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The scientific production of Kombucha: a global bibliometric review

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Abstract

Kombucha, a fermented beverage obtained from the fermentation of green tea sweetened by a symbiotic culture of bacteria and yeasts, has aroused growing interest due to its antioxidant, antimicrobial, and probiotic properties and diversity of applications. In this context, this study carries out a bibliometric analysis of scientific production on Kombucha between 2000 and 2025, using indexed databases to map research trends, the most influential authors, collaboration networks, and predominant themes. The results show a significant increase in the number of publications in recent years, with a greater concentration of studies from 2016 onward. The main countries producing knowledge on Kombucha include the United States, China, and Brazil, with relevant international collaborations. The most frequently addressed topics involve the chemical and microbiological characterization and bioactive compounds of the beverage, as well as investigations into food safety and the development of new derivative products. The analysis of co-authorship networks revealed the existence of consolidated research groups, especially renowned institutions in the field of food science and technology. The findings of this study reinforce Kombucha as an emerging and interdisciplinary topic, pointing to opportunities for future research aimed at innovation, optimization of fermentation processes, and evaluation of benefits to human health.

Practical Application: Kombucha is used in studies investigating the potential for new bioactive compounds, food safety, and improvements in fermentation processes.

Keywords: bibliometria; bebida probiótica; chá fermentado, SCOBY; antioxidante; fermentação.

1. INTRODUCTION

Kombucha is a fermented beverage made from sweetened black or green tea infused with *Camellia sinensis*, using a symbiotic culture of bacteria and yeasts (SCOBY—Symbiotic Culture Of Bacteria and Yeast) (Jarrell et al., 2000). It probably originated in the Manchuria region of China over 2,000 years ago and has been spread and consumed in various parts of the world over time. Its global market has grown significantly, reaching a value of US$1.84 billion in 2019. Projections indicate an estimated growth rate of 23.2% by 2027 (Fortune Business Insights, 2019).

The large growth in this market may be due to the teas, plant extracts, and microorganisms involved in fermentation, providing this drink with beneficial health properties (Antolak et al., 2021). Food science and technology professionals are increasingly aware of the nutritional and health benefits of foods produced with live probiotic microorganisms (Oliveira, 2020).

In this context, it is important to carry out a bibliometric survey to map global scientific production on this subject, with the aim of providing support for future research. Bibliometrics stands out as a relevant methodological tool for analyzing the evolution of research and technological advancement, allowing a panorama of academic production to be drawn up, contributing significantly to strategic decision-making in information management and the dissemination of knowledge (Corrêa et al., 2024; Okubo, 1997).

The aim of this study was to carry out a bibliometric analysis of Kombucha on the Web of Science and Scopus databases between 2000 and 2025, identifying the volume of publications, main authors, institutions, impact journals, geographical distribution, research areas, and trends in future studies.

1.1 Relevance of the work

The use of Kombucha has shown great relevance due to its functional properties and versatile applications. As a fermented drink, it stands out for being a rich source of probiotics, antioxidants, and bioactive compounds that promote digestive health,

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strengthen the immune system, and help detoxify the body. Kombucha has also been used in research aimed at developing new food products adapted to the demands of consumers looking for healthy and natural options.

2. MATERIALS AND METHODS

2.1 Search strategy, data selection, and collection

The search for Kombucha took place on February 15, 2025, in two different databases, Web of Science and Scopus, using the following terms in English: Kombucha, fermented tea, probiotic drink. These terms were searched for in the topics of the papers, thus identifying those that appeared in the title, keywords, or abstract according to the platforms, following the methodology of Almeida et al. (2021). Filters were applied to delimit the time from 2000 to February 2025, selecting only articles, review articles, and book chapters. Data was collected using the "Analyze Results" tool, available in both databases. The rest of the information was obtained by exporting the data available on the platforms, which was then used for analysis in VOSVIER®

2.2 Data analysis

After collection, the data was analyzed in Excel, version 2408, and QtiPlot version 0.9.8.3. The exported data was initially processed in VOSviewer, version 1.6.20, to identify synonymous and plural terms. This data was then exported to Excel to create a merger file (Thesaurus), in order to ensure that the information was correctly accounted for. VOSviewer is software that specializes in creating and analyzing network maps in academic and social contexts. A flowchart was created to represent the data search, collection, and analysis model in Figure 1.

3. RESULTS AND DISCUSSION

3.1 Bibliometric analysis

After filtering, the Web of Sciense® database returned a total of 3,249 papers, of which 2,971 were original articles and 278 review articles. Of these, the majority were published in English (3,188), reflecting the dominance of this language in scientific communication. Other languages appear to a lesser extent, such as Japanese (19), Spanish (12), Polish (6), and German and Portuguese (5). Languages such as Chinese, Croatian, Malay, Russian, French, Korean, and Turkish were even less representative.

