University of Chinese Medicine, China Academy of Chinese Medical Sciences, Heilongjiang University of Chinese Medicine, Chengdu University of Chinese Medicine, and Shanghai University of Traditional Chinese Medicine. Among the high-productivity institutions, Beijing University of Chinese Medicine had the highest publication volume (128 articles). However, the betweenness centrality values of the publishing institutions were generally low. The highest betweenness centrality value was 0.01 (<0.1) for Beijing University of Chinese Medicine, and the network density was 0.0036. This indicates that although numerous institutions conduct research in the field of EA treatment for depression, inter-institutional collaboration is limited, and closer cooperation needs to be developed.

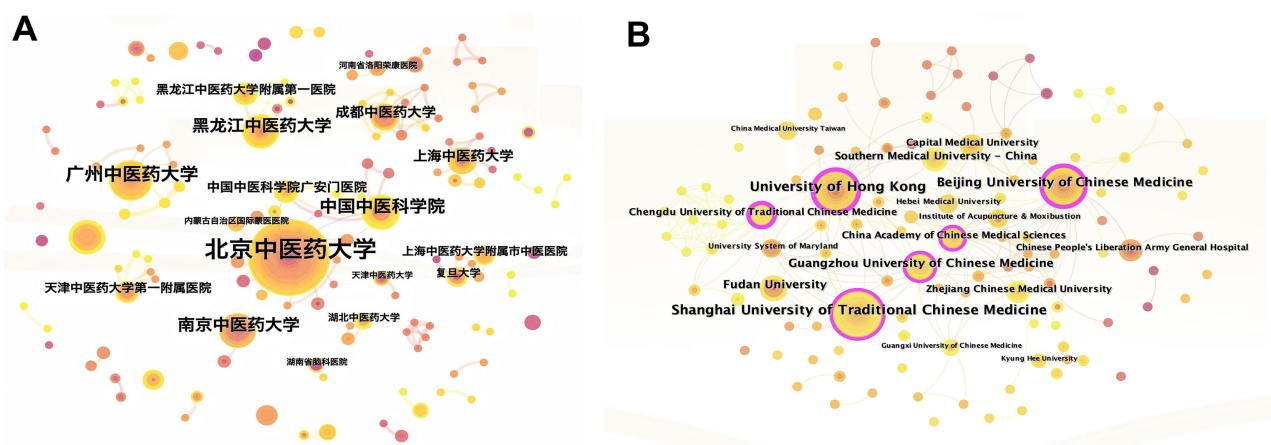


Figure 6. Collaborative network of Chinese and English literature institutions for electroacupuncture treatment of depression. (A) Collaborative network map of Chinese literature institutions; (B) Collaborative network map of English literature institutions.

3.6. Keyword Co-Occurrence Network Analysis

Keywords typically represent the core content of articles. Statistical analysis of keyword frequency can reveal research hotspots within a specific field (Chen, 2006). Software parameters were set according to the methods section. After preliminary visualization, synonyms were merged, such as “印堂” (Yintang) into “印堂穴” (Yintang acupoint) and “behavior” into “behaviors.”

The keyword co-occurrence map generated from the included English literature is shown in **Figure 7(B)**, containing 141 nodes and 469 links. Combining **Figure 7(B)** and **Table 3**, in addition to the search terms, keywords such as brain, behaviors, acupuncture point, and randomized controlled trial appeared with high frequency. This indicates that the current focus of the English literature lies in clinical trials and depression-related behaviors.

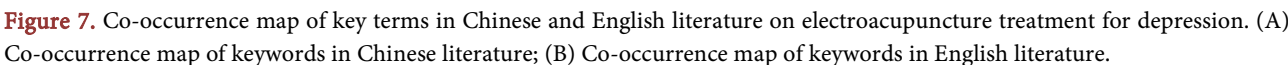


Table 3. Frequency distribution of the top 20 high-frequency keywords related to electroacupuncture treatment for depression.

