

Research Trends of Pharmacopuncture: a bibliometric analysis using VOSviewer (2007-2023)

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Objectives: Pharmacopuncture is considered a unique new type of acupuncture in Korean medicine (KM). This study was performed to investigate the research trends regarding pharmacopuncture through a bibliometric analysis using VOSviewer.

Methods: The Web of Science Core Collection was searched for this study. The search terms were pharmacopuncture and pharmaco-puncture. The search was conducted on May 23, 2023, and 185 studies retrieved up to this date were included. Software VOSviewer version 1.6.19 was used to perform the bibliometric analysis. After data clearing, keyword co-occurrence and cooperation pattern analyses were performed.

Results: The number of studies on pharmacopuncture have gradually increased since the mid-2000s, with the most published in 2020 (46 studies). The quality of the studies has also steadily increased, and recently, several randomized controlled trials of pharmacopuncture have been conducted. Moreover, this treatment has been investigated in the context of KM clinical practice guideline development in Korea. The scope of pharmacopuncture studies to date seems to be limited to musculoskeletal pain and bee venom pharmacopuncture. The researchers from Jaseng Medical Foundation have been the core researchers in the field of pharmacopuncture in Korea. They collaborated with researchers from universities or government-funded research institutes. However, small-scale research teams from KM clinics and university researchers were also identified as independent clusters.

Conclusion: Pharmacopuncture research has grown both quantitatively and qualitatively, but the scope needs to be further expanded. There is also a gap between the use of pharmacopuncture by KM doctors in clinical settings and pharmacopuncture research. Based on these findings, some suggestions for future studies in this field are discussed. Furthermore, these findings may be used as data to expand and globalize pharmacopuncture research in the future.

Keywords: bee venoms, bibliometrics, pharmacopuncture, traditional East Asian medicine, VOSviewer

INTRODUCTION

Pharmacopuncture, which combines acupuncture and the injection of herbal medicine into acupoints, is a new form of acupuncture treatment being investigated for its therapeutic potential for obesity and musculoskeletal disorders [1, 2]. Recently, the efficacy of pharmacopuncture for other conditions, including insomnia [3], hot flashes in menopause [4], mild cognitive impairment [5], and stroke [6], has also been investigated.

Although a similar treatment method called “acua-acupuncture” exists in traditional Chinese medicine (TCM), pharmacopuncture is considered a unique new type of acupuncture in Korean medicine (KM) [7, 8] because acua-acupuncture is born from the combination of TCM and Western medicine (WM) based on various experiments and does not emphasize TCM theory; however, pharmacopuncture emphasizes KM theories, including meridian theory, traditional herbal formulas, and Qi and flavor theory, without combining them with WM [7]. For exam-

ple, according to a review comparing acua-acupuncture in TCM and pharmacopuncture in KM, acua-acupuncture uses herbal medicines mainly composed of *Salviae Miltiorrhizae Radix* and *Angelicae Gigantis Radix* along with various WM medications, and pharmacopuncture most often uses bee venom (BV) [9].

According to the analysis of 37,490 acupuncture treatments, including 3,398 pharmacopuncture treatments collected from 222 KM doctors (KMDs) in South Korea, pharmacopuncture is a safe treatment with rare adverse events [10]. A systematic review investigating BV pharmacopuncture, the most frequently used pharmacopuncture in South Korea [9], showed a significantly higher frequency of an adverse reaction of itchiness with pharmacopuncture than the control group (risk ratio, 6.68; 95% confidence intervals, 2.37 to 18.84) [11]. In South Korea, the Ministry of Health and Welfare in September 2018 introduced the Accreditation System of External Herbal Dispensaries, resulting in improved and standardized quality of pharmacopuncture [12]. Pharmacopuncture is presently a non-insured treatment at KM clinics, and more than 65% of the clinics that provide non-insured treatment have adopted this treatment [13].

Bibliometric analysis analyzes and maps bibliographic indicators in published documents for a given topic using statistical and mathematical methods. Compared with a meta-analysis, this methodology quantitatively summarizes the bibliographic characteristics of a research topic, thus helping to identify relevant research articles in a particular field of interest [14]. As a unique type of Korean acupuncture, pharmacopuncture was first described in the early 20th century [15], and preclinical and clinical studies on this treatment have been conducted [7]. Although a review article longitudinally analyzed pharmacopuncture studies published in South Korea until 2014 [7], new studies have been published in this field for approximately 10 years since then. A short review by Litscher et al. described a bibliometric analysis of pharmacopuncture studies published up to 2012, but acua-acupuncture in TCM and pharmacopuncture in KM were not distinguished; furthermore, the analytical method used was simple and lacked visualization [16]. Therefore, this study was performed to investigate the research trends in pharmacopuncture through a bibliometric analysis using VOSviewer.

