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BIBLIOMETRIC ANALYSIS OF GLOBAL RESEARCH ON THE EFFECTS OF GARLIC ON BREAST CANCER FROM 1992 TO 2024

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Abstract

Background: Garlic and breast cancer represents a rapidly advancing area of research with significant potential for cancer therapy. However, there is a notable gap in the literature regarding a comprehensive bibliometric analysis that systematically maps the global research landscape in this field. This pioneering study aims to bridge this gap a thorough and multidimensional bibliometric investigation.

Methods: Specifically, it examines the available literature on the application of garlic for cancer therapy, utilizing the Web of Science (WOS) and Scopus database as the primary information sources. The study employs various analytical tools, including the bibliometrix package in R Studio software to conduct an in-depth analysis of the published scientific literature.

Results: A total of 422 articles were identified through the Web of Science Core Collection database, amassing 10,977 citations, with a consistent annual increase in the number of publications. The analysis covers a significant timespan from 1992 to 2024, involving 290 sources and 479 documents, with a consistent annual increase in the number of publications. United States, Tabriz University of Medical Sciences, Nutrition and Cancer, and SINGH S respectively. Most global cited documents were obtained by Parkin et al. 2001, and the most local cited references were obtained by Challier B, in 1998, published in Eur J Epidemiol. Most frequent keywords words were human, garlic, female, and breast cancer, respectively.

Conclusion: This study provides valuable reference and enlightenment for researchers in this field. As research progresses, researches are anticipated to offer significant hope and breakthroughs in the treatment of breast cancer.

Keywords: Web of Science (WOS), Scopus, citation, authors, publication

Introduction

As the most common malignant tumor in the world in terms of both incidence and death, breast cancer is a major public health problem (1). As per the GLOBOCAN 2020 (Global Cancer

Statistics), the global number of new cases and deaths due to breast cancer in 2020 was expected to be 2.261 million (2). Female breast cancer has a rising incidence and death rate in China; in 2015, there were over 303,000 new cases and 71,000 reported deaths (3). Genetic alterations, hormone imbalances, lifestyle decisions (such as smoking, obesity), and environmental variables (such as exposure to specific chemicals or radiation) are some of the risk factors that lead to breast cancer development (4). Based on unique molecular traits, breast cancer demonstrates molecular heterogeneity (5). The development of more efficient and customized treatments has advanced significantly as long as research on the molecular features of breast cancer maintain (1).

According to recent research, dietary supplements, especially those high in antioxidants, immune-boosting, and anti-cancer components, may help lower the incidence and progression of cancer (6, 7). Numerous anti-breast cancer compounds have been identified by traditional herbal remedies, while many of their methods of action remain unclear (8).). Garlic and brightly colored fruits and vegetables are widely known for having the potential to cause cancer among the dietary goods that have been researched (9, 10). Garlic is a multi-use medicinal herb whose components include anti-tumor, immunological-stimulating, antioxidant, cardioprotective, and antidiabetic effects (10, 11). Garlic, for instance, has been shown to slow the formation of tumors in mice (12). In patients with advanced cancer, aged garlic extract (AGE) lowered the risk of cancer and stopped the NK cells from declining (13, 14). Research currently available indicates that the oils from pomegranate pericarp, garlic, and onions, respectively, stimulate the differentiation of leukemic and prostate cancer cells (15, 16). Nevertheless, the precise differentiation mechanism and the essential molecular markers remain unknown.

Herbal medicine therapy is therefore essential to the treatment of breast cancer in the age of precision medicine (1). A quantitative study of targeted therapy for breast cancer is necessary due to the growing quantity of published research covering a wide variety of issues. In order to obtain a thorough grasp of the new directions in targeted breast cancer treatment, this study searched and examined literature from 2003 to 2022 using the Web of Science Core Collection database (1).

A quantitative study and analytical tool, bibliometrics examines a number of aspects of scholarly literature, such as quantity, quality, influence, distribution, and more. Alan Pritchard first released it in 1969 with the goal of using an analysis of the norms and features of academic publications to comprehend the state of research, the direction of progress, and the frontier dynamics of a particular area (17). The amount of literature, the number of citations, the distribution of authors and institutions, the analysis of keywords, the journal impact factor, and more are among the research goals of bibliometrics. Our goal in this work was to do a bibliometric analysis of papers covering targeted treatment for breast cancer published during the previous 20 years in order to pinpoint areas of interest for further investigation, highlight emerging trends in the field, and offer valuable perspectives (17).

Methods

Data source and search strategy

The Web of Science database (WOS), PubMed, and Scopus provided the data used in this study, which are acknowledged as the leading databases for bibliometric analysis and are used extensively. On July 6, 2024, all papers about garlic for breast cancer from 1992 to 2024 were

retrieved and downloaded for additional analysis in order to avoid bias brought on by frequent database updates.
Only research papers and review articles written in English were taken into consideration for this study once the search was finished and non-original research and review publications were ruled out.

Data Extraction and Collection

To obtain a comprehensive collection of relevant literature, a meticulous search strategy was implemented across three preeminent academic databases: Scopus, PubMed and WOS. Our search strategy involved a two-step process for each database.
A first comprehensive search was performed on the three database and then refined the results using the following filters: 1) Language: English 2) Document Types: Articles and Reviews. we applied filters to restrict the results (Table 1).
The bibliographic data we collected encompassed details such as publication year, citation counts, countries of origin, institutions, authors, journals, funding agencies, research topics, keywords, and references. We employed R software to merge and deduplicate the extracted data. Finally, the data was stored in the BibTeX format to facilitate further analysis.

Bibliometric Indicators and Analysis Tools

Our analysis incorporated the following bibliometric indicators and software tools:

- **Impact Factor (IF) and Quartile Ranks:** The Impact Factor (IF) and quartile rankings of journals in relevant subject categories were retrieved from the 2020 Journal Citation Reports (JCR).
- **H-index:** This metric is used to quantify the cumulative influence of a country's research output. An H-index of 20, for instance, indicates that 20 publications have each been cited at least 20 times.
- **Software Tools and Platforms:** The analysis involved both qualitative and quantitative methods, utilizing the following software:
  - R version 2023.12.1 package and online analysis platforms (https://www.bibliometrix.org/)
  - VOSviewer We build and depict bibliometric networks using VOSviewer 1.6.18 (Van Eck and Waltman, Leiden University, Netherlands) for bibliometric analysis and mapping procedures (18).

Bibliometric Analysis

This bibliometric investigation utilized two main analytical tools: R version 2023.12.1. The R package Bibliometrix version 4.0.0 was employed to conduct several quantitative analyses. These analyses included calculating publication and citation counts, analyzing keyword frequency, examining collaboration networks among countries and authors, and creating three-field plots to visualize keyword co-occurrence. The open-source R-Studio development environment and the Bibliometrix package were used for quantitative analysis, data analysis, and interpretation.
The data-gathering approach involved extracting dependable data from the Scopus database, which was then loaded into the Bibliometrix R package for thorough bibliometric analysis. Through conducting these complementary analyses, we could uncover patterns and trends

within the corpus, leading to a deeper understanding of the research landscape concerning CAP and its effects on cancer.