Chinese literature				English literature		
Rank	Keyword	Frequency	Centrality	Keyword	Frequency	Centrality
1	电针	623	0.7	acupuncture	70	0.46
2	抑郁症	561	0.94	depression	28	0.69
3	针刺治疗	105	0.31	brain	20	0.27
4	大鼠	53	0.12	disorder	20	0.13
5	海马	47	0.1	acupuncture point	17	0.08
6	慢性应激	44	0.08	behaviors	17	0.13
7	针灸疗法	41	0.1	expression	17	0.07
8	针药并用	24	0.05	anxiety	16	0.14
9	临床研究	22	0.02	antidepressant	13	0.1
10	氟西汀	21	0.05	model	13	0.12
11	音乐电针	18	0.01	randomized controlled trial	12	0.09
12	中风	17	0.01	rating scale	12	0.07
13	行为学	16	0.02	activation	11	0.07
14	临床观察	15	0.02	stress	11	0.08
15	帕罗西汀	15	0.01	electroacupuncture	9	0.11
16	临床疗效	13	0.01	mechanisms	8	0.02
17	生活质量	13	0.01	symptoms	7	0.13
18	焦虑	13	0.02	chronic pain	6	0.05
19	脑卒中	12	0.04	animal-model	5	0.07
20	hpa 轴	12	0.02	antidepressant treatment	5	0.03

3.6.2. Keyword Cluster Analysis

Based on the keyword co-occurrence network maps, the LLR (Log-Likelihood Ratio) algorithm was employed to conduct cluster analysis of keywords (Figure 8), aiming to illustrate the research hotspots within the field of EA treatment for depression.

As shown in Figure 8(A), the keyword co-occurrence map for Chinese literature yielded a modularity (Q) value of 0.5355 (Q > 0.3 indicates a significant clustering structure) and a mean silhouette (S) value of 0.8463 (S > 0.7 indicates that the clustering is efficient and convincing) (Chen et al., 2015). Cluster #0 pertained to disease types; Clusters #1, #4, and #5 were related to different acupuncture treatment modalities; Cluster #2 involved treatment methods frequently combined with EA therapy; Cluster #3 represented experimental animals commonly used in research; and Cluster #6 pertained to acupoints commonly stimulated by EA.

As shown in Figure 8(B), the keyword co-occurrence map for English literature

yielded a Q value of 0.5048 (>0.3) and an S value of 0.7906 (>0.7), indicating that the clustering was also reasonable and effective (Chen et al., 2015). Cluster #0 represented commonly used treatment methods for depression; Cluster #1 pertained to disease types; Cluster #2 involved acupoints commonly stimulated by EA; Cluster #3 was related to symptoms associated with depression; Cluster #4 pertained to research methods; and Clusters #5 and #6 were related to the mechanisms of EA treatment for depression.

