



Global Research Trends on Herbal Medicine for Hypertension: A Bibliometric and Visual Analysis from 1979 to 2025

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Abstract

Hypertension is a major risk factor for cardiovascular disease globally. Despite widespread availability of conventional treatments, blood pressure control rates remain low globally. Herbal medicine is an alternative or complementary medicine that is gaining increasing attention. Scientific analysis is needed to understand the dynamics of global research on this topic. This study uses a data-driven bibliometric approach from *Scopus*, covering publications from 1979 to 2025. The analysis was conducted using *Biblioshiny* and *VOSviewer* software to evaluate publications, collaborations and keyword trends. A total of 2,954 documents were analysed with an annual growth rate of publications of 9.74 % and an average of 31.38 citations per document. China, the United States and India were the countries with the highest contributions in terms of both publications and citations. Institutions such as the China Academy of Chinese Medical Sciences and China Medical University emerged as the most active research centres. Plants such as *Allium sativum*, *Hibiscus sabdariffa* and *Olea europaea* were the main focus of research. Keyword clusters indicated two major focuses: clinical and pharmacological aspects. International collaboration was still relatively low (17.81 %) but showed potential for growth. Research on herbal medicine for hypertension shows steady growth and multidisciplinary approaches.

Key words: Hypertension; Herbal medicine; Antihypertensive agents; Complementary therapies.

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Introduction

Hypertension or high blood pressure is one of the main risk factors for cardiovascular disease, which is the number one cause of death globally.¹ According to *the World Health Organisation* (WHO), around 1.28 billion adults aged 30-79 years worldwide have hypertension, with two-thirds of them living in low- and middle-income

countries.^{2, 3} Despite the availability of various conventional antihypertensive drugs, the global blood pressure control rate is still low, only around 14 %. Factors such as drug side effects, high treatment costs and low patient compliance with long-term treatment are challenges in hypertension management.^{4, 5}

Herbal medicine has long been part of traditional medicine systems in various cultures and is gaining increasing attention as an alternative or complement to conventional therapies for hypertension.⁶ In recent decades, scientific research on the potential of medicinal plants to treat hypertension has grown rapidly.⁷ Various studies have identified the antihypertensive mechanisms of plant extracts and their bioactive compounds, such as inhibition of angiotensin-converting enzyme (ACE), diuretic effects, antioxidants and vasodilators.^{8,9} Some medicinal plants that have been shown to have antihypertensive effects include garlic (*Allium sativum*), roselle (*Hibiscus sabdariffa*), olive (*Olea europaea*). Several other plant species have also been widely studied for their antihypertensive potential, including *Rauwolfia serpentina*, *Camellia sinensis*, *Panax ginseng* and *Ginkgo biloba*.^{10,11}

Despite the increasing number of scientific publications on herbal medicine for hypertension, there has been no comprehensive analysis of global research trends in this field.¹² Bibliometric analysis is a quantitative method that allows the assessment of the structure and dynamics of scientific research by analysing publications, citations and collaborations in a specific field. This approach can identify research trends, key contributors and knowledge gaps that can inform future research directions.^{13,14}

This study aimed to conduct a bibliometric analysis of the global literature on herbal medicine for hypertension published from 1979 to 2025. Specifically, this study analysed the development of publications, primary publication sources, most productive authors and institutions, international collaboration patterns and research topic trends in this field.

Methods

This study used a bibliometric analysis approach to explore trends and patterns in global scientific literature related to herbal medicine for hypertension published during the period 1979 to 2025. Some of the main components analysed in this study included: types and languages of documents, developments in the number of publications per year, the most frequently used keywords, citation analysis and the number of cited articles, countries with the most cited publica-

tions and patterns of international collaboration in herbal medicine research for hypertension.¹⁵

Database

The data source for this bibliometric analysis came from the *Scopus* database, which was accessed on 10 May 2025. *Scopus* was chosen because it has a wide indexing coverage, high data quality and complete metadata, including information on authors, institutional affiliations, keywords, publication sources and data citations. Data were obtained using the following search string: (“herbal medicine” OR “hypertension”). Only documents with the types of original articles (original research), review articles and conference papers were included. Documents such as editorials, letters to the editor and non-peer-reviewed publications were excluded from the analysis.^{16,17}

Bibliometric indicators

Bibliometric indicators analysed in this study included: (1) document type and language, (2) annual publication development during the period 1979-2025, (3) the most relevant publication sources, (4) the most productive authors, (5) the most influential institutions, (6) country of origin of corresponding author, (7) the most cited country. Data on the most active and most cited authors, institutions and publications were collected directly from *Scopus* by calculating the number of citations and documents published per year. For data visualisation, software was used namely *Biblioshiny* (R Studio).^{18,19}

Results

Bibliometric analysis of publications related to herbal medicine for hypertension during the period 1979 to 2025 produced a total of 2,954 documents spread across 1,183 scientific publication sources. The annual growth of publications reached 9.74 %, with an average document age of 10.2 years and an average of 31.38 citations per document. Content analysis showed that there were 25,725 keyword pluses and 6,129 keywords from authors, reflecting the diversity of research topics. A total of 10,935 authors were involved, with 250 authors writing documents individually. The average number of authors per document was 5.33 and 17.81 % of publications were the result of international collaboration (Table 1).