Scopus® returned 3,638 papers after refinement, of which 3,108 were original articles, 355 review articles, and 175 book chapters. Of these, the majority are in English (3,227), followed by Chinese (211) and Korean (53). Other languages, such as Persian (36), Japanese (30), and Russian (26), are less representative, while Spanish, Polish, Portuguese, and German appear with less significant numbers. Languages such as Turkish, Croatian, Malay, French, and others have a marginal presence.

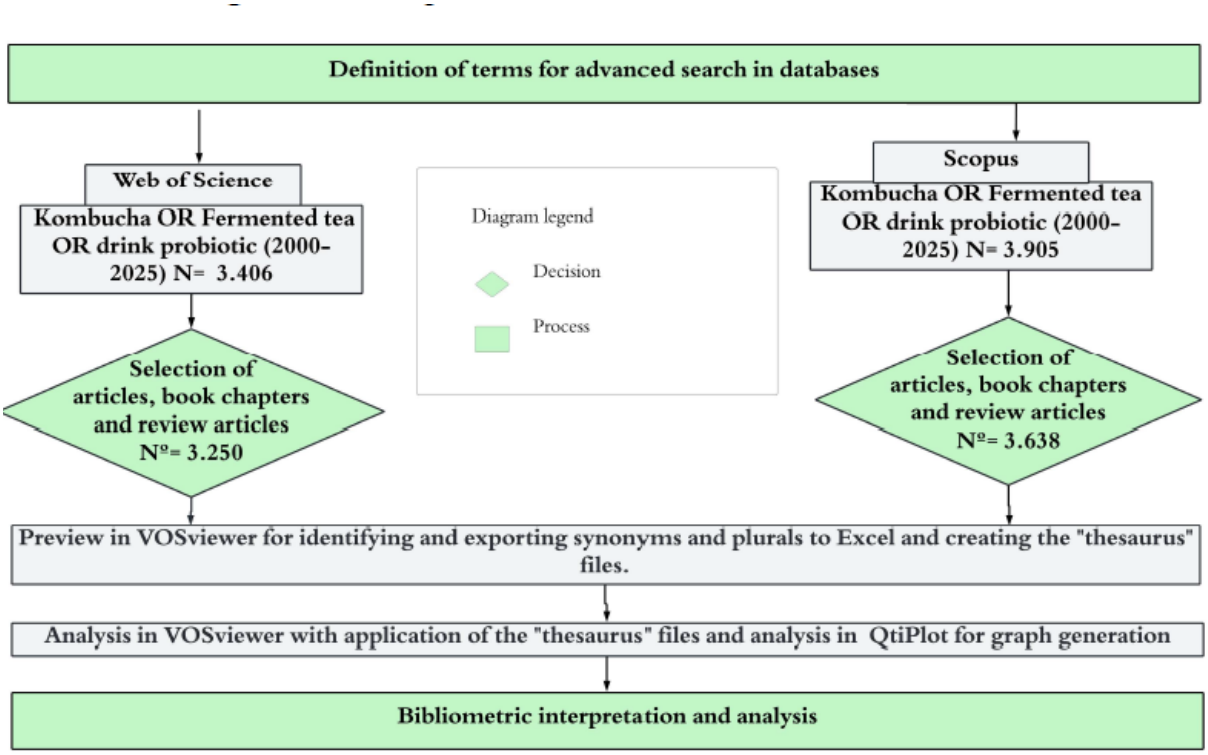

Figure 1. Flowchart of the model for search, collection, and analysis.
Source: Own authors (2025).

3.2 Analysis of publications

An analysis of the data on publications on Kombucha in the Scopus® and Web of Science® databases, shown in Figure 2, reveals a significant growth trend over the years, especially since 2016.

In the early years of the 21st century, publications were scarce, with less than 20 articles per year in both databases. However, from 2016 on, there was an acceleration in the number of publications, reaching a significant peak in 2024 with 533 articles in Scopus® and 442 in Web of Science®. In addition, the year 2025 already showed publications registered in both databases, which suggested that the growth in research into Kombucha should continue.

3.3 Most productive countries in Kombucha studies

Analyzing the countries with the highest number of published documents, there are a total of 104 countries that have published on Kombucha in Web of Science® and 106 in Scopus®. Figure 3 shows the 10 most productive countries on this subject in each database.

China leads scientific production in both databases, with 762 publications in Web of Science® and 841 in Scopus®, followed by the United States, with 317 publications in Web of Science® and 288 in Scopus®. India has 214 publications on Web of Science® and 285 on Scopus®, reflecting its growth in scientific research. Brazil appears with 185 publications in Web of Science® and 182 in Scopus®, with a slight decrease in the number of publications in Scopus®. South Korea has 152 publications on Web of Science® and 191 on Scopus®, surpassing Brazil on the second basis. Japan has 171 publications on Web of Science® and 174 on Scopus®. Iran has 137 publications in Web of Science® and 166 in Scopus®, while South Africa has 134 publications in Web of Science® and 0 in Scopus®, assuming that the Scopus® database may not capture the publications of some countries. Poland appears with 110 publications in Web of Science® and 132 in Scopus®, and Thailand with 108 in Web of Science® and 118 in Scopus®. In addition, the United Kingdom, which is not in the top 10 of Web of Science®, has 125 publications in Scopus®, showing that Scopus® has more comprehensive coverage in some areas of research.