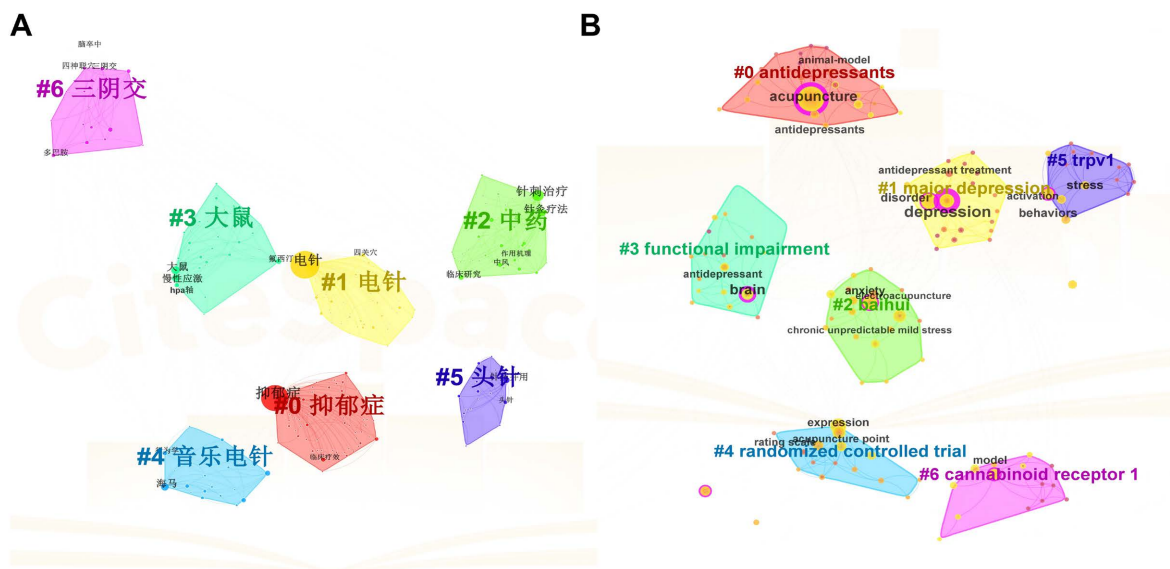


Figure 8. Cluster analysis of Chinese and English literature on electroacupuncture treatment for depression. (A) Cluster analysis diagram of Chinese literature; (B) Cluster analysis diagram of English literature.

3.6.3. Timeline View and Keyword Burstness Analysis

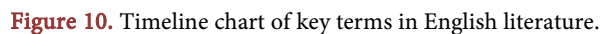
The clustered keyword maps were converted into timeline views (Figure 9 and Figure 10) to reflect the relationships among clusters and the temporal span of literature within each cluster. Keyword burstness reflects keywords that appear with high frequency within a certain period, indicating the importance of those terms in the research field and the changes in attention they receive over time. These two maps enable the exploration of research hotspots and the forecasting of research frontiers in the relevant field.

As inferred from Figures 9-11, in the included Chinese literature, antidepressants such as “fluoxetine” and “amitriptyline” garnered considerable attention between 2003 and 2010. Different types of EA, such as “music electroacupuncture” and “auricular electroacupuncture,” received heightened attention between 2010 and 2015. After 2015, keywords related to the mechanisms of EA treatment for depression, such as “neurotransmitter,” “gut microbiota,” and “metabolic pathway,” became research hotspots. In the included English literature, research hotspots from 2003 to 2010 primarily focused on animal models and antidepressants. Between 2010 and 2015, the microscopic mechanisms of EA treatment for depression began to attract researchers’ attention, with the emergence of keywords

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Figure 10. Timeline chart of key terms in English literature.