Table 1: Descriptive statistics of publications related to herbal medicine for hypertension in the period 1979-2025 based on data from Scopus

Category	Mark
Main information about data	
Timespan	1979:2025
Sources (journals, books, etc)	1183
Documents (doc)	2954
Annual growth rate (%)	9.74
Document average age	10.20
Average citations per doc	31.38
References	0
Document contents	
Keywords Plus (ID)	25725
Author's Keywords (DE)	6129
Authors	
Authors	10935
Authors of single-authored docs	250
Authors collaboration	
Single-authored docs	292
Co-authors per doc	5.33
International co-authorships (%)	17.81

Publication trends

In the early period, from 1979 to around 2000, research activity was minimal with the number of articles approaching zero. However, after 2000, there was a gradual increase in article production with some fluctuations. A significant acceleration began around 2010, when the number of articles steadily increased to around 60-80 per year. From 2015 to 2020, there was a dramatic growth, reaching around 200 articles per year. The most significant peak occurred around 2022, when the

number of articles reached almost 250 before experiencing a sharp decline the following year, dropping to levels comparable to 2015. Figure 1 provides a clear visual representation of how scientific interest and attention in herbal medicine for hypertension has evolved over the past four decades. The sharp increase during 2020-2022 may reflect breakthroughs in research methodology, increased funding and attention to complementary medicine approaches, or increased interest in alternative medicine during the global pandemic. The subsequent decline may indicate a phase of consolidation or a shift in research priorities. Thus, this graph not only shows research trends but also indicates key periods in the development of the science in this area, reflecting how herbal approaches to the management of hypertension have transitioned from a highly niche area to a significant research domain with substantial scientific attention.

Co-occurrence network

The results of the bibliometric analysis in Figure 2 show a visualisation of the co-occurrence network of keywords that frequently appear together in publications on herbal medicine for hypertension in the period 1979-2025. This network was built using keyword analysis taken from publication metadata, which was then mapped based on the strength of the relationship between keywords using *VOSviewer* software. In this visualisation, nodes (circles) represent keywords, while the size of the node indicates the frequency of occurrence of the keyword. Meanwhile, the connecting lines between nodes (edges) indicate the strength of the co-occurrence relationship; the

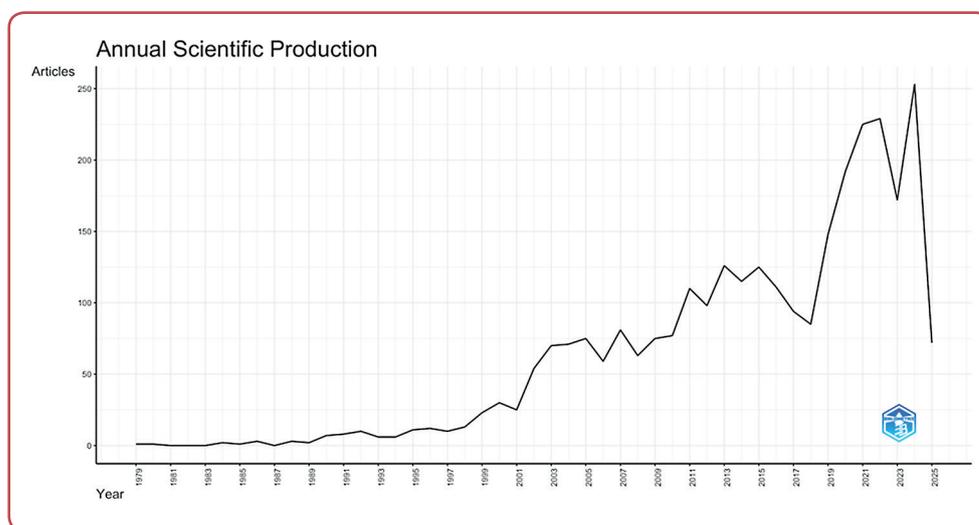


Figure 1: Precision study for hypertension created in Biblioshiny. Number of scientific articles published each year on “Global research trends on herbal medicines for hypertension” from 1979 to 2025.