MATERIALS AND METHODS

1. Search strategy

The Science Citation Index Expanded (SCIE) database and

the Emerging Source Citation Index (ESCI) were searched within the Web of Science Core Collection. The search terms were pharmacopuncture and pharmaco-puncture, and these terms were searched as the topic (i.e., title, abstract, or keywords). There were no restrictions for the literature type filter and publication language. The search query was as follows: TI = (pharmacopuncture) OR TI = (pharmaco-puncture). The search date was May 23, 2023, and 185 studies retrieved up to this date were included. The bibliometric information of the studies was downloaded in a “plain text” format, with the option of “full record with cited references.”

2. Analytical strategy

This bibliometric analysis used the software VOSviewer version 1.6.19 (Centre for Science and Technology Studies, Leiden University, Leiden, The Netherlands). The “plain text” format from the Web of Science Core Collection was imported into this software for analysis after performing data clearing to merge synonyms. The modifications to the “plain text” file after a manual review of the extracted keywords and organizations were as follows: 1) Keywords: the keywords “bee venom acupuncture” and “bee venoms” were changed to “bee venom”; “herbal acupuncture” was changed to “pharmacopuncture”; “Korean traditional medicine” and “traditional Korean medicine” were changed to “Korean medicine.” 2) Organizations: “Haeundae Jaseng Hospital of Korean Medicine” and “Jaseng Hospital of Korean Medicine” were changed to “Jaseng Medical Foundation”; “Kyung Hee University Hospital at Gangdong” was changed to “Kyung Hee University.”

The year of publication of the documents was analyzed in order of frequency. VOSviewer was used to rank the most productive authors on this topic. Productivity was evaluated by calculating the number of documents, number of citations, and total link strength (TLS) values. In the case of TLS, the higher the number is, the stronger the connectivity with other nodes (i.e., authors). Moreover, the study examined the journals that most frequently published research in this field. As of 2021, these journals are classified as ESCI or SCIE, according to the Journal Citation Reports by Clarivate.

Keyword co-occurrence analysis for author keywords was performed to investigate research topics among pharmacopuncture studies. The counting method was “full counting,” with the minimum number of occurrences of a keyword = “3.” The resolution and minimum cluster size were set to “0.3” and

“1”, respectively, for the cluster map. Cooperation pattern analysis for authors was performed to investigate author patterns in pharmacopuncture research. The counting method was “full counting,” and the minimum number of documents of an author was “5.” Resolution and minimum cluster size were set to “1.0” and “1,” respectively, for the network map.

3. Ethical consideration

This study was based on published documents; therefore, ethical approval was not required.

the number of studies on pharmacopuncture has gradually increased, with most studies published in 2020 (46 studies). The number decreased to 22 studies in 2021 but increased to 27 in 2022. Recently, pharmacopuncture has been considered in the context of developing clinical practice guidelines (CPGs) for KM. According to a survey for developing KM CPGs for rheumatoid arthritis in 2023, pharmacopuncture was a highly preferred treatment by KMDs for this condition, followed by acupuncture and herbal medicine [17]. According to the estimated linear trend line, pharmacopuncture studies have increased with a slope of 1.70 (Fig. 1).

RESULTS

1. Distribution by publication years

In a review article by Yin et al. in 2007 [8], pharmacopuncture was introduced as “new practical and integrated forms of therapeutic modalities” of Korean acupuncture. Since then,

2. Distribution by authors

The most productive (documents: 29) and influential (citations: 248, TLS: 123) author on pharmacopuncture was In-Hyuk Ha from Jaseong Medical Foundation. Six of the top 10 productive authors on pharmacopuncture were from Jaseong Medical Foundation (60%), a private medical foundation. Three

Number of publications

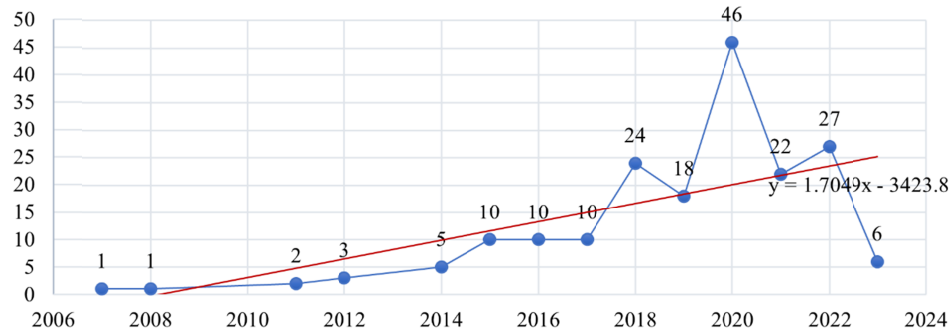


Figure 1. The number of annual publications on pharmacopuncture (published up to 23 May 2023). Note. The x-axis corresponds to the year of publication, and the y-axis corresponds to the number of publications. The red line corresponds to the linear trend line.

