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REVIEW

Tracing Evolution of Hotspots and Frontiers: A Bibliometric Exploration of Acupuncture Therapy in Irritable Bowel Syndrome

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Background: Acupuncture therapy is widely utilized globally to treat irritable bowel syndrome (IBS) with promising outcomes. However, in recent years, bibliometric analyses have yet to be performed. Consequently, this paper aims to comprehensively analyze the literature from the past 20 years using CiteSpace, VOSviewer, and Excel to identify research hotspots and predict future trends.

Methods: A bibliometric search on acupuncture therapy for IBS was conducted using the Web of Science Core Collection, covering 2004 to 2024. The bibliometric analysis included examining annual publications, countries, authors, cited authors, institutions, journals, cited journals, cited references, and keywords. CiteSpace 6.3.R1, VOSviewer 1.6.18, and Microsoft Excel 2021 facilitated this analysis by creating a knowledge mapping.

Results: A total of 128 papers were included in the final analysis, revealing a general upward trend in annual publications. The predominant type of literature identified was articles. China exhibited the highest centrality of published articles. Wu Huangan emerged as the most prolific author, while Drossman DA had the most cited publications. The Shanghai University of Traditional Chinese Medicine was identified as the most productive institution. Evidence-based Complementary and Alternative Medicine published the most relevant articles, whereas Gastroenterology was the most frequently cited journal. The article Pei LX (2020) was the most cited reference, and Chao GQ (2014) had the highest centrality among cited references. Keyword analysis identified research hotspots focused on clinical symptoms (especially abdominal pain) and gut-related mechanisms. Furthermore, keyword burst analysis revealed that visceral hypersensitivity and gut microbiota are key research frontiers, indicating recent surges in scientific interest.

Conclusion: This study analyzed the literature on acupuncture therapy for IBS by bibliometric methods, revealing its current status and research hotspots and providing a reference for researchers to conduct more in-depth studies in the field.

Keywords: acupuncture therapy, irritable bowel syndrome, bibliometric analysis, visceral hypersensitivity, abdominal pain, gut microbiota

Introduction

Irritable bowel syndrome (IBS) is one of the most prevalent disorders of gut-brain interaction. According to the Rome IV criteria, IBS is clinically defined as recurrent abdominal pain associated with two or more of the following: pain related to defecation, a change in stool frequency, or a change in stool form. Symptoms like bloating are common but not part of the core diagnostic criteria.[1] According to recent global meta-analyses utilizing the more stringent Rome IV criteria, the prevalence of IBS is estimated to be around 3–5% globally, and it remains more prevalent in women.[2] The variation in reported prevalence often reflects the diagnostic criteria used, as older criteria like Rome III tended to yield higher estimates.[3] Emerging evidence suggests that there are sex-specific differences in aspects such as visceral hypersensitivity, stress responses, and gut microbiota composition, potentially influenced by sex hormones.[4] These differences may, in turn, affect how patients respond to various treatments, although this remains an active area of investigation. The pathogenesis of IBS is

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complex and not fully elucidated.[5] However, it is widely recognized as a disorder involving an interplay of factors such as visceral hypersensitivity, abnormal gastrointestinal motor function, altered gastrointestinal mucosal and immune function, abnormalities in the gut microenvironment, and altered central nervous system (CNS) processing.[6,7] Two core endophenotypes are visceral hypersensitivity and altered CNS processing. Visceral hypersensitivity refers to a lowered pain threshold in response to gut stimuli, such as distension. At a physiological level, this involves the sensitization of peripheral afferent nerves in the gut wall, potentially mediated by molecules like 5-hydroxytryptophan (5-HT), brain-derived neurotrophic factor, and proteases released from mast cells.[8,9] These peripheral signals are then transmitted to the CNS, where altered central processing occurs. Neuroimaging studies have identified changes in brain activity in key pain-processing regions, such as the anterior cingulate cortex, insula, and prefrontal cortex, in patients with IBS. This suggests a dysregulation in how the brain interprets and modulates incoming signals from the gut.[10] Abdominal pain is the main symptom of IBS, which will most seriously affect the patient's daily quality of life.[11,12] In addition, IBS adds a considerable burden to society.[13] Current management strategies for IBS often involve a multi-modal approach targeting symptoms. This includes pharmacological agents, such as antispasmodics for pain, alongside dietary interventions and supplements, including probiotics and certain forms of phytotherapy. The evidence for the synergistic effects of these treatments is still evolving, and many patients continue to experience persistent symptoms, which has led to a growing interest in complementary approaches, such as acupuncture therapy.[14–16]

Acupuncture therapy, a key modality within traditional Chinese medicine, has a long history of use for gastrointestinal disorders.[15] As a therapeutic intervention, it is now widely applied globally and has emerged as a prominent complementary treatment for IBS.[17] A growing body of evidence, including numerous systematic reviews and large-scale randomized controlled trials, suggests that acupuncture is effective in managing key IBS symptoms, particularly by reducing the severity of abdominal pain and alleviating associated anxiety.[18–21] Despite a growing body of literature on acupuncture therapy for IBS, its overall knowledge structure, thematic evolution, and collaborative patterns remain unmapped. While systematic reviews focus on clinical outcomes, they lack a macroscopic overview of the field's architecture. As research becomes increasingly fragmented-spanning from clinical trials to complex mechanistic studies-a quantitative knowledge map is necessary. This bibliometric analysis provides practical significance by identifying key contributors to foster collaboration, defining the intellectual base for newcomers, and, most importantly, revealing knowledge gaps and promising future research directions by visualising the evolution of hotspots and frontiers in this therapeutic domain.

Bibliometrics employs statistical techniques on gathered data to examine published information and its associated metadata, aiming to illustrate the connections among various published works.[22] Bibliometrics uses various methods to analyze different research areas across disciplines, assess a paper's influence by tallying the citations it receives from other publications, and build collaborative networks that inform scholars about the field's current state and frontier trends.[23–26]

CiteSpace is a Java-based information visualization tool created by Prof. Chaomei Chen, designed to analyze scientific literature visually, thereby intuitively showcasing the research trends within a specific professional domain.[27–29] In addition to CiteSpace, VOSviewer is another powerful software application dedicated to constructing visual bibliometric networks.[30] Together, these tools play a significant role in analyzing and visualizing research outputs, contributing to the broader field of bibliometrics. This research seeks to perform an in-depth examination of studies related to acupuncture therapy for IBS conducted over the last 20 years. By employing bibliometric techniques, we aim to map the knowledge structure of this domain, specifically by: (1) identifying research hotspots, defined as the most frequent and central topics that represent the core of the field, and (2) detecting emerging research frontiers, defined as topics that have received a sudden surge of scientific attention in recent years. This will allow us to visualize the field's critical research areas and predict its evolving trends.

Methods

Data Sources and Search Strategies

Data for this bibliometric analysis was gathered from the Web of Science Core Collection (WoSCC) on June 18, 2024, via the Jiangxi University of Chinese Medicine library. The search strategy is outlined as follows: TS=(Acupuncture OR Acupuncture Therapy OR Acupuncture Treatment OR Electroacupuncture OR Acupuncture and Moxibustion OR Needle

Knife OR Manual Acupuncture OR Warm Acupuncture OR Ear Acupuncture OR Moxibustion OR Fire Acupuncture OR Scalp Acupuncture OR Skin Acupuncture) AND TI=(Irritable Bowel Syndromes OR Syndrome, Irritable Bowel OR Syndromes, Irritable Bowel OR Colitis, Mucous OR Colitides, Mucous OR Mucous Colitides OR Mucous Colitis OR Colon, Irritable OR Irritable Colon),[31] with the time range set from January 1, 2004 to May 31, 2024. There were no restrictions on the country, type, or language of publications, but incomplete literature and literature that did not fit the subject matter were excluded from the study. The comprehensive search strategy can be found in Table 1. Figure 1 details the data screening process. After removing irrelevant publications, the final dataset was exported and saved as plain text files in the savedrecs.txt format for subsequent analysis. Two researchers (WZF and YS) independently screened the titles and abstracts of all retrieved records based on the above criteria. Full texts were reviewed when the relevance was unclear. Any disagreements were resolved by discussion with a third reviewer (XHY). For data cleaning, author name disambiguation was performed using CiteSpace's built-in merging function and manual verification. Ambiguous author names were cross-referenced with their institutional affiliations and publication history to ensure accuracy.

Analysis Tools

Plain text files exported from the WoSCC were imported into CiteSpace 6.3.R1 and VOSviewer 1.6.18. We performed several analyses to address our research questions, beginning with a co-occurrence analysis of countries, authors, institutions, and keywords to map collaborative networks and knowledge structure. Specifically, research hotspots were identified by analyzing high-frequency and high-centrality keywords within the co-occurrence network. In contrast, research frontiers were determined using the citation burst detection algorithm in CiteSpace. This algorithm identifies keywords exhibiting intense and recent citation bursts, representing emerging trends and future research directions. Finally, a cluster analysis of references and keywords was also conducted to understand the thematic structure of the field further. The parameters set in CiteSpace were as follows: time slicing from January 2004 to May 2024, with a duration of two years per slice; all selection for source terms; node type set to one at a time; and thresholds for country, author, cited author, institution, journal, cited journal, cited reference, and keyword set to the G-index (k=25). The clustering labels were determined using the LLR algorithm, and the analysis included pruning through pathfinder and pruning sliced networks while leaving the other parameters at their default values. Additionally, network visualization of institutions and overlay visualization of journals was conducted using VOSviewer 1.6.18. Literature data was analyzed using Microsoft Excel 2021, focusing on the number of documents and year of publication.