3.4 The most productive areas of research into Kombucha

Web of Science® identified a total of 96 subject areas, while Scopus® identified only 26. Analysis of the most productive subject areas in the two databases revealed significant differences in the categorization of studies.

While Web of Science® identified a total of 96 thematic areas, Scopus® showed only 26, reflecting different classification criteria between the databases (Table 1). It can be seen that, in Scopus®, the most productive area is agricultural and biological sciences, with 2,117 publications, followed by biochemistry, genetics, and molecular biology (794) and medicine (748), indicating a strong emphasis on biological and health research. On Web of Science®, the predominant category is food science technology, with 1,489 publications, highlighting the specific focus of the base on the food industry, followed by chemistry (540) and nutrition and dietetics (400). In addition, areas such as chemical engineering, pharmacology, and microbiology appear in both databases, although with different positions and numbers of publications. These variations may be related to the scope and indexing criteria of each database, impacting the visibility and direction of research within their respective areas.

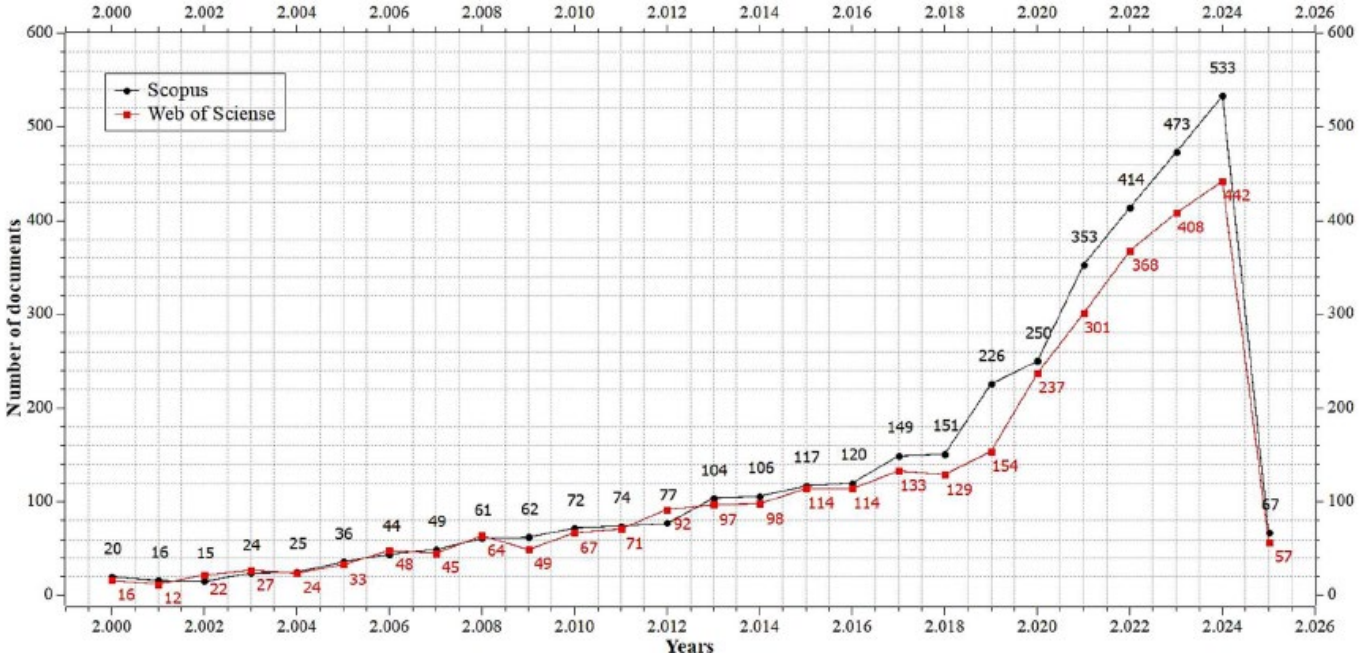

Figure 2. Annual distribution of documents published about Kombucha.
Source: Own authors (2025).