Result

Annual publication trends analysis

This study performed a bibliometric analysis of research on the utilization of garlic in cancer treatment. The analysis covers a significant timespan from 1992 to 2024, involving 290 sources and 479 documents. Over this period, there has been a consistent rise in the quantity of research produced, with an annual growth rate of 5.94%. The average age of the documents is rather recent, standing at 10.9 years. In this investigation, we utilized an extensive dataset comprising 8,639 references, along with 7,182 Keywords Plus (ID) and 1286 Author's keywords (DE). These findings emphasize the wide range of subjects investigated in the field of garlic's influence on cancer. Overall, the analysis involved collaboration among 1,891 authors, with 28 contributing to single-authored documents. This cooperative nature of the research is seen in the average of 5.17 co-authors per document, with 5.219% of publications originating from international collaborations (Figure 1 & Table 2).

Figure 3. show a comprehensive summary of the average number of total citations per article and year. Notably, the earliest publication in 1992, received an average of 4.79 citations per year over its 33-year lifespan. Each document receives 58.3 citations on average, demonstrating significant impact and widespread distribution across the scientific community (Table 2).

Countries

The global research landscape investigating the effects of garlic on cancer shows robust international cooperation and varied contributions from prominent countries and institutes.

Country Scientific Productions, were shown in (Figure 2 A & B). The United States has become the leading contributor, responsible for 225 publications of the total research output in this domain. Nevertheless, China and India closely trail behind, with 127 and 94 publications respectively.

Figure 2 C and Table S1 showed that the most relevant countries by corresponding author were USA with 114 articles, India with 67 articles, China with 40 articles, Korea with 16 articles, and Iran with 15 articles. It has been showed that the most cited countries are the USA (8882), France (2458), India (2105), China (1482), Korea (1340), Australia (824). These results mean that studies were mostly cited in the USA (Figure 2 D).

Institutional affiliations

In order to clarify institutional affiliations within the study field of garlic and cancer, we investigated it using the R bibliometric tool. The most affiliation in recent years were Tabriz University of Medical Sciences from Iran (n=212 articles) and Nanjing University of Chinese Medicine from China (n= 153) that are also in the ranking of the most productive countries (Figure 4).

Journals

Our study involved a thorough analysis of scholarly publications in the field of cancer research, specifically focusing on sources which are considered fundamental according to Bradford's Law and that have a significant impact within their local context. Nutrition and Cancer, Nutrients, Anti-Cancer agents in Medicinal Chemistry, Breast Cancer Research and Treatment and Journal of Nutrition have emerged as the top contributors, with 12, 9, 7,7 and 7 papers, respectively

(Figure 5, A & B and Table S2). These journals have consistently maintained high levels of output over time. Moreover, it is worth noting that Nutrition and Cancer, Anti-Cancer Agents in Medicinal Chemistry, Breast Cancer Research and Treatment and Journal of Nutrition have demonstrated significant h-index values of 9, 7, 7 and 7, respectively, highlighting their substantial impact in the field of literature (Figure 5, C). The most citations were obtained by these journals: Cancer Research (244), Carcinogenesis (239), Journal of Agricultural and Food Chemistry (197), and The Journal of nutrition (178).

Authors

Our investigation has identified the ten authors who have produced the most publications on garlic and cancer research. IP C is the top contributor, with 15 articles, accounting for 5.29% of the total fractionation articles. IP C demonstrates a significant influence on total citations, with a total of 1770 citations and a noteworthy h-index of 15. SINGH S and LISK D were notable contributors, having published 12 and 11 publications, respectively. Darling-Reed S, Li S, Taka E, Wang F, Zhao Y, Chen Y, and Kim S are in a next rank.

Most local cited authors were Hioki K (12), Kiuchi K (12), Nakagawa H (12), Senzaki H (12), Tanaka K (12) (Table S3 and Figure 6 a, b & d).

Collaboration

Figure S1 A show collaboration network between authors. Singh s, Zhao y, Ip c, Darling-reed s, and Li s have been the most cooperative authors respectively. Figure S1 B show collaboration network between countries. USA, China, Saudi Arabia, U Arab emirates, and Malaysia have been the most cooperative countries respectively.

Citations

In order to evaluate the effects and significance of academic publications in the fields of garlic and cancer research, we carried out an extensive analysis of citations.

Most global cited documents were obtained by Parkin et al. 2001), Ganz et al. 2002), Kundu et al. 2008), Whanger et al. (2004), Kushi et al. (2006), Imran et al. (2019), Reddy et al. (2003), Sharifi-rad et al. (2020), Whanger et al. (2002), and Acharya et al. (2010). Most local cited documents were obtained by Nakagawa H, 2001, Carcinogenesis, Xiao D, 2006, Carcinogenesis, and Ip c, 1994, carcinogenesis. Most local cited references were obtained by Challier B, 1998, Eur J Epidemiol, V14, P737, DOI 10.1023/A:1007512825851, Na Hk, 2012, Biochem Pharmacol, V84, P1241, DOI 10.1016/J.BCP.2012.08.024, and Nakagawa H, 2001, Carcinogenesis, V22, P891, DOI 10.1093/CARCIN/22.6.891 (Table S4 & Figure S2)

These influential studies have received a significant number of citations, highlighting their importance in furthering our understanding of garlic and its use in cancer research. In order to understand the changes in citation patterns over time, we examined the reference spectroscopy on a yearly basis. This analysis identified variations in citation activity across time, characterized by significant spikes and declines found in different years (Figure S2 D).

keywords

A comprehensive investigation of frequently used keywords and terms found in publication titles, abstracts, keywords, and author-supplied keywords provides a diverse viewpoint on common research topics, concepts, and developing areas of interest in the field of garlic and cancer research. Creating co-occurrence networks and overlay visualizations of keywords can help identify the thematic regions that are becoming popular. Additionally, techniques like

keyword burst detection can identify new emerging keywords and subjects, indicating prospective research frontiers and future research directions.
The investigation of frequently used words in the titles, abstracts, and keywords of publications unveiled prominent themes and concepts that are prevalent in research on garlic and cancer.
Most frequent keywords words were human (319), garlic (276), female (241), breast cancer (225), article (190), humans (189), nonhuman (164), apoptosis (145), antineoplastic agent (132), and garlic extract (130).
Most frequent author keywords were cancer (73) garlic (71), breast cancer (68), apoptosis (45), chemoprevention (29), diallyl disulfide (23), diallyl trisulfide (22), allicin (20), and medicinal plants (17).
Most important related keywords and author keywords with less frequency were Antioxidant, Dietary Supplements, Herbal Medicine, Toxicity, Herb-Drug Interaction, Inflammation, Bioavailability, Nutraceuticals, and Oxidative Stress (Figure S3 & Table S5).
Figure S4 show Thematic Map of the Keywords Plus and the Author's Keywords (A & B), Co-occurrence Network of the Keywords Plus and the Author's Keywords (C & D), Map of Thematic Evaluation of the Keywords Plus and the Author's Keywords (E & F). Figure S5 show Factorial Analysis of Topic Dendrogram for the Keywords Plus and the Author's Keywords. Trend Topics of the keywords plus and author's keywords were shown in Figure S6 (A & B). All of them confirm our results.

