Acupuncture and Herbal Medicine

Modern technological advances in traditional medicine: global insights from the 2025 top 50 high-impact researches

Bo Pang[1], Yibing Chen[1], Haitao Lyu[2], Chong Li[3], Lei Zhang[4], Xiaohui Fan[5], Ling Zhao[6], Jianfeng Tu[7], Linlin Dong[8], Junhua Zhang[1,*]

[1]Tianjin University of Traditional Chinese Medicine, Tianjin, China; [2]Hong Kong Traditional Chinese Medicine Phenome Research Center, School of Chinese Medicine, Hong Kong Baptist University, Hong Kong, China; [3]Guangdong-Hong Kong-Macao Joint Laboratory for New Drug Screening, School of Pharmaceutical Sciences, Southern Medical University, Guangzhou, China; [4]Department of Pharmaceutical Botany, School of Pharmacy, Naval Medical University, Shanghai, China; [5]Zhejiang University of Traditional Chinese Medicine, Hangzhou, China; [6]Chengdu University of Traditional Chinese Medicine, Chengdu, China; [7]International Acupuncture and Moxibustion Innovation Institute, School of Acupuncture-Moxibustion and Tuina, Beijing University of Chinese Medicine, Beijing, China; [8]Institute of Chinese Meteria Medica, China Academy of Chinese Medical Sciences, Beijing, China.

Introduction

To further promote the modernization and global dissemination of traditional Chinese medicine (TCM), the editorial board of *Acupuncture and Herbal Medicine (AHM)*, in collaboration with several leading institutions, has continued the annual selection of the "World Top 50 High-Impact Research of Traditional Medicine." This initiative aims to showcase cutting-edge advances, foster international collaboration, and accelerate the translation of scientific achievements into clinical and industrial applications. The 2025 selection was jointly organized by Tianjin University of Traditional Chinese Medicine, the Institute of Scientific and Technical Information of China, the China Association of Traditional Chinese Medicine, and Wolters Kluwer. The final list was announced on April 23, 2025, at the opening ceremony of the Fourth High-Quality Development Conference of Traditional Chinese Medicine, to facilitate global sharing of research achievements in TCM modernization.

Summary of the "Top 50 High-Impact Research of Traditional Medicine"

The selection process incorporated a multidimensional evaluation framework, encompassing journal influence, article impact, author influence, public engagement, and academic significance. Articles were sourced through database indexing, expert nominations, and self-recommendations. The final selection involved online public voting, peer reviews, and expert consensus (Table 1).

The 50 high-impact articles[1–50] were published across 31 internationally recognized journals, including *Acta Pharmaceutica Sinica B*, *Nature Communications*, *JAMA Network Open*, *ACS Nano*, *Advanced Science*, and *Molecular Plant*. The average impact factor of the publishing journals was 18.7. At the time of analysis, the 50 articles had been cited an average of 38.36 times per article. The most cited paper, published in *ACS Nano*, had 156 citations and focused on exosome-based nanomicelles for glioblastoma therapy[30]. Shanghai Jiao Tong University was the most influential institution with seven publications and 384 citations. Geographically, 44 of the 50 studies were led by Chinese institutions, one was an international collaboration between China and other countries, and the remaining five were led by institutions in the United States, Iran, South Korea, and other countries. China also ranked highest in total citations (1819), followed by the United States (334), Australia (67), Iran (51), and Sweden (27) (Figure 1).

These articles covered six major research domains: clinical and acupuncture, biosynthetic, medicinal resource, pharmaceutical preparation, phytochemical, and pharmacological research. Keyword evolution analysis revealed a shift from an earlier focus on general mechanisms, such as apoptosis, inflammation, and oxidative stress, toward more specific diseases like breast cancer, glioblastoma, and gastric cancer (Figure 2). References to natural products (e.g., ginseng, curcumin, and artemisinin) and advanced methodologies, such as network pharmacology, machine learning, and nanotechnology, have increased notably. Emerging research topics included ferroptosis, pyroptosis, immunogenic cell death, tumor microenvironment

Bo Pang and Yibing Chen contributed equally to this work.

**Corresponding author. Junhua Zhang, E-mail: zjhtcm@foxmail.com*

How to cite this article: *Pang B, Chen YB, Lyu HT, Li C, Zhang L, Fan XH, Zhao L, Tu JF, Dong LL, Zhang JH. Modern technological advances in traditional medicine: global insights from the 2025 top 50 high-impact researches. Acupunct Herb Med 2025;5(4):491–497. doi: 10.1097/HM9.0000000000000179*

Received 10 November 2025 / Accepted 30 November 2025

Copyright © 2025 Tianjin University of Traditional Chinese Medicine. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Table 1