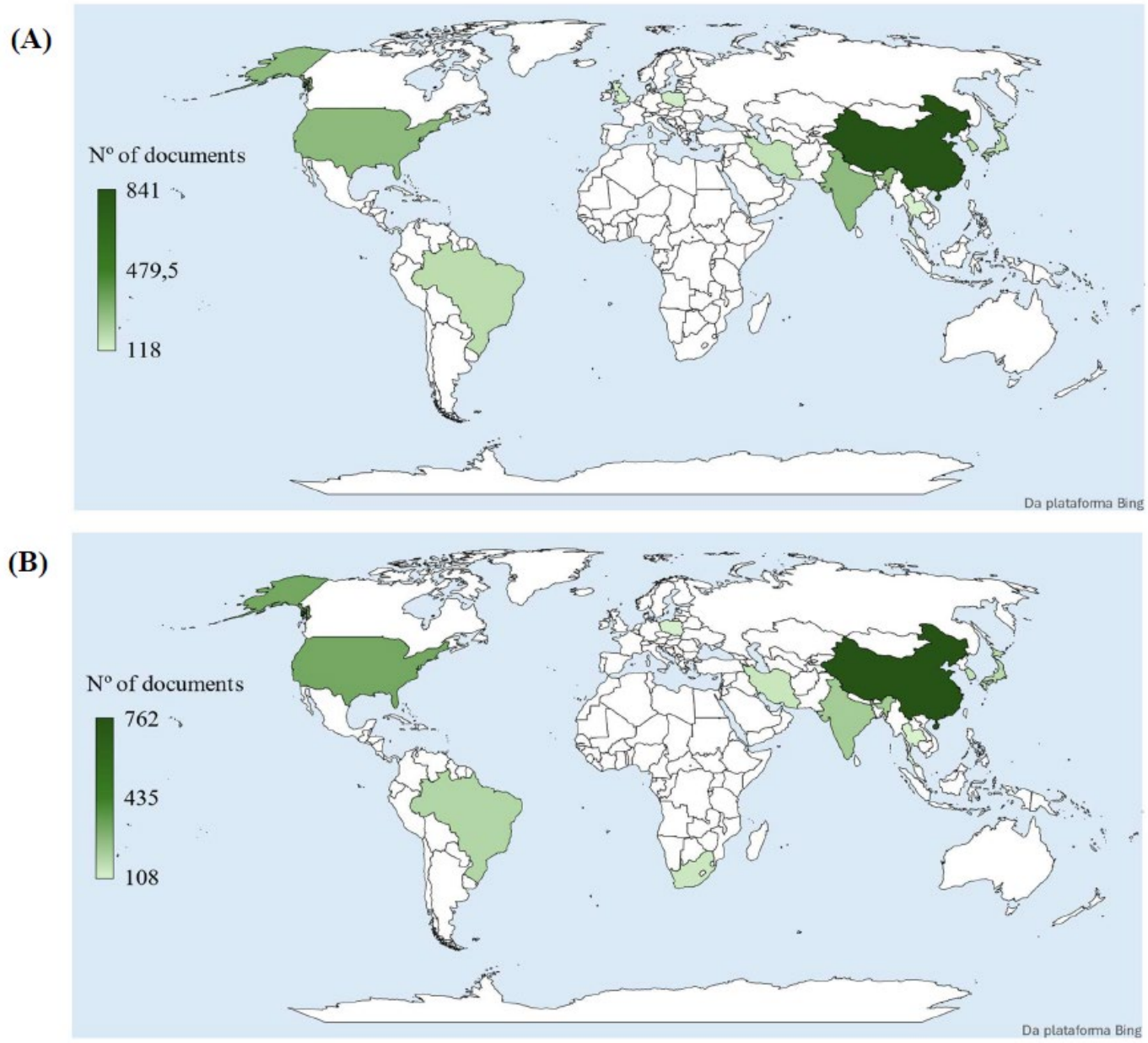

Figure 3. The 10 most productive countries regarding Kombucha research in (A) Scopus® and (B) Web of Science®.
Source: Own authors (2025).

3.5 Analysis of research institutions

A total of 3,448 studies on Kombucha have been published on Web of Science®, while only 125 have been published on Scopus®, of which a ranking has been drawn up of the 10 most productive (Table 2). It is worth noting that the number of institutions may exceed the number of documents in the database because the institutions collaborate with each other on articles, accounting for several joint institutions in just one paper.

The most productive institutions in the two databases show a strong presence of researchers from China, reflecting the country's great interest and investment in research into functional foods, such as Kombucha, reinforcing the data stated in Figure 3, of the most productive countries. There are also some countries highlighted in the same figure, such as Africa, Thailand, and Iran. The Ministry of Education of the People's Republic of China tops the Scopus® list, followed by institutions such as the University of Novi Sad in Serbia and Stellenbosch University in South Africa. On Web of Science®, South Africa's Stellenbosch University stands out, followed by other Chinese institutions such as China's Ministry of Agriculture and Rural Affairs and Anhui Agricultural University. Other countries also stand out, such as Iran, with the Islamic Azad University, and Egypt, with the Egyptian Knowledge Bank.

3.6 Analysis of the most studied keywords and future trends over the last 5 years (2020–2025)

After visualizing the data using the VOSviewer® software, we identified a total of 2,570 keywords chosen by the authors, showing those that met the criterion of at least 6 occurrences

in the documents, of which only 75 were suitable for Web of Science®. In Scopus®, we obtained a total of 7,982, with the criterion of at least 18 terms due to the large number, presenting 71 that met this criterion after merging synonyms.

Table 1. Top 10 most productive thematic areas of the analyzed databases.