Table 1. The highly productive authors on pharmacopuncture

Rank	Author	Nationality	Affiliation	Documents (% of 185)	Citations	TLS
1	Ha, In-Hyuk	South Korea	Jaseng Medical Foundation	29 (15.68)	248	123
2	Lee, Yoon Jae	South Korea	Jaseng Medical Foundation	20 (10.81)	179	102
3	Lee, Jinho	South Korea	Jaseng Medical Foundation	19 (10.27)	211	96
4	Shin, Joon-Shik	South Korea	Jaseng Medical Foundation	16 (8.65)	228	88
	Kim, Me-Riong	South Korea	Jaseng Medical Foundation	16 (8.65)	206	94
	Hwang, Ji Hye	South Korea	Gachon University	16 (8.65)	62	17
7	Shin, Byung-Cheul	South Korea	Pusan National University	14 (7.57)	178	70
8	Lee, Myeong Soo	South Korea	Korea Institute of Oriental Medicine	13 (7.03)	167	52
9	Kim, Kyeong Han	South Korea	Woosuk University	9 (4.86)	31	6
10	Park, Ki Byung	South Korea	Jaseng Medical Foundation	7 (3.78)	137	51

TLS, total link strength.

authors were affiliated with universities (30%), and one was affiliated with the Korea Institute of Oriental Medicine (10%), which is a government-funded research institute (Table 1).

3. Distribution by journals

The most popular journal in this field was the Journal of Acupuncture and Meridian Studies (documents: 31, citations: 71), and the most influential journal in this field was Evidence-based Complementary and Alternative Medicine (documents: 14, citations: 152). Two (20%) of the top 10 journals were indexed in ESCI, and the remaining eight (80%) were indexed in SCIE. The journal with the highest journal impact factor (5.075 in 2021) was Toxins (Basel) (Table 2).

4. Frequently cited articles

The most frequently cited publication on pharmacopuncture was the review by Yin et al. [8] (citations: 40) published in 2007. This review introduced the basic concept and history of pharmacopuncture [8]. Two [18, 19] of the 10 most frequently cited publications were animal experiments, and a study by Luna et al. [18] (citations: 38) reported the benefits of acepromazine injection into an acupuncture point (i.e., Governor Vessel 1) as a concept of pharmacopuncture in horses. Another animal study by Cai et al. [19] (citations: 33) reported that BV injected into an acupuncture point (i.e., Stomach Meridian 36) in a mouse model of amyotrophic lateral sclerosis showed proinflammatory and neuroprotective effects through involvement in the endogenous immune modulatory system of the central nervous sys-

tem. Among these 10 publications, four clinical studies [20-23] were included, and a retrospective chart review by Kim et al. [20] (citations: 35) analyzed the safety of acupuncture and pharmacopuncture using data from approximately 80,000 patients. As a result, these treatments showed a safe profile, and hypersensitivity to BV (incidence rate: 0.23%) was relatively common [20]. A case series by Park et al. [21] (citation: 34) reported symptomatic improvement by BV pharmacopuncture in three out of four patients with chemotherapy-induced peripheral neuropathy. In a retrospective chart review by Lee et al. [23] (citations: 26), data from 12 KM hospitals were analyzed to evaluate the use of pharmacopuncture in patients with musculoskeletal disease, and the results showed that this treatment was performed for 98.6% of inpatients and 77.6% of outpatients. A randomized sham-controlled clinical trial by Seo et al. [22] (citations: 26) reported significant clinical benefits after 3 weeks of BV pharmacopuncture in 54 patients with nonspecific chronic lower back pain. Two systematic reviews [1, 24] were included in the frequently cited publications on pharmacopuncture. A review by Kim et al. [24] (citations: 31) found that pharmacopuncture reduced body weight in overweight patients (Hedges' $g = 0.411$). Another review by Park et al. [1] (citations: 26) analyzed 29 randomized controlled clinical trials using pharmacopuncture published in Korea up to 2014 and suggested the clinical potential of pharmacopuncture for obesity and musculoskeletal disorders (Table 3).