Summary of the 2025 top 50 high-impact research articles on traditional medicine

No.	Research area	Title	Journal	Author
1	Clinical and acupuncture research	Acupuncture and doxylamine-pyridoxine for nausea and vomiting in pregnancy: A randomized, controlled, 2 × 2 factorial trial	*Ann Intern Med*	Wu et al.[1]
2	Clinical and acupuncture research	Acupuncture for chemotherapy-associated insomnia in breast cancer patients: an assessor-participant blinded, randomized, sham-controlled trial	*Breast Cancer Res*	Zhang et al.[2]
3	Clinical and acupuncture research	Development of a tongue image-based machine learning tool for the diagnosis of gastric cancer: a prospective multicentre clinical cohort study	*EClinicalMedicine*	Yuan et al.[3]
4	Clinical and acupuncture research	Effect of yoga and mediational influence of fatigue on walking, physical activity, and quality of life among cancer survivors	*J Natl Compr Canc Netw*	Lin et al.[4]
5	Clinical and acupuncture research	Effects of Tai Chi Chuan on cognitive function in adults 60 years or older with type 2 diabetes and mild cognitive impairment in China: A randomized clinical trial	*JAMA Netw Open*	Chen et al.[5]
6	Clinical and acupuncture research	Efficacy and Safety of Panax notoginseng Saponins in the Treatment of Adults with Ischemic Stroke in China: A Randomized Clinical Trial	*JAMA Netw Open*	Wu et al.[6]
7	Clinical and acupuncture research	Efficacy of Acupuncture for Chronic Spontaneous Urticaria: A Randomized Controlled Trial	*Ann Intern Med*	Zheng et al.[7]
8	Clinical and acupuncture research	Electroacupuncture for motor dysfunction and constipation in patients with Parkinson's disease: a randomised controlled multi-center trial	*EClinicalMedicine*	Li et al.[8]
9	Clinical and acupuncture research	Electroacupuncture improves swallowing function in a post-stroke dysphagia mouse model by activating the motor cortex inputs to the nucleus tractus solitarii through the parabrachial nuclei	*Nat Commun*	Yao et al.[9]
10	Clinical and acupuncture research	Electroacupuncture vs sham electroacupuncture in the treatment of postoperative ileus after laparoscopic surgery for colorectal cancer: A multicenter, randomized clinical trial	*JAMA Surg*	Wang et al.[10]
11	Clinical and acupuncture research	Flexible needle-type Microbiosensor for real-time monitoring traditional acupuncture-mediated adenosine release *in vivo*	*Biosens Bioelectron*	Chang et al.[11]
12	Clinical and acupuncture research	GET FIT: A randomized clinical trial of Tai Ji Quan versus strength training for fall prevention after chemotherapy in older, postmenopausal women cancer survivors	*J Clin Oncol*	Winters-Stone et al.[12]
13	Clinical and acupuncture research	Traditional Chinese medicine compound (Tongxinluo) and clinical outcomes of patients with acute myocardial infarction: The CTS-AMI randomized clinical trial	*JAMA*	Yang et al.[13]
14	Clinical and acupuncture research	Traditional Chinese medicine Pingchan granule for motor symptoms and functions in Parkinson's disease: A multicenter, randomized, double-blind, placebo-controlled study	*Phytomedicine*	Gu et al.[14]
15	Clinical and acupuncture research	Acupuncture vs massage for pain in patients living with advanced cancer: The IMPACT randomized clinical trial	*JAMA Netw Open*	Epstein et al.[15]
16	Biosynthetic research	A chromosome-level genome assembly reveals that a bipartite gene cluster formed *via* an inverted duplication controls monoterpenoid biosynthesis in Schizonepeta tenuifolia	*Mol Plant*	Liu et al.[16]
17	Biosynthetic research	A chromosome-level genome assembly reveals that tandem-duplicated CYP706V oxidase genes control oridonin biosynthesis in the shoot apex of Isodon rubescens	*Mol Plant*	Sun et al.[17]
18	Biosynthetic research	Functional characterization of a cycloartenol synthase and four glycosyltransferases in the biosynthesis of cycloastragenol-type astragalosides from *Astragalus membranaceus*	*Acta Pharm Sin B*	Duan et al.[18]
19	Biosynthetic research	Insights into the missing apiosylation step in flavonoid apiosides biosynthesis of Leguminosae plants	*Nat Commun*	Wang et al.[19]
20	Biosynthetic research	Tandemly duplicated CYP82Ds catalyze 14-hydroxylation in triptolide biosynthesis and precursor production in Saccharomyces cerevisiae	*Nat Commun*	Zhang et al.[20]
21	Medicinal resource research	Functional divergence of CYP76AKs shapes the chemodiversity of abietane-type diterpenoids in genus Salvia	*Nat Commun*	Hu et al.[21]
22	Medicinal resource research	Genomic, transcriptomic, and epigenomic analysis of a medicinal snake, Bungarus multicinctus, to provides insights into the origin of Elapidae neurotoxins	*Acta Pharm Sin B*	Xu et al.[22]
23	Medicinal resource research	Profiling of phytohormone-specific microRNAs and characterization of the miR160-ARF1 module involved in glandular trichome development and artemisinin biosynthesis in Artemisia annua	*Plant Biotechnol J*	Guo et al.[23]
24	Pharmaceutical preparation research	A nanomedicine-enabled ion-exchange strategy for enhancing curcumin-based rheumatoid arthritis therapy	*Angew Chem Int Ed Engl*	Yang et al.[24]

(Continued)