Charts Explanation

CiteSpace employs a time-centric visualization for its nodes. Each node is often depicted with tree rings, where the size and color of each ring can represent the activity in a specific time slice. Furthermore, the overall color of the node typically signifies the year of its first appearance. This approach is compelling for understanding the history and temporal trajectory of a research topic, which was crucial for our goal of tracing its evolution. A purple outer ring is a unique CiteSpace feature indicating high betweenness centrality, highlighting nodes that act as critical bridges in the network. CiteSpace also embeds temporal information into its links (the lines connecting nodes). The color of a link can be set to represent the year in which the connection first appeared, allowing for the tracing of knowledge diffusion

Table 1 Search Queries

Set	Results	Search Query
#1	22905	TS=(Acupuncture OR Acupuncture Therapy OR Acupuncture Treatment OR Electroacupuncture OR Acupuncture and Moxibustion OR Needle Knife OR Manual Acupuncture OR Warm Acupuncture OR Ear Acupuncture OR Moxibustion OR Fire Acupuncture OR Scalp Acupuncture OR Skin Acupuncture)
#2	9726	TI=(Irritable Bowel Syndromes OR Syndrome, Irritable Bowel OR Syndromes, Irritable Bowel OR Colitis, Mucous OR Colitides, Mucous OR Mucous Colitides OR Mucous Colitis OR Colon, Irritable OR Irritable Colon)
#3	175	#1 AND #2

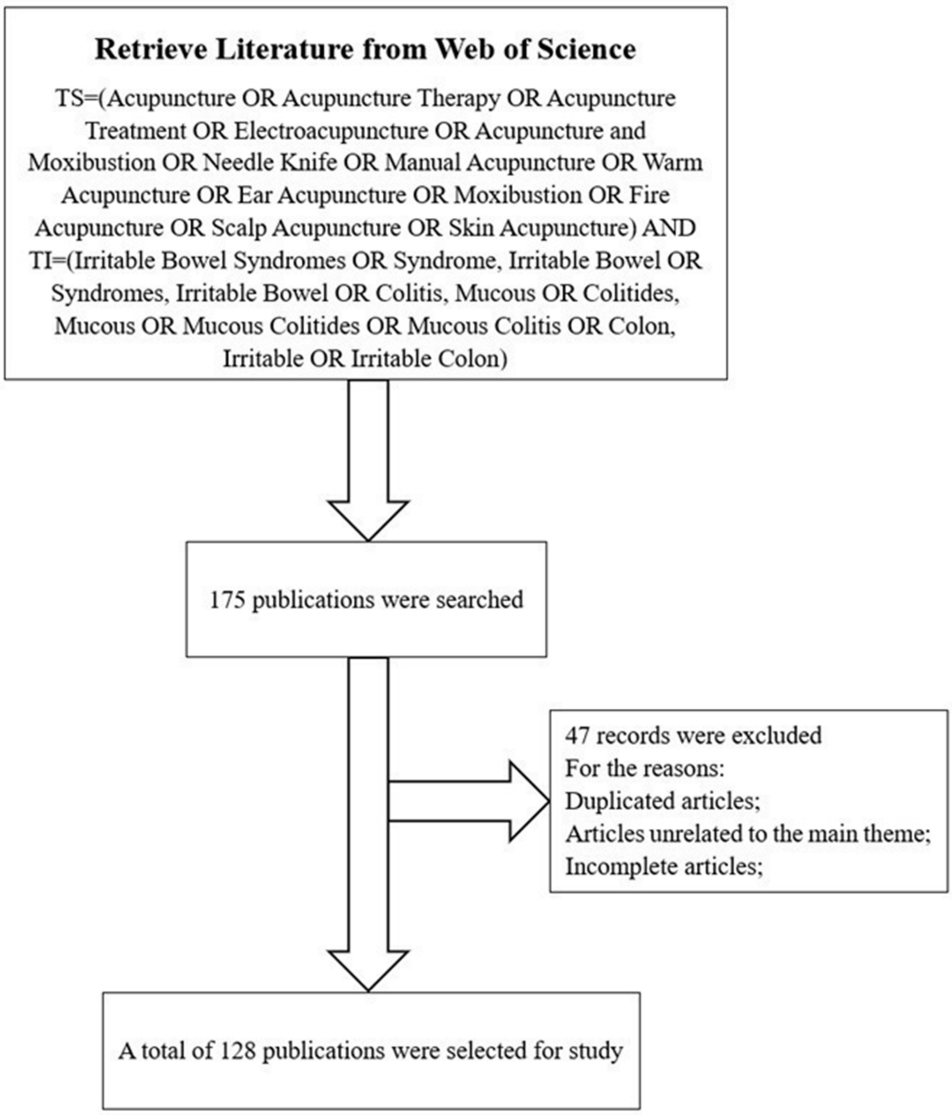

Figure 1 Flow Chart of Article Screening.

over time. VOSviewer, in contrast, uses a relational or distance-based visualization. The primary purpose of its node placement is to ensure that the distance between any two nodes reflects the strength of their association. This makes its maps highly intuitive for understanding clustering and thematic relationships. The color of a node in VOSviewer is typically used to represent its cluster membership, not its age, making it superior for displaying the results of its robust clustering algorithm. VOSviewer visualizes links primarily to represent association strength. The thickness of a link directly corresponds to the co-occurrence frequency or co-citation strength, providing an obvious and immediate visual cue about the most important relationships that form the backbone of the network.

Results

Annual Publications Analysis

After screening, a final selection of 128 publications on acupuncture therapy for IBS from the past 20 years was included for analysis. This includes 88 articles, 30 reviews, 6 Meeting Abstracts, 2 Corrections, 1 Article; Early Access, and 1 Review; Early Access (Figure 2).

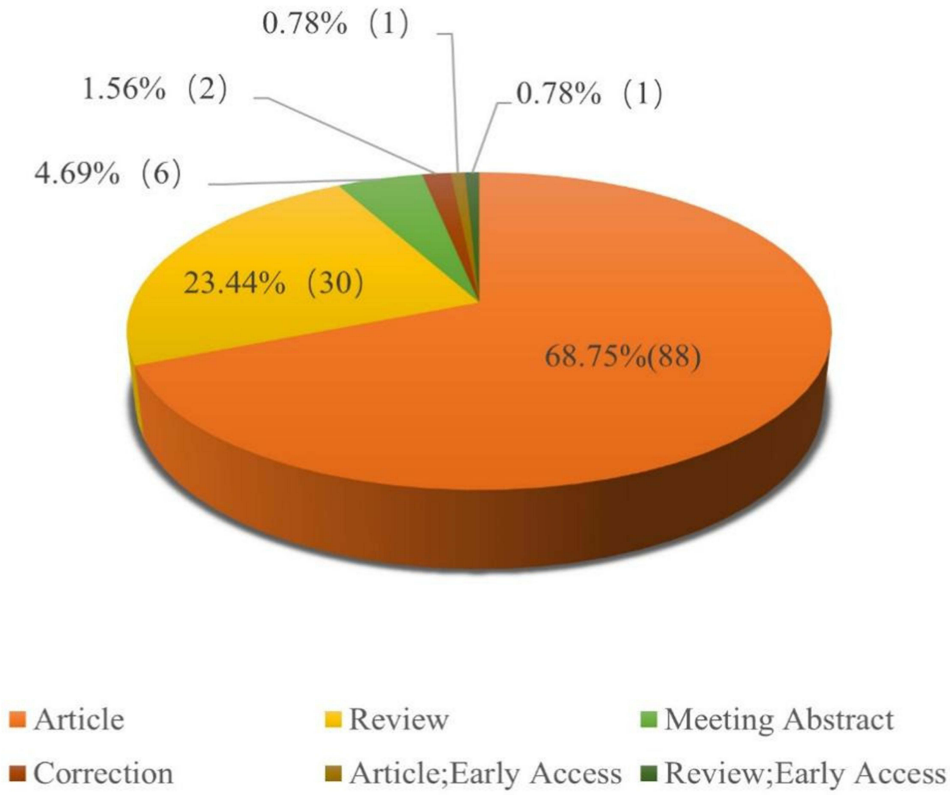

Figure 2 Type of Literature on Acupuncture Therapy for IBS.