5. Keyword co-occurrence analysis

A network of author keywords of the studies included in the

Table 2. The popular journals in which pharmacopuncture researches were published

Rank	Journals	Documents (% of 185)	Citations	Index (2021)	JIF (2021)
1	Journal of Acupuncture and Meridian Studies	31 (16.76)	71	ESCI	N/A
2	Journal of Pharmacopuncture	28 (15.14)	38	ESCI	N/A
3	Medicine (Baltimore)	15 (8.11)	65	SCIE	1.817
4	Evidence-based Complementary and Alternative Medicine	14 (7.57)	152	SCIE	2.650
5	European Journal of Integrative Medicine	10 (5.41)	49	SCIE	1.813
6	Toxins (Basel)	7 (3.78)	75	SCIE	5.075
7	BMC Complementary and Alternative Medicine	6 (3.24)	76	SCIE	4.782
8	Complementary Therapies in Clinical Practice	4 (2.16)	10	SCIE	3.577
	Semina-Ciencias Agrarias	4 (2.16)	8	SCIE	0.595
	Integrative Medicine Research	4 (2.16)	5	SCIE	4.473

ESCI, Emerging Source Citation Index; JIF, journal impact factor; N/A, not applicable; SCIE, Science Citation Index Expanded.

Table 3. The frequently cited publications on pharmacopuncture

Rank	Title (journal, year)	Study design	Major findings	Total citations
1	Korean acupuncture: the individualized and practical acupuncture (Neurological Research, 2007)	Narrative review	<i>"New practical and integrated forms of therapeutic modalities, such as herbal acupuncture or pharmacopuncture, have also been developed by Korean acupuncture."</i>	40
2	Comparison of pharmacopuncture, aquapuncture and acepromazine for sedation of horses (Evidence-based Complementary and Alternative Medicine, 2008)	Animal study	<i>"Acepromazine-pharmacopuncture on GV1 in horses produced a mild sedation when compared with the conventional dose of acepromazine."</i>	38
3	To bee or not to bee: the potential efficacy and safety of bee venom acupuncture in humans (Toxicon, 2018)	Narrative review	<i>"In small studies, BV pharmacopuncture has been used in man to successfully treat a number of musculoskeletal diseases such as lumbar disc disease, OA of the knee, RA, adhesive capsulitis, and lateral epicondylitis. ... An important concern is the safety of BV. BV can cause anaphylaxis, and several deaths have been reported in patients who successfully received the therapy prior to the AE."</i>	37
4	Safety of acupuncture and pharmacopuncture in 80,523 musculoskeletal disorder patients: a retrospective review of internal safety inspection and electronic medical records (Medicine (Baltimore), 2016)	Retrospective review	<i>"AEs associated with acupuncture/pharmacopuncture were forgotten needle (n = 47), hypersensitivity to bee venom (n = 37), presyncopic episode (n = 4), pneumothorax (n = 4), and infection (n = 2). ... Incidence of AEs associated with acupuncture/pharmacopuncture treatment was low, and most cases were not serious."</i>	35
5	Effects of sweet bee venom pharmacopuncture treatment for chemotherapy-induced peripheral neuropathy: a case series (Integrative Cancer Therapies, 2012)	Case series	<i>"Marked improvements of VAS, WHO CIPN grade, and physical section scores of FACT-G were seen in 3 patients among 4 patients after sweet BV pharmacopuncture treatment. Most important, there were no related adverse side effects found."</i>	34
6	The effects of bee venom acupuncture on the central nervous system and muscle in an animal hSOD1G93A mutant (Toxins (Basel), 2015)	Animal studies	<i>"BV pharmacopuncture into certain acupoints may act as a chemical stimulant to activate those acupoints and subsequently engage the endogenous immune modulatory system in the CNS in an animal model of ALS."</i>	33
7	Effect of acupuncture and intervention types on weight loss: a systematic review and meta-analysis (Obesity Reviews, 2018)	Systematic review and meta-analysis	<i>"Our study suggests that the effect of acupuncture on weight loss may be maximized when auricular and manual acupuncture or pharmacopuncture treatment is combined with lifestyle modification in patients with overweight."</i>	31
8	Pharmacopuncture in Korea: a systematic review and meta-analysis of randomized controlled trials (Evidence-based Complementary and Alternative Medicine, 2016)	Systematic review and meta-analysis	<i>"This systematic review suggests the potential of pharmacopuncture for obesity and musculoskeletal diseases."</i>	26
	Usage report of pharmacopuncture in musculoskeletal patients visiting Korean medicine hospitals and clinics in Korea (BMC Complementary Medicine and Therapies, 2016)	Retrospective review	<i>"We verified patterns of pharmacopuncture use for musculoskeletal disease treatment in Korea, and use of pharmacopuncture varied depending on disease or symptom severity."</i>	26
	Efficacy of bee venom acupuncture for chronic low back pain: a randomized, double-blinded, sham-controlled trial (Toxins (Basel), 2017)	Randomized controlled clinical trial	<i>"After 3 weeks of the treatment, significant improvements were observed in the bothersomeness, pain intensity, and functional status in the BV pharmacopuncture group compared with the sham group."</i>	26