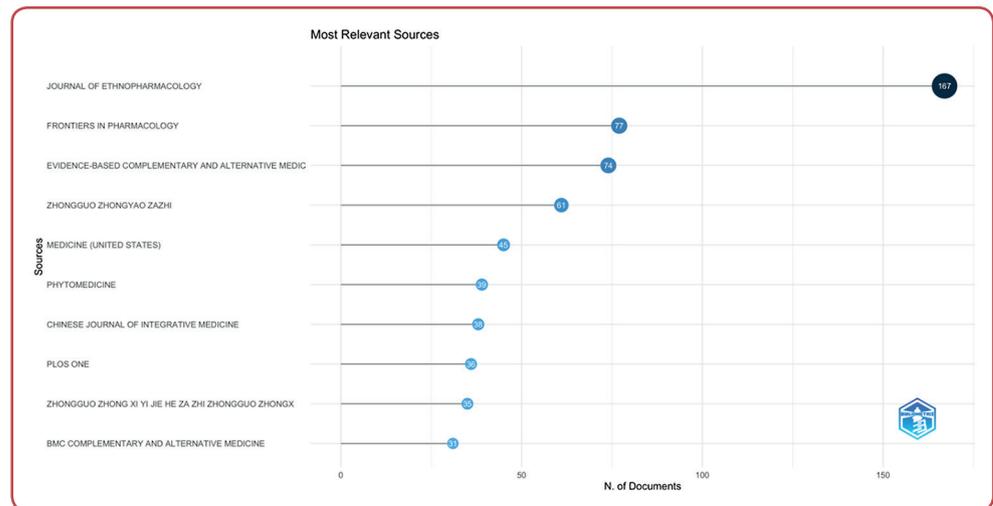


Figure 3: The most relevant publication sources related to hypertension disease (1979-2025), based on the number of published documents. Visualisation created using Biblioshiny

ciplinary journals such as “Plos One”, “Zhongguo Zhong Xi Yi Jie He Za Zhi Zhongguo Zhongx” and “BMC Complementary and Alternative Medicine” also showed significant contributions in disseminating research on herbs for hypertension, indicating that this topic has received attention from the conventional medical community. These findings indicate that research on herbal medicine for hypertension is published in various journals with diverse focuses, from ethnopharmacology and traditional medicine journals to cardiovascular medicine journals, which strengthens the multidisciplinary nature of this research field.²⁰

The most productive authors

The results of the bibliometric analysis in Figure 4 show the list of the most productive authors in the field of herbal medicine research for hyper-

tension during the period 1979-2025 based on the number of documents published. This graph shows that several authors consistently produce a large number of scientific contributions, reflecting their dominance in herbal medicine research for hypertension. Author Wang Y was ranked first with a total of 64 documents, followed by Li Y with 60 documents and Zhang Y with 60 documents. These authors appear to have an intensive research focus in the field of herbal pharmacology, especially for hypertension and are likely to be involved in various international collaborations and large projects. Other authors who also recorded high productivity were Liu Y (51 documents), Chen Y (50 documents), Wang J (47 documents), Wang X (44 documents) and Li X (42 documents). Meanwhile, names such as Liu J and Li J, although at

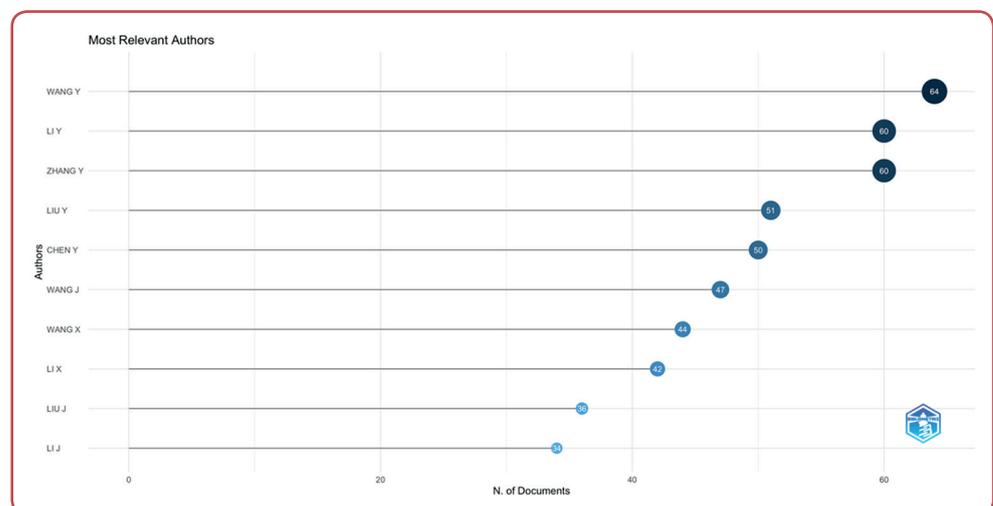


Figure 4: List of most productive authors in hypertension research (1979–2025) based on the number of published documents. Visualisation created using Biblioshiny.

the bottom of the graph, still show a significant number of publications above 30 documents. These data reflect the consistent contribution of a number of researchers in supporting scientific progress in the field of herbal medicine for hypertension and opening up opportunities for collaboration across institutions and countries.²¹

The most relevant affiliations

The results of the bibliometric analysis in Figure 5 show the most relevant or influential affiliated institutions in publications related to herbal medicine for hypertension during the period 1979-2025.²² This affiliation is assessed based on the number of articles published by researchers under the auspices of the institution. China Academy of Chinese Medical Sciences is in the top position with a total of 108 articles, making it the most active institution in scientific contributions to herbal medicine research for hypertension. Followed by China Medical University with 102 articles, strengthening China's position as a leading research centre in this field. Other renowned institutions such as Beijing University of Chinese Medicine (90 articles), Mashhad University of Medical Sciences (90 articles) and China Medical University Hospital (66 articles) also play an important role in producing high-quality research. Affiliations from various countries have also made significant contributions, such as Shanghai University of Traditional Chinese Medicine (60 articles), indicating the dominance of institutions from China in herbal medicine research for hypertension. This reflects the long tradition of herbal medicine in the Chinese health system and the national focus on the scientific validation

of traditional medicine. Other institutions from other countries that made the top list included Kyung Hee University, Chinese University of Hong Kong, Tehran University of Medical Sciences and Chengdu University of Traditional Chinese Medicine. This geographic diversity shows that herbal medicine research for hypertension has become a global concern, albeit with a high concentration in East Asia.²³