Table 1
Continued

No.	Research area	Title	Journal	Author
25	Pharmaceutical preparation research	Effective treatment of knee osteoarthritis using a nano-enabled drug acupuncture technology in mice	*Adv Sci (Weinh)*	Xu et al.[25]
26	Pharmaceutical preparation research	Engineered UIO-66 metal-organic framework for delivery of curcumin against breast cancer cells: An *in vitro* evaluation	*J Drug Deliv Sci Technol*	Bazzazan et al.[26]
27	Pharmaceutical preparation research	Exudate absorbing and antimicrobial hydrogel integrated with multifunctional curcumin-loaded magnesium polyphenol network for facilitating burn wound healing	*ACS Nano*	Gong et al.[27]
28	Pharmaceutical preparation research	Ginseng-derived exosome-like nanovesicles extracted by sucrose gradient ultracentrifugation to inhibit osteoclast differentiation	*Nanoscale*	Seo et al.[28]
29	Pharmaceutical preparation research	Glycyrrhetinic acid liposomes encapsulated microcapsules from microfluidic electrospray for inflammatory wound healing	*Adv Funct Mater*	Zhi et al.[29]
30	Pharmaceutical preparation research	Immune exosomes loading self-assembled nanomicelles traverse the blood–brain barrier for chemo-immunotherapy against glioblastoma	*ACS Nano*	Cui et al.[30]
31	Pharmaceutical preparation research	Mechanistic engineering of celastrol liposomes induces ferroptosis and apoptosis by directly targeting VDAC2 in hepatocellular carcinoma	*Asian J Pharm Sci*	Luo et al.[31]
32	Pharmaceutical preparation research	Paclitaxel-loaded ginsenoside Rg3 liposomes for drug-resistant cancer therapy by dual targeting of the tumor microenvironment and cancer cells	*J Adv Res*	Zhu et al.[32]
33	Pharmaceutical preparation research	Powerful synergy of traditional Chinese medicine and aggregation-induced emission-active photosensitizer in photodynamic therapy	*ACS Nano*	Sun et al.[33]
34	Phytochemical research	A new class of potent liver injury protective compounds: Structural elucidation, total synthesis and bioactivity study	*Acta Pharm Sin B*	Ji et al.[34]
35	Phytochemical research	Functional annotation map of natural compounds in traditional Chinese medicines library: TCMs with myocardial protection as a case	*Acta Pharm Sin B*	Xing et al.[35]
36	Phytochemical research	Pseudotargeted metabolomics approach enabling the classification-induced ginsenoside characterization and differentiation of ginseng and its compound formulation products	*J Agric Food Chem*	Wang et al.[36]
37	Phytochemical research	(+)/(-)-Yanhusamides A-C, three pairs of unprecedented benzylisoquinoline-pyrrole hetero-dimeric alkaloid enantiomers from Corydalis yanhusuo	*Acta Pharm Sin B*	Wang et al.[37]
38	Pharmacological research	Allosteric activation of transglutaminase 2 *via* inducing an “open” conformation for osteoblast differentiation	*Adv Sci (Weinh)*	Yang et al.[38]
39	Pharmacological research	Astragaloside IV derivative HHQ16 ameliorates infarction-induced hypertrophy and heart failure through degradation of lncRNA4012/9456	*Signal Transduct Target Ther*	Wan et al.[39]
40	Pharmacological research	Capsaicin receptor TRPV1 maintains quiescence of hepatic stellate cells in the liver *via* recruitment of SARM1	*J Hepatol*	Tao et al.[40]
41	Pharmacological research	Celastrol suppresses colorectal cancer *via* covalent targeting peroxiredoxin 1	*Signal Transduct Target Ther*	Xu et al.[41]
42	Pharmacological research	LBP1C-2 from Lycium barbarum alleviated age-related bone loss by targeting BMPRIA/BMPRII/Noggin	*Carbohydr Polym*	Sun et al.[42]
43	Pharmacological research	Macrophage inactivation by small molecule wedelolactone *via* targeting sEH for the treatment of LPS-induced acute lung injury	*ACS Cent Sci*	Zhang et al.[43]
44	Pharmacological research	Naringenin in Si-Ni-San formula inhibits chronic psychological stress-induced breast cancer growth and metastasis by modulating estrogen metabolism through FXR/EST pathway	*J Adv Res*	Zhang et al.[44]
45	Pharmacological research	Periplocin suppresses the growth of colorectal cancer cells by triggering LGALS3 (galectin 3)-mediated lysophagy	*Autophagy*	Wang et al.[45]
46	Pharmacological research	Profiling the antimalarial mechanism of artemisinin by identifying crucial target proteins.	*Engineering*	Gao et al.[46]
47	Pharmacological research	Schisandra lignans ameliorate nonalcoholic steatohepatitis by regulating aberrant metabolism of phosphatidylethanolamines	*Acta Pharm Sin B*	Xue et al.[47]
48	Pharmacological research	Tanshinone IIA enhances the therapeutic efficacy of mesenchymal stem cells derived exosomes in myocardial ischemia/reperfusion injury *via* up-regulating miR-223-5p	*J Control Release*	Li et al.[48]
49	Pharmacological research	Traditional medicine Pien Tze Huang suppresses colorectal tumorigenesis through restoring gut microbiota and metabolites	*Gastroenterology*	Gou et al.[49]
50	Pharmacological research	Use of deep-learning assisted assessment of cardiac parameters in zebrafish to discover cyanidin chloride as a novel keap1 inhibitor against doxorubicin - induced cardiotoxicity	*Adv Sci (Weinh)*	Liu et al.[50]

remodeling, and advanced drug delivery systems, such as nanoparticles and extracellular vesicles. Further analysis highlighted the application of traditional medicine in modern disease prevention and treatment, including non-pharmacological therapies (eg, acupuncture and Tai Chi), key active compounds (eg, astragaloside, triptolide, and curcumin), and their mechanisms of action in cancer as well as cardiovascular, neurological, and metabolic diseases (Figure 3).