AE, adverse event; ALS, amyotrophic lateral sclerosis; BV, bee venom; CIPN, chemotherapy-induced peripheral neuropathy; CNS, central nervous system; FACT-G, Functional Assessment Cancer Therapy-General; GV, governor vessel; OA, osteoarthritis; RA, rheumatoid arthritis; VAS, visual analogue scale; WHO, World Health Organization.

keyword co-occurrence analysis was constructed. Three clusters found in this network were “pharmacopuncture,” “Korean medicine,” and “acupuncture.” The cluster “pharmacopuncture” was far from the cluster “acupuncture” and close to the cluster “Korean medicine,” suggesting that pharmacopuncture was originally studied in the context of acupuncture; however, the topic of pharmacopuncture gradually and independently strengthened. One of the core nodes of the cluster “Korean medicine” was “BV.” “Pharmacopuncture” and “BV” were included in different clusters, which is consistent with the tendency of some studies to consider and describe pharmacopuncture as a treatment using materials excluding BV [20]. The nodes included in the cluster “pharmacopuncture” with materials other

than BV included “hominis placenta” and “MOK.” The most remarkable feature of the overlay visualization network graph is that the highest level of evidence in the hierarchy of evidence-based medicine (EBM), such as “pragmatic clinical trials,” “randomized controlled trials,” and “clinical practice guidelines,” has recently been introduced into research in this field (Fig. 2).

6. Cooperation pattern analysis

In a network of cooperation pattern analysis, the blue cluster of Hwang et al. was isolated on the right side. This cluster of researchers has published several pharmacopuncture studies since 2017. These researchers included Ji Hye Hwang, affli-