Corresponding author's countries

The results of the bibliometric analysis in Figure 6 show the distribution of documents based on the country of origin of the corresponding author in herbal medicine research for hypertension during the period 1979-2025.^{24,25} This graph illustrates two types of publications: single country publications (SCP) and multiple country publications (MCP), which represent the level of international collaboration of each country. China ranks highest as the country with the largest number of publications, both from domestic (SCP) and international (MCP) collaborations, with a total of more than 750 documents. It is followed by the United States (USA) which also shows a large contribution with around 250 publications, with a higher proportion of international collaboration than China. India, Korea, Iran and Japan follow as countries with significant contributions, indicating the high interest in herbal medicine research for hypertension in countries with strong herbal medicine traditions. Countries such as the United Kingdom, Australia, South Africa and Turkey also occupy important positions in scientific publications in this field, indicating the active involvement of Asia, Europe and North America. It is also

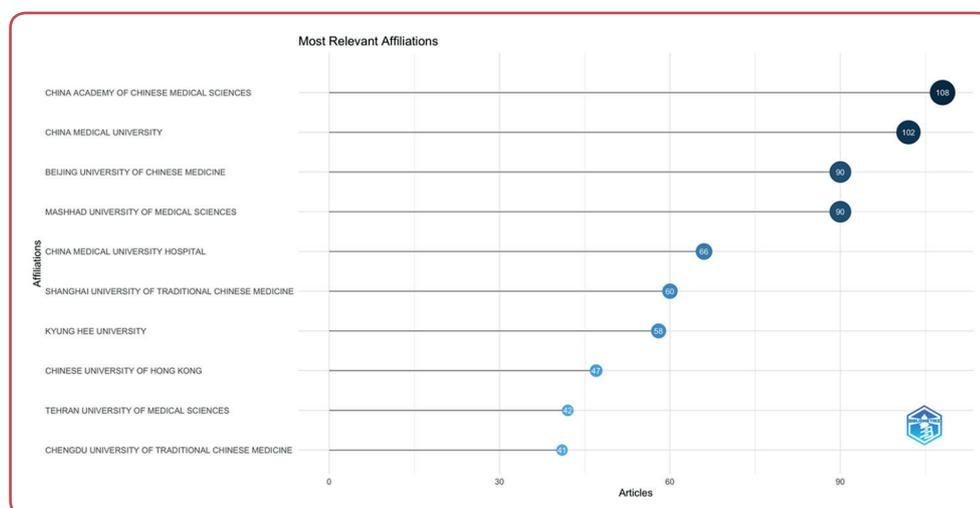


Figure 5: Most relevant institutional affiliations in hypertension research (2023–2025) based on the number of articles published. Visualisation created using Biblioshiny.

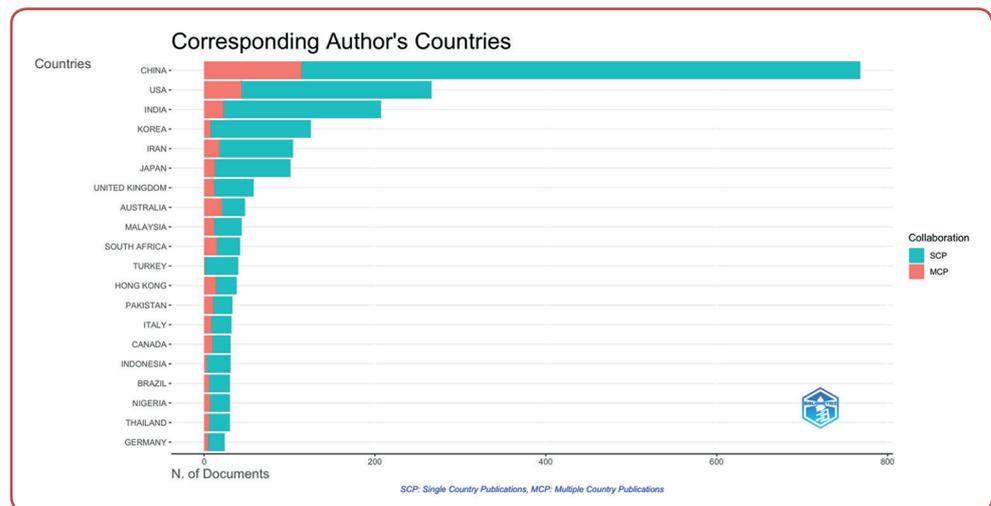


Figure 6: Country of origin of corresponding authors in hypertension publications (1979–2025) with indication of national (SCP) and international (MCP) collaboration. Visualisation created using Biblioshiny.

apparent that countries such as Hong Kong, Pakistan and Italy have a significant share of international collaboration, as indicated by the high proportion of MCPs. This reflects the importance of cross-border collaboration in strengthening the quality and scope of global scientific research on herbal medicine for hypertension.