Implications and perspectives

The 2025 top 50 high-impact research studies reflect the dynamic and interdisciplinary nature of traditional medicine research. A clear trend is emerging toward integrating advanced technologies, such as artificial intelligence, multi-omics, and nanotechnology, with traditional knowledge to address complex chronic diseases and age-related conditions. Growing international collaborations and high-impact publications underscore the global relevance and scientific maturation of traditional medicine. Notably, China's dominant contribution and citation impact underscore its pivotal role in leading the global research landscape of traditional medicine. However, the active participation and high citation frequencies from countries such as the United States, Australia, and Sweden reflect a growing international recognition and collaborative spirit in this field. These trends are clearly oriented toward addressing complex chronic diseases, age-related conditions, and precision medicine, demonstrating the unique value of traditional medicine in global public health. Several promising frontiers have emerged from this analysis.

Integration of traditional non-drug therapies with modern neuromodulation

The convergence of traditional non-pharmacological therapies such as acupuncture, Tai Chi, and yoga with modern technologies represents a promising frontier. Acupuncture, in particular, has been increasingly studied for its role in neuromodulation, with electroacupuncture shown to improve motor function in Parkinson disease and swallowing in post-stroke models. These approaches are now being combined with bioelectronic medicine and real-time biosensing, enabling precise interventions for neurological and psychiatric disorders. The integration of mind-body exercises, such as Tai Chi and yoga, into rehabilitation and supportive care for cancer survivors and patients with chronic diseases further underscores the potential of these low-risk, holistic interventions in modern healthcare.

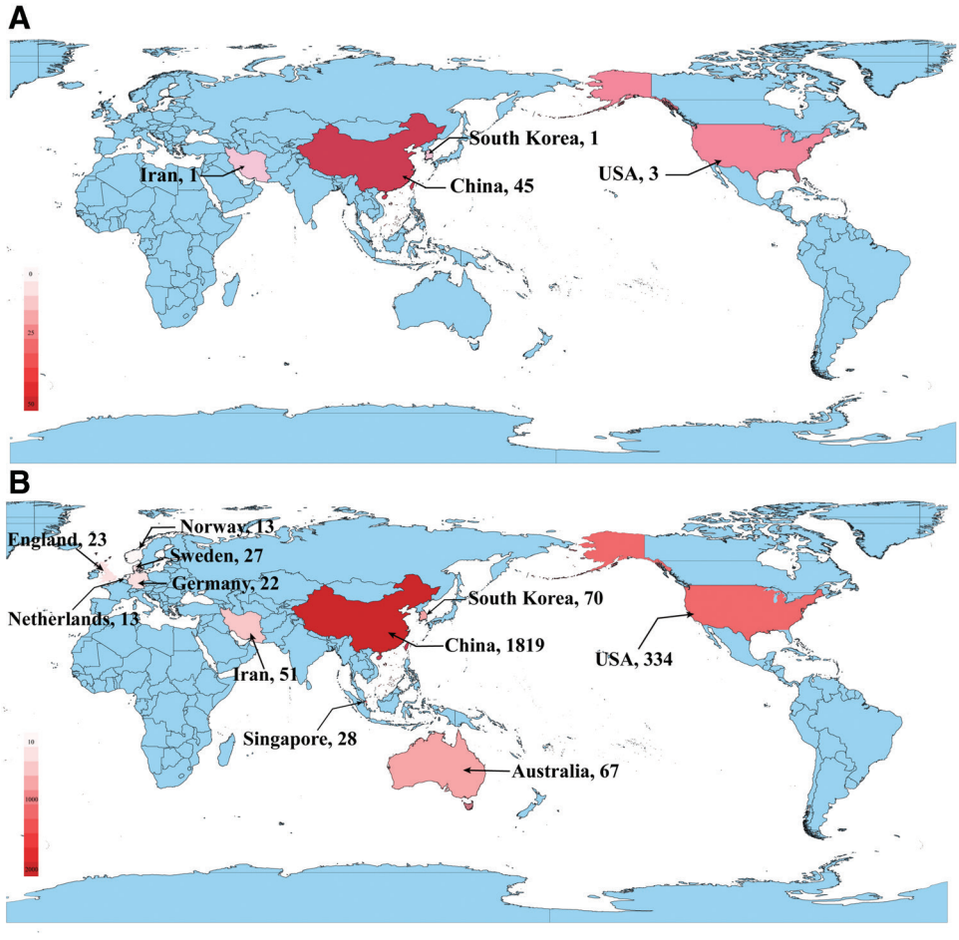


Figure 1. The geographical distribution map of the publication volume and citations of the 50 most influential articles in the field of traditional medicine. (A) The distribution of the top 50 most influential research countries in the field of traditional medicine; (B) National map of 50 most influential studies in traditional medicine cited (as of September 10, 2025, countries with > 10 citations). *Figure 1 was obtained through free download from the Standard Map Service of China (http://bzdt.ch.mnr.gov.cn/index.html), and the author marked the countries/regions using image editing software.