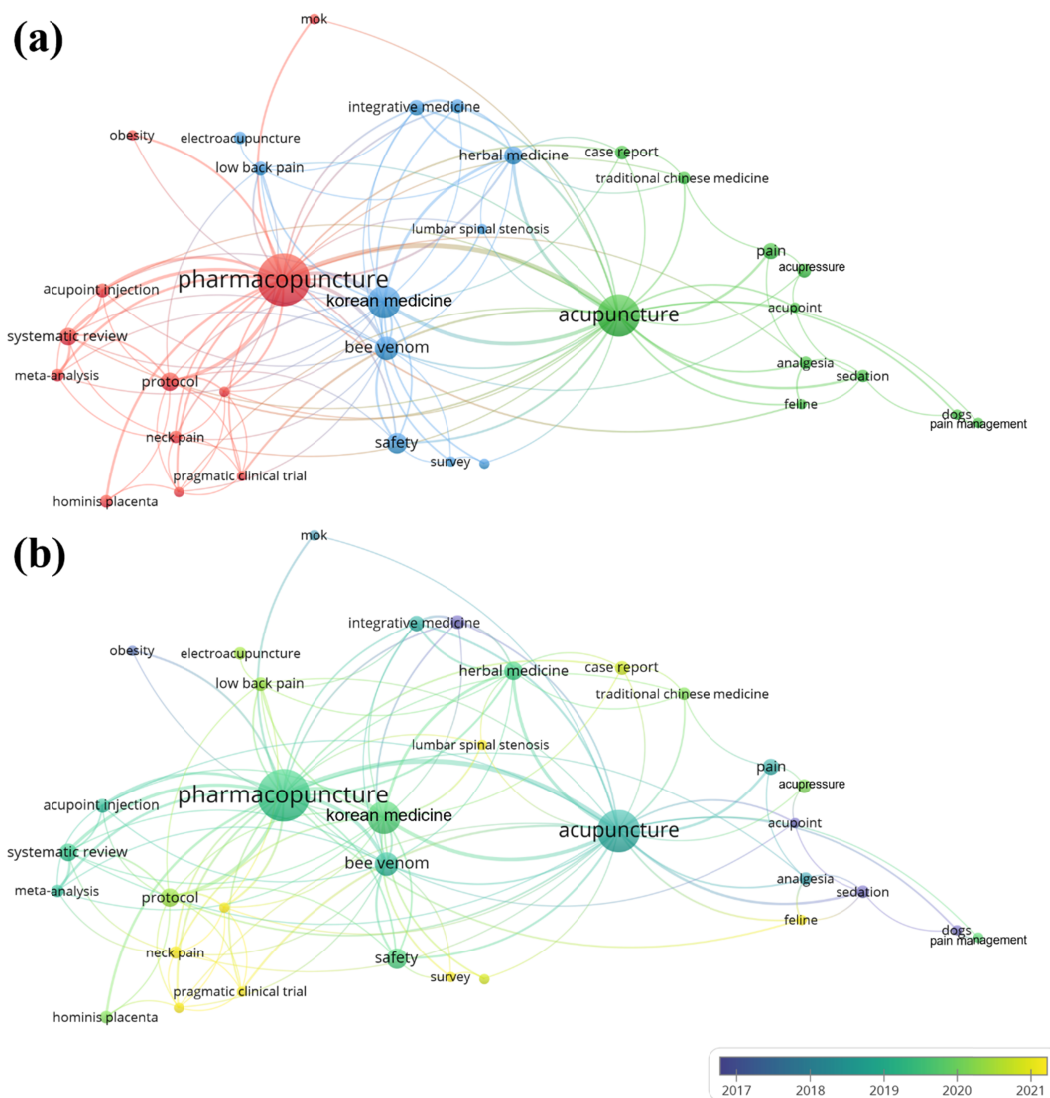


Figure 2. Keyword co-occurrence analysis of author keywords in pharmacopuncture studies: (a) Keyword co-occurrence network graph; and (b) Overlay visualization network graph. Note. Red cluster: pharmacopuncture; Blue cluster: Korean medicine; Green cluster: acupuncture.

ated with Gachon University, and Jaseung Ku and Chul Jung, affiliated with KM clinics. Their studies comprised several case reports [25-27] and in vivo or in vitro experiments [28-32]. In this cluster, Jaseung Ku was considered a current researcher. Clusters on the left side of the network were researchers who had conducted clinical studies on pharmacopuncture. Among them, In-Hyuk Ha was the largest and most central node. His early study on pharmacopuncture prospectively observed the long-term effects of integrative therapy, including pharmacopuncture in lumbar disc herniation [33]. His recent studies included a survey to develop a KM CPG for scoliosis [34] and a pragmatic randomized controlled trial protocol to investigate the effectiveness and safety of pharmacopuncture for chronic lower back pain [35]. These clusters were dense and overlapping, but Kyeong Han Kim and Soo-Hyun Sung were located laterally. These researchers were affiliated with the Jaseng Medi-

cal Foundation, universities, and government-funded research institutes. In the nodes of these clusters, Kyoung Sun Park, Eun-Jung Kim, and Soo-Hyun Sung were the most current researchers (Fig. 3).

DISCUSSION

1. Trends in pharmacopuncture research

This bibliometric analysis investigated the trends in pharmacopuncture research. Overall, the number of studies on pharmacopuncture has gradually increased since the mid-2000s. Interestingly, 2020, the year the coronavirus disease 2019 (COVID-19) pandemic was declared, was the year with the most pharmacopuncture publications (46 studies). However, among the 185 studies included in the analysis, there were no

