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CURRENT TOPIC

Trends in Traditional Medicine Research as an Alternative Treatment for Lung Cancer: Bibliometric Analysis 2015-2024

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Abstract

Lung cancer, a leading cause of death, is influenced by smoking. Treatment includes conventional and alternative therapies, with traditional medicine showing potential in overcoming resistance and improving patient prognosis. This study explored the trends and developments in research related to traditional medicine as an alternative therapy for lung cancer through bibliometric analysis during the period 2015–2024. Data were obtained from the *Scopus* database, resulting in 349 relevant documents. Analysis using *VOSviewer* and R Studio software showed a significant increase in the number of publications, with a peak in 2024. This article identified contributions from 1,839 authors and 177 sources, with the *Journal of Ethnopharmacology* as the main contributor. Keywords such as "lung cancer," "apoptosis" and "anticancer" were frequently used, reflecting the research focus on the molecular mechanisms and potential of traditional medicine. China and India dominated the global contributions, followed by the United States. International collaboration also played an important role in the development of research. The results showed that traditional medicine, including traditional Chinese medicine (TCM) and active compounds from spices such as curcumin, have the potential to inhibit cancer cell proliferation, enhance apoptosis and overcome drug resistance. This study underscores the importance of a multidisciplinary approach to exploring traditional medicine in lung cancer therapy.

Key words: Medicine, traditional; Lung neoplasms; Bibliometrics.

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Introduction

Cancer is an abnormal cell growth that results from the ability to evade the body's immune system mechanisms.[1] Cancer is a 21st century health problem responsible for 16 % of deaths worldwide. *Globocan* 2022 shows an increase in cancer incidence to 19.96 million cases with 9.74 million deaths. The 5 cancers with the highest cases are lung (12.4 %), breast (11.6 %), colorectal (9.6 %), prostate (7.3 %) and gastric cancer (4.9 %).[1] Lung cancer is the cancer with the highest mortality rate in the world at 1,817,172 deaths (18.7 %).[2]

Lung cancer is an abnormal cell growth in the parenchymal tissue of the lung or bronchi.[2] Lung cancer can be triggered by the activity of active or passive smoking which shows a 20-fold increase between smokers and non-smokers. Cigarettes as a carcinogenic agent can cause lung tissue dyspla-

sia that affects genetic mutations.[3] Lung cancer is outlined by its histopathological features, namely "no-small cell lung carcinoma" (NSCLC) with 80-85 % of cases and "small cell lung carcinoma" (SCLC) 25-30 % of cases.[4] Most patients are diagnosed at a late stage, hence the need for cancer detection awareness especially in high-risk populations.[5, 6] Poor prognosis is shown in patients with cancer stages III and IV who generally have spread to the lymph nodes.[6] Research on cancer prognosis shows that only about 20 % of patients with poor prognosis survive 5 years after diagnosis.[7] This highlights the significant challenges in managing cancer, especially for patients in critical condition. Combination therapy, which combines conventional drugs with traditional medicines, can provide better outcomes, particularly for patients with poor prognosis.[8] Further studies also suggest that traditional treatments can play an important role in reducing the risk of metastasis recurrence in lung cancer.[9]

Generally, the management of lung cancer is surgery, chemotherapy or radiotherapy.[10] Anticancer drugs have common targets such as epidermal growth factor receptor (EGFR) and tyrosine kinase inhibitors,[11] immunotherapy with immune checkpoint inhibitory targets (ICIs) and programmed cell death 1 (PD-1) have been proven to play an important role in treatment.[12, 13] Previous research shows the existence of anticancer drug resistance arising from the complexity of cancer cells and high intra-tumour heterogeneity which is a new health challenge.[14] The development of drugs in the form of nanoparticles to obtain better pharmacokinetics and specify the therapeutic target of a drug is a current research trend.[15, 16]