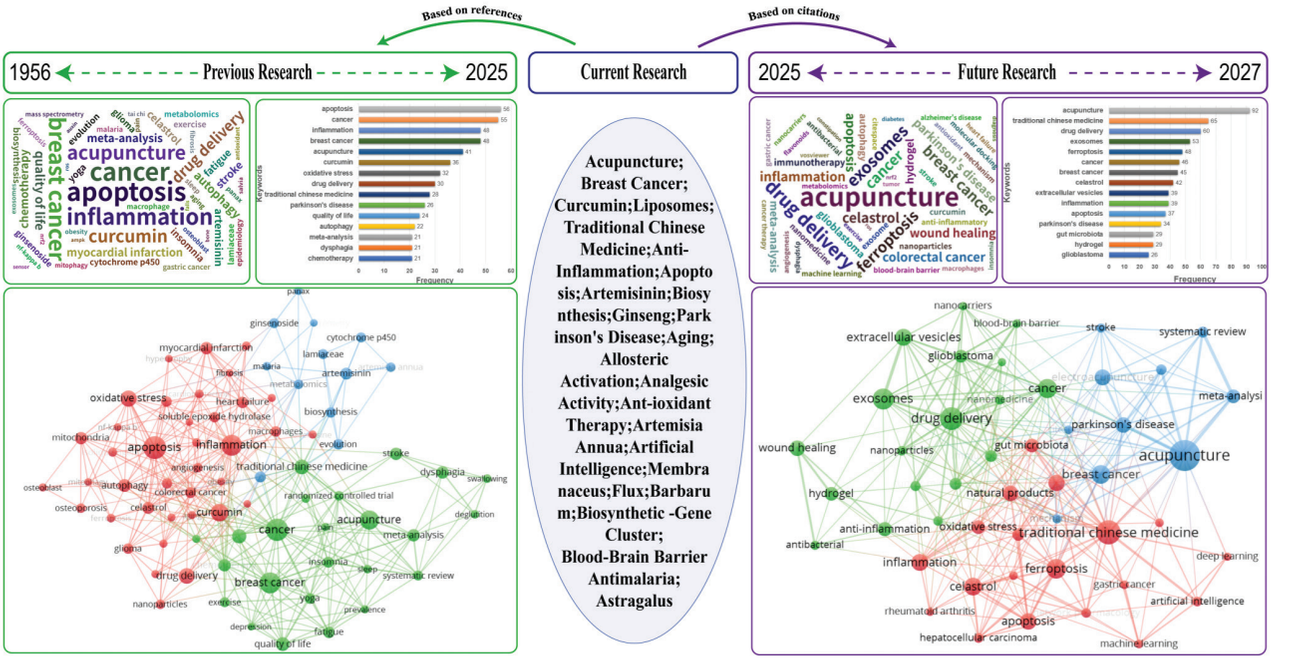


Figure 2. Visualization map generated using high-frequency keywords from the references and citations of the top 50 high-impact research articles.

Systems pharmacology and multi-omics insights into herbal active compounds

The "multi-component, multi-target, multi-pathway" characteristics of traditional medicine are increasingly being validated through network pharmacology, functional omics, and machine learning. Studies on compounds such as Tripterygium glycosides, ginsenosides, and curcumin have revealed their involvement in complex mechanisms, including ferroptosis, immunogenic cell death, and gut microbiota–metabolite axes. These insights not only elucidate the systemic actions of herbal medicines but also facilitate the discovery of synergistic combinations and the repositioning of traditional formulas for modern diseases such as breast cancer, glioblastoma, and diabetic kidney disease.

Nanotechnology and engineering biology-driven drug innovation

Advances in biomaterial-based and exosome-mediated drug delivery systems have revolutionized the bioavailability and targeting efficacy of herbal formulations. Nano-formulations such as cyclodextrin-based carriers, mitochondria-targeted conjugates, and turmeric-derived exosomes have demonstrated enhanced therapeutic outcomes in colorectal cancer, glioblastoma, and inflammatory bowel disease. Concurrently, synthetic biology and enzyme engineering enable the sustainable production of high-value plant-derived compounds such as artemisinin and triptolide, thereby addressing supply limitations and paving the way for green manufacturing of traditional medicine ingredients.

Data-driven and artificial intelligence–enabled precision herbal medicine

The application of artificial intelligence, high-throughput screening, and multi-omics profiling is accelerating the transition from empirical use to precision application of traditional medicine. Machine learning models have been used to identify mitophagy inducers in Alzheimer disease and to optimize biosynthetic pathways for sandalwood oil and other natural products. These tools also support patient stratification, target prediction, and formula optimization, effectively aligning the holistic philosophy of traditional medicine with the data-driven paradigm of modern precision medicine.

For the third consecutive year, the editorial board of AHM has selected the "Top 50 High-Impact Research of Traditional Medicine" published in 2025 through objective indicators and a rigorous selection process[51-52]. This annual selection not only highlights the most impactful scientific advances but also enhances public awareness and trust in traditional medicine. We aspire to collaborate with researchers and experts worldwide in this vibrant field. By consistently publishing and recognizing high-impact academic achievements, we can collectively advance the modernization and globalization of traditional medicine, ultimately contributing to the well-being of humankind.

Conflicts of interest statement

Junhua Zhang is an editorial board member of this journal. None of the other authors declare any conflicts of interest.

Funding

None.

Author contributions

Bo Pang and Yibing Chen are the main drafters of the manuscript. Haitao Lyu, Chong Li, Lei Zhang, Xiaohui Fan, Ling Zhao, Jianfeng Tu, Linlin Dong and Junhua