Discussion

This study investigated the use of garlic in cancer therapy using a bibliometric method. This investigation concentrated on assessing the journal outlets, monitoring the rate of publication development, and pinpointing important topic areas within the field of study.
The analysis covers a significant timespan from 1992 to 2024, involving 290 sources and 479 documents. Over this period, there has been a consistent rise in the quantity of research produced, with an annual growth rate of 5.94%.
The United States has become the leading contributor, responsible for 225 publications of the total research. Nevertheless, China and India closely trail behind, with 127 and 94 publications respectively. Most relevant countries by corresponding author were USA, India and China.
The top spot in terms of publications belongs to the United States, indicating the country's major role in the investigation of targeted treatment for breast cancer. This might have something to do with US funding for cancer research (19). Data on global investments in public and philanthropic cancer research was collected by a research team between 2016 and 2020 for a study that was published in The Lancet. They found that 66,388 cancer research projects received financing totaling $24.5 billion. 57.3% of all funding for cancer research came from the US, with the UK coming in second (9.8%), the European Union (5.4%), and China (4.4%) (20).
However, the most cited countries are the USA (8882), France (2458), India (2105), China (1482). This implies that the influence of US scholars' work has improved. The Tabriz University of Medical Sciences in Iran is ranked first among the top 10 universities in terms of publication volume, demonstrating its exceptional research power and impact in the field of targeted treatment for breast cancer. Nanjing University of Chinese Medicine from China that are also is the second in the ranking of the most productive countries. It highlights the significant advantage that China is making an effort to keep up with the latest developments in targeted

treatment for breast cancer. Nutrition and Cancer, Nutrients, Anti-Cancer agents in Medicinal Chemistry, have emerged as the top contributor's journals have consistently maintained high levels of output over time. Moreover, it is worth noting that Nutrition and Cancer, Anti-Cancer Agents in Medicinal Chemistry, Breast Cancer Research and Treatment and Journal of Nutrition have demonstrated significant h-index values highlighting their substantial impact in the field of literature. However, the most citations were obtained by these journals: Cancer Research, Carcinogenesis and Journal of Agricultural and Food Chemistry, and The Journal of nutrition.

After examining the geographic distribution of the publication areas of the top journals and the top cited journals, we discovered that the United States and the United Kingdom had a strong position in the academic research field of breast cancer. In addition to highlighting the dominance of Europe and the US in academic research on breast cancer, this occurrence also shows how international researchers frequently select reputable journals based in Western nations to publish their findings. From the analysis of authors IP C is the top contributor, with 15 articles, accounting for 5.29% of the total fractionation articles. IP C demonstrates a significant influence on total citations, with a total of 1770 citations and a noteworthy h-index of 15. SINGH S, LISK D, Darling-Reed S, Li S, Taka E, Wang F, Zhao Y, Chen Y, and Kim S are in a next rank. In the course of collaboration between and authors, USA, china, saudi arabia, u arab emirates and Malaysia have been the most cooperative countries respectively. Singh s, Zhao y, Ip c, Darling-reed s and Li s have been the most cooperative authors respectively. Notable partnerships were also discovered among the top ten most prolific authors. We should support and enhance international collaboration and communication to facilitate the ongoing development of targeted therapy for breast cancer. This will allow authors and institutions from many nations and regions to engage in cooperative research in this area.

Most global cited documents were obtained by Parkin et al. 2001), Ganz et al. 2002), Kundu et al. 2008), Whanger et al. (2004), Kushi et al. (2006), Imran et al. (2019), Reddy et al. (2003), Sharifi-rad et al. (2020), Whanger et al. (2002), and Acharya et al. (2010). Among the top highly cited references, most local cited references were obtained by Challier B, 1998, Eur J Epidemiol, V14, P737, DOI 10.1023/A:1007512825851, Na Hk, 2012, Biochem Pharmacol, V84, P1241, DOI 10.1016/J.BCP.2012.08.024, and Nakagawa H, 2001, Carcinogenesis, V22, P891, DOI 10.1093/CARCIN/22.6.891

Therefore, a thorough examination of the research achievements and trends reported in these highly cited articles will help researchers working on breast cancer targeted therapy make even more progress in this area.

Most important related keywords and author keywords with less frequency were Antioxidant, Dietary Supplements, Herbal Medicine, Toxicity, Herb-Drug Interaction, Inflammation, Bioavailability, Nutraceuticals and Oxidative Stress.

Antioxidant and anti-inflammatory components found in garlic are health-promoting. Studies have demonstrated that chemicals found in garlic can both directly and indirectly prevent the growth and spread of malignant tumors by reducing oxidative stress and chronic inflammation (21). Garlic extracts have been shown to have a positive impact on cancer cells' growth processes, metabolic pathways, and metabolic pathways (22). As such, they may be used as adjuvant therapy in cancer treatment with minimal to no adverse effects. Since the anticancer impact of garlic extracts is most likely closely linked to antioxidant and anti-inflammatory pathways (23). It is better to take garlic primarily to prevent the development of cancer and to

help cure chronic inflammation (23). Garlic extracts will thus be employed in the development and production of medications intended for oral distribution, as determined by the findings of preclinical research (24). If the effectiveness of certain garlic chemical compounds at dosages appropriate for human consumption is verified, further research into these compounds' direct effects on cancer cells may serve as the foundation for the creation of medications for the main treatment of cancer.

Author Contribution Statement

KSH, SM, KS and FG designed the study. KSH extracted the data from the database and performed the statistical analysis. All the authors analyzed and discussed the data. All the authors reviewed the successive versions of the manuscript and approved the final version.

Disclosure Statement

The authors declare no conflicts of interest.

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Data Availability Statement

All data used in this study have been included in the manuscript.

Conflict of interest

There is no conflict of interest

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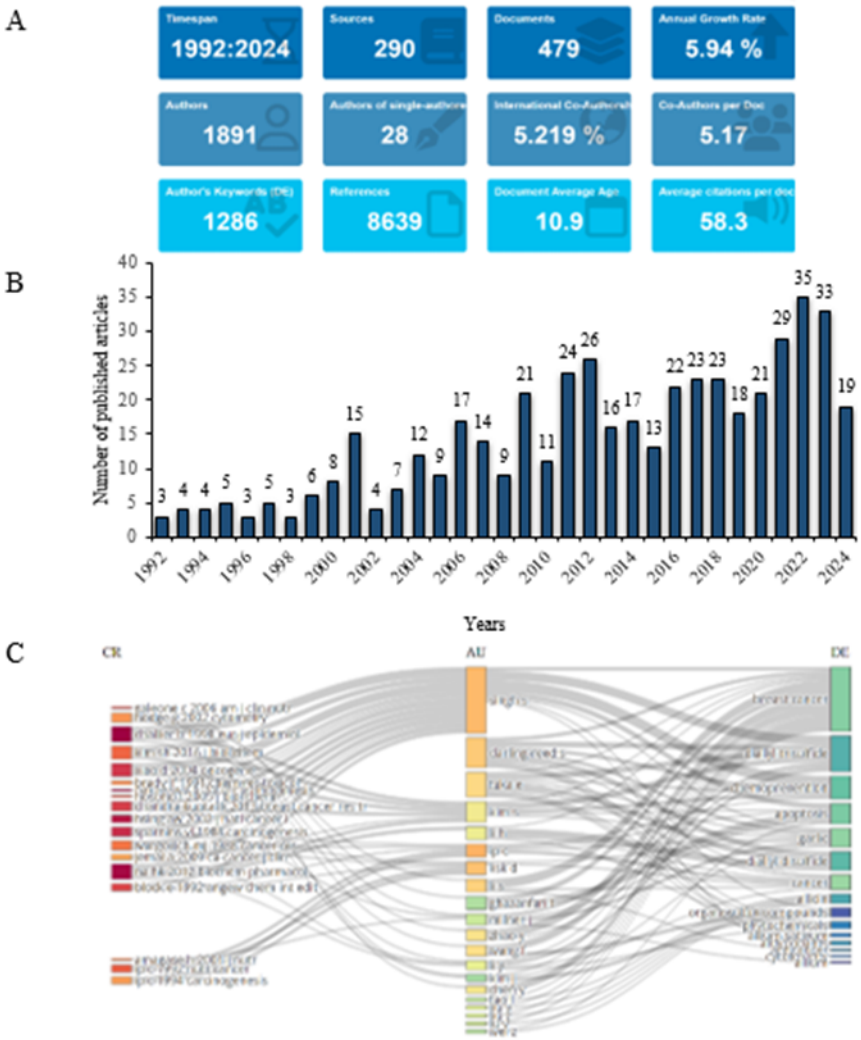