Scientific production by country

The results of the bibliometric analysis in Figure 7 show a map of the distribution of global scientific contributions related to herbal medicine research for hypertension during the period 1979-2025.²⁶ Darker blue colours indicate a higher number of publications, while light blue to grey colours indicate lower to no contributions. China and the

United States appear to dominate in terms of the number of publications, marked by the striking dark blue colour. Countries such as India, South Korea, Brazil, Japan and several Western European countries (Germany, England, Italy) also show high publication intensity, indicating substantial research activity in the region. East Asia and South Asia appear to be the main centres of research in this field, reflecting the strong tradition of herbal medicine in the region. On the other hand, many countries in Africa, Central America and parts of Central Asia show limited participation or even no recorded contributions. This map illustrates the geographical imbalance in scientific production, with countries with strong herbal medicine traditions and established research

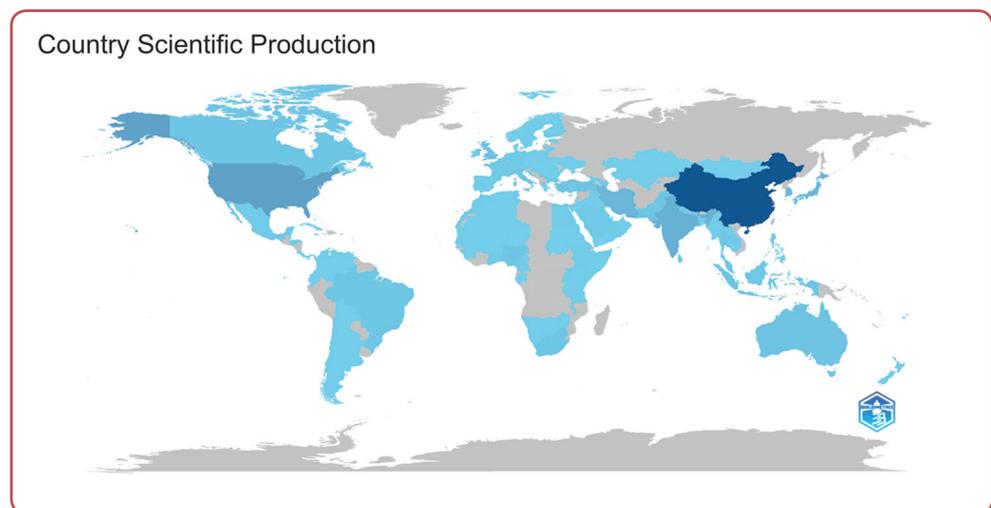


Figure 7: World map of scientific production related to hypertension by author's country of origin. Dark blue indicates the highest number of publications and light blue to grey indicates lower contributions. Visualisation created using Biblioshiny.

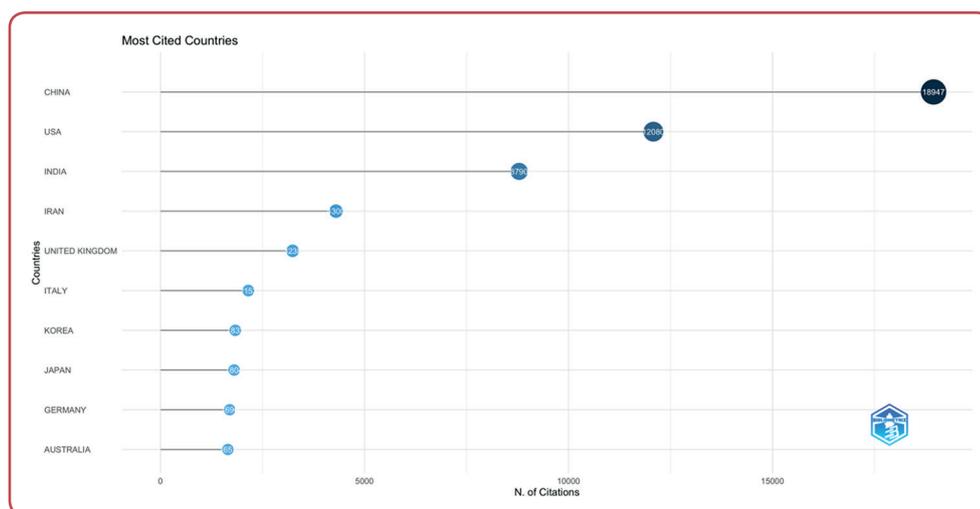


Figure 8: Countries with the highest number of citations in the scientific literature related to hypertension. China and the USA stand out significantly, indicating a high level of influence in the global academic community. Visualisation created using Biblioshiny.

infrastructures becoming the main centres of herbal medicine research for hypertension. However, the increasing contributions from countries such as Brazil, Nigeria and Iran indicate positive developments in the geographical diversification of research in this field.