Between 2004 and 2024, there was a variable but steady increase in the volume of publications discussing acupuncture therapy for IBS (Figure 3). Since 2004, there have been five distinct periods of increase. The first occurred in 2007–2008 when the number of publications rose from 1 to 4. The second was in 2011–2012, with an increase from 2 to 9 publications. The third period, 2013–2014, saw publications grow from 2 to 7. The fourth period, from 2016 to 2018, increased from 4 to 11 publications. The fifth period, from 2019 to 2022, witnessed a rise from 9 to 22 publications, with all periods reflecting a multiplicative increase. Notably, from 2016 to 2022, the period saw accelerated growth, with publication output reaching an all-time high of 22 publications in 2022. However, a sharp decline was observed in 2023, dropping to 9 publications. As our search was conducted in mid-2024, the data for 2023 and 2024 are still preliminary. The overall trajectory over the 20 years remains fluctuating, but general growth indicates sustained, albeit variable, research interest in this topic.

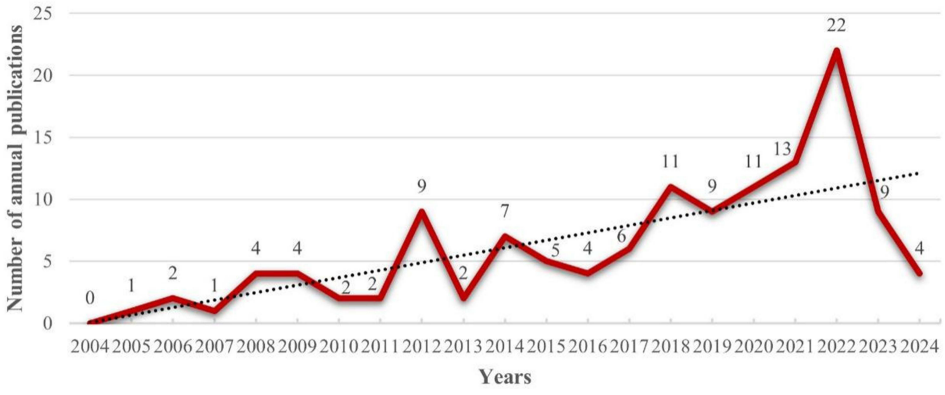

Figure 3 The Number of Annual Publications on Acupuncture Therapy for IBS.

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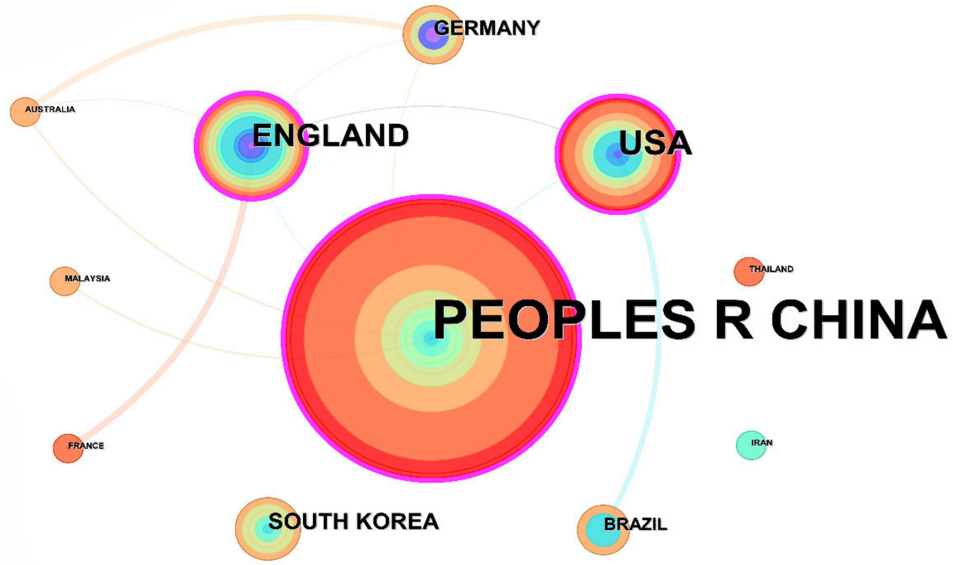

Figure 4 Map of Countries on Acupuncture Therapy for IBS.

Analysis of Countries

Over the past two decades, 11 countries have contributed to the literature on acupuncture therapy for IBS (Figure 4). As illustrated in Table 2, China leads with the highest number of publications (101), followed by the United States (16) and England (12). In terms of betweenness centrality, both China (0.36) and England (0.36) rank first. This indicates that these countries act as critical bridges in the international collaboration network, connecting different clusters of collaborating nations. Notably, while China's high score is driven by its massive output, England's equally high score, despite a much smaller number of publications, highlights its unique role as a key international facilitator. The United States follows with a centrality score of 0.27, suggesting a need for enhanced collaboration with other nations in this area.

Analysis of Authors and Co-Cited Authors

Ultimately, a total of 290 authors contributed to this research. As illustrated in Figure 5, an author map depicting acupuncture therapy for IBS was generated using CiteSpace. The three most prolific authors were Wu HuanGan (28), Liu HuiRong (18), and Bao ChunLi (17), all of whom are from China and have maintained close collaborations with one another (Table 3). In terms of betweenness centrality, the top authors were Zhang Wei (0.11) and Li Ying (0.10). A high centrality score suggests these authors play the role of boundary spanners, connecting different research teams that might not otherwise collaborate. This is distinct from authors with high publication counts (like Wu HuanGan), who may be the core of a single large cluster rather than a bridge between multiple clusters.

Table 2 Top 5 Countries Linked to Acupuncture Therapy for IBS

Ranking	Counts	Countries	Ranking	Centrality	Countries
1	101	Peoples R China	1	0.36	Peoples R China
2	16	USA	2	0.36	England
3	12	England	3	0.27	USA
4	5	South Korea	4	0	South Korea
5	4	Germany	5	0	Germany

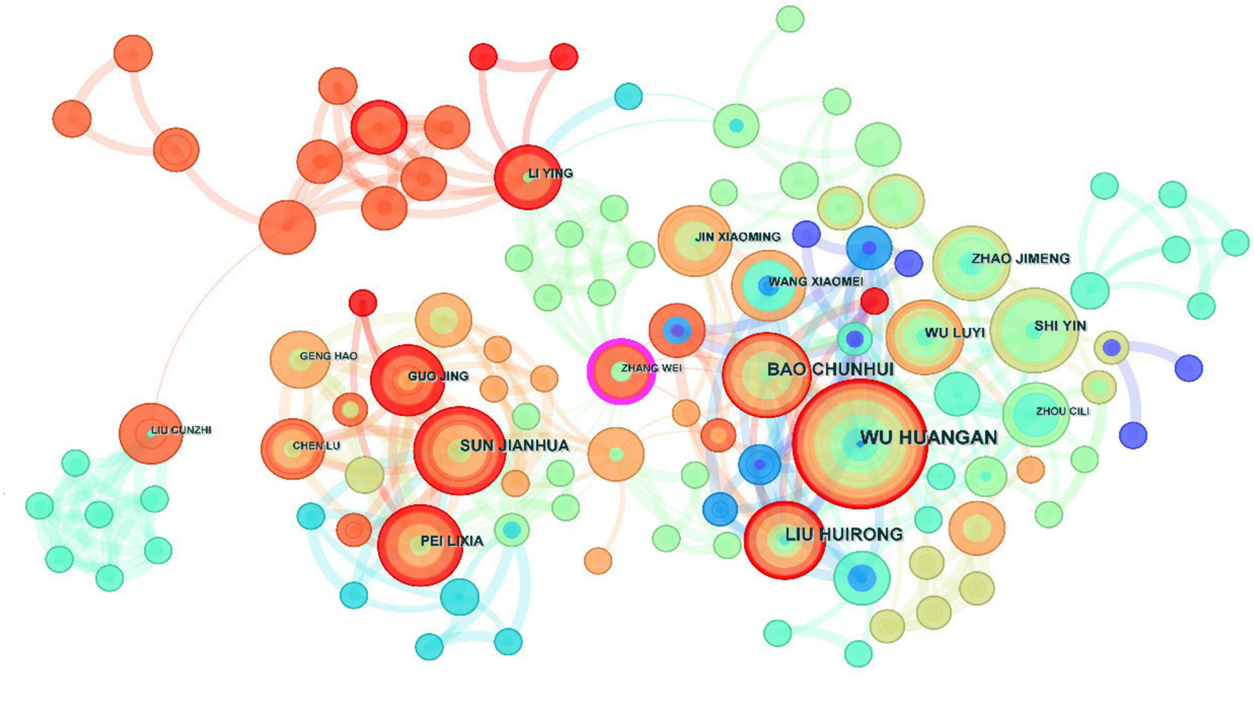

Figure 5 Map of Authors on Acupuncture Therapy for IBS.

A co-citation relationship exists between two authors when the literature of a third author simultaneously cites their works. A total of 368 cited authors were involved in this analysis. As illustrated in Figure 6, a co-cited author map of acupuncture therapy for IBS was generated using CiteSpace. Table 4 presents the top 10 most cited authors with the highest betweenness centrality. Drossman DA (47) is the most co-cited author. It is important to note that total citation counts can be biased towards authors with earlier publications. However, this high count still highlights Drossman DA's foundational role in the field, with his work being frequently referenced by later researchers. Findings from a research study in which he participated indicate that central neuromodulators alleviate IBS symptoms by addressing the pain and motility issues associated with gut-brain dysregulation, thereby enhancing quality of life.[32] Additionally, the top five co-cited authors with the highest centrality are Brandt LJ (0.28), Camilleri M (0.19), Schneider A (0.19), Liu HR (0.19), and Drossman DA (0.15).