Scopus	
Research area	**Number of publications**
1 Agricultural and biological sciences	2117
2 Biochemistry, genetics, and molecular biology	794
3 Medicine	748
4 Immunology and microbiology	554
5 Chemistry	526
6 Engineering	379
7 Nursing	343
8 Chemical engineering	276
9 Pharmacology, toxicology, and pharmaceutics	265
10 Social sciences	154
Web of Science	
1 Food science technology	1,489
2 Chemistry	540
3 Dietary nutrition	400
4 Agriculture	353
5 Biotechnology and applied microbiology	288
6 Microbiology	270
7 Biochemistry and molecular biology	250
8 Pharmacological pharmacy	144
9 Science, technology, and other topics	126
10 Engineering	104

The nodes or circles shown in Figure 4 represent the density of occurrences of the terms, while the lines or links represent the interaction of these themes. It is also possible to see the studies over the last 5 years by the color distinctions, thus making it possible to understand trend terms for future research and gaps in this theme on Kombucha.

Among the most common terms on Web of Science®, the term "Kombucha" appears with 253 occurrences, thus demonstrating the logic of research on this subject, where it is the main term in bibliometric research. This is followed by the term "antioxidant activity" (140), "fermentation" (132), "phenolic compounds" and "probiotics" with 74 each, "fermented tea" and "tea" with 60 occurrences each. The others appear with fewer than 60 occurrences. These terms lead the way in terms of studies on this subject, while the most recent terms studied were "SCOBY", "microorganisms", "bioactivity", "flavor", "toxicity", "fermented beverages", "bioactive compounds", "functional food", "antibacterial activity", "fermented foods", "intestinal microbiology", "microbial diversity", "cytotoxicity", and "organic acids". As a result, future trends for research on this topic should involve a deeper understanding of the relationship between gut microbiota and health, greater emphasis on food safety, discovery of new bioactive compounds, innovation in fermented products, and optimization of sensory quality.

In Scopus®, among the data found for the most studied terms on this topic, "Kombucha" appears with 550 occurrences, "probiotics" (552), "fermentation" (352), "antioxidant activity" (328), "phenolic compounds" (147), "tea" (132), and "bacterial cellulose" (120). The other terms show lower data than those presented. The most recent terms in Scopus® are "SCOBY", "bioactive compounds", "volatile compounds", "flavor", "acetic acid bacteria",

Table 2. Top 10 most productive research institutions on Kombucha studies in both databases.

Scopus		
Research institution	**Publications**	**Country**
1 Ministry of Education of the People's Republic of China	112	China
2 University of Novi Sad	73	Serbia
3 Stellenbosch University	59	South African
4 Chinese Academy of Agricultural Sciences	58	China
5 Hunan Agricultural University	54	China
6 Anhui Agricultural University	53	China
7 Chiang Mai University	50	Thailand
8 Yunnan Agricultural University	47	China
9 ARC Infruitec-Nietvoorbij	46	South African
Web of Science		
1 University de Stellenbosch	67	South African
2 Ministry of Agriculture and Rural Affairs	66	China
3 Anhui Agricultural University	57	China
4 Chinese Academy of Agricultural Sciences	53	China
5 University Islâmica Azad	53	Iran
6 University Novi Sad	50	Serbia
7 University Chiang Mai	49	Thailand
8 University Agrícola de Hunan	45	China
9 Egyptian Knowledge Bank	42	Egypt
10 South African Agricultural Research Council	40	South African