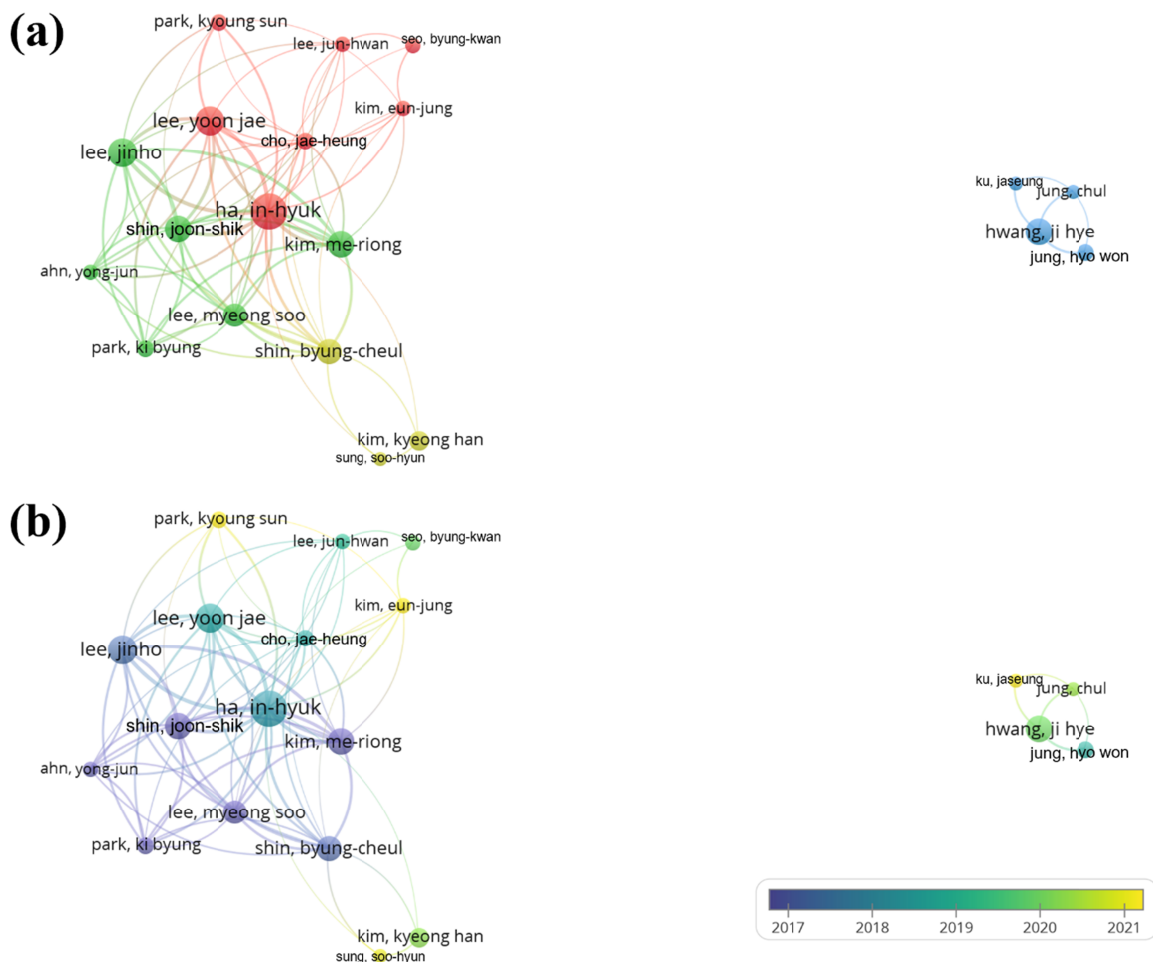


Figure 3. Cooperation pattern analysis of author in pharmacopuncture studies: (a) Cooperation pattern analysis network graph; and (b) Overlay visualization network graph. Note. Red cluster: In-Hyuk Ha; Green cluster: Jinho Lee; Yellow cluster: Byung-Cheul Shin; Blue cluster: Ji Hye Hwang.

studies related to COVID-19; therefore, changes in the research environment caused by COVID-19 could have affected researchers in this field. Over time, studies on pharmacopuncture have increased the level of evidence in the context of EBM. For example, recent surveys of KMDs [17, 34] examining the use of pharmacopuncture in the context of KM CPG development, randomized controlled trials [3, 4, 22, 35] using pharmacopuncture, and a meta-analysis [1] have been conducted. These results can be interpreted as the quantitative and qualitative growth of pharmacopuncture studies in Korea.

Despite the increase in pharmacopuncture studies, the bibliometric analysis results showed limited scope. Specifically, according to the keyword co-occurrence analysis of author keywords, research topics in this field are focused on musculoskeletal pain, such as lower back pain, lumbar spinal stenosis, and neck pain. Non-musculoskeletal conditions evaluated in pharmacopuncture research included obesity, but with a small node size; thus, there were few studies. Similar results were found in a systematic review of pharmacopuncture by Park et al. [1], which reported the clinical potential of pharmacopuncture for obesity and musculoskeletal disorders. A narrow scope was also observed in the medicinal materials used in pharmacopuncture. Although KMDs have used various medicinal materials in pharmacopuncture in clinical settings [8], the conducted studies mainly focused on BV. Although relatively rare, *hominis placenta* and MOK (i.e., a polyherbal extract) have also been investigated. Among the 10 frequently cited publications on pharmacopuncture investigated in this study, four [19, 21, 22, 36] directly and four [1, 8, 20, 23] indirectly dealt with BV.

Few researchers have conducted studies on this topic. Specifically, as a result of analyzing the distribution by authors of studies in this field, most of the productive and influential authors were Korean researchers. Some non-Korean researchers also reported novel and impactful research [18], but it was sporadic and did not achieve quantitative or qualitative growth. According to the results of a cooperation pattern analysis, the authors of pharmacopuncture studies could be divided into two unconnected groups. The large-scale group is an active pharmacopuncture research group, and Jaseng Medical Foundation (which the most productive and influential author, In-Hyuk Ha, is affiliated with) occupies a core position. Jaseng Medical Foundation owns the largest private KM hospitals in Korea, and these hospitals treat musculoskeletal disorders such as lower back pain. The periphery of these core researchers comprised researchers from universities or government-funded research

institutes. Their human and material resources are related to the discovery that pharmacopuncture studies have focused on musculoskeletal disorders in Korea. However, the small-scale group included professor Ji Hye Hwang from Gachon University and researchers from KM clinics. Pharmacopuncture studies conducted by this group were not limited to musculoskeletal disorders but also included several non-clinical experiments [28-32] and studies on non-musculoskeletal conditions such as thyroid dysfunction [30], obesity [25], and systemic sclerosis [27]. Interestingly, they recently also published an *in vivo* study [28] to test the toxicity of pharmacopuncture using a new solution, no-pain pharmacopuncture.