Analysis of Institutions

The institutions' network visualization was assessed, revealing that 107 entities participated in the study. Figure 7 illustrates a map of institutions involved in acupuncture therapy for IBS, developed using VOSviewer. The top five

Table 3 Top 5 Authors Linked to Acupuncture Therapy for IBS

Ranking	Authors	Counts	Ranking	Authors	Centrality
1	Wu HG	28	1	Zhang W	0.14
2	Liu HR	18	2	Li Y	0.10
3	Bao CH	17	3	Wu HG	0.08
4	Sun JH	13	4	Liu HR	0.05
5	Pei LX	12	5	Yang JW	0.05

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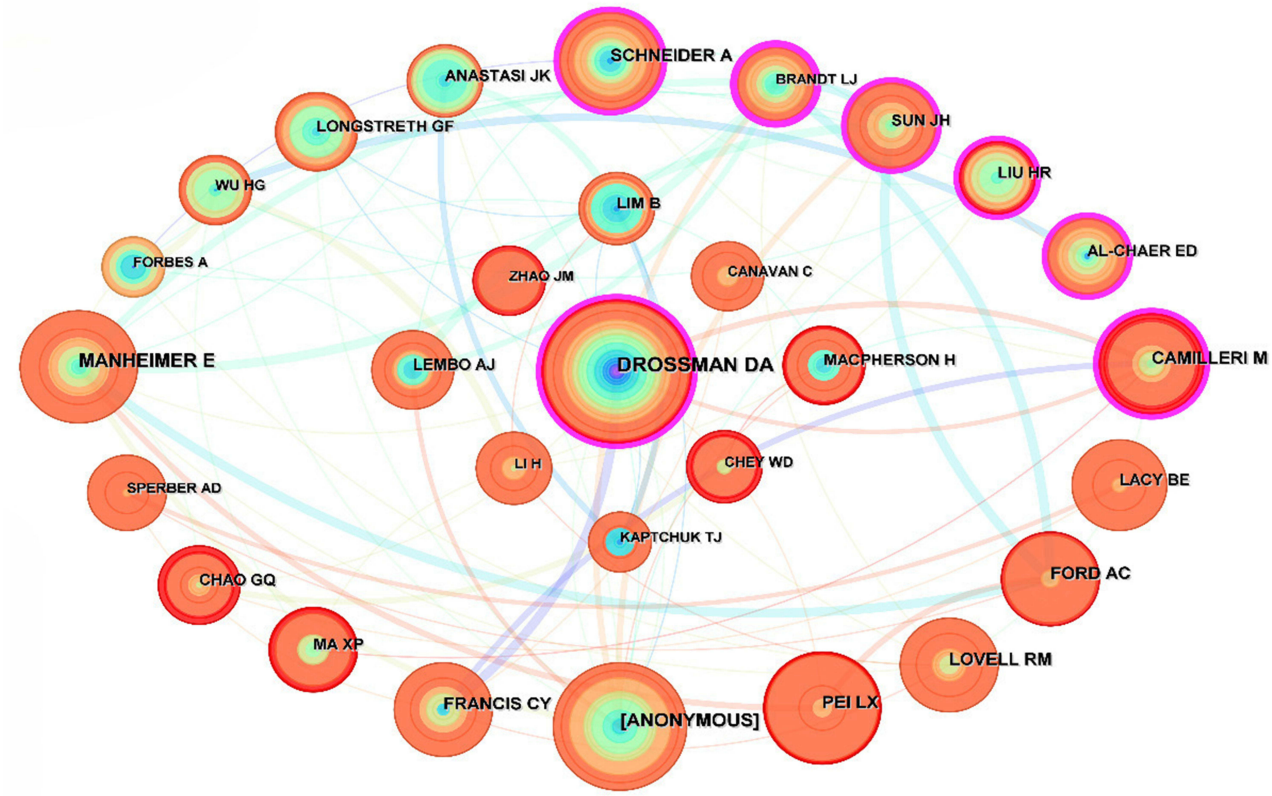

Figure 6 Map of Co-cited Authors on Acupuncture Therapy for IBS.
Notes: The [ANONYMOUS] in Figure 6 is an anonymous cited author and is therefore excluded from Table 4.

organizations based on publication counts are listed in Table 5. Shanghai University of Traditional Chinese Medicine (SUTCM) leads with 26 publications, Nanjing University of Chinese Medicine with 16, and Chengdu University of Traditional Chinese Medicine with 15. Furthermore, the institution exhibiting the highest betweenness centrality is SUTCM (0.40). This high centrality underscores SUTCM's pivotal role as a hub connecting various institutional clusters. SUTCM not only produces high-volume research but also serves as a key conduit for knowledge and collaboration

Table 4 Top 10 Co-Cited Authors Linked to Acupuncture Therapy for IBS

Ranking	Author	Counts	Ranking	Author	Centrality
1	Drossman DA	47	1	Brandt LJ	0.28
2	Manheimer E	36	2	Camilleri M	0.19
3	Camilleri M	32	3	Schneider A	0.19
4	Pei LX	31	4	Liu HR	0.19
5	Schneider A	27	5	Drossman DA	0.15
6	Francis CY	26	6	Al-Chaer ED	0.14
7	Lovell RM	24	7	Sun JH	0.12
8	Ford AC	24	8	Chao GQ	0.09
9	Sun JH	23	9	Forbes A	0.09
10	Lacy BE	21	10	Lovell RM	0.08

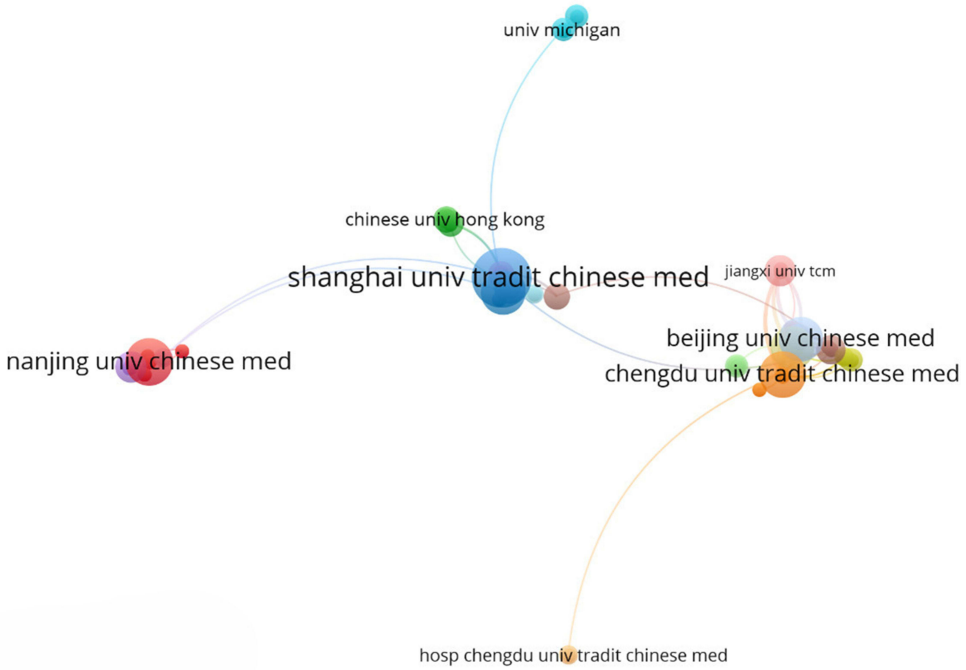

Figure 7 Map of Institutions on Acupuncture Therapy for IBS.

between other research groups. Notably, SUTCM not only has the highest publication output, establishing it as the most productive institution, but also holds the top degree of betweenness centrality, highlighting its crucial role as a collaborative bridge and a central hub within the research network. P2X7R plays a role in inducing pain by affecting P2X3R in the visceral hypersensitivity response in IBS. In contrast, electroacupuncture (EA) plays an analgesic role by inhibiting the activation of P2X7R, according to the SUTCM in a newly published paper.[33] The map of institutional cooperation networks shows that Chinese domestic institutions are working together relatively closely and that cooperation with other countries at the international level should be strengthened.