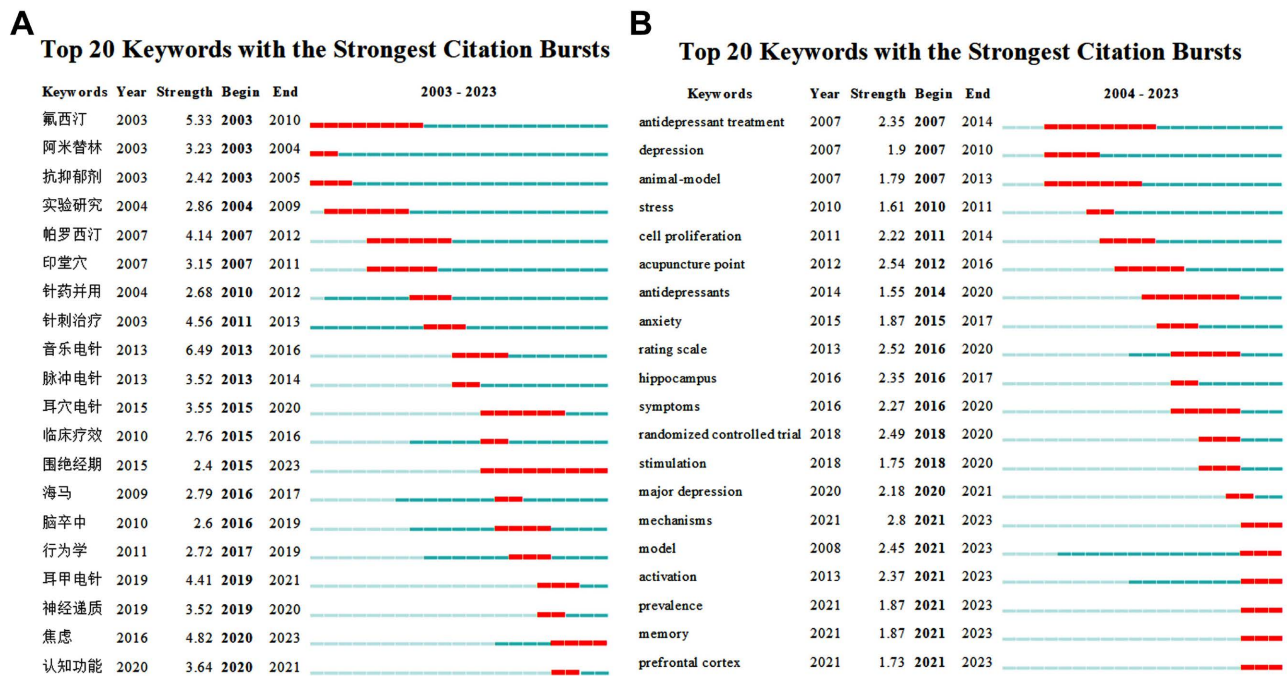


Figure 11. Highlighted keyword distribution in Chinese and English literature. (A) Keyword prominence map of Chinese literature; (B) Keyword prominence map of English literature.

4. Discussion

This study employed CiteSpace, VOSviewer software, and the R bibliometric package Bibliometrix to conduct a visualization analysis of the literature on EA treatment for depression retrieved from the CNKI and Web of Science databases. Maps pertaining to countries, authors, institutions, and keywords were generated to analyze the development of this field through co-occurrence mapping, with the aim of elucidating current research hotspots and predicting future research trends.

4.1. Analysis of Publication Volume, Countries, Authors, and Institutional Collaboration in EA Treatment for Depression

Statistical analysis of annual publication volumes revealed that Chinese publications in this field have stabilized at a high level, while English publications have exhibited an overall upward trend. All core authors identified in both Chinese and English datasets are researchers based in China, which reflects that Chinese scholars dominate global publication output of electroacupuncture for depression research, with sustained stable annual output of Chinese-language literature.

Visualization analysis of author collaborations revealed that the authors in the included literature have formed a core author-driven team development model. The most influential domestic teams in this field are those led by Tu Ya, Li Zhi-gang, and Ren Lu. Meanwhile, the first publications of highly productive scholars in Fang Jiliang's team and those involved in the English literature appeared relatively late, suggesting, to some extent, that the research directions of these teams

are more closely aligned with recent research hotspots. Fang Jiliang's team has focused on EA treatment for depression, specifically investigating brain mechanisms using fMRI following auricular EA and auricular concha EA in different populations with depression (He et al., 2021; Xu et al., 2019). Their recent research indicates that auricular concha EA has the effect of immediately modulating the functional activity of brain regions within the cognitive control network, default mode network, reward network, and visual processing network in patients with first-episode depression (FED), which may represent a potential brain effect mechanism underlying its treatment of FED (Sun et al., 2023).

The institutional collaboration analysis maps indicated that among the Chinese literature, Beijing University of Chinese Medicine had relatively close connections with other research institutions. Although institutions with relatively high publication volumes and influence have emerged in the map, inter-institutional connections remain limited. This lack of communication may lead to issues such as the inability to complement respective strengths (Feng et al., 2026). In the included English literature, domestic Chinese institutions accounted for a high proportion of the top 20 publishing institutions. Furthermore, the country collaboration map indicated that, apart from China, relatively few other countries are engaged in research in this field.

Existing clinical literature indexed in CNKI and WOS frequently reports positive therapeutic outcomes of electroacupuncture for depression, as reflected by the high frequency of clinical trial keywords in co-occurrence analysis (Cao et al., 2026; Han et al., 2021), its global acceptance still needs improvement. Potential adverse effects of EA (such as hematoma and pain) (Yin et al., 2022), the relatively short duration of clinical trials on EA for depression, and individual variability in needling techniques (Zhao et al., 2021) may contribute to this situation. This suggests that domestic scholars could strengthen collaborative relationships to promote the development of this field in China. Simultaneously, enhancing international exchange and cooperation could promote the internationalization of research in this field. Furthermore, scholars could conduct more in-depth reflection and research on clinical trials, employing more scientific and standardized treatment and evaluation criteria to improve international acceptance.

4.2. Analysis of Research Content and Hotspots in EA Treatment for Depression

Analysis of keyword-related maps indicated that keywords such as “rat”, “chronic stress” and “fluoxetine” appeared with high frequency, suggesting that experimental designs related to depression in current research are relatively mature. Chronic unpredictable mild stress is the primary method for constructing animal models, and fluoxetine is frequently selected as the positive control drug. High-frequency keywords such as “clinical observation”, “quality of life” and “randomized controlled trial” indicate that clinically related research is also a key focus of this field.