The use of traditional medicine has the potential to be an alternative therapy in lung cancer.[17] The multi-target mode of action of traditional medicine allows it to regulate more systems such as apoptosis and reactive oxygen species (ROS) regulation.[18] Previous review showed the process of traditional as anticancer through increasing apoptosis and autophagy, inhibiting cell proliferation and migration and helping to alleviate drug resistance.[19-22] Various herbal plants have been studied for their anticancer activity, particularly in lung cancer, with several plants showing significant potential in *in vivo* studies. For example, *Yucca aloifolia, Undaria pinnatifida* and *Semecarpus anacardium* have demonstrated notable anticancer activity.[23] Additionally, compounds like *tevebioside*, which inhibits the PI3K-AKT pathway, have been shown to enhance apoptosis in cancer cells.[24] Similarly, *Ginsenoside* from ginseng can activate P53, the "guardian of the genome" and overcome resistance to anticancer drugs.[25] Other compounds, such as *Piper longum* L, have been found to suppress the NF-kB pathway and inhibit the STAT pathway, both of which are associated with cancer cell proliferation.[26, 27]

Bibliometric research of traditional Chinese medicine (TCM) for the treatment of inflammatory bowel disease (IBD) and lymphoma in 2023 shows that the topic is still interesting to discuss.[28, 29] However, to date, there has been no specific study focusing on the trends and bibliometric models that explore the role of traditional medicine as an anticancer strategy. This absence of targeted research presents a critical gap in the literature. Bibliometric analysis of traditional medicine in lung cancer was conducted to determine the level of interest of this topic to be discussed. The results of the analysis of traditional medicine in lung cancer are presented in bibliographic form, mapping the distribution of each research variable helps in the analysis and visualisation of the results. The use of bibliometric analysis aimed to study publication patterns and research structures, so as to provide an overview of retrospective research.[30]

Methods

This study used a bibliometric approach, an analytical method that aimed to map and analyse the distribution of scientific publications, including articles, conference papers, books and other documents.[31] Previous studies have shown that bibliometric methods are very effective in identifying research trends, collaboration patterns and the results of specific studies.[31] This analysis is often used as an initial step to understand existing research gaps and provide insight into the direction of research that needs to be done in the future. With this method, researchers can gain a comprehensive view of the research landscape, providing a significant impact on the development of future studies.[30]

The data sources used in this study came from the *Scopus SciVerse* database for publications during the period 2015 to 2024. The selection of *Scopus* as the primary database was driven by

its broader coverage of scientific literature compared to other platforms such as *PubMed* and *Dimensions*. Moreover, *Scopus* offers more detailed and high-quality metadata, including citation information and author affiliations, which enhances the accuracy and depth of bibliometric analysis.

The data search process was carried out using the keywords "lung cancer" and "traditional medicine" or "ethnomedicine." These keywords were applied to the search options in the article title, abstract and keywords in the *Scopus* database. To ensure data relevant to the focus of the study, subjects related to "computer science," "physics and astronomy," "mathematics," "energy," "economics, econometrics and finance" and "arts and humanities" were excluded from the analysis. The research data were downloaded on 24 January 2025, through the official *Scopus* website. In the initial process, a search using the specified keywords resulted in 497 documents. However, after filtering by considering the year of publication and exclusion criteria, the number of documents suitable for analysis was reduced to 349 articles. This process ensures that the data analysed were relevant to the research objectives and reflects the desired trends.

Data analysis was conducted with the help of two main software, namely *VOSviewer* version 1.6.1618 and R Studio with *the Biblioshiny* package. *VOSviewer* was used to map and visualise research networks, such as relationships between keywords, collaboration patterns between countries and publication sources. This software is very useful for producing visual maps that show connections between research elements clearly and easily understood. On the other hand, R Studio with *the Biblioshiny* package provides flexibility in conducting statistical analysis and producing additional visualisations that support bibliometric results.

This study included several types of analysis, covering various aspects of publications. First, the analysis of the development of publications over time, second, documents with the highest number of citations were analysed, third, sources or journals with the highest number of publications. Keyword analysis was carried out to identify the most frequently used terms in publications. The study also evaluated the contribution of various countries by analysing the number of documents produced and the number of citations obtained, as well as international collaboration between countries.