Analysis of Journals and Co-Cited Journals

The results obtained from the overlay visualization analysis utilizing VOSviewer software indicated that 128 publications focusing on acupuncture therapy for IBS were published across 52 different journals (Figure 8). Table 6 displays the top 10 most active journals. Notably, the five journals with the highest production were Evidence-based Complementary and Alternative Medicine (11), Medicine (9), World Journal of Gastroenterology (7), Acupuncture in Medicine (7), and Trials

Table 5 Top 5 Institutions Linked to Acupuncture Therapy for IBS

Ranking	Institutions	Counts	Ranking	Institutions	Centrality
1	Shanghai University of Traditional Chinese Medicine	26	1	Shanghai University of Traditional Chinese Medicine	0.40
2	Nanjing University of Chinese Medicine	16	2	China Academy of Chinese Medical Sciences	0.23
3	Chengdu University of Traditional Chinese Medicine	15	3	Fudan University	0.15
4	Fudan University	13	4	Shandong University of Traditional Chinese Medicine	0.12
5	Beijing University of Chinese Medicine	13	5	Chinese University of Hong Kong	0.10

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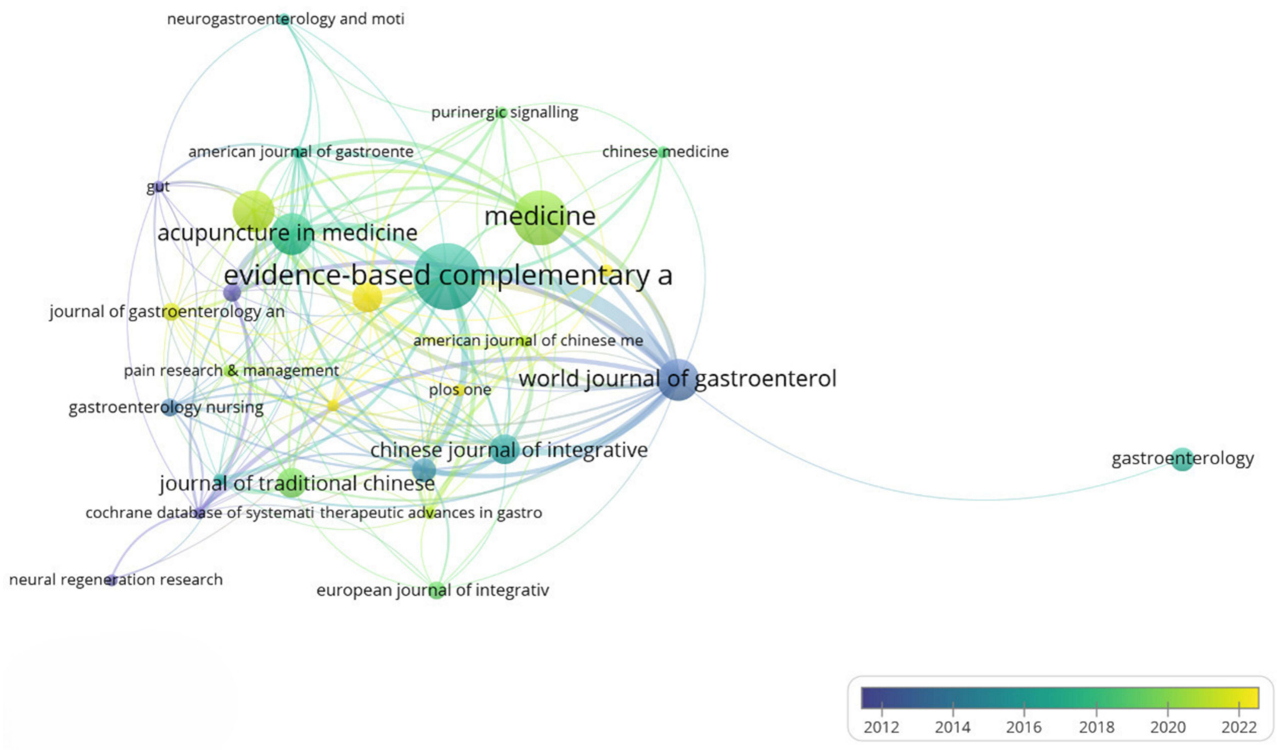

Figure 8 Map of Journals on Acupuncture Therapy for IBS.

(7). The World Journal of Gastroenterology had the highest average citation count at 40.57. While raw citation counts can be influenced by journal prestige and article age, this high average suggests that its publications have been particularly impactful or foundational within this research community. Nonetheless, the significant variation in the average citations among the top 10 journals highlights the necessity for enhancing the research quality in publications concerning acupuncture therapy for IBS.

Researchers can locate and categorize journals by analyzing co-cited journals, determining their core or marginal positions within a discipline, and evaluating academic journals. Figure 9 illustrates a co-citation journal graph for

Table 6 Top 10 Journals Linked to Acupuncture Therapy for IBS

Ranking	Journal	Counts	Citations	Average Citations
1	Evidence-based Complementary and Alternative Medicine	11	155	14.09
2	Medicine	9	57	6.33
3	World Journal of Gastroenterology	7	284	40.57
4	Acupuncture in Medicine	7	101	14.43
5	Trials	7	15	2.14
6	Frontiers in Neuroscience	5	22	4.40
7	Chinese Journal of Integrative Medicine	5	108	21.60
8	Journal of Traditional Chinese Medicine	5	39	7.80
9	BMC Complementary and Alternative Medicine	4	130	32.50
10	Gastroenterology	4	3	0.75

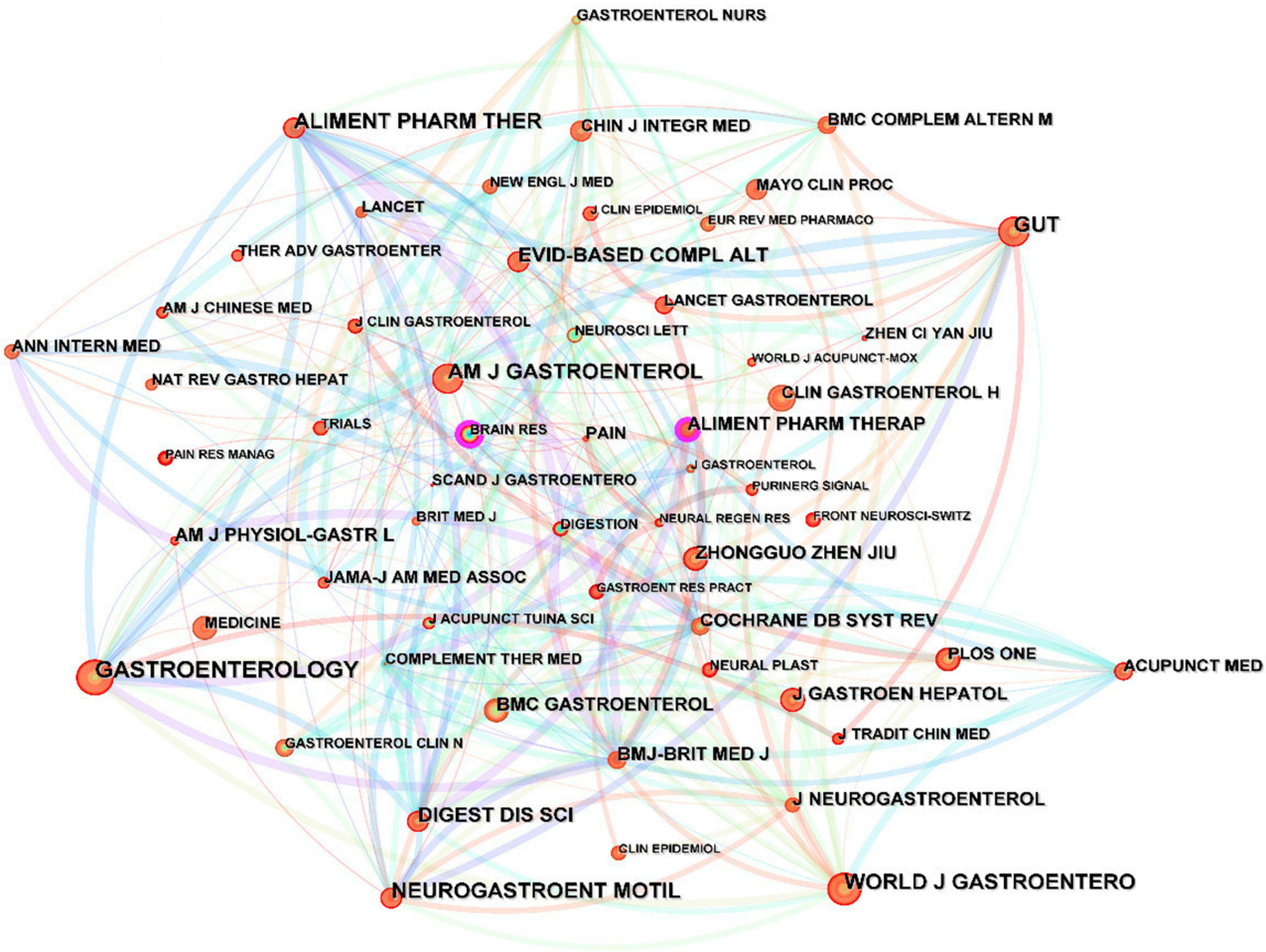

Figure 9 Map of Co-cited Journals on Acupuncture Therapy for IBS.