Figure 1. Overview of information, A. Main information, B. Annual scientific production article per year, C. Three field plot between authors (AU), author countries (AU_CO), and author keywords (DE)

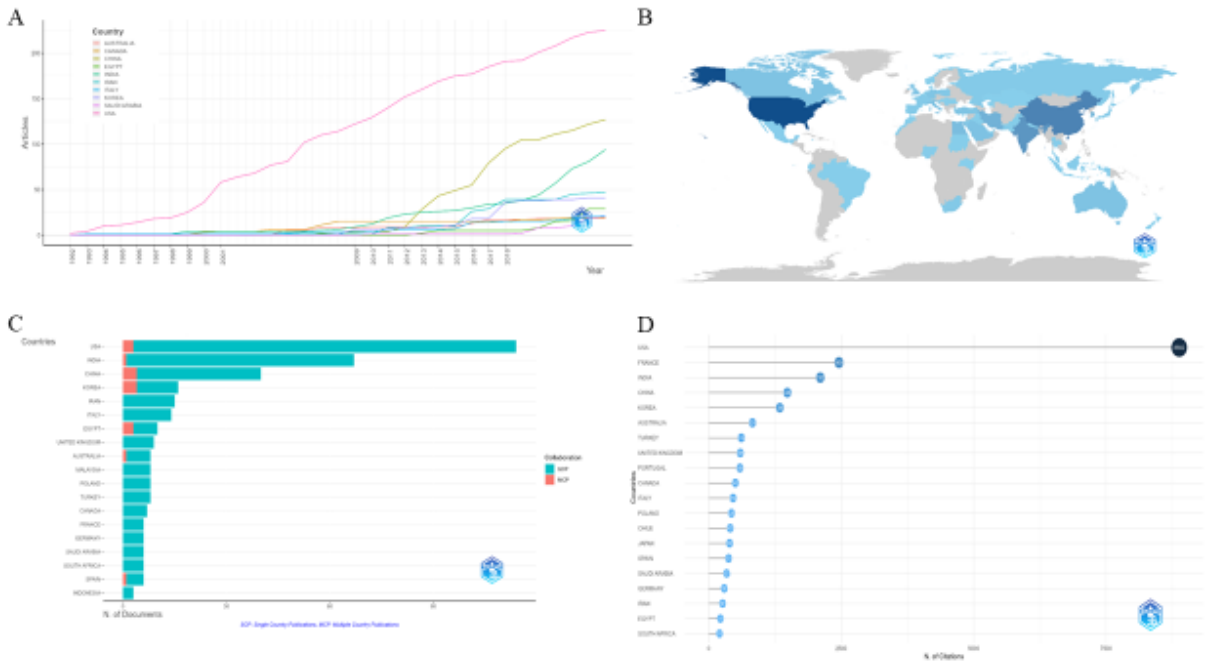

Figure 2. Country Production Over Time (A & B), Most Relevant Countries (C), Most Cited Countries (D).

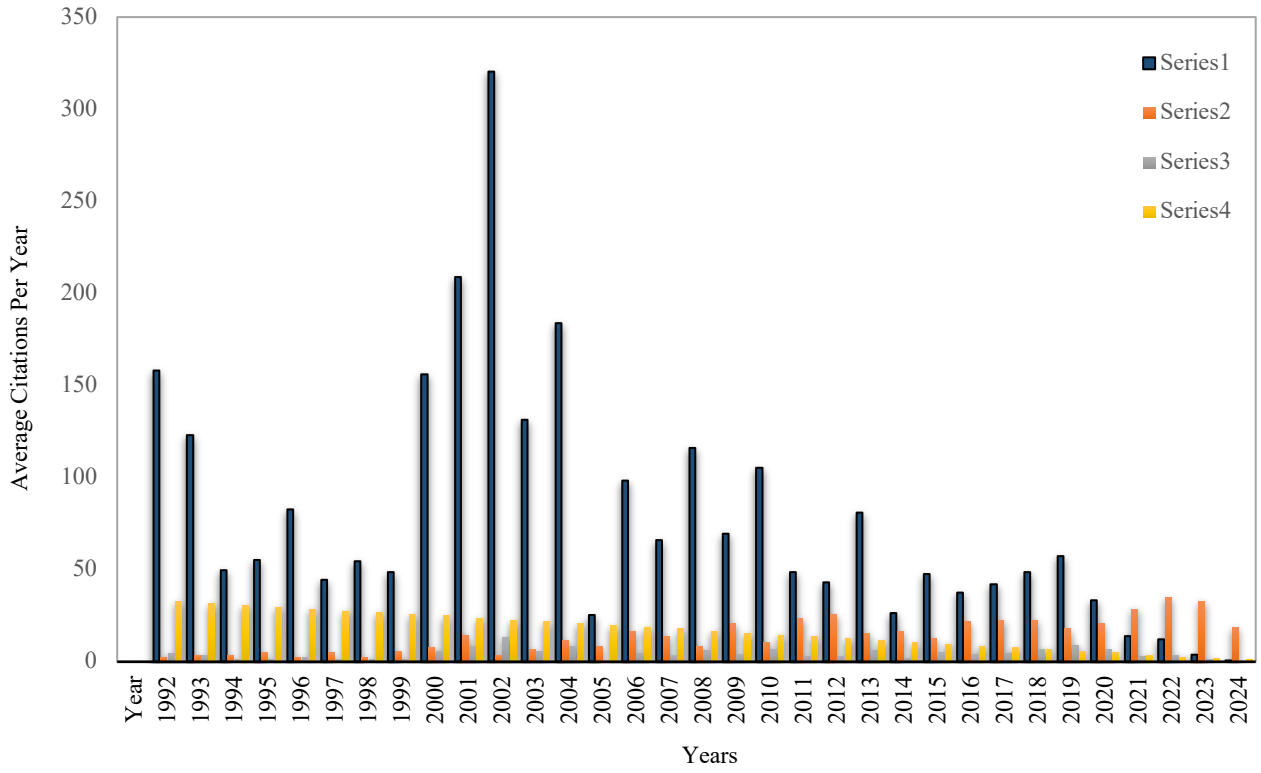

Figure 3. a comprehensive summary of the average number of citations received each year, spanning the entire duration of the study. Notably, the earliest publication in 1992, received an average of 4.79 citations per year over its 33-year lifespan.