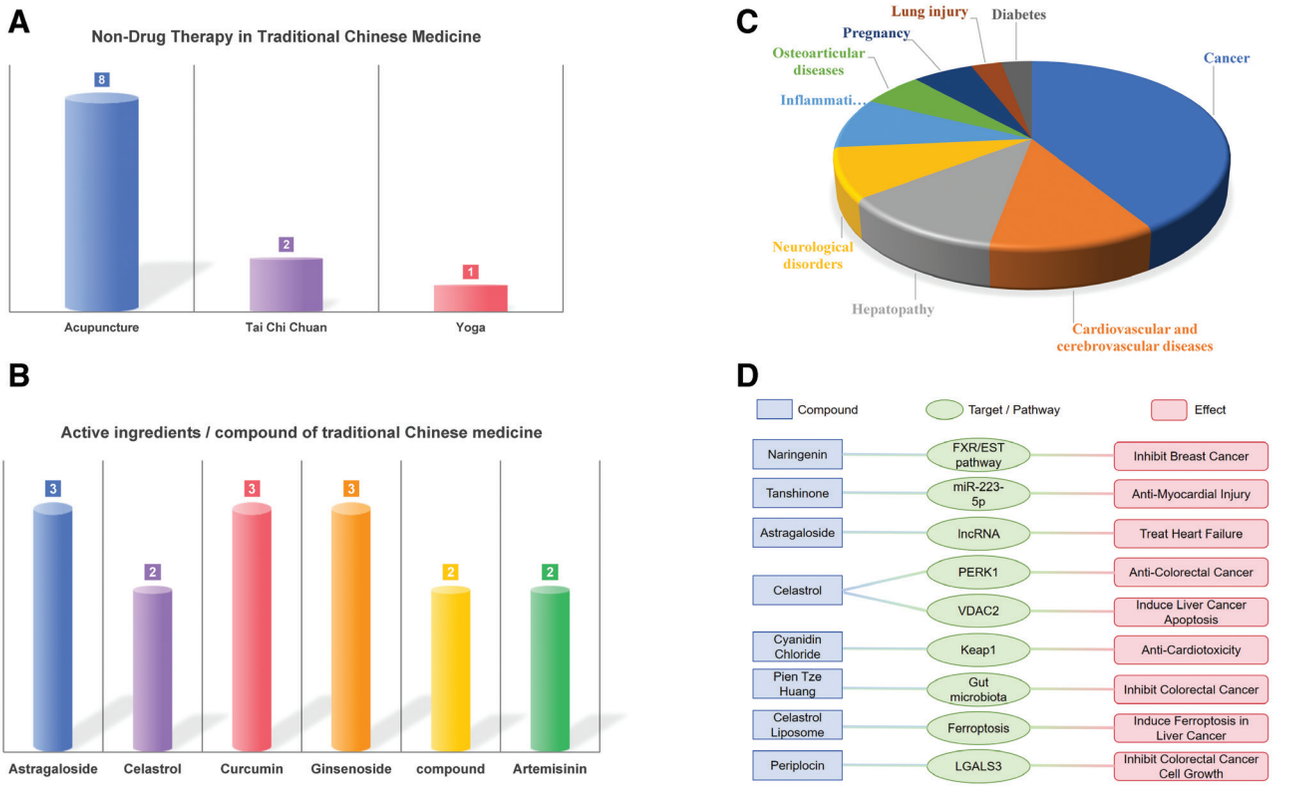


Figure 3. The core dimensions of traditional Chinese medicine (TCM) in modern disease prevention and treatment research include non-pharmacological therapies, active ingredients, disease domains, and molecular mechanisms. (A) Research on TCM non-drug therapy (acupuncture and moxibustion, taijiquan, yoga). (B) Research on representative active ingredients/compounds of TCM. (C) Distribution of disease fields in TCM research. (D) Molecular targets/pathways and pharmacological effects of active ingredients.

Zhang conceived the manuscript idea, and revised and provided critical version of the manuscript. All authors contributed to the revision of the manuscript and approved the final manuscript.

Ethical approval of studies and informed consent

Not applicable.

Acknowledgments

None.

Data availability

All data generated or analyzed during this study are included in this published article.

References

[1] Wu XK, Gao JS, Ma HL, et al. Acupuncture and doxylamine-pyridoxine for nausea and vomiting in pregnancy: a randomized, controlled, 2×2 factorial trial. *Ann Intern Med* 2023;176(7):922–933.
[2] Zhang JL, Qin ZS, So TH, et al. Acupuncture for chemotherapy-associated insomnia in breast cancer patients: an assessor-participant blinded, randomized, sham-controlled trial. *Breast Cancer Res* 2023;25(1):49.
[3] Yuan L, Yang L, Zhang SC, et al. Development of a tongue image-based machine learning tool for the diagnosis of gastric cancer: a prospective multicentre clinical cohort study. *EClinicalMedicine* 2023;57:101834.
[4] Lin PJ, Altman BJ, Gilmore NJ, et al. Effect of yoga and mediational influence of fatigue on walking, physical activity, and quality of life among cancer survivors. *J Natl Compr Canc Netw* 2023;21(2):153–162.e2.
[5] Chen YN, Qin JW, Tao LY, et al. Effects of Tai Chi Chuan on cognitive function in adults 60 years or older with type 2 diabetes and mild cognitive impairment in China: a randomized clinical trial. *JAMA Netw Open* 2023;6(4):e237004.
[6] Wu LF, Song HQ, Zhang C, et al. Efficacy and safety of panax notoginseng saponins in the treatment of adults with ischemic stroke in China: a randomized clinical trial. *JAMA Netw Open* 2023;6(6):e2317574.
[7] Zheng H, Xiao XJ, Shi YZ, et al. Efficacy of acupuncture for chronic spontaneous urticaria: a randomized controlled trial. *Ann Intern Med* 2023;176(12):1617–1624.
[8] Li KS, Xu SF, Wang RP, et al. Electroacupuncture for motor dysfunction and constipation in patients with Parkinson's disease: a randomised controlled multi-centre trial. *EClinicalMedicine* 2023;56:101814.
[9] Yao LL, Ye QP, Liu Y, et al. Electroacupuncture improves swallowing function in a post-stroke dysphagia mouse model by activating the motor cortex inputs to the nucleus tractus solitarii through the parabrachial nuclei. *Nat Commun* 2023;14(1):810.
[10] Wang Y, Yang JW, Yan SY, et al. Electroacupuncture vs sham electroacupuncture in the treatment of postoperative ileus after laparoscopic surgery for colorectal cancer: a multicenter, randomized clinical trial. *JAMA Surg* 2023;158(1):20–27.
[11] Chang HE, Huo MZ, Zhang QX, et al. Flexible needle-type microbiosensor for real-time monitoring traditional acupuncture-mediated adenosine release *in vivo*. *Biosens Bioelectron* 2023;235:115383.
[12] Winters-Stone KM, Horak F, Dieckmann NF, et al. GET FIT: a randomized clinical trial of Tai Ji Quan versus strength training for fall prevention after chemotherapy in older, postmenopausal women cancer survivors. *J Clin Oncol* 2023;41(18):3384–3396.
[13] Yang YJ, Li XD, Chen GH, et al. Traditional Chinese medicine compound (Tongxinluo) and clinical outcomes of patients with acute myocardial infarction: the CTS-AMI randomized clinical trial. *JAMA* 2023;330(16):1534–1545.
[14] Gu SC, Shi R, Gaoag C, et al. Traditional Chinese medicine Pingchan granule for motor symptoms and functions in Parkinson's disease: a multicenter, randomized, double-blind, placebo-controlled study. *Phytomedicine* 2023;108:154497.