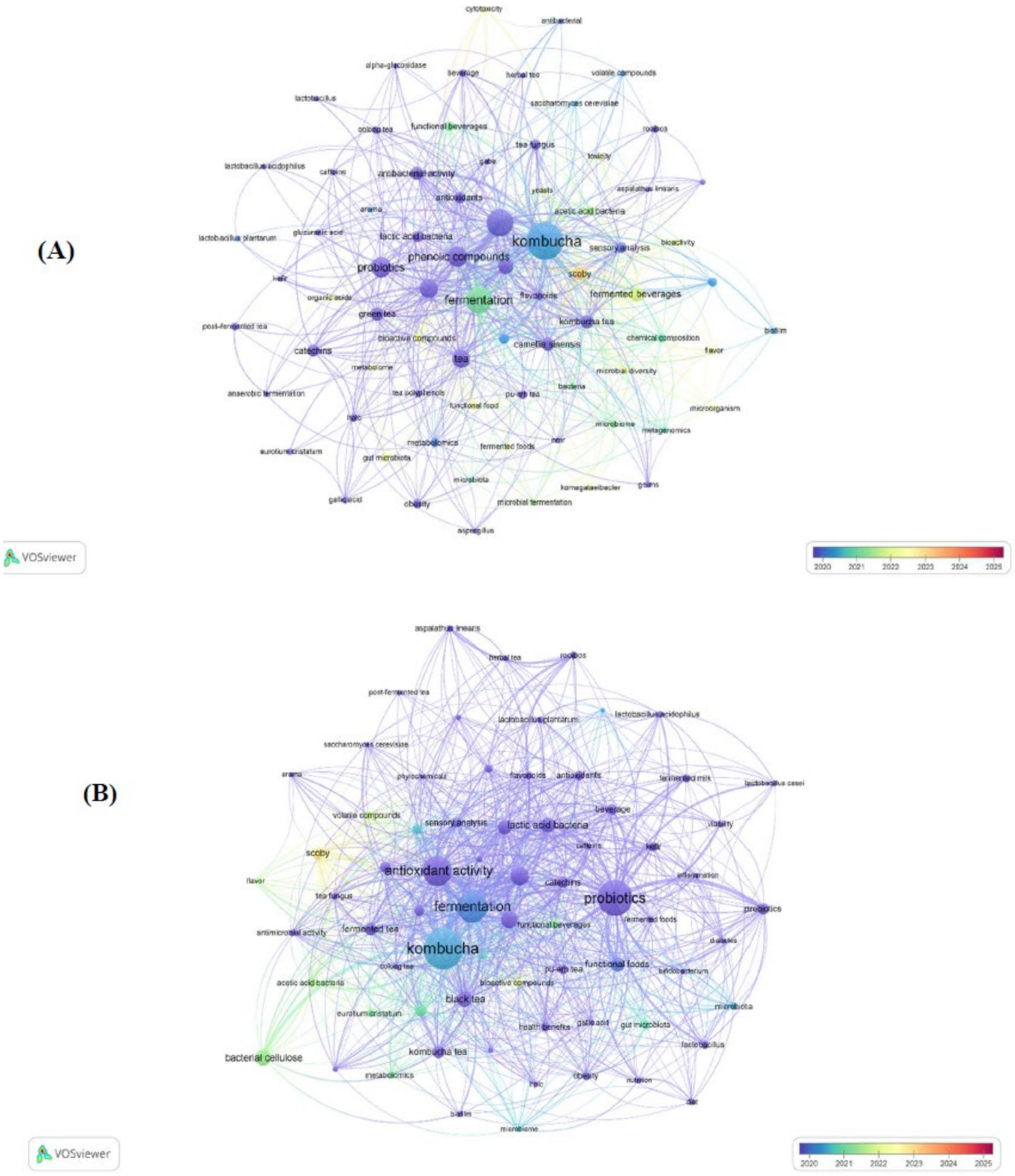

Figure 4. Network map of keyword occurrences over the last 5 years in (A) Web of Science and (B) Scopus.
Source: Own authors (2025).

"bacterial cellulose", "functional beverages", "Eurotium cristatum", "intestinal microbiology", "microbiota", and "metabolomics".

Based on these terms, research into Kombucha is moving toward controlled fermentation, optimization of microorganisms, and the application of metabolomics to understand bioactive compounds. The use of bacterial cellulose in biomaterials and the development of enriched functional drinks stand out.

3.7 Analysis of the most cited magazines or journals and their impact factor

The data obtained from Web of Science® resulted in a total of 356 journals publishing on Kombucha. Adopting a criterion of at least 10 documents and citations per journal resulted in 20 journals that met this criterion (Table 3). In the Scopus database, a total of 1,261 journals were published on Kombucha with only 25 meeting the criterion of having at least 19 documents and 10 citations (Figure 5).

Among the 20 most cited in Web of Science®, *Food Chemistry* stands out as the leader with 3,198 citations, followed by *Journal of Agricultural and Food Chemistry* (2,022), *Food Research International* (1,254), *LWT—Food Science and Technology* (1,032), *Nutrients* (991), *Journal of Functional Foods*

Table 3. The five most cited journals and their impact factor.

Scopus	
Periodic	**Impact factor**
1 Food Chemistry	8.5
2 Food Research International	7.0
3 LWT—Food Science and Technology	6.0
4 Nutrients	4.8
5 Journal of Functional Foods	3.8
Web of Science	
1 Food Chemistry	8.5
2 Journal of Agricultural and Food Chemistry	5.7
3 Food Research International	7.0
4 International Journal of Food Microbiology	5.0
5 LWT	6.0