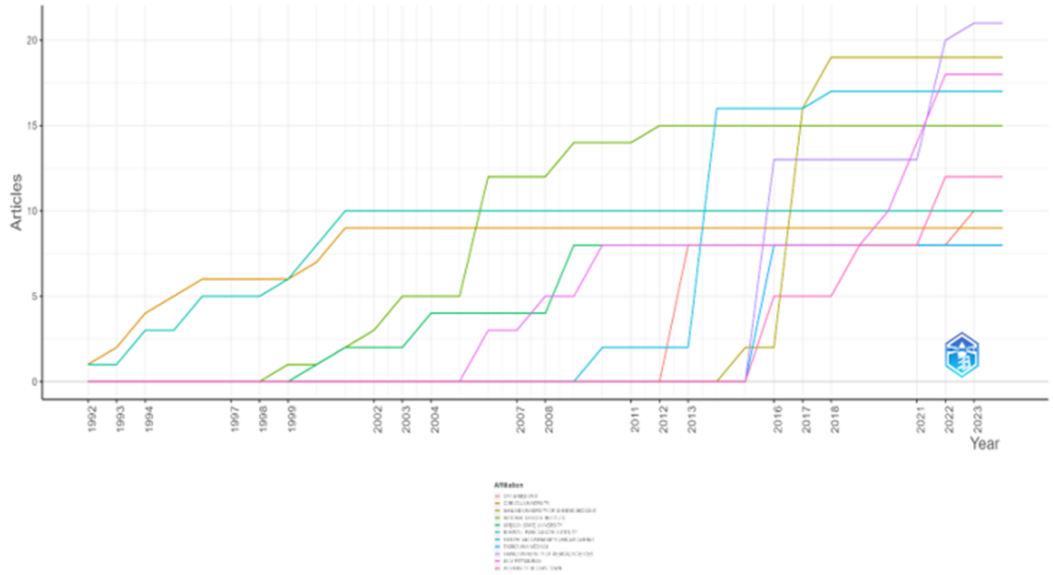

Figure 4. Affiliations' Production over Time.

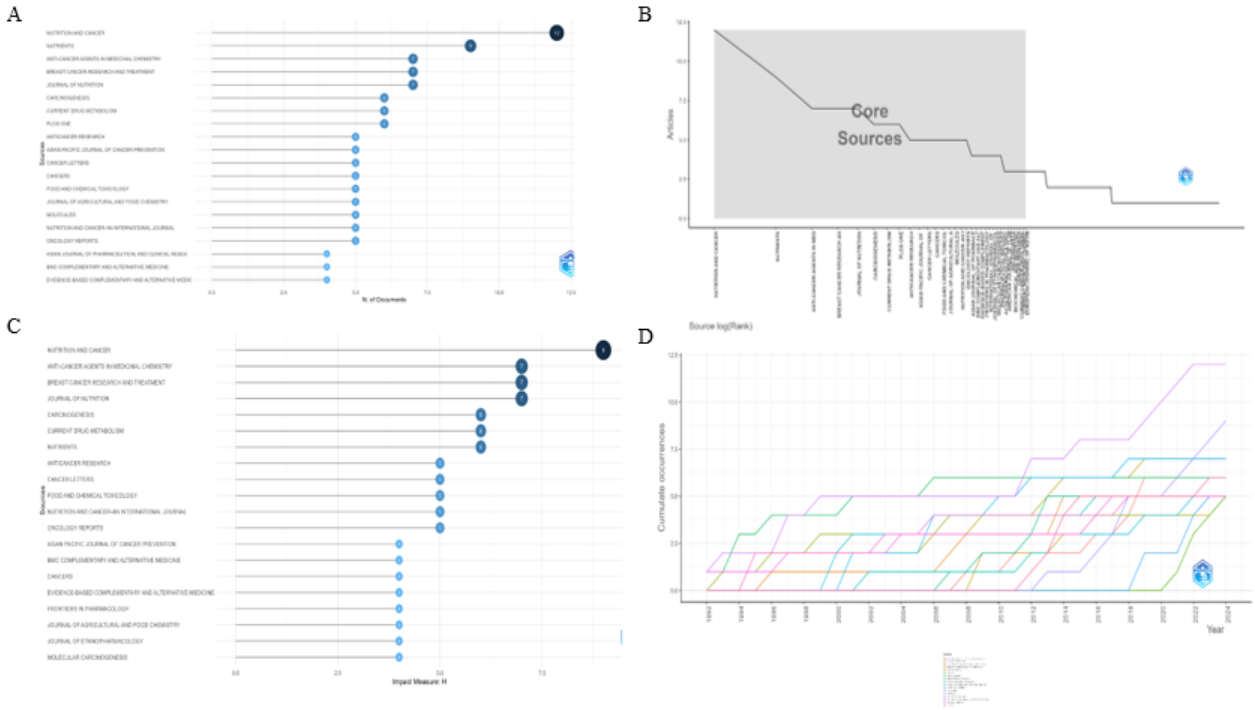

Figure 5. A. Most Relevant Sources, B. Core Sources by Bradford's Law, C. Source Impact by H-index, D. Sources' Production over Time

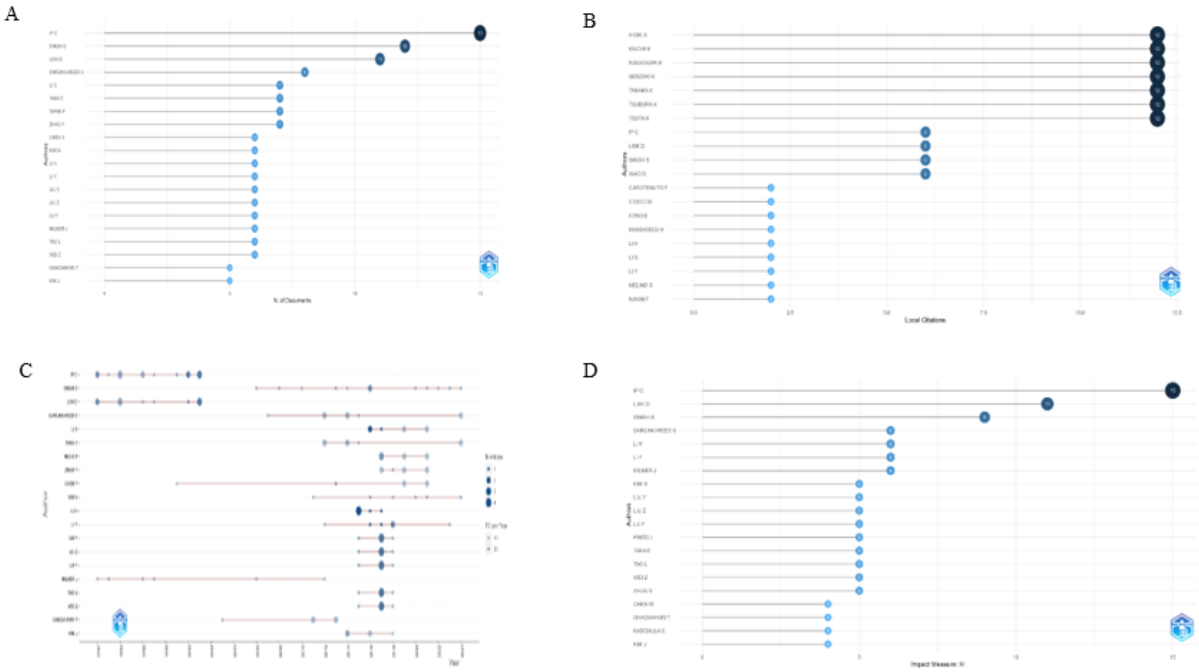

Figure 6. Authors, A. Most Relevant Authors, B. Most Local Cited Authors, c. Authors' Production over Time, D. Authors' Local Impact