[15] Epstein AS, Liou KT, Romero SAD, et al. Acupuncture vs massage for pain in patients living with advanced cancer: the IMPACT randomized clinical trial. *JAMA Netw Open* 2023;6(11):e2342482.
[16] Liu CC, Smit SJ, Dang JJ, et al. A chromosome-level genome assembly reveals that a bipartite gene cluster formed *via* an inverted duplication controls monoterpenoid biosynthesis in *Schizonepeta tenuifolia*. *Mol Plant* 2023;16(3):533–548.
[17] Sun YW, Shao J, Liu HL, et al. A chromosome-level genome assembly reveals that tandem-duplicated CYP706V oxidase genes control oridonin biosynthesis in the shoot apex of Isodon rubescens. *Mol Plant* 2023;16(3):517–532.
[18] Duan YY, Du WY, Song ZJ, et al. Functional characterization of a cycloartenol synthase and four glycosyltransferases in the biosynthesis of cycloastragenol-type astragalosides from *Astragalus* membranaceus. *Acta Pharm Sin B* 2023;13(1):271–283.
[19] Wang HT, Wang ZL, Chen K, et al. Insights into the missing apiosylation step in flavonoid apiosides biosynthesis of Leguminosae plants. *Nat Commun* 2023;14(1):6658.
[20] Zhang YF, Gao J, Ma L, et al. Tandemly duplicated CYP82Ds catalyze 14-hydroxylation in triptolide biosynthesis and precursor production in *Saccharomyces cerev*isiae. *Nat Commun* 2023;14(1):875.
[21] Hu JD, Qiu S, Wang FY, et al. Functional divergence of CYP76AKs shapes the chemodiversity of abietane-type diterpenoids in genus *Salvia*. *Nat Commun* 2023;14(1):4696.
[22] Xu J, Guo S, Yin XM, et al. Genomic, transcriptomic, and epigenomic analysis of a medicinal snake, Bungarus multicinctus, to provides insights into the origin of Elapidae neurotoxins. *Acta Pharm Sin B* 2023;13(5):2234–2249.
[23] Guo ZY, Hao K, Lv ZY, et al. Profiling of phytohormone-specific microRNAs and characterization of the miR160-ARF1 module involved in glandular trichome development and artemisinin biosynthesis in Artemisia annua. *Plant Biotechnol J* 2023;21(3):591–605.
[24] Yang JC, Yang BW, Shi JL. A nanomedicine-enabled ion-exchange strategy for enhancing curcumin-based rheumatoid arthritis therapy. *Angew Chem Int Ed Engl* 2023;62(44):e202310061.
[25] Xu WJ, Xiao Y, Zhao MZ, et al. Effective treatment of knee osteoarthritis using a nano-enabled drug acupuncture technology in mice. *Adv Sci (Weinh)* 2023;10(28):e2302586.
[26] Bazzazan S, Moeinabadi-Bidgoli K, Lalami ZA, et al. Engineered UIO-66 metal-organic framework for delivery of curcumin against breast cancer cells: an *in vitro* evaluation. *J Drug Delivery Sci Technol* 2023;79:104009.
[27] Gong Y, Wang P, Cao R, et al. Exudate absorbing and antimicrobial hydrogel integrated with multifunctional curcumin-loaded magnesium polyphenol network for facilitating burn wound healing. *ACS Nano* 2023;17(22):22355–22370.
[28] Seo K, Yoo JH, Kim J, et al. Ginseng-derived exosome-like nanovesicles extracted by sucrose gradient ultracentrifugation to inhibit osteoclast differentiation. *Nanoscale* 2023;15(12):5798–5808.
[29] Zhi Y, Che J, Zhu H, et al. Glycyrrhetinic acid liposomes encapsulated microcapsules from microfluidic electrospray for inflammatory wound healing. *Adv Funct Mater* 2023;33(43):2304353.
[30] Cui JW, Wang X, Li J, et al. Immune exosomes loading self-assembled nanomicelles traverse the blood–brain barrier for chemo-immunotherapy against glioblastoma. *ACS Nano* 2023;17(2):1464–1484.
[31] Luo P, Zhang Q, Shen S, et al. Mechanistic engineering of celastrol liposomes induces ferroptosis and apoptosis by directly targeting VDAC2 in hepatocellular carcinoma. *Asian J Pharm Sci* 2023;18(6):100874.
[32] Zhu Y, Wang AN, Zhang SY, et al. Paclitaxel-loaded ginsenoside Rg3 liposomes for drug-resistant cancer therapy by dual targeting of the tumor microenvironment and cancer cells. *J Adv Res* 2023;49:159–173.
