Current Overview of Scientific Production on Therapies and Treatments Against Helicobacter pylori: Article of Review Scientometric*

Panorama actual de la producción científica sobre terapias y tratamientos contra Helicobacter pylori: Artículo de revisión cienciométrica

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Abstract

Helicobacter pylori infection represents a significant public health concern due to its high global prevalence and strong association with gastrointestinal diseases, including chronic gastritis, peptic ulcers, and gastric cancer. Despite the growing scientific interest in this bacterium, no recent scientometric review had focused exclusively on the therapies and treatments aimed at its eradication. This study conducted a scientometric analysis of scientific production from 2004 to 2024, using the Web of Science and Scopus databases. A total of 1,128 unique articles were identified and analyzed using tools such as Python, Gephi, and Inkscape to visualize trends, collaboration networks, and key academic contributors. A sustained growth in scientific output was observed (5.09%), with a recent expansion phase between 2020 and 2024. China led in publication volume, while the United States stood out in terms of citation impact.

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Most articles were published in Q1 journals, with Helicobacter and World Journal of Gastroenterology being the most prolific. Authors such as D. Graham, P. Malfertheiner, and J. Gisbert were notable for their high influence and extensive collaboration networks.This analysis provides a structured overview of scientific developments related to H. pylori and helps identify research gaps, priorities, and opportunities for international collaboration.

Keywords: Helicobacter pylori, gastrointestinal diseases, therapies, bacterial infection, diagnosis, antimicrobial resistance, gastric cancer, gastritis, public health, epidemiology.

Resumen

La infección por *Helicobacter pylori* representa un problema relevante de salud pública por su elevada prevalencia mundial y su fuerte asociación con enfermedades gastrointestinales, incluyendo gastritis crónica, úlceras pépticas y cáncer gástrico. A pesar del creciente interés científico en esta bacteria, no existía hasta ahora una revisión cienciométrica reciente centrada exclusivamente en las terapias y tratamientos diseñados para su erradicación. Este estudio realizó un análisis cienciométrico de la producción científica entre 2004 y 2024, utilizando las bases de datos Web of Science y Scopus. Se identificaron 1.128 artículos únicos, analizados a través de herramientas como Python, Gephi e Inkscape para visualizar tendencias, redes de colaboración y principales actores académicos. Se observó un crecimiento sostenido en la producción científica (5,09%), con una fase de expansión reciente (2020–2024). China lideró en volumen de publicaciones, mientras que Estados Unidos destacó en impacto por citaciones. La mayoría de los artículos se publicaron en revistas Q1, siendo *Helicobacter* y *World Journal of Gastroenterology* las más productivas. Autores como D. Graham, P. Malfertheiner y J. Gisbert sobresalieron por su alta influencia y redes de colaboración amplias. Este análisis proporciona una visión estructurada del desarrollo científico sobre H. pylori y permite identificar vacíos, prioridades de investigación y oportunidades de colaboración internacional.

Palabras claves: Helicobacter pylori, enfermedades gastrointestinales, terapias, infección bacteriana, diagnóstico, resistencia antimicrobiana, cáncer gástrico, gastritis, salud pública, epidemiología.

1. Introduction

Helicobacter pylori infection is a major public health concern