acupuncture therapy for IBS generated using CiteSpace. Table 7 lists the ten journals with the highest betweenness centrality in acupuncture therapy for IBS. Only two journals, Alimentary Pharmacology and Therapeutics and Brain Research, exhibited betweenness centrality values greater than 0.1. This signifies their important role as interdisciplinary

Table 7 The Top 10 Co-Cited Journals Linked to Acupuncture Therapy for IBS

Ranking	Journal	Centrality	Ranking	Journal	Counts
1	Aliment Pharm Ther	0.15	1	Gastroenterology	97
2	Brain Res	0.13	2	Gut	89
3	Complement Ther Med	0.09	3	World J Gastroentero	86
4	Am J Physiol-Gastr L	0.08	4	Am J Gastroenterol	83
5	Acupunct Med	0.08	5	Aliment Pharm Ther	69
6	Pain	0.08	6	Neurogastroent Motil	68
7	Ann Intern Med	0.08	7	Digest Dis Sci	61
8	Brit Med J	0.08	8	Evid-Based Compl Alt	51
9	Neural Regen Res	0.08	9	Bmj-Brit Med J	42
10	J Gastroenterol	0.08	10	Am J Physiol-Gastr L	38

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bridges. These journals likely publish research that connects the core knowledge base of gastroenterology with related fields, such as pharmacology and neuroscience, facilitating knowledge transfer across disciplines. The journal with the highest frequency of occurrences was Gastroenterology (97), followed by Gut (89), World Journal of Gastroenterology (86), American Journal of Gastroenterology (83), and Alimentary Pharmacology and Therapeutics (69).

Analysis of Co-Cited References

Co-citation reference is a phenomenon whereby one or more later papers jointly cite two earlier papers, with a higher co-citation frequency indicating a more vital relevance between the two. In this analysis, a complete count of 374 references was included. Figure 10A demonstrates the creation of a co-citation reference map related to acupuncture therapy for IBS, which was produced using CiteSpace. Table 8 and Table 9 display the five most cited references with the most extraordinary centrality concerning acupuncture therapy for IBS within the last two decades. The three most cited articles include a paper by Pei LX published in Mayo Clinic Proceedings in 2020,[34] an article by Oka P in The Lancet Gastroenterology and Hepatology in 2020,[2] and a publication by Sperber AD in Gut in 2017.[35] Pei LX (2020)[34] and Anastasi JK (2009)[36] both concluded from a randomized controlled trial that acupuncture reduces the severity of abdominal pain and shows considerable promise in improving symptoms of irritable bowel syndrome (IBS). Oka P (2020)[2] aims to determine the global prevalence of IBS through a meta-analysis. Guo JB (2020)[37] aimed to clarify the effectiveness of acupuncture therapy for IBS through a meta-analysis, which revealed that acupuncture improves clinical outcomes, demonstrates a favorable safety profile and alleviates pain levels. However, these conclusions require further validation through higher-quality evidence. Regarding centrality, the top article was by Chao GQ (2014).[38] Its high betweenness centrality suggests it serves as an important intellectual bridge, linking different research themes or historical stages of the literature. For example, it is likely cited alongside both early clinical efficacy studies and later mechanistic explorations, thus connecting these different knowledge domains. The results indicated that acupuncture was beneficial for patients with IBS; however, a limitation was the insufficient sample size.[38] Consequently, there has been significant interest in researching the efficacy of acupuncture therapy for IBS, which appears to be a promising treatment

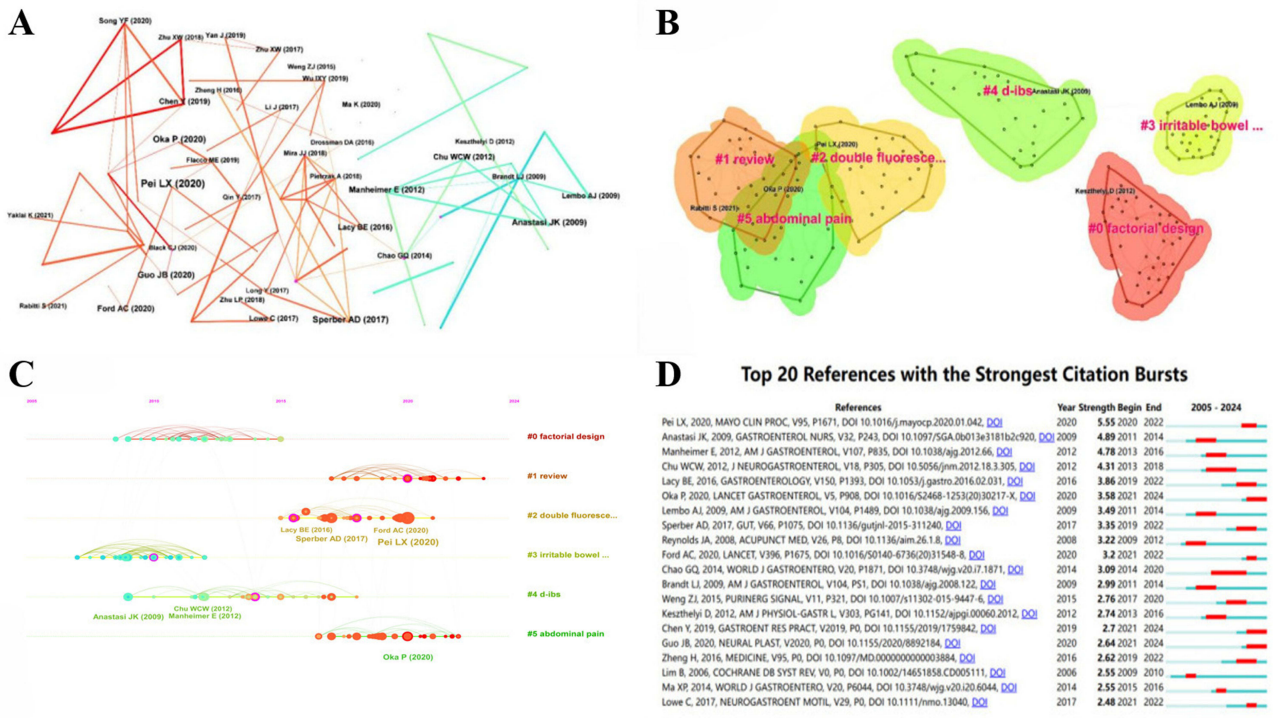

Figure 10 (**A**) Map of Co-cited References on Acupuncture Therapy for IBS. (**B**) Cluster Map of Co-cited References on Acupuncture Therapy for IBS. (**C**) Cluster Timeline Map of Co-cited References on Acupuncture Therapy for IBS. (**D**) Map of Top 20 Co-cited References with the Strongest Citation Bursts.

Table 8 Top 5 Counts of Co-Cited References Linked to Acupuncture Therapy for IBS

Ranking	Cited Reference	Counts	Author (Publication Year)
1	Effect of Acupuncture in Patients With Irritable Bowel Syndrome: A Randomized Controlled Trial[34]	18	Pei LX (2020)
2	Global prevalence of irritable bowel syndrome according to Rome III or IV criteria: a systematic review and meta-analysis[2]	11	Oka P (2020)
3	The global prevalence of IBS in adults remains elusive due to the heterogeneity of studies: a Rome Foundation working team literature review[35]	11	Sperber AD (2017)
4	Acupuncture for Adults with Diarrhea-Predominant Irritable Bowel Syndrome or Functional Diarrhea: A Systematic Review and Meta-Analysis[37]	10	Guo JB (2020)
5	Symptom Management for Irritable Bowel Syndrome A Pilot Randomized Controlled Trial of Acupuncture/Moxibustion[36]	10	Anastasi JK (2009)

Table 9 Top 5 Centrality of Co-Cited References Linked to Acupuncture Therapy for IBS

Ranking	Cited Reference	Centrality	Author (Publication Year)
1	Effectiveness of acupuncture to treat irritable bowel syndrome: A meta-analysis[38]	0.39	Chao GQ (2014)
2	World Gastroenterology Organisation Global Guidelines Irritable Bowel Syndrome A Global Perspective Update September 2015[41]	0.26	Quigley EMM (2016)
3	Global burden of irritable bowel syndrome: trends, predictions and risk factors[42]	0.16	Black CJ (2020)
4	Perceptions of the public healthcare system from private-care patients with irritable bowel syndrome with constipation in Spain[43]	0.11	Mira JJ (2018)
5	Warming Moxibustion Relieves Chronic Visceral Hyperalgesia in Rats: Relations to Spinal Dynorphin and Orphanin-FQ System[39]	0.10	Qi L (2013)

option for alleviating patients' pain symptoms. Furthermore, Qi L conducted a primary research study demonstrating that moxibustion alleviates chronic visceral hyperalgesia by activating the spinal dynorphin and orphanin-FQ systems.[39] Researchers have identified that IBS manifests as chronic abdominal pain and one pathophysiological theory posits that the brain-gut axis is responsible for regulating intestinal pain.[40] It is important to note that the mechanisms through which acupuncture affects IBS-related pain, such as abdominal pain, have yet to be thoroughly explored, and it is anticipated that relevant theories will become more substantiated shortly.