[33] Sun FY, Shen HC, Liu QQ, et al. Powerful Synergy of Traditional Chinese medicine and aggregation-induced emission-active photosensitizer in photodynamic therapy. *ACS Nano* 2023;17(19):18952–18964.
[34] Ji KL, Liu W, Yin WH, et al. A new class of potent liver injury protective compounds: structural elucidation, total synthesis and bioactivity study. *Acta Pharm Sin B* 2023;13(8):3414–3424.
[35] Xing XD, Sun MR, Guo ZF, et al. Functional annotation map of natural compounds in traditional Chinese medicines library: TCMs with myocardial protection as a case. *Acta Pharm Sin B* 2023;13(9):3802–3816.
[36] Wang XY, Jiang MT, Lou J, et al. Pseudotargeted metabolomics approach enabling the classification-induced ginsenoside characterization and differentiation of ginseng and its compound formulation products. *J Agric Food Chem* 2023;71(3):1735–1747.
[37] Wang LY, Xia GY, Xia H, et al. (+)/(-)-Yanhusamides A-C, three pairs of unprecedented benzylisoquinoline-pyrrole hetero-dimeric alkaloid enantiomers from Corydalis yanhusuo. *Acta Pharm Sin B* 2023;13(2):754–764.
[38] Yang Z, Zhang XW, Zhuo FF, et al. Allosteric activation of transglutaminase 2 *via* inducing an "open" conformation for osteoblast differentiation. *Adv Sci (Weinh)* 2023;10(18):e2206533.
[39] Wan JJ, Zhang Z, Wu CN, et al. Astragaloside IV derivative HHQ16 ameliorates infarction-induced hypertrophy and heart failure through degradation of lncRNA4012/9456. *Signal Transduct Target Ther* 2023;8(1):414.
[40] Tao L, Yang GY, Sun TT, et al. Capsaicin receptor TRPV1 maintains quiescence of hepatic stellate cells in the liver *via* recruitment of SARM1. *J Hepatol* 2023;78(4):805–819.
[41] Xu H, Zhao HF, Ding CY, et al. Celastrol suppresses colorectal cancer *via* covalent targeting peroxiredoxin 1. *Signal Transduct Target Ther* 2023;8(1):51.
[42] Sun CX, Chen X, Yang SP, et al. LBP1C-2 from Lycium barbarum alleviated age-related bone loss by targeting BMPRIA/BMPRII/Noggin. *Carbohydr Polym* 2023;310:120725.
[43] Zhang J, Zhang M, Huo XK, et al. Macrophage inactivation by small molecule wedelolactone *via* targeting sEH for the treatment of LPS-induced acute lung injury. *ACS Cent Sci* 2023;9(3):440–456.
[44] Zhang JP, Wang N, Zheng YF, et al. Naringenin in Si-Ni-San formula inhibits chronic psychological stress-induced breast cancer growth and metastasis by modulating estrogen metabolism through FXR/EST pathway. *J Adv Res* 2023;47:189–207.
[45] Wang K, Fu SY, Dong LX, et al. Periplocin suppresses the growth of colorectal cancer cells by triggering LGALS3 (galectin 3)-mediated lysophagy. *Autophagy* 2023;19(12):3132–3150.
[46] Gao P, Wang JY, Chen JY, et al. Profiling the antimalarial mechanism of artemisinin by identifying crucial target proteins. *Engineering* 2023;31:86–97.
[47] Xue LJ, Liu KQ, Yan CX, et al. Schisandra lignans ameliorate nonalcoholic steatohepatitis by regulating aberrant metabolism of phosphatidylethanolamines. *Acta Pharm Sin B* 2023;13(8):3545–3560.
[48] Li S, Yang K, Cao WL, et al. Tanshinone IIA enhances the therapeutic efficacy of mesenchymal stem cells derived exosomes in myocardial ischemia/reperfusion injury *via* up-regulating miR-223-5p. *J Control Release* 2023;358:13–26.
[49] Gou HY, Su H, Liu DH, et al. Traditional medicine Pien Tze Huang suppresses colorectal tumorigenesis through restoring gut microbiota and metabolites. *Gastroenterology* 2023;165(6):1404–1419.
[50] Liu CT, Wang YC, Zeng YX, et al. Use of deep-learning assisted assessment of cardiac parameters in zebrafish to discover cyanidin chloride as a novel keap1 inhibitor against doxorubicin-induced cardiotoxicity. *Adv Sci (Weinh)* 2023;10(30):2301136.
[51] Pang B, Chen YB, Wang S, et al. World's top 50 high-impact research studies in traditional medicine in 2024. *Acupunct Herb Med*. 2024;4(4):552–558.
[52] Li X, Xu D, Tu JF, et al. The "Top 50 High Impact Researches of Traditional Medicine" published in 2021. *Acupunct Herb Med*. 2023;3(4):232–243.