Results

This study focused on the analysis of literature related to lung cancer treatment using traditional methods. Based on a search in the *Scopus* database, a total of 349 documents were obtained that met the research criteria. These documents were produced by 1,839 authors who contributed during the period 2015 to 2024. Of the total documents, the distribution of publication types was: 211 documents were articles, 126 were reviews, 7 were book chapters, 4 documents were editorials and 1 document was a short survey.

The development of the number of publications related to lung cancer treatment with traditional medicine showed an increasing trend from year to year. The peak was recorded in 2024 with a total of 60 published documents. Previously, in 2022 and 2023, 51 published documents were found each. However, although there was an overall increase, this trend was not completely stable. For example, there was a decrease in the number of publications in 2017, which only recorded 15 documents, after previously reaching 24 documents in 2016. The number of publications increased again in 2018 with the same number, namely 24 documents. These data show that although there were small fluctuations, interest in this research in general continues to grow.

The number of citations was used to evaluate the impact of these documents in the research field. The ten documents with the highest citations were further analysed. The document with the highest citations was written by Guo J in 2022, published in the journal *Signal Transduction and Targeted Therapy.* The study titled "Aging and aging-related diseases: from molecular mechanisms to interventions and treatments" has been cited 449 times. Next, the study by Zheng J in 2016, published in the journal *Nutrients* under the title "Spices for Prevention and Treatment of Cancers," received 248 citations. In third place, there was a study by Lelli D in 2017 published in the journal *Pharmacological Research,* under the title "Curcumin use in pulmonary diseases: State of the art and future perspectives," which has been cited 238 times.

A total of 177 sources had contributed to publications related to lung cancer treatment using traditional methods. The source with the largest contribution was the *Journal of Ethnopharmacology*,

which published 24 documents with a total of 707 citations. Then, *Frontiers in Pharmacology* followed with 15 publications and 519 citations. *Phytomedicine* was in third place with 9 published documents, while *Pharmaceuticals* contributed with 6 documents. There were also 8 sources that each published 5 documents and 4 other sources published 4 documents. Interestingly, although *Pharmacological Research* only published 5 documents, the number of citations obtained was quite high, indicating the quality and influence of these documents in this field. Figure 1 shows the Top 10 Sources related to lung cancer treatment research using traditional medicine