Meanwhile, keywords related to different types of EA (e.g., “music electroacupuncture” and “auricular concha electroacupuncture”) and different acupoints stimulated by EA (e.g., “Baihui” (GV20) and “Yintang” (GV29)) appeared with high frequency. Corresponding cluster labels were present in the clustering maps, and these keywords have ceased to exhibit burstness (**Figure 11**), indicating that scholars have conducted considerable exploration in these areas in past research. Combining keywords from the clustering and timeline maps, such as “acetylcholine” and “metabolic pathway” cluster labels such as “TRPV1” and “cannabinoid receptor 1” and keywords still exhibiting burstness in the keyword burstness map, such as “mechanisms” it is evident that research on the mechanisms of EA treatment for depression has become a hotspot and focus of this field.

Regarding the efficacy of different EA types in treating depression, Ji Qian et al. found that both music EA and pulsed EA exerted antidepressant effects superior to fluoxetine, with music EA showing a trend toward superiority over pulsed EA in improving the behavior of rats with chronic stress-induced depression (Ji et al., 2013a; Ji et al., 2013b). Liu Yueting et al. (Liu et al., 2020) discovered that both auricular margin EA and auricular concha EA improved depressive behavior in rats, but the efficacy of auricular margin EA was inferior to that of auricular concha EA. Regarding the efficacy of EA stimulation at different acupoints for treating depression, Roberto Gonzalez et al. found (Gonzalez et al., 2011), through intervention in different populations with depression, that EA at Baihui (GV20) and Yintang (GV29), combined with manual acupuncture at Sanyinjiao (SP6), effectively controlled and reduced depressive symptoms. Chen Tao et al. (Chen et al., 2021a) suggested that EA at the Siguan acupoints significantly improved behavioral indicators in rats with post-stroke depression. Du Li et al. proposed that EA at Shenmen (HT7) - Sanyinjiao (SP6) was superior to EA at Sanyinjiao (SP6) alone in improving insomnia severity and anxiety/depression status, with Shenmen (HT7) playing a major role in alleviating anxiety and depression (Du et al., 2022).

4.3. Research on Mechanisms of EA Treatment for Depression

Among Chinese publications in 2023, Lu Yujia et al. suggested that the mechanism by which EA ameliorates depressive symptoms may be related to the regulation of BDNF/TrkB/CREB signaling pathway-related proteins in hippocampal tissue and the elevation of monoamine neurotransmitters 5-HT, NE, and DA levels (Lu et al., 2023). Song Guixia et al. proposed that EA combined with fluoxetine improves depressive behavior, potentially through a mechanism involving the improvement of the diversity and relative abundance of beneficial gut microbiota and the up-regulation of brain-gut axis-related molecule expression, such as 5-HT and 5-HTP (Song et al., 2022). Among English publications in 2023, Hu et al. (2023) suggested that EA ameliorates post-stroke depression (PSD)-related behavioral and cognitive dysfunction and promotes mitochondrial biogenesis by activating CB1R, representing a novel mechanism of EA treatment for PSD. Pang et al. (2023) indicated that P2X7R might be a target for EA intervention in the liver-brain axis for treat-

ing depression.

5. Conclusion

This study employed bibliometric methods to analyze research trends in EA treatment for depression from 2003 to 2023, helping relevant scholars establish a basic framework of existing research in this field and understand its development status and research hotspots. Additionally, the analysis provides valuable reference points for researchers newly entering the field regarding the selection of future research topics. Furthermore, through the author collaboration network maps, scholars in the field can identify potential collaborators more intuitively and conveniently, thereby strengthening collaborative efforts.

This analysis reveals that research on the mechanisms of EA treatment for depression has currently become a hotspot and focus. There remains room for development in clinical safety research on EA treatment for depression. Researchers may consider employing more standardized treatment and evaluation criteria in clinical trials on EA for depression to enhance the acceptance of EA therapy. Furthermore, this study has certain limitations due to the influence of built-in software parameters and the use of network science indicators in bibliometric analysis. In the future, domestic and international researchers should actively establish collaborations to promote innovative development in the field of EA treatment for depression.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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