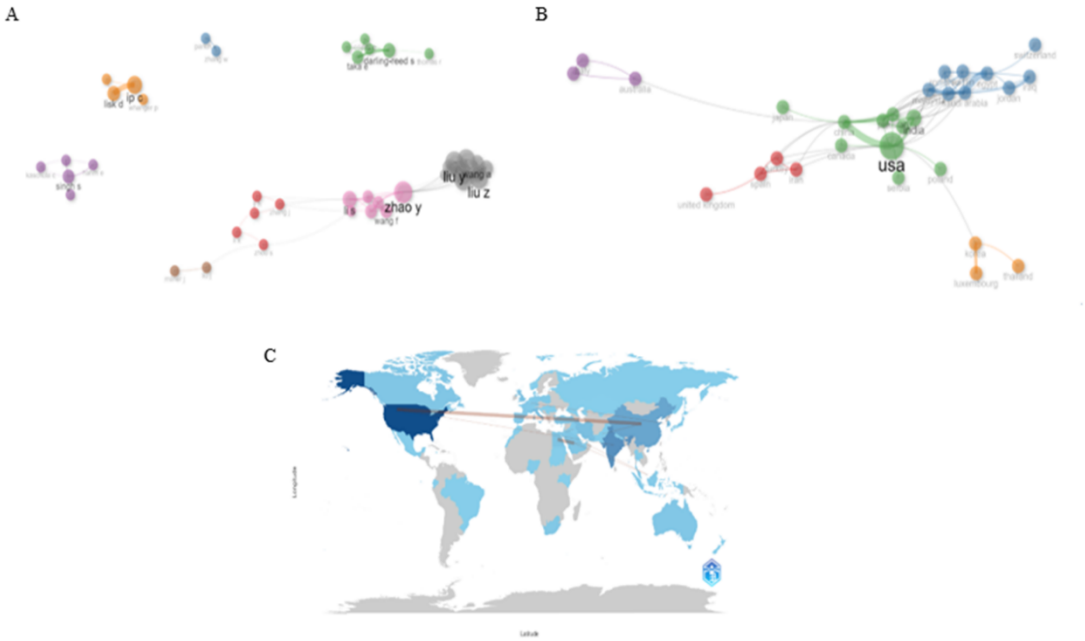

Figure S1. A. Collaboration_Network between Authors, B. Collaboration_Network between countries, C. Country Collaboration Map,

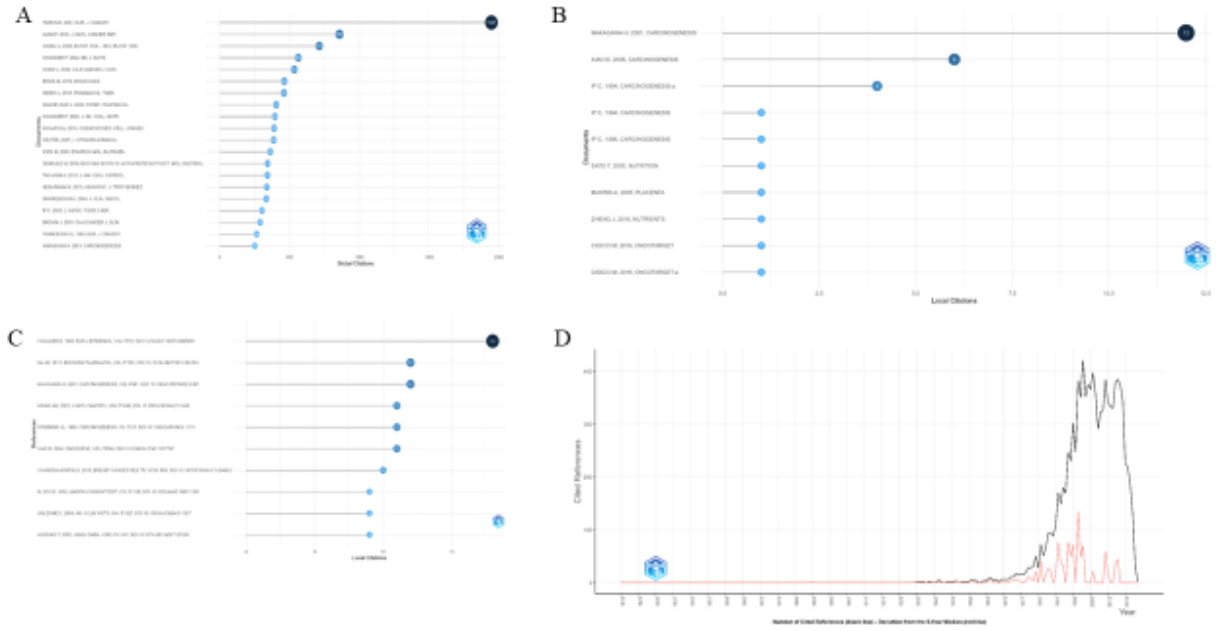

Figure S2. A. Most Global Cited Documents, B. Most Local Cited Documents, Most Local Cited Reference d. Reference Spectroscopy

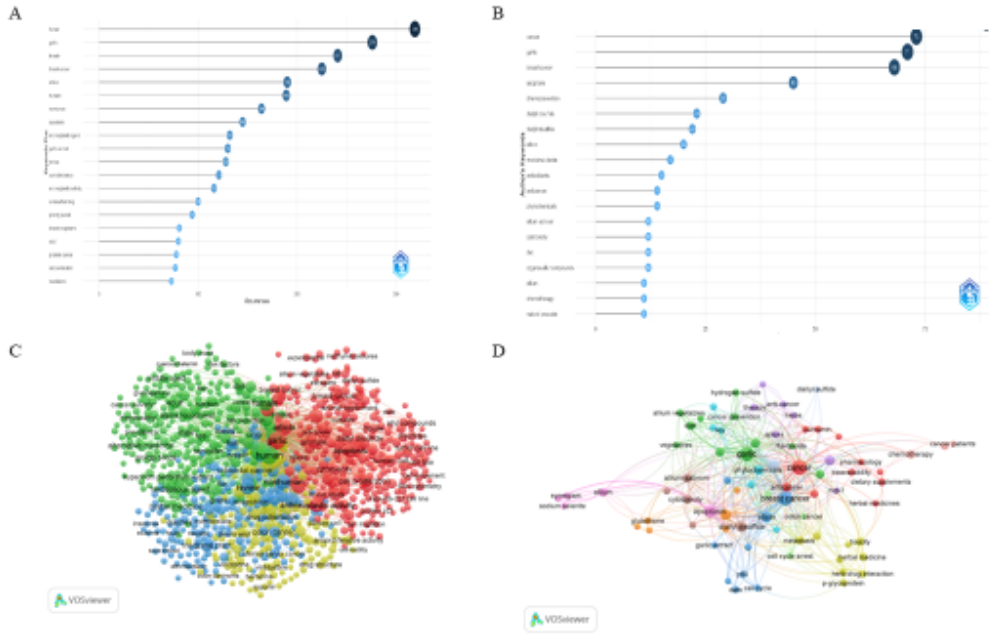

Figure S3. Keywords, A and B. Most frequent words of the keywords plus and author's keywords, C. and D. Word Cloud of the keywords plus and author's keywords respectively. C and D were drawn by VOSviewer.