Citespace was utilized to perform a cluster analysis of references to explore research directions and emerging trends within the body of knowledge and extract critical information from cited references. The modularity Q=0.8425 and the weighted mean silhouette S=0.938 (S>0.7) indicate that the clustering is reliable and convincing. The co-citation cluster analysis (Figure 10B) reveals a core intellectual structure synthesised from three domains. A large cluster focused on clinical trial methodology (like #0 factorial design and #3 therapy) highlights the community's persistent effort to establish the clinical efficacy of acupuncture therapy for IBS. Another significant domain is centred on symptom-specific research (like #4 d-ibs and #5 abdominal pain), indicating that research has been heavily driven by clinical needs, particularly pain management and diarrhea-predominant IBS. Most revealingly, a smaller but distinct cluster has emerged related to neurophysiological mechanisms (like #2 double fluorescent neural tracing technique). The timeline view (Figure 10C) shows this mechanistic cluster is one of the more recent to appear, suggesting a thematic evolution and a progressive shift from asking "if" acupuncture works to investigating "how" it works, with a growing focus on tracing

the neural pathways involved. Additionally, the research is linked to anxiety. For instance, corticotropin-releasing factor-related peptide (CRF) is one of the brain-gut peptides, and anxiety is associated with the brain's CRF/CRF1 signaling pathway. EA has been shown to effectively decrease the concentration of CRF in the hypothalamus of rats with chronic visceral hypersensitivity IBS.[44]

The references were examined for citation bursts, leading to selecting the top 20 based on their strength, as illustrated in Figure 10D. Pei LX (2020)[34] authored the article with the highest intensity score of 5.55. Research indicates that acupuncture may aid in treating IBS by reestablishing a balanced brain-gut axis through regulating regulatory transmitters. The latest burst references from 2021 onwards include works by Oka P (2020),[2] Chen Y (2019),[45] and Guo JB (2020).[37] Chen Y aims to investigate the mechanisms by which EA influences dual regulation in gut-brain interaction disorders.[45] It is evident that the emphasis of the research lies in mechanistic studies.

Analysis of Keywords

Trends in research can be discerned by examining the keywords found in studies focused on acupuncture therapy for IBS. Evaluating research hotspots and emerging trends in this domain can be carried out by observing either a surge in the frequency of keywords within citations or a growth in the occurrences of specific keywords over a specified timeframe. In total, 229 keywords were identified. As illustrated in Figure 11A, a co-occurring keyword map regarding acupuncture therapy for IBS was developed using CiteSpace, while Table 10 presents the ten keywords with the highest frequency and centrality. The five keywords that appeared most frequently were irritable bowel syndrome (57), acupuncture (25), quality of life (20), electroacupuncture (19), and management (19); in terms of betweenness centrality, the top five keywords with the most significant occurrence were irritable bowel syndrome (0.33), acupuncture (0.23), expression (0.22), electroacupuncture (0.19), and mechanism (0.17). Regarding frequency of occurrence, quality of life, management, prevalence, and supplementation were among the most prominent keywords, suggesting that ongoing research will likely concentrate on clinical studies assessing the effectiveness of acupuncture therapy for IBS. A randomized controlled trial implies that acupuncture is a viable treatment option for IBS within the context of complementary and alternative

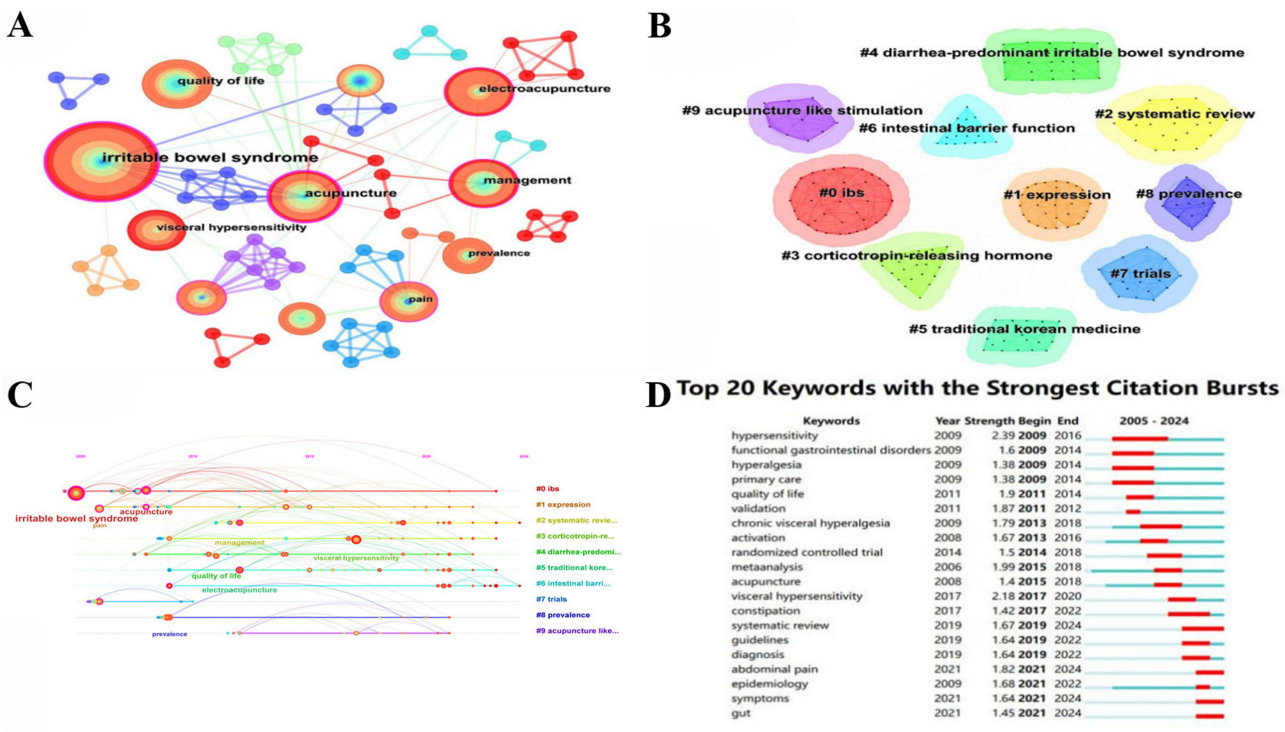

Figure 11 (**A**) Map of Co-cited Keywords on Acupuncture Therapy for IBS. (**B**) Cluster Map of Co-cited Keywords on Acupuncture Therapy for IBS. (**C**) Cluster Timeline Map of Co-cited Keywords on Acupuncture Therapy for IBS. (**D**) Map of Top 20 Co-cited Keywords with the Strongest Citation Bursts.

Table 10 Top 10 Co-Occurring Keywords Linked to Acupuncture Therapy for IBS

Ranking	Keywords	Counts	Ranking	Keywords	Centrality
1	Irritable bowel syndrome	57	1	Irritable bowel syndrome	0.33
2	Acupuncture	25	2	Acupuncture	0.23
3	Quality of life	20	3	Expression	0.22
4	Electroacupuncture	19	4	Electroacupuncture	0.19
5	Management	19	5	Mechanisms	0.17
6	Visceral hypersensitivity	15	6	Management	0.15
7	Pain	12	7	Activation	0.12
8	Prevalence	11	8	Pain	0.11
9	Disorders	10	9	Disorders	0.11
10	Complementary	10	10	Functional gastrointestinal disorder	0.10

medicine.[38] The notable centrality of the keywords expression, mechanism, electroacupuncture, and activation indicates that exploring the mechanisms behind acupuncture therapy (such as electroacupuncture) for IBS through fundamental research is a crucial area of exploration. For instance, the role of the P2X3 receptor in visceral pain associated with IBS is significant. EA down-regulates the expression of P2X3 receptors, diminishing the sensitivity to visceral pain, which implies that EA may effectively manage visceral pain in IBS.[46] In another study, Stimulation of ST25 and CV12 by EA reduced visceral hypersensitivity. This pain-relieving effect was accomplished by lowering the quantity of colonic enterochromaffin cells and the concentration of 5-HT.[47]

Based on the clustering and timeline graphs, it is possible to illustrate the frontier trends in this research area over the past two decades. The keyword cluster analysis (Figure 11B) provides strong evidence for an evolving research trajectory. The emergence of clusters named after specific modern biological pathways, such as #3 corticotropin-releasing hormone and #6 intestinal barrier function, confirms that the focus is shifting. Research is moving beyond foundational questions of whether acupuncture is effective to a more sophisticated investigation of its effectiveness, particularly through tracing relevant neural pathways. A clustering timeline map was generated (Figure 11C), which illustrates the evolution of the research topic over the past 20 years. Most of the research in this area has been conducted after 2009, with early studies primarily focused on clusters #0 ibs, #1 expression, and #7 trials, the earliest of which occurred before 2007. Clusters #2 systematic review and #6 intestinal barrier function emerged after 2006 and continue to be relevant today. The main focuses of the study include systematic review, meta-analysis, diarrhea-predominant irritable bowel syndrome, clinical research, traditional korean medicine, trials, and prevalence. Mechanistic studies have concentrated on the brain-gut axis, chronic visceral hypersensitivity, expression, spinal cord, hyperalgesia, corticotropin-releasing hormone, and acupuncture-like stimulation. We speculate that future research may encompass intestinal barrier function, rectal sensation, and gut microbiota.