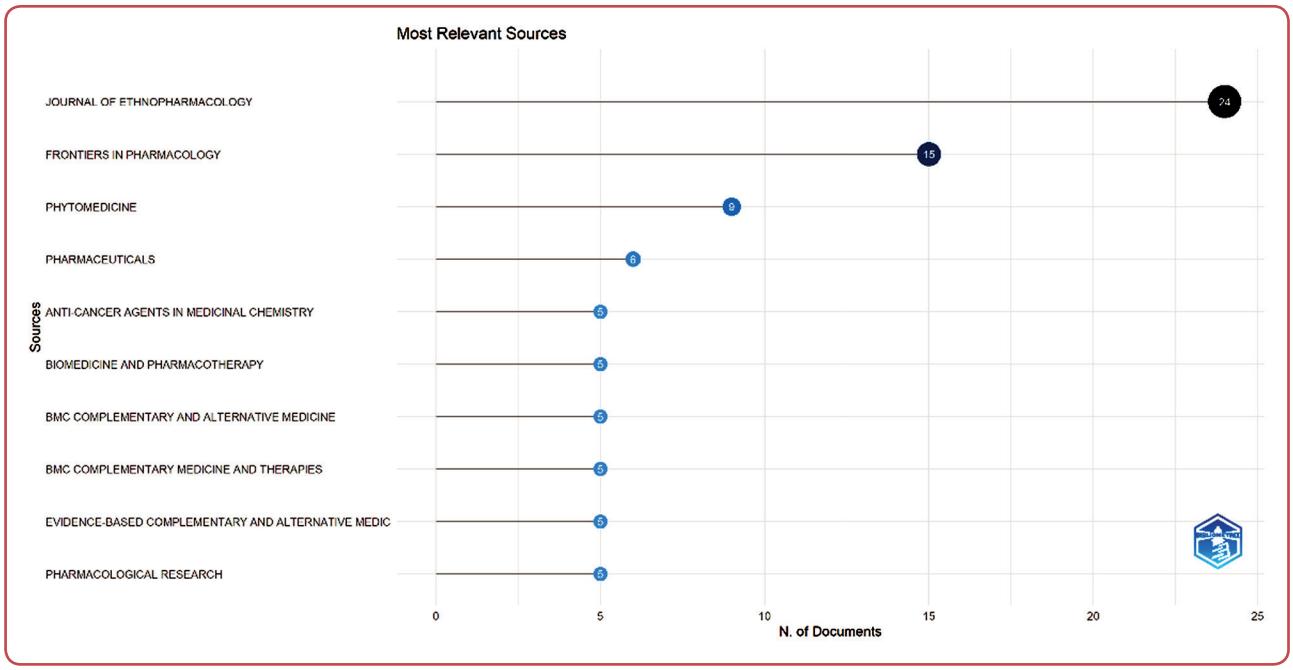

Figure 1: Top 10 sources related to research on lung cancer treatment with traditional medicine