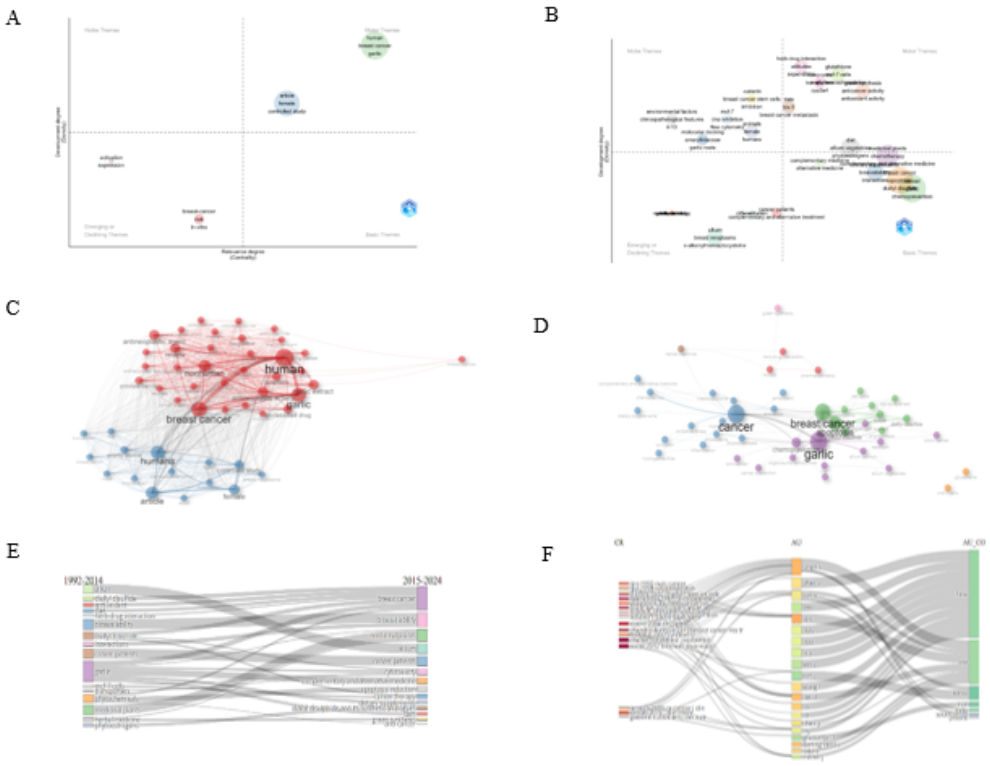

Figure S4. A. and B. Thematic Map of the Keywords Plus and the Author's Keywords, C. and D. Co_occurrence Network of the Keywords Plus and the Author's Keywords, E. and F. Map of Thematic Evaluation of the Keywords Plus and the Author's Keywords

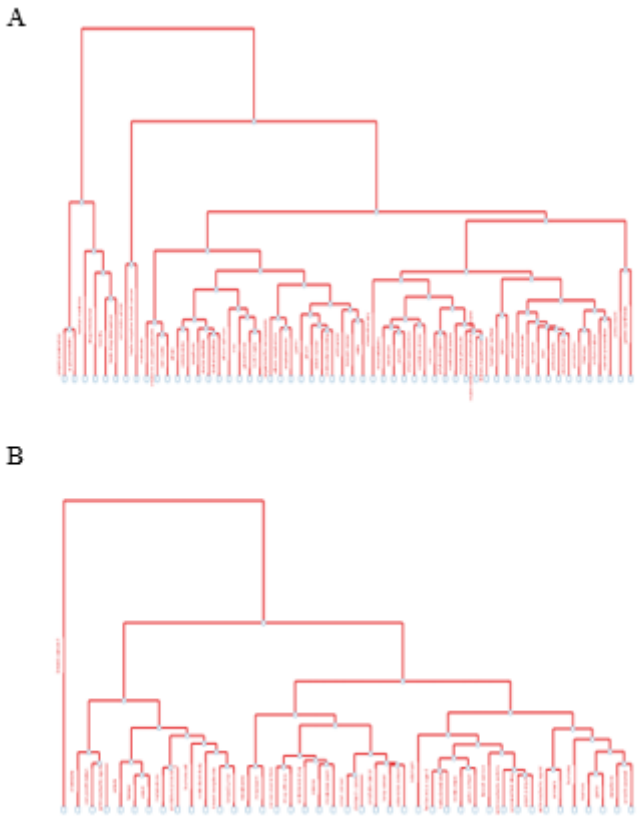

Figure S5 A. and B. Factorial Analysis of Topic Dendrogram for the Keywords Plus and the Author's Keywords

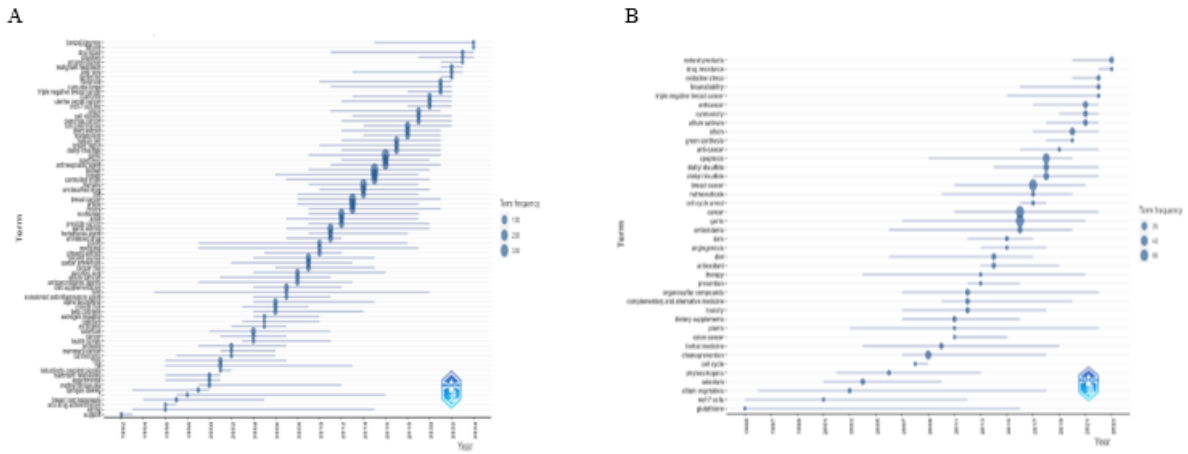

Figure S6 A. and B. Trend Topics of the keywords plus and author's keywords

Table 1:

Databases	Query	Results before limitations keyword	Results after limitations
Scopus	TITLE-ABS-KEY ("Breast Neoplasms" OR "Breast Tumors" OR "Breast Carcinoma" OR "Carcinoma, Breast") AND TITLE-ABS-KEY ("Allium sativum" OR "Garlic")	419 documents found Article: 234 Review: 130 English: 408	354 documents found Limited to Article: 226 Limited to Review: 128 Limited to English: 354