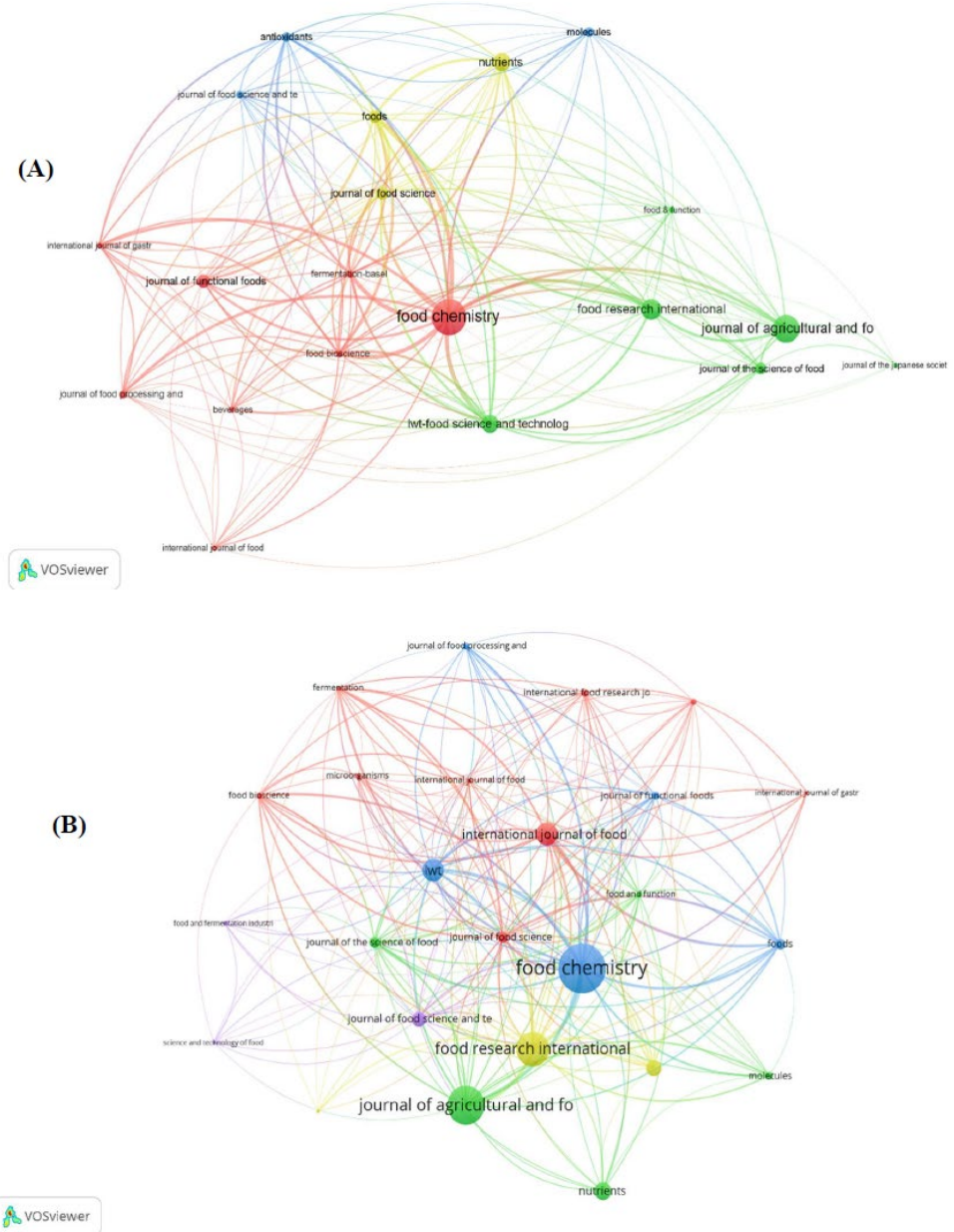

Figure 5. Network map of citations in (A) Web of Science and (B) Scopus.
Source: Own authors (2025).

(585), *Journal of Food Science* (577), and *Foods* (543). The other journals appear with lower numbers than these. In terms of Scopus® journals, *Food Chemistry* also leads with 5,854 citations, followed by the *Journal of Agricultural and Food Chemistry* (4,437), *Food Research International* (3,865), *International Journal of Food Microbiology* (2,453), *LWT* (2,425), *Nutrients* (1,864), *Frontiers in Microbiology* (1,646), and *Journal of Food Science and Technology* (1,508).

Analysis of the most cited journals in these databases reveals the dominance of the journal *Food Chemistry*, which has the highest impact factor in both databases (8.5), highlighting its relevance in the area of food science and technology. *Food Research International* and *LWT—Food Science and Technology* also appear on both lists, reinforcing their role as important sources for research into food properties and safety. However, there are notable differences between the databases: Web of Science® includes the *Journal of Agricultural and Food Chemistry* (5.7) and the *International Journal of Food Microbiology* (5.0), showing a focus more on food chemistry and microbiology. Scopus® highlights *Nutrients* (4.8) and the *Journal of Functional Foods* (3.8), which suggests an emphasis on nutritional and functional aspects of food.

3.8 Most productive authors

A total of 13,812 authors were found on the Web of Science® and 159 on the Scopus® database (Figure 6). Analysis of the most productive authors on Web of Science® and Scopus® reveals important information about scientific production in the area under investigation. On Web of Science®, "Joubert, E." stands out as the most productive author with 59 published documents, followed by "Beer, D." with 37 publications. "Liu ZH, Wang Y., Tanaka T. and Zhang L." also made significant contributions, ranging from 26 to 29 documents. In the Scopus® database, "Joubert, E." maintains a prominent position with 50 publications, while "Liu, Z." and "Tanaka, T." follow with 28 and 26 documents, respectively.