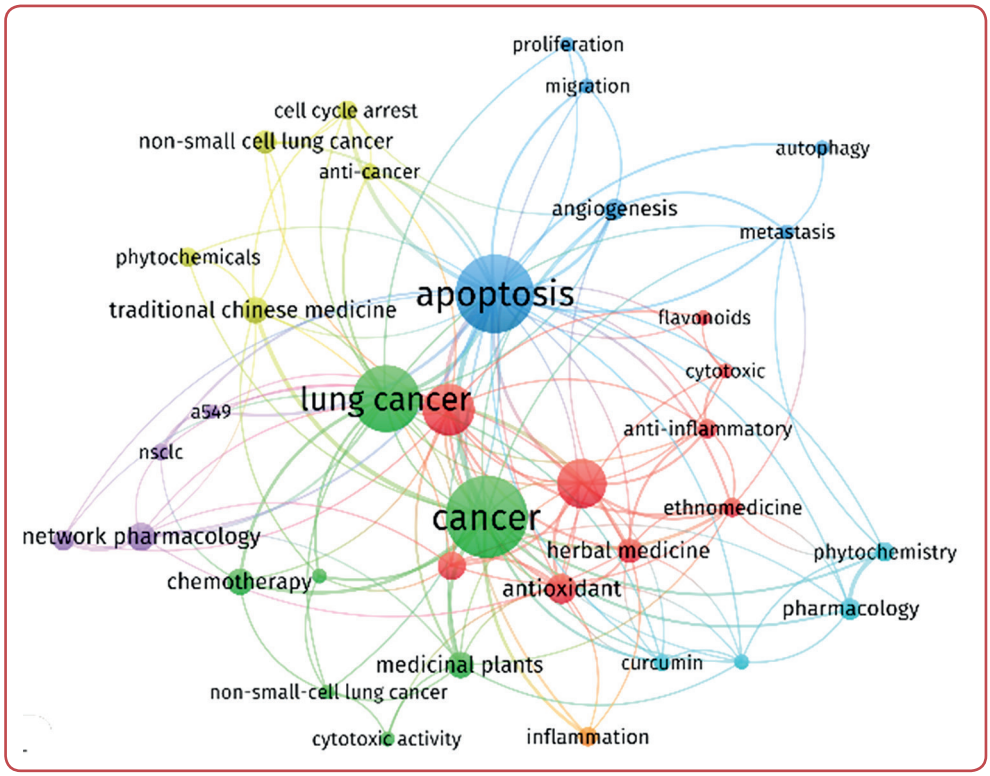

Figure 2: Network visualisation of keywords used by authors

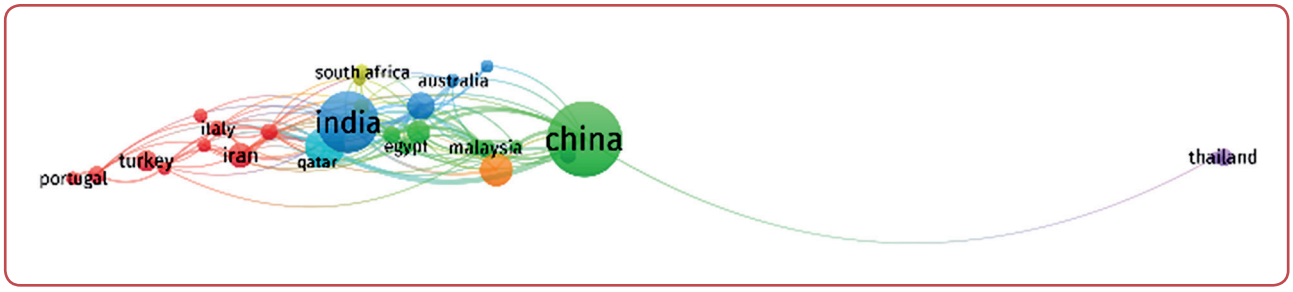

Figure 3: Network visualisation of author countries related to research on lung cancer treatment with traditional medicine

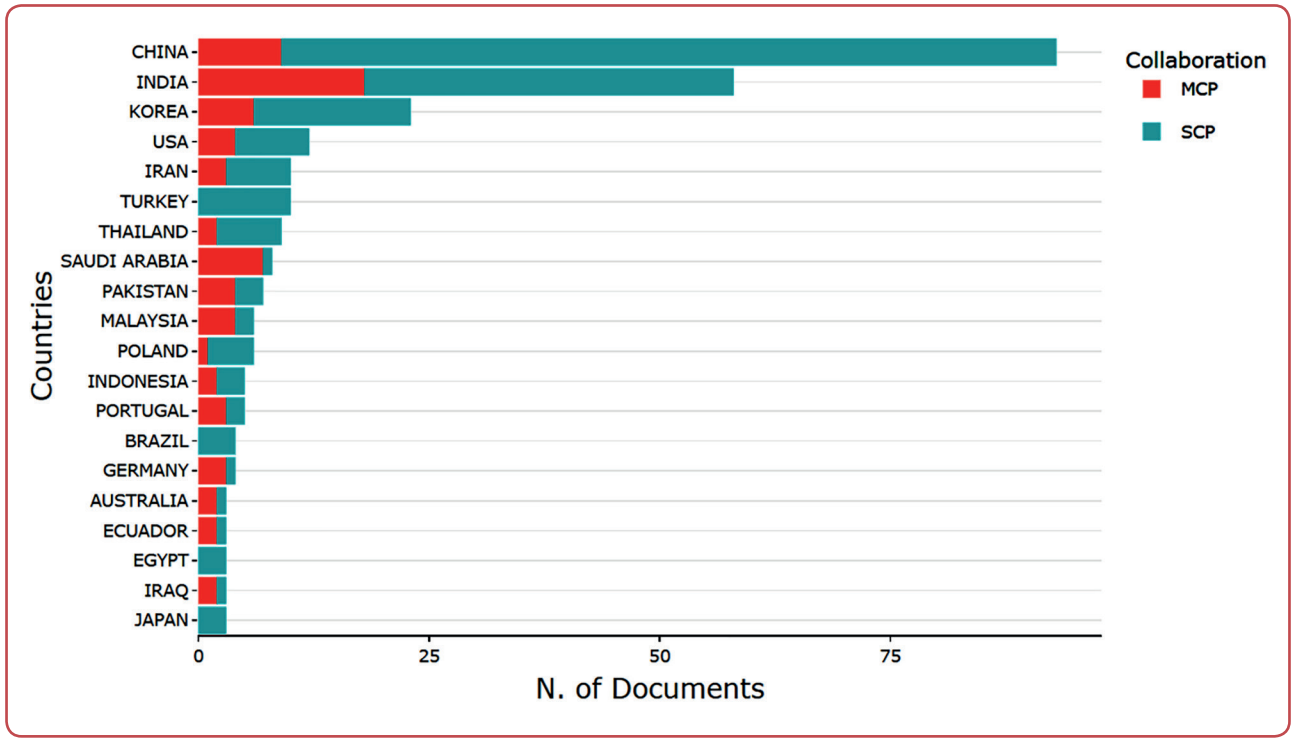

Figure 4: Collaboration between related research on lung cancer treatment with traditional medicine