The most cited countries

The results of the bibliometric analysis in Figure 8 show the countries with the highest number of citations in scientific publications related to herbal medicine for hypertension during the period 1979-2025. China ranks first with a total of 18,947 citations, followed by the USA with 12,080 citations and India with 8,790 citations. This shows that publications from these three countries are not only productive but also have a high scientific impact. Iran, the United Kingdom, Italy, Korea, Japan, Germany and Australia each received less than 5,000 citations, indicating a significant contribution to the development of knowledge in this field. This distribution underlines the dominance of developed countries in terms of scientific influence, although some developing countries are beginning to show increasing visibility and impact in the global scientific community.

Discussion

A bibliometric study of global trends in herbal medicine for hypertension from 1979 to 2025 reveals significant developments in this field, re-

flected by an annual publication growth of 9.74 % with an average of 31.38 citations per document. These findings indicate a substantial increase in scientific interest and impact of herbal medicine research for hypertension as global awareness of alternative approaches to treating a chronic condition with increasing prevalence grows. The publication pattern shows an interesting evolution, with research activity being minimal before 2000, then experiencing a gradual increase with significant acceleration starting in 2010, peaking around 2022 with almost 250 articles before declining. This trend is likely driven by the increasing global prevalence of hypertension, technological advances in phytochemical analysis, a paradigm shift in health systems that increasingly recognise the potential of traditional medicine and an awareness of the limitations of conventional medicine.²⁷ The decline after 2022 may indicate a consolidation phase and a shift from quantitative exploration to a focus on quality and clinical validation.

From a geographical perspective, there was a significant disparity in scientific production, with China dominating in terms of number of publications (> 750 documents) and citations (18,947), followed by the United States (\pm 250 publications, 12,080 citations) and India (8,790 citations). China's dominance is in line with the long tradition of herbal medicine in its health system and the national priority on scientific validation of traditional medicine. Asian countries such as Korea, Iran and Japan also contribute significantly, reflecting the rich heritage of traditional medicine in the region. Meanwhile, contributions from

some countries in Africa, Central America and parts of Central Asia are still limited, indicating gaps in research capacity and infrastructure across geographical regions. Although the overall international collaboration rate was only 17.81 %, countries such as Hong Kong, Pakistan and Italy show a high proportion of international collaboration, indicating the potential for strengthening cross-border collaboration in herbal medicine research for hypertension. Chinese institutions dominate the list of most productive affiliates, with China Academy of Chinese Medical Sciences (108 articles) and China Medical University (102 articles) at the top, reaffirming China's position as a global hub for herbal medicine research for hypertension. In terms of author productivity, Wang Y, Li Y and Zhang Y contributed the most, each producing more than 60 papers. The concentration of research among a small number of authors and institutions indicates deep specialisation and highlights the opportunity to expand participation by other authors and institutions.^{28,29}

Keyword co-occurrence network analysis revealed the conceptual structure of the research with two main clusters: clinical and methodological aspects (red cluster) focusing on clinical evaluation and synthesis of scientific evidence and pharmacological and phytochemical aspects (blue cluster) emphasising therapeutic mechanisms and ethnomedicine.³⁰ The keywords "hypertension" and "herbal medicine" were the main hubs with strong connections to other keywords. Some of the medicinal plants that were the focus of the research included garlic (*Allium sativum*), roselle (*Hibiscus sabdariffa*), olive (*Olea europaea*), *Rauwolfia serpentina*, *Camellia sinensis*, *Panax ginseng* and *Ginkgo biloba*, the most prevalent antihypertensive mechanisms among herbal drugs include ACE inhibition, calcium channel blocking, diuretic effects, nitric oxide-mediated vasodilation, antioxidant activity and central nervous system modulation. Studies have employed various methodologies such as enzyme inhibition assays, animal models, clinical trials and molecular docking. ACE inhibition remains the most explored mechanism, often linked with flavonoid-rich plants like *Camellia sinensis* and *Allium sativum*.^{11,31} This reflects the effort to understand the molecular basis of the therapeutic effects of medicinal plants on hypertension.

Regarding publication media, *Journal of Ethnopharmacology* ranked the top with 167 documents, followed by *Frontiers in Pharmacology* (77

documents) and *Evidence-Based Complementary and Alternative Medicine* (74 documents). The diversity of journals in which these publications are published reinforces the multidisciplinary nature of this research, while the presence of multidisciplinary journals such as *PLoS One* demonstrates the recognition by the conventional medical community of the potential of herbal medicine in the management of hypertension. Despite significant growth in herbal medicine research for hypertension, challenges remain such as low levels of international collaboration and geographical disparities in scientific production.^{5,32} On the other hand, increasing global interest, advances in analytical technology and paradigm shifts in health systems provide opportunities for further development. Future research should increase focus on clinical validation, standardisation of herbal products and integration into standard clinical protocols to strengthen the position of herbal medicine as a safe and effective approach in the management of hypertension.

Conclusion

Bibliometric analysis of global research on herbal medicine for hypertension during the period 1979-2025 provides a comprehensive picture of scientific developments and contributions in this field, with an annual publication growth of 9.74 % and an average of 31.38 citations per document. China, the United States and India emerged as major contributors, both in terms of number of publications and citations, with Chinese institutions dominating the list of most productive affiliates. Research focuses on clinical, methodological, pharmacological and phytochemical aspects, with an emphasis on specific medicinal plants such as garlic, roselle and olive and antihypertensive mechanisms including ACE inhibition, diuretic effects, antioxidants and vasodilators. *The Journal of Ethnopharmacology*, *Frontiers in Pharmacology* and *Evidence-Based Complementary and Alternative Medicine* were the main publication platforms reflecting the multidisciplinary nature of the research. Despite challenges such as low international collaboration and geographical disparities, the results of this study can form the basis for future research agendas, identification of collaboration opportunities and formulation of policies that

support the development of herbal medicine as an effective alternative or complement in the management of hypertension. Increased focus on clinical validation, standardisation and integration into conventional treatment protocols will strengthen the contribution of herbal medicine to the global effort to address the health burden of hypertension.

Ethics

This study was a secondary analysis based on the currently existing data and did not directly involve with human participants or experimental animals. Therefore, the ethics approval was not required in this paper.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

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References

1. O'Shea PM, Griffin TP, Fitzgibbon M. Hypertension: the role of biochemistry in the diagnosis and management. *Clin Chim Acta.* 2017 Feb;465:131-43. doi: 10.1016/j.cca.2016.12.014.
2. Rukunuzzaman M, Khatun N, Nessa A, Wahed F, Sharmin A, Meherubin I, et al. Study on body mass index, serum total cholesterol and serum triglycerides in adult male hypertensive patients. *Mymensingh Med J.* 2023 Jan;32(1):44-8. PMID: 36594299.
3. Mondal MK, Nessa A, Khatun N. Study of body mass index, blood pressure, serum sodium in newly diagnosed hypertensive patients. *Mymensingh Med J.* 2023 Apr;32(2):355-60. PMID: 37002745.

4. Aronow WS. Approaches for the management of resistant hypertension in 2020. *Curr Hypertens Rep.* 2020 Jan 8;22(1):3. doi: 10.1007/s11906-019-1013-0.
5. Cao Y, Xie L, Liu K, Liang Y, Dai X, Wang X, et al. The antihypertensive potential of flavonoids from Chinese herbal medicine: a review. *Pharmacol Res.* 2021 Dec;174:105919. doi: 10.1016/j.phrs.2021.105919.
6. Sankararaman S, Velayuthan S, Chen Y, Robertson J, Sferra TJ. Role of traditional Chinese herbal medicines in functional gastrointestinal and motility disorders. *Curr Gastroenterol Rep.* 2022 Mar;24(3):43–51. doi: 10.1007/s11894-022-00843-8.
7. Kamyab R, Namdar H, Torbati M, Ghojzadeh M, Araj Khodaei M, Fazljou SMB. Medicinal plants in the treatment of hypertension: a review. *Adv Pharm Bull.* 2021 Sep;11(4):601–17. doi: 10.34172/apb.2021.090.
8. Chakraborty R, Roy S. Angiotensin converting enzyme inhibitors from plants: a review of their diversity, modes of action, prospects, and concerns in the management of diabetes centric complications. *J Integr Med.* 2021 Nov;19(6):478–92. doi: 10.1016/j.joim.2021.09.006.
9. Chen L, Wang L, Shu G, Li J. Antihypertensive potential of plant foods: research progress and prospect of plant derived angiotensin converting enzyme inhibition compounds. *J Agric Food Chem.* 2021 May 12;69(18):5297–305. doi: 10.1021/acs.jafc.1c02117.
10. Elkafrawy N, Younes K, Naguib A, Badr H, Kamal Zewain S, Kamel M, Raoof GFA, El Desoky AM, Mohamed S. Antihypertensive efficacy and safety of a standardized herbal medicinal product of *Hibiscus sabdariffa* and *Olea europaea* extracts (NW Roselle): a phase II, randomized, double blind, captopril controlled clinical trial. *Phytother Res.* 2020 Dec;34(12):3379–87. doi: 10.1002/ptr.6792.
11. Abdel Rahman RF, Hessin AF, Abdelbaset M, Ogaly HA, Abd Elsalam RM, Hassan SM. Antihypertensive effects of Roselle Olive combination in L NAME induced hypertensive rats. *Oxid Med Cell Longev.* 2017;2017:9460653. doi: 10.1155/2017/9460653.
12. Tabatabaei Malazy O, Atlasi R, Larijani B, Abdollahi M. Trends in publication on evidence based antioxidative herbal medicines in management of diabetic nephropathy. *J Diabetes Metab Disord.* 2016 Feb 13;15:1. doi: 10.1186/s40200-016-0221-2.
13. Irham LM, Amukti DP, Adikusuma W, Singh D, Chong R, Pranata S, et al. Trends in drug repurposing for chronic hepatitis B infection: bibliometric based approach 1990–2024. In: *BIO Web of Conferences.* EDP Sciences; 2025. doi: 10.1051/bioconf/202414804003.
14. Amukti DP, Irham LM, Surono S, El Khair R, Adikusuma W, Satria R, et al. Atherosclerosis research in the genomic era: global trends from 1983 to 2024. *Bulgarian Cardiology.* 2024 Dec 31;30(4):40–8. doi: 10.3897/bg-cardio.30.e143367.
15. Irham LM, Amukti DP, Adikusuma W, Singh D, Chong R, Basyuni M, et al. Applied of bioinformatics in drug discovery and drug development: bioinformatic analysis 1996–2024. *BIO Web Conf.* 2024 Jan 9;148:01003. doi: bioconf/202414801003.
16. Zhao H, Liu JB, Bao ZF, Xu YX, Wang ZQ. Global research trends in dental stem cells: a bibliometric and visualized study. *Tissue Eng Part B Rev.* 2022 Aug;28(4):733–44. doi: 10.1089/ten.TEB.2021.0080.
17. Chen S, Wu P, Zhang T, Zhang J, Gao H. Global scientific trends on the islet transplantation in the 21st century: a bibliometric and visualized analysis. *Medicine (Baltimore).* 2024 Apr 26;103(17):e37945. doi: 10.1097/MD.00000000000037945.
18. Wang G, Liu T, He WT. Visualization analysis of research hotspots and trends on gastrointestinal tumor organoids. *World J Gastrointest Oncol.* 2024 Jun 15;16(6):2826–41. doi: 10.4251/wjgo.v16.i6.2826.
19. Lan WP, Guo W, Zhou X, Li Z. Research trends on traditional Chinese medicine and acute pancreatitis: a bibliometric analysis from 2007 to mid 2023. *Heliyon.* 2024 Feb 15;10(5):e25659. doi: 10.1016/j.heliyon.2024.e25659.
20. Sun Y, Li X, Zhang Y, Tang S. The research status of central venous catheterization associated thrombosis: a bibliometrics analysis. *Ann Transl Med.* 2022 May;10(10):561. doi: 10.21037/atm-22-1552.
21. Jimenez Collado D, Velasco Sepúlveda BH, Lee Á, Vera Duarte GR, Graue Hernandez EO, Navas A. Corneal and ocular surface contributions from Mexico: a bibliometric analysis from 1913 to 2022. *Cureus.* 2024 Aug 15;16(8):e66965. doi: 10.7759/cureus.66965.
22. Xing J, Liu J, Han M, Jiang Y, Jiang J, Huang H. Bibliometric analysis of traditional Chinese medicine for smoking cessation. *Tob Induc Dis.* 2022 Nov 9;20:97. doi: 10.18332/tid/154961.
23. Li T, Yan Q, Huang W. Research trends on acupuncture for neuropathic pain: a bibliometric analysis from 1979 to 2023. *Medicine (Baltimore).* 2024 May 3;103(18):e37962. doi: 10.1097/MD.00000000000037962.
24. Kim TH, Kang JW. Research status quo in traditional Mongolian medicine: a bibliometric analysis on research documents in the Web of Science database. *Evid Based Complement Alternat Med.* 2021 Dec 28;2021:5088129. doi: 10.1155/2021/5088129.
25. Hashimoto H, Sekine M, Nishizaki Y, Aune D, Mizuno A, Homma Y, et al. Global trends in the value of author order across medical publications: a cross sectional bibliometric study. *Clin Transl Sci.* 2025 Feb;18(2):e70157. doi: 10.1111/cts.70157.
26. Chissaque A, Guimarães E, Limaymanta CH, Conjo C, Sebastião Capece BP, et al. Post independence health research productivity in Portuguese speaking African countries: a bibliometric analysis of 43 years of research and higher education in Mozambique. *Heliyon.* 2024 Aug 3;10(15):e35767. doi: 10.1016/j.heliyon.2024.e35767.
27. Park PG, Park E, Kang HG. Increasing trend in hypertension prevalence among Korean adolescents from 2007 to 2020. *BMC Public Health.* 2024 Feb 26;24(1):617. doi: 10.1186/s12889-024-18093-w.
28. Dagli N, Haque M, Kumar S. Bibliometric analysis and visualization of clinical trials on the therapeutic potential of essential oils (1967–2024). *Cureus.* 2024 Apr 1;16(4):e57430. doi: 10.7759/cureus.57430.
29. Huang D, Luo Z, Song X, Zou K. Global research on sufentanil use in anesthesiology from 2003 to 2023: a bibliometric analysis. *Front Pharmacol.* 2024 Sep 26;15:1412726. doi: 10.3389/fphar.2024.1412726.
30. Lin X, Zhou Y, Ye L, Wang B, Jiao Y, Yu W, et al. A bibliometric and visualized analysis of hepatic ischemia reperfusion injury (HIRI) from 2002 to 2021. *Heliyon.* 2023 Nov 19;9(11):e22644. doi: 10.1016/j.heliyon.2023.e22644.
31. Sanou A, Konaté K, Belemnaba L, Sama H, Kaboré K, Dakuyo R, et al. In vivo diuretic activity and anti hypertensive potential of *Hibiscus sabdariffa* extract by inhibition of angiotensin converting enzyme and hypertension precursor enzymes. *Foods.* 2024 Feb 9;13(4):534. doi: 10.3390/foods13040534.
32. Dong Z, Dai H, Feng Z, Liu W, Gao Y, Liu F, et al. Mechanism of herbal medicine on hypertensive nephropathy (review). *Mol Med Rep.* 2021 Apr;23(4):234. doi: 10.3892/mmr.2021.11873.