

Ginger (*Zingiber Officinale*) as a Medicinal Plant: Bibliometric Review

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ABSTRACT

Ginger has been used as a traditional medicine since ancient times. Research on ginger as a medicinal plant has been extensively conducted, and there are existing literature studies on the topic. However, a bibliometric study specifically focused on ginger as a medicinal plant has not been carried out. This research aims to examine the research trends on ginger as a medicinal plant in the past 20 years (2004-2023). The data were obtained from the ScienceDirect database and visualized using VOSviewer. The visualization results of the bibliometric study indicate that ginger is connected to medicinal plants, and it exhibits numerous health effects. New fields of ginger research include the Covid-19 epidemic outbreak, pharmacology, chemometrics, and molecular docking. This could be important in the future development of ginger study. The highest number of research studies was conducted in 2021. The Journal of Ethnopharmacology emerges as the most significant contributor to this research.

Keywords: ginger, *Z.officinale*, medicinal plant, bibliometric, VOSviewer

INTRODUCTION

Humans have been using medicinal plants from ancient times, both traditionally as well as through generations. Plant-based medicinal treatments have substantially took advantage in the healing of numerous ailments. Ginger is a medicinal herb that has been utilized by people for centuries. Ginger (*Zingiber officinale*) is a popular cooking spice recognized for its spicy flavor and characteristic scent. However, in addition to its culinary use, ginger has medical benefits and is commonly used to treat a variety of diseases.

Various bioactive compounds, such as gingerol, shogaol, zingerone, and others, are recognized to play important roles in distinct biological functions. Because of its capacity to reduce the risk of numerous diseases such as cancer and colitis, ginger has tremendous potential as a functional food ingredient. It also has anti-inflammatory, antioxidant, and antibacterial properties, lowers cholesterol, and has several other advantages (Garza-Cadena *et al.*, 2023).

Ginger is native to tropical Asia but has been cultivated worldwide. There are records of its rhizomes being used in culinary and medicinal applications, recognized by different cultures as a useful spice for treating nausea and stomach discomfort. The use of ginger, whether fresh or dried, allows for the treatment of various conditions related to pain. Most of the compounds tend to be processed using extraction methods to obtain the necessary components for medicinal purposes, resulting in nutraceutical products (Semwall *et al.*, 2015; Garza-Cadena *et al.*, 2023).

Numerous studies on ginger and its health effects have been undertaken, and there is a substantial body of literature investigating the medical characteristics of ginger as a plant. However, no bibliometric study on this topic has been done. As a result, it is critical for carrying out a bibliometric study on ginger as a

medicinal plant to comprehend the scope of previous research and to decide the future direction of research.

Bibliometric analysis is used to identify the underlying framework of citations that reflect the development of knowledge over time. This analysis aims to quantitatively measure the published studies to describe and evaluate their results, including the authors, institutions, and journals publishing research in a specific field of knowledge. Furthermore, the analysis aims to analyze the dissemination of knowledge on related topics. Thus, bibliometric analysis can provide valuable insights into understanding trends and advances in ginger-related research (Elisha and Viljoen, 2021; Melo *et al.*, 2021; Rodríguez-Rojas *et al.*, 2019; Arifah *et al.*, 2022).

MATERIALS AND METHOD

Data sources

Literature data on ginger as a medicinal plant is obtained from the Scopus database. References to *Zingiber officinale* as a medicinal plant are taken from the Scopus database because it has more comprehensive and extensive data. The keywords used in the Scopus database are “*Zingiber officinale*” OR “ginger” OR “medicine” OR “medicinal”. Scientific literature sought contains either one of the keywords, terms, or phrases in the title, abstract, article, or keywords. The scientific literature used is from the last 20 years (2004-2023) and is limited to English-language publications.

Data Extraction and Analysis

Data extraction and analysis are done by collecting existing scientific literature information, including relevant titles, abstracts, keywords, and articles. After the data is extracted, analysis is conducted to understand and analyze the collected data. The gathered literature is stored in the “.RIS” format. The data is then exported to Vosviewer version 1.6.19 for further bibliometric analysis (van Eck and Waltman, 2020). The parameters used for the results include publication trends, analysis of contributing publishers, keyword co-occurrence network, and overlay. Data extraction and analysis are described in Fig.1.

Term map

VOSviewer is a software used to analyze and visualize bibliometric data from a database in the form of words appearing in the titles, abstracts, and keywords of selected literature. The data visualization takes the form of a bubble map, where each bubble represents a word or phrase appearing in the literature. The color of the bubbles indicates the number of citations per publication that contain that word. The distance between two bubbles indicates how often those two words appear together (Yeung *et al.*, 2018; Arifah *et al.*, 2022).