SCP: single country publication; MCP: multiple country publication;

Keyword analysis showed that 1,220 keywords were repeatedly used in publications related to this topic. Of these, 36 keywords were repeated at least 5 times, as visualised in Figure 2. The most frequent keyword was "cancer," which appeared 51 times, indicating the relevance of the data to the study. Other frequently used keywords included "apoptosis" (47 times), "lung cancer" (39 times), "cytotoxicity" (27 times), "anticancer" (25 times) and "antioxidant" (13 times). Two other important keywords, "network pharmacology" and "traditional medicine," were repeated 12 times each. The relationship between the two suggests that traditional medicine often began with a network pharmacology approach before proceeding to preclinical trials. Other keywords such as "chemotherapy," "medicinal plants" and "traditional Chinese medicine" also appeared frequently, each appearing 11 times.

The analysis results showed that 69 countries have contributed to publications on traditional lung cancer treatment. The network visualisation in Figure 3 shows 29 countries that have more than 5 documents. China was the country with the largest contribution, publishing 116 documents with the highest number of citations, namely 2,962 times. India was in second place with 82 published documents and 1,654 citations. These two countries dominate the number of publications, reflecting great attention to traditional medicine research for lung cancer patients. The United States is in third place with 28 documents and 1,178 citations, followed by South Korea and Saudi Arabia with 27 documents each.

International collaboration in this study was analysed based on the categories of single country publication (SCP) and publication with collabora-

tion between countries multiple country publication (MCP), as visualised in Figure 4. The results of the analysis show that China had the highest level of collaboration, followed by India, South Korea and the United States. This collaboration indicates a high international interest in this topic, which ultimately affects the number of publications and the level of citations obtained.

Discussion

The results of this study indicate that the topic of lung cancer treatment using traditional medicine has become an area of increasing interest over the past decade. The increase in the number of publications from year to year reflects the high interest in exploring this alternative treatment, with the peak number of publications recorded in 2024. Although there are fluctuations in certain years, the overall trend indicates significant progress. Contributions from various types of publications. This shows the multidisciplinary approach used by researchers to understand the potential of traditional medicine in the treatment of lung cancer. This is reinforced by the high number of citations to previously published documents.

Aging is often associated with inhibition of cell proliferation, but recent findings suggest that aging may also act as a driver of cancer cell growth.[32] This property makes aging have a dual effect on tumorigenesis: it is an antagonist that inhibits tumour growth, but also an agonist that can support cancer development. These findings provide new perspectives in understanding the dynamics of aging in the elderly, especially in the context of cancer. Moreover, the use of conventional anticancer therapies in the elderly tends to cause damage to both cancer cells and normal cells.[32] This highlights the importance of more specific and selective therapeutic approaches for elderly patients, making the development of elderly-friendly therapies a very promising research direction in the future.

TCM is a form of traditional medicine that continues to develop to this day. With a history of more than 3,500 years, TCM focuses on the principle of strengthening the body while eliminating the aetiology of the disease.[33] In the context of cancer treatment, TCM has long been used both as a primary therapy and as a complementary therapy during chemotherapy and radiotherapy. In addition, TCM is also often used to prevent cancer recurrence after surgery.[34] TCM's contribution to oncology includes the development of cancer diagnosis, treatment theory and basic research related to the mechanism of action of traditional medicine. One of the advantages of TCM is its ability to integrate holistic concepts in medicine, where the body is viewed as an interconnected system. This makes TCM relevant in modern research, especially in exploring a more personalised and patient-oriented treatment approach. The future development of TCM is expected to be a foundation for research on other traditional medicines, both in terms of drug formulation and evaluation of its effectiveness. In the era of health globalisation, TCM also has the potential to become a model for traditional medicine from various other cultures, thus creating synergy between traditional approaches and modern medical technology.