Analyzing citation burst keywords can illuminate the research hotspots related to acupuncture therapy for IBS. Figure 11D presents the top 20 keywords exhibiting the strongest citation bursts from 2004 to 2024. Hypersensitivity is the keyword that demonstrates the highest strength, and it first emerged in 2009. Early studies focused on the relationship between hypersensitivity, functional gastrointestinal disorders, hyperalgesia, and acupuncture. From 2011 to 2017, the research emphasis shifted to investigating the mechanisms linking acupuncture to chronic visceral hyperalgesia and visceral hypersensitivity. The number of systematic reviews has increased significantly in recent years, demonstrating an upgrade in the quality of research in the area. Furthermore, in the last three years, studies have concentrated on how acupuncture alleviates abdominal pain symptoms and modulates gut function, a subject that has recently gained significant attention.

Discussion

General Information and Research Landscape

This study presents the first bibliometric analysis of acupuncture therapy for IBS, mapping the knowledge structure and evolution of this field over the past two decades. Our findings reveal a rapidly growing yet relatively concentrated research landscape. The growth is evidenced by the annual output of publications, which has shown a general upward, albeit fluctuating, trajectory, indicating a growing interest from the research community. While the field experienced a peak in 2022 followed by a decline, the overall trend suggests that acupuncture for IBS remains an active area of investigation; the reasons for the recent decline are likely multifactorial, and further monitoring is needed to determine if this is a temporary dip or a new trend. This concentration is characterized by the overwhelming dominance of China in terms of publication volume, productive authors, and institutions, which underscores its pivotal role in advancing this field, likely attributable to its cultural heritage and significant research investment in acupuncture.[15,48] However, this concentration also highlights critical challenges. One is the limited international collaboration; while Chinese institutions cooperate closely domestically, robust partnerships with leading gastroenterology research centers in other countries are scarce, which may hinder the global dissemination of findings. Furthermore, the disparity between the journals publishing this research (often specialty complementary medicine journals) and the high-impact journals being cited indicates that the evidence base, while growing, needs further strengthening through more rigorous clinical trials and mechanistic studies to gain broader acceptance in mainstream medicine.

Methodological Quality and Field Maturation

A crucial question for any clinical field is the identification of studies with the highest methodological quality. It is important to clarify that a bibliometric analysis, including this one, is not designed to perform a formal quality assessment of individual studies. Our metrics of citation and centrality reflect academic impact and influence, not necessarily methodological perfection.

However, our analysis provides several indirect indicators of the field's methodological maturation. First, the most highly cited references, such as the large randomized controlled trial by Pei LX (2020)[34,] have become foundational pillars of the field, suggesting community consensus on their importance. Second, our analysis of keywords reveals a significant increase in the frequency and burst strength of terms like systematic review, meta-analysis, and trials in recent years (Figure 11D). This trend strongly indicates a collective move towards higher standards of evidence-based practice and a general improvement in the methodological rigor of the research being published in this domain.

Evolution of Research Focus and Knowledge Base

The intellectual foundation of this field has evolved dynamically, reflecting a maturation of the research agenda. Initially, studies focused primarily on establishing clinical efficacy through randomized controlled trials and systematic reviews, as evidenced by the frequently cited meta-analyses and clinical guidelines.[37,38,41] This phase was crucial for providing a foundational evidence base. In recent years, however, the research frontier has shifted decisively towards elucidating the underlying mechanisms, with a particular focus on two interconnected areas: abdominal pain relief and modulation of gut function.

The keyword and reference burst analysis clearly demonstrates that mechanistic investigations are at the forefront. Research is no longer just asking "if" acupuncture works, but "how" it works. Our analysis identifies several key mechanistic pathways currently under intense investigation:

(1) Modulation of the Brain-Gut Axis: EA has been shown to decrease visceral hypersensitivity by regulating key neurotransmitters and peptides within the brain-gut axis, such as reducing CRF,[44,45] normalizing 5-HT levels, and balancing calcitonin gene-related peptide and neuro-peptide Y.[49,50]
(2) Peripheral Mechanisms in the Gut: There is growing evidence that acupuncture and moxibustion can restore intestinal barrier function by upregulating tight junction proteins (like Claudin-1 and Occludin),[51] inhibiting mast cell activation,[52] and modulating the gut microbiota and its metabolites.[53,54]

This progression from symptom-focused trials to mechanism-oriented research signifies a deepening of the field's scientific inquiry, aiming to provide a biological rationale for the benefits of acupuncture in IBS.

Intervention Techniques and Mechanistic Insights

The primary intervention methods identified in the literature include manual acupuncture, moxibustion, and electro-acupuncture. Our keyword analysis reveals that electroacupuncture is a widespread and central term, suggesting it is the most extensively studied modality within this research domain. While our bibliometric analysis can identify which technique receives the most academic attention, it cannot directly compare their therapeutic results. Answering the crucial clinical question of which treatment works best requires a different methodology, namely a systematic review and meta-analysis of clinical trial data. Highly cited reviews in our dataset, such as those by Guo JB (2020)[37] and Chao GQ (2014),[38] have begun to address this by synthesizing evidence for acupuncture's general efficacy. However, a detailed comparative effectiveness review of different acupuncture techniques remains a promising direction for future evidence synthesis. Our study provides a valuable foundation for such work by highlighting that the richest evidence base for comparison is likely to be found in the electroacupuncture literature.

The intense research focus on EA has led to a growing body of literature elucidating how it may modulate visceral pain in IBS. Synthesizing the high-impact mechanistic studies in our analysis, EA appears to exert its analgesic effects through a multi-level pathway along the gut-brain axis. At the peripheral level, this includes downregulating nociceptive receptors, such as P2X3,[46] reducing pain-sensitizing mediators, like 5-HT,[47] and restoring the intestinal barrier.[50] At the spinal and supraspinal levels, EA is thought to activate endogenous pain-control systems, consistent with the "gate control theory", by modulating spinal dynorphin systems[39] and regulating key central molecules like CRF in the hypothalamus.[18,44]

The scientific significance of this evolving understanding is that it provides a plausible biological basis for EA's therapeutic effects in IBS, framing it as a mechanistically understandable neuromodulation therapy. Further high-quality trials, particularly those focusing on EA, are warranted to explore the combined effects on therapeutic efficacy and mechanisms of action, thereby improving patient care.

Strengths and Limitations

To our knowledge, this study is the first to employ bibliometric techniques to map the intellectual landscape of acupuncture therapy for IBS. Its primary strength lies in providing a quantitative and visual overview of a defined 20-year period, identifying key contributors, collaborative networks, and thematic evolution, thus offering a roadmap that complements traditional reviews. However, in the interest of transparency, we must acknowledge several important methodological limitations.

First, our analysis is constrained by the scope of our search. The dataset was drawn exclusively from the WoSCC, omitting other major databases like Scopus, which may have limited the breadth of included literature. Compounding this, our search strategy employed inconsistent search fields, a restrictive approach that likely undercaptured some relevant studies. Furthermore, the search was conducted on May 31, 2024, and does not include the most recent publications. Consequently, our dataset should be viewed as a representative snapshot of the core literature within a specific timeframe, rather than an exhaustive census. Second, and critically, our citation metric interpretation must be cautiously approached. The analysis did not normalize citation counts by publication year, introducing a significant bias favoring older publications with more time to accrue citations. Therefore, citation counts should be understood as a measure of a publication's historical impact or recognition, not as a direct or unbiased proxy for its scientific quality. Acknowledging these constraints is crucial for a balanced interpretation of our findings and highlights clear avenues for more comprehensive bibliometric studies in the future.

Conclusion

This bibliometric analysis provides the first comprehensive knowledge map of the research landscape for acupuncture therapy in IBS over the past two decades. Our findings reveal a steadily growing field, with Chinese institutions forming the core of the collaborative network. The thematic trajectory shows a clear and significant evolution from early-stage clinical efficacy studies

to more recent, sophisticated investigations into the underlying mechanisms, particularly those related to the gut-brain axis, visceral hypersensitivity, and gut microbiota. It is crucial to note that these findings map patterns of academic interest, not clinical effectiveness. Ultimately, this study provides a macroscopic roadmap that highlights key achievements, identifies emerging frontiers, and underscores the need for greater international collaboration to advance this promising field of research.

Abbreviations

IBS, Irritable bowel syndrome; CNS, Central nervous system; 5-HT, 5-hydroxytryptophan; WoSCC, Web of Science Core Collection; SUTCM, Shanghai University of Traditional Chinese Medicine; CRF, Corticotropin-releasing factor; EA, Electroacupuncture.

Data Sharing Statement

The data utilized in this study can be accessed through the Core Collection database of the Web of Science.

Research Ethics

This study did not include patient information and, therefore, did not require ethical approval.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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