The most popular journal of pharmacopuncture research was the *Journal of Acupuncture and Meridian Studies*, followed by the *Journal of Pharmacopuncture*. Both these journals are published by the Korean Pharmacopuncture Institute, a corporation specializing in pharmacopuncture in Korea. Other than these two journals, there were no pharmacopuncture-specific journals among the higher-ranked journals. Importantly, no journal is indexed to the SCI focusing on pharmacopuncture. However, given that the *Journal of Acupuncture and Meridian Studies* and the *Journal of Pharmacopuncture* are indexed in the ESCI, the first SCI index journal related to pharmacopuncture could be one of them. As described above, pharmacopuncture research in Korea has grown both quantitatively and qualitatively, and considering that musculoskeletal pain has been intensively studied, it is regrettable that these studies have rarely been published in mainstream pain-related journals [35, 37-41] (6/185, 3.24%).

2. Suggestions for future studies in this field

Based on the findings of the bibliometric analysis, the author would like to offer the following suggestions for future studies in this field. First, pharmacopuncture is considered unique and distinguished from *acua-acupuncture* of TCM due to its emphasis on KM theories, including meridian theory, traditional herbal formulas, and Qi and flavor theory [7, 9]. However, among the published pharmacopuncture studies, those conducted with designs reflecting KM theory seemed lacking. Luna et al. in 2008 [18] reported a distinct effect when acepromazine was injected into the acupuncture point, but there has been a lack of studies reflecting this KM theory since then. Therefore, study designs to characterize the nature of pharmacopuncture are recommended; for example, the differential effectiveness

and safety of pharmacopuncture based on pattern identification may be investigated. However, expanding the scope of pharmacopuncture and embracing research regarding the injection of natural products will help to develop studies on pharmacopuncture and overcome the research pool limited to Korean researchers. For example, a research team in India reported an *in vivo* study of Injection Harsha 22, a polyherbal formulation [42], and such studies on injectable natural products could be linked to pharmacopuncture research in Korea. Second, studies on the therapeutic mechanisms underlying various medicinal materials in pharmacopuncture are encouraged. Although various medicinal materials are used by KMDs for pharmacopuncture in clinical settings, studies on individual components of pharmacopuncture have been mainly confined to BV. It is essential to fill this research gap and evaluate materials other than BV to revitalize quantitative and qualitative pharmacopuncture research. Based on these findings, the most promising individual materials for pharmacopuncture after BV include *hominis placenta* and MOK. Furthermore, new promising medicinal materials for pharmacopuncture developed via historical data analysis and preclinical experiments are needed. Third, although pharmacopuncture studies in Korea have accumulated high-level clinical evidence, mainly in musculoskeletal pain, they have been published in complementary and integrative medicine journals. Publishing high-level clinical research on pharmacopuncture for musculoskeletal pain in pain-specific mainstream journals will promote the globalization of pharmacopuncture and facilitate the establishment of pharmacopuncture research networks with researchers in other countries. Fourth, in addition to its use in musculoskeletal conditions or obesity, efforts are necessary to discover promising clinical conditions for introducing pharmacopuncture. As in the case of professor Ji Hye Hwang in the cooperation pattern analysis, a model in which researchers from universities and researchers from KM clinics who treat various diseases can collaborate should be encouraged. In the current research landscape of pharmacopuncture in Korea, studies centered at Jaseng Medical Foundation may provide a higher level of evidence on pharmacopuncture for musculoskeletal conditions, and studies involving researchers from local KM clinics will help to expand the indications for pharmacopuncture.

3. Strengths and limitations

This study is the first to analyze research trends in pharma-

copuncture in detail through a bibliometric analysis; however, it has the following limitations. First, this study selected the SCIE and ESCI as databases of interest through the Web of Science Core Collection. Therefore, some pharmacopuncture studies published in journals not indexed in the SCIE or ESCI databases could have been omitted. Furthermore, depending on when the journal was indexed in the SCIE or ESCI database, some relevant studies may have been missing from inclusion in this study. Second, bibliometric analysis and visualization using VOSviewer is prone to manipulation by changes in software settings. Therefore, the results of this study may be influenced by the author's subjective judgment. Third, there have been legal issues related to the methods of performing pharmacopuncture and its research in Korea, and these issues may be related to the changes in research trends identified in this study; however, our study did not analyze their relevance.

CONCLUSION

The number of studies on pharmacopuncture has gradually increased since the mid-2000s. In addition, the quality of the studies has also steadily increased, and recently, randomized controlled trials of pharmacopuncture have been conducted. This treatment has also been investigated in the context of KM CPG development. However, the present scope of pharmacopuncture studies is limited to musculoskeletal pain and BV pharmacopuncture, suggesting the existence of gaps between the use of pharmacopuncture by KMDs in clinical settings and pharmacopuncture research. These findings may be used as data to expand and globalize pharmacopuncture research in the future.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

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