Bibliometric analysis reveals a growing scientific interest in the use of traditional medicine as an alternative therapy for lung cancer. Various bioactive compounds derived from traditional and spices, such as curcumin, flavonoids and triterpenoids, exhibit anticancer properties through complex molecular mechanisms, including the modulation of signalling pathways like JAK2/STAT3, PI3K/Akt and RAS/RAF/MEK/ERK.[35-38] Curcumin, for example, not only promotes apoptosis in cancer cells but also provides protective effects against chronic pulmonary diseases.[36, 37] Other compounds, such as honokiol and Asiatic acid, act by regulating microRNA expression and inhibiting cellular proliferation.[39] Additionally, several medicinal plants such as *Aloe vera*, *Allium cepa* and *Crocus sativus* have shown potential to suppress lung cancer progression through specific biological pathways. These findings offer a scientific foundation for the development of safer, herbal-based therapeutic strategies that support integrative cancer treatment approaches.[40-44]

The development of traditional medicine as an alternative treatment for lung cancer has increased significantly in the last decade, especially after the COVID-19 pandemic.[45] The pandemic has accelerated research to find new drugs that have multi-target mechanisms of action.[46, 47] In this context, herbal plants are an attractive choice because they contain phytochemical compounds that can target various biological pathways. The network pharmacology approach is increasingly

being used to map the biological mechanisms of active herbal compounds and develop traditional medicines more systematically.[48] This method allows the development of evidence-based traditional medicines with quantitative and dynamic analysis, providing a stronger scientific basis for traditional medicine. The presence of network pharmacology keywords that often appear in publications indicates the importance of this method in traditional medicine research. With this method, the development of traditional medicines is not only empirically based, but also utilises modern technology to validate their effectiveness and safety. This underscores the need for a more integrated approach between tradition and science to produce holistic and innovative health solutions.

Analysis of country contributions showed the dominance of China and India, indicating their leadership in traditional medicine research. Publications from these two countries reflect not only academic interest, but also a long tradition of using herbal medicines in their health systems, such as Ayurveda and traditional Chinese medicine. This is evidenced by the many concepts of diagnosis, treatment and knowledge of the molecular basis of herbal medicine developed through TCM. The high number of publications, citations and international collaborations, this study shows the positive prospects of traditional medicine as a complementary approach in managing lung cancer.

The findings from this bibliometric analysis highlight the growing academic interest in traditional medicine as a potential complementary approach in lung cancer treatment. However, several challenges remain, particularly in the areas of standardisation, scientific validation and the development of supportive health policies. Addressing these challenges is essential to facilitate the integration of traditional therapies into mainstream oncology practice. Therefore, future research should not only focus on expanding the evidence base for the efficacy and safety of these treatments but also explore their practical application in clinical settings. By doing so, traditional medicine could offer additional therapeutic options that are accessible, culturally relevant and potentially beneficial for lung cancer patients around the world.

The limitations of this bibliometric study on traditional medicine as an alternative treatment for lung cancer include its reliance on a single database like *Scopus*, which may exclude relevant publications from other sources such as *PubMed* or *Web of Science*, potentially leading to incomplete data coverage. The study is also constrained by the predefined keywords, which may have overlooked related studies that use different terminologies. Additionally, bibliometric analysis focuses on publication patterns and trends, providing limited insights into the quality or clinical applicability of the research. Future studies should incorporate multiple databases and more diverse methodologies to ensure comprehensive and holistic analysis.

Conclusion

This study reveals a positive trend in traditional medicine research as an alternative therapy for lung cancer during 2015–2024. The results showed an increase in the number of publications and global collaborations, with dominant contributions from China and India. Traditional medicines, such as TCM and active compounds from herbal plants, such as curcumin and flavonoids, have been shown to have anticancer potential through molecular mechanisms, including induction of apoptosis and inhibition of cancer cell proliferation. This study strengthens the argument that traditional medicine can be a promising approach for lung cancer therapy, especially in overcoming drug resistance and side effects of conventional therapies. This study also emphasises the importance of integrating traditional and modern approaches for the development of more personalised and effective treatments.

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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