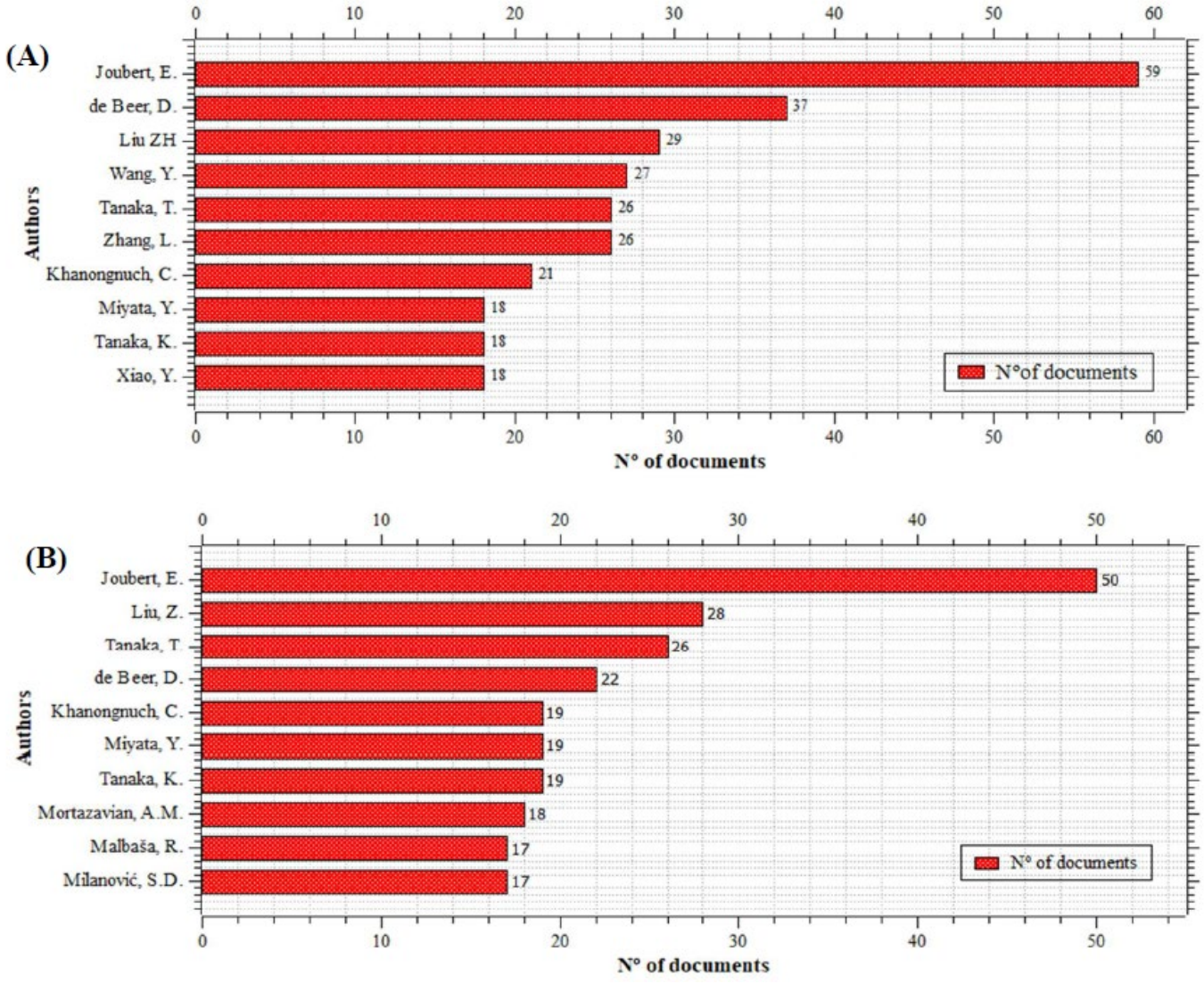

Figure 6. Top 10 most productive authors in (A) Web of Science and (B) Scopus.
Source: Own authors (2025).

Authors such as "Beer, D." and "Khanongnuch, C." also appear in both databases, indicating that their scientific production is widely recognized. The presence of common names between the two databases reinforces the relevance of these researchers to the field.

4. CONCLUSION

The bibliometric analysis carried out shows a significant growth in scientific production related to Kombucha in recent years, especially since 2016, reflecting the increase in global interest in fermented foods with potential functional benefits.

There was a predominance of publications in English, which corroborates the consolidation of this language as the main vehicle for international scientific dissemination. China stands out as the main producer of knowledge on the subject, followed by the United States, India, and Brazil, the latter being relevant in the Latin American scenario.

The most productive areas in the databases analyzed varied between agricultural, biological, and health sciences, with food science and technology standing out, which demonstrates the multidisciplinary nature of studies involving Kombucha. The most productive institutions and authors reinforce Asian and South African leadership, with consistent contributions in terms of quantity and impact. In addition, the most recurrent keywords and emerging terms identify future trends involving intestinal microbiota, food safety, bioactive compounds, and the biotechnological application of bacterial cellulose.

The data obtained demonstrates the consolidation of Kombucha as an object of scientific interest as well as signaling strategic opportunities for the advancement of research aimed at food safety, food functionality, and biotechnological applications.

The interface between fermented foods and human health, especially with regard to intestinal microbiota and bioactive compounds, is a promising field for the development of innovative and sustainable solutions in the area of food science and technology.

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