WOS	TITLE-ABS-KEY ("Breast Neoplasms" OR "Breast Tumors" OR "Breast Carcinoma" OR "Carcinoma, Breast") AND TITLE-ABS-KEY ("Allium sativum" OR "Garlic")	228 results Article: 173, Review Article: 47, Proceeding Paper: 8, Meeting Abstract: 6, Early Access: 2, English: 226, German: 1, Polish: 1	218 results Article: 173, Review Article: 45, Proceeding Paper: 8 Early Access: 2 English: 218
PubMed	TITLE-ABS-KEY ("Breast Neoplasms" OR "Breast Tumors" OR "Breast Carcinoma" OR "Carcinoma, Breast") AND TITLE-ABS-KEY ("Allium sativum" OR "Garlic")	122 results After limitations: Limited to English: 121 results	Results after doing R codes SW.G 99 duplicated documents have been removed SWP.G 112 duplicated documents have been removed

Table 2. Main information

Description	Results
Main Information About Data	
Timespan	1992:2024
Sources (Journals, Books, etc)	290
Documents	479
Annual Growth Rate %	5.94
Document Average Age	10.9
Average Citations Per Doc	58.3
References	8639
Document Contents	
Keywords Plus (ID)	7182
Author's Keywords (DE)	1286
Authors	
Authors	1891
Authors Of Single-authored Docs	28
Authors Collaboration	
Single-authored Docs	34
Co-authors Per Doc	5.17
International Co-authorships %	5.219

Table S1. Corresponding author's countries, countries' scientific production, and most cited countries (total), SCP: Single country publication, MCP: Multiple countries publication, Freq: Frequency, TC: Total citations

Country	Articles	SCP	MCP	Freq	MCP_Ratio	TC	Average Article Citations
USA	114	111	3	0.238	0.026	8882	77.90
INDIA	67	66	1	0.14	0.015	2105	31.40
CHINA	40	36	4	0.084	0.1	1482	37.00
KOREA	16	12	4	0.033	0.25	1340	83.80
IRAN	15	15	0	0.031	0	261	17.40
ITALY	14	14	0	0.029	0	459	32.80
EGYPT	10	7	3	0.021	0.3	219	21.90
UNITED KINGDOM	9	9	0	0.019	0	595	66.10
AUSTRALIA	8	7	1	0.017	0.125	824	103.00
MALAYSIA	8	8	0	0.017	0	33	4.10

Table S2. Sources' Local Impact & Core Sources by Bradford's Law

Element	h_index	g_index	m_index	TC	NP	PY_start	Rank	Freq	cumFreq	Country of Publication	Zone
Nutrition and Cancer	9	12	0.273	543	12	1992	1	12	12	United States	Zone 1
Anti-Cancer Agents in Medicinal Chemistry	7	7	0.412	430	7	2008	3	7	28	Netherlands	Zone 1
Breast Cancer Research and Treatment	7	7	0.233	472	7	1995	4	7	35	Netherlands	Zone 1
Journal of Nutrition	7	7	0.292	463	7	2001	5	7	42	United States	Zone 1

Carcinogenesis	6	6	0.182	692	6	1992	6	6	48	England	Zone 1
Current Drug Metabolism	6	6	0.333	356	6	2007	7	6	54	Netherlands	Zone 1
Nutrients	6	9	0.5	632	9	2013	2	9	21	Switzerland	Zone 1
Anticancer Research	5	5	0.172	133	5	1996	9	5	65	Greece	Zone 1
Cancer Letters	5	5	0.156	469	5	1993	11	5	75	Ireland	Zone 1
Food and Chemical Toxicology	5	5	0.217	121	5	2002	13	5	85	England	Zone 1

Table S3. Most Relevant Authors, Their Local Citations, and indexes
TC: Total Citation

Authors	Articles	Articles Fractionalized	h_index	g_index	m_index	TC	NP	PY_start
Ip C	15	5.29	15	15	0.455	1770	15	1992
Singh S	12	3.67	9	12	0.474	475	12	2006
Lisk D	11	3.64	11	11	0.333	1387	11	1992
Darling-Reed S	8	0.99	6	8	0.333	137	8	2007
Li S	7	0.72	3	7	0.333	448	7	2016
Taka E	7	0.79	5	7	0.385	125	7	2012
Wang F	7	1.00	2	7	0.25	89	7	2017
Zhao Y	7	0.55	3	7	0.375	56	7	2017
Chen Y	6	0.83	2	6	0.077	129	6	1999
Kim S	6	1.16	5	6	0.357	142	6	2011

Paper	DOI	Total Citations	TC per Year	Normalized TC	References
PARKIN D, 2001, EUR. J. CANCER	10.1016/s0959-8049(01)00267-2	1947	81.13	9.32	
GANZ P, 2002, J. NATL. CANCER INST.	10.1093/jnci/94.1.39	858	37.30	2.68	
KUNDU J, 2008, MUTAT. RES. - REV. MUTAT. RES.	10.1016/j.mrrev.2008.03.002	713	41.94	6.13	
WHANGER P, 2004, BR. J. NUTR.	10.1079/BJN20031015	563	26.81	3.06	
KUSHI L, 2006, CA-A CANCER J. CLIN.	10.3322/canjclin.56.5.254	534	28.11	5.43	
IMRAN M, 2019, MOLECULES	10.3390/molecules24122277	462	77.00	8.03	
REDDY L, 2003, PHARMACOL. THER.	10.1016/S0163-7258(03)00042-1	460	20.91	3.50	
SHARIFI-RAD J, 2020, FRONT. PHARMACOL.	10.3389/fphar.2020.01021	405	81.00	12.12	
WHANGER P, 2002, J. AM. COLL. NUTR.	10.1080/07315724.2002.10719214	395	17.17	1.23	
ACHARYA A, 2010, OXIDATIVE MED. CELL. LONGEV.	10.4161/oxim.3.1.10095	389	25.93	3.69	

Table S4. Ten articles of the most globally cited documents

Table S5. Most Frequent Author Keywords and Keywords.

	Author Keywords	Frequency	Keywords	Frequency
1.	Cancer	73	Human	319
2.	Garlic	71	Garlic	276
3.	Breast Cancer	68	Female	241
4.	Apoptosis	45	Breast Cancer	225
5.	Chemoprevention	29	Article	190
6.	Diallyl Disulfide	23	Humans	189
7.	Diallyl Trisulfide	22	Nonhuman	164
8.	Allicin	20	Apoptosis	145
9.	Medicinal Plants	17	Antineoplastic Agent	132
10.	Antioxidants	15	Garlic Extract	130
11.	Anticancer	14	Review	128
12.	Phytochemicals	14	Controlled Study	121
13.	Allium Sativum	12	Antineoplastic Activity	116
14.	Cytotoxicity	12	Unclassified Drug	100
15.	Diet	12	Priority Journal	94
16.	Organosulfur Compounds	12	Breast Neoplasms	81
17.	Allium	11	Adult	80
18.	Chemotherapy	11	Prostate Cancer	78
19.	Natural Products	11	Cell Proliferation	77
20.	Complementary And Alternative Medicine	10	Neoplasms	73
21.	Metastasis	10	Plant Extract	69
22.	Selenium	10	Aged	68
23.	Antioxidant	9	Animals	67
24.	Dietary Supplements	9	Lung Cancer	66
25.	Herbal Medicine	9	Male	65
26.	Toxicity	9	Cancer Prevention	63
27.	Herb-Drug Interaction	8	Antineoplastic Agents	62
28.	Inflammation	8	Human Cell	61
29.	Bioavailability	7	Diet	58

30. Nutraceuticals	7	Herbaceous Agent	58
31. Oxidative Stress	7	Medicinal Plant	57