RESULTS AND DISCUSSION

Publication trends

The latest research data was collected and stored as of September 2nd, 2023, from the Scopus database. A total of 447 literature sources were obtained after filtering from 626 publications on ginger and its medicinal benefits, originating from 155 publishers. Fig. 2 shows the publication trends over the past 20 years. The observed publication trend covers the last 20 years, from 2004 to 2023. The number of publications on ginger and its health advantages fluctuates over years, but it has increased considerably in 2021 compared to prior years. However, starting in 2019, there has been a rise in publications. The increase between 2019 and 2021 is allegedly to be due to ginger being used as a medicine or herbal remedy to treat Covid-19, as ginger has benefits in boosting the immune system. According to (Córdoba-Tovar *et al.*, 2022) Ginger (*Z. officinale*) has emerged as a significant natural ingredient that has garnered increased attention during the Covid-19

pandemic. There has been a notable rise in the number of studies and research conducted on Ginger between 2019 and 2021. Following *N. sativa* and *G. glabra*, *Z. officinale* is the third plant with possible usefulness in treating Covid-19. Its effectiveness is attributed to its antiviral activity. Several countries, including India, China, Iran, the USA, and Saudi Arabia, have actively pursued research on the potential of *Z. officinale* during the Covid-19 pandemic. These countries have recognized the importance of exploring the therapeutic properties of *Z. officinale* in combating the virus and have contributed significantly to the growing body of research in this field.

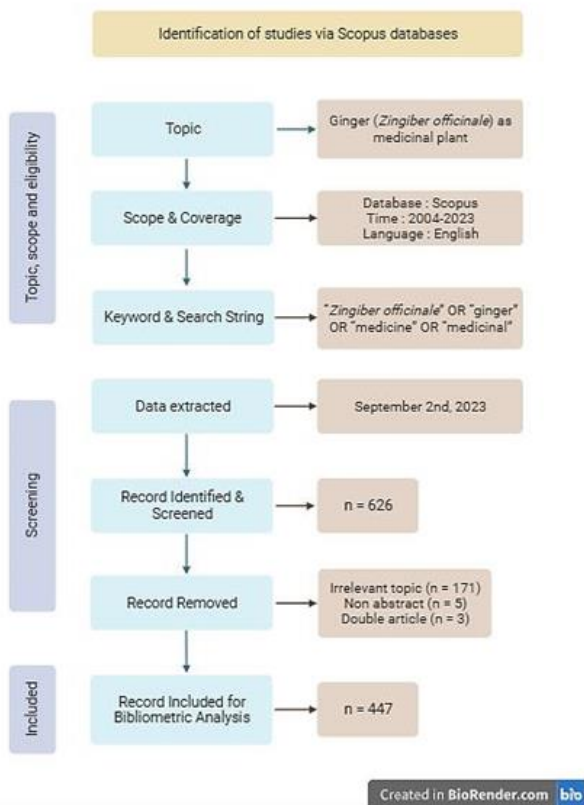


Fig. 1. Flow diagram of the search strategy

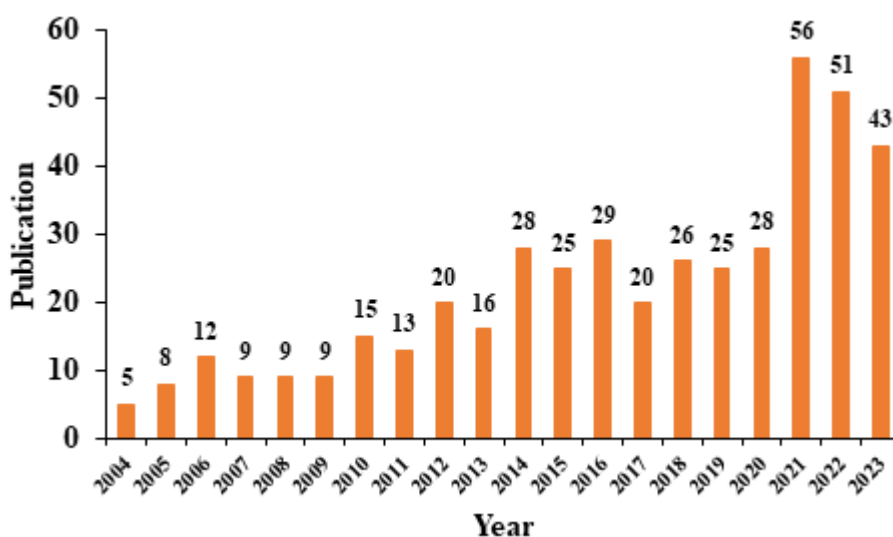


Fig. 2. Publication trends on *Z. officinale* as a medicinal plant

Ginger (*Z. officinale*) as a medicinal plant has long been utilized by the Chinese, India, and Middle East ethnic group as a traditional medicine, passed down from generation to generation. The health benefits of ginger have been extensively documented, including its role in boosting the immune system, treating obesity, hypertension, cancer, Covid-19, asthma, and malaria, as well as its anti-diabetic and anti-inflammatory properties. These health benefits of ginger are attributed to its bioactive compounds, including gingerol, 6-gingerol, 6-shogaol, flavonoids, phenolic compounds, essential oils, and antioxidant activity.

Analysis of Top Contributing Publishers

The most productive publisher is Elsevier/Journal of Ethnopharmacology, with a total of 97 publications on *Z. officinale* as a medicinal plant. Among the 155 publishers, 3 publishers have the highest number of publications. Having information about publishers that have published a significant amount of scientific literature on *Z. officinale* as a medicinal plant can facilitate future research development. The table of publishers and their publication counts can be seen in Table 1.

Table 1. Top Contributing Publishers

No.	Publisher	Publication
1	Journal of Ethnopharmacology	97
2	Journal of Herbal Medicine	21
3	Saudi Journal of Biological Sciences	14

Keyword co-occurrence network and overlay

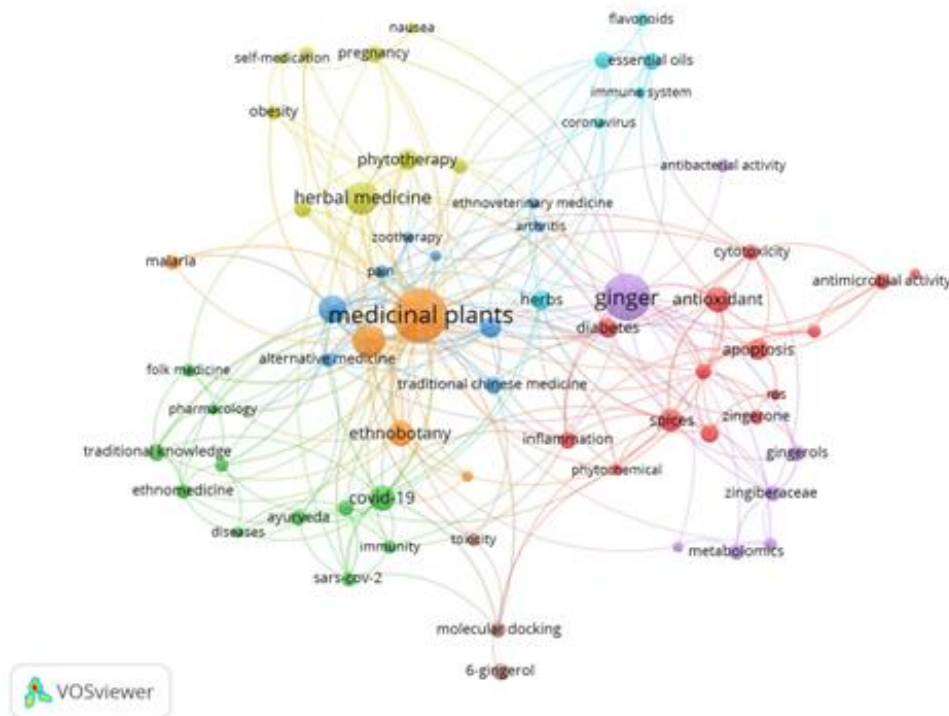


Fig. 3. Keyword co-occurrence network

Based on the keywords used, it can be observed in the visualization in Fig. 3 that *Z. officinale* (ginger) is depicted as a medicinal plant. Ginger has a bubble map that is nearly the same size as the medicinal plants, indicating that ginger, like other medicinal plants, has been extensively studied. The research trends on ginger as a medicinal plant are diverse, including its benefits for immunity, nausea, malaria, diabetes, hypertension, obesity, arthritis, its use in Ayurveda, and its recent use as an alternative treatment for Covid-19. Additionally, ginger, referred to as a medicinal plant, has connections to traditional Chinese medicine, herbal medicine, ethnobotany, pharmacology, and ethnopharmacology. Ethnobotany is a subfield of study that focuses on the complex link between humans and plants. Ethnobotany delves into the traditional understanding of plant classification, cultivation techniques, and their numerous applications in areas such as subsistence, medical practices, and shelter construction (Iwu, 2002). Then there's pharmacology, which is a branch of medicine that combines biology, biology, and pharmaceutical sciences to study the effects of pharmaceuticals or prescriptions. The study of how these chemicals interact with the body and the effects they have on various levels of biological systems is known as pharmacology (Vallance & Smart, 2006). Whereas ethnopharmacology is an interdisciplinary field that explores the active ingredients in historically and traditionally used plants for medicinal purposes. It combines concepts from ethnobotany, medical anthropology, and pharmacognosy to uncover the therapeutic potential of natural sources (Grundmann *et al.*, 2023). These fields are related to the use of natural medicines by communities and the exploration of their efficacy and effects

Based on the visualization of the keyword occurrence overlay in Fig. 4, it can be observed that the research trend on ginger as a medicinal plant from 2018-2023 was predominantly conducted in 2020-2021, as indicated by the greenish-turquoise color of the bubble map. Meanwhile, purple bubbles indicate that research on this topic has been carried out for a long time. However, there are also emerging research areas related to ginger that has been less explored, such as ginger research on pharmacology, chemometrics, and molecular docking. This is reflected by the yellow color on the bubble map, indicating that these studies were conducted in 2023 and are relatively new. Meanwhile, the research trend on ginger for Covid-19 occurred in the mid-2021 to 2022 period.

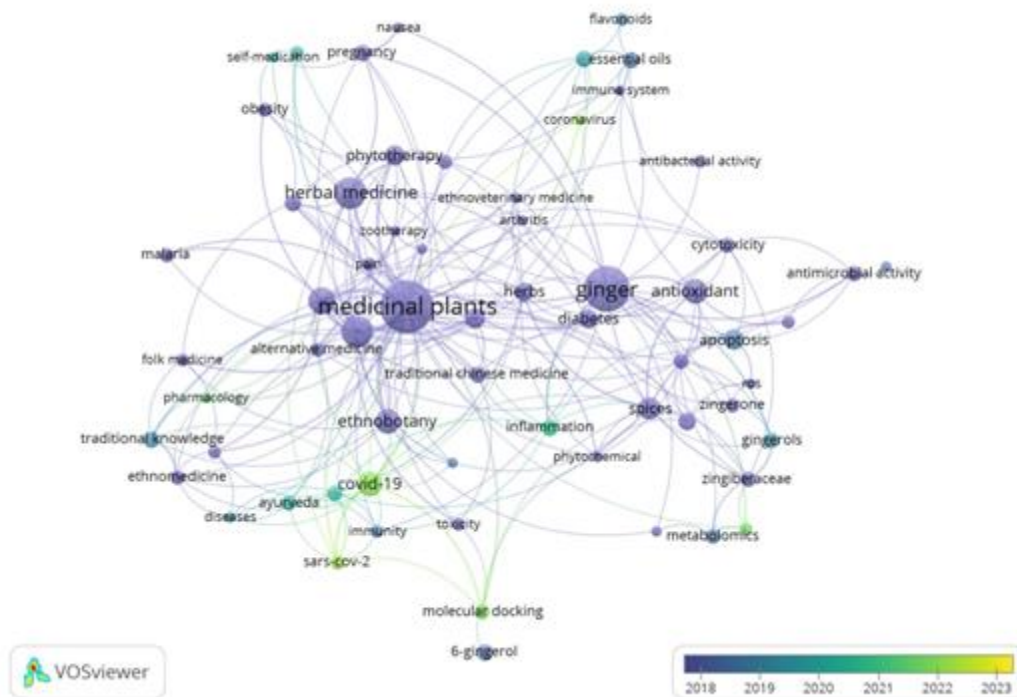


Figure 4. Keyword co-occurrence overlay

CONCLUSION

The study of ginger as a medicinal plant's bibliometric review entails assessing and quantifying numerous characteristics of scientific literature, such as scientific publications, citations, author partnerships, research networks, and other trends. Data from multiple sources were acquired from the ScienceDirect database between 2004 and 2023. According to the VOSviewer visualization results, the research trend on *Z. officinale* as a medicinal plant seems to increase from 2019 but drops in 2023, with the maximum number of publications in 2021. With 97 publications, the Journal of Ethnopharmacology is the most prolific publisher. Ginger's interaction with medicinal plants is linked to the pharmacological benefits it delivers. Among the health benefits of ginger are its benefits for immunity, malaria, nausea, diabetes, hypertension, obesity, arthritis, its usage in Ayurveda, self medication, pregnancy, zootherapy, and so on. Its merits in recent use as an alternate treatment for Covid-19 are also highlighted. Ginger's associations with pharmacology, chemometrics, and molecular docking have garnered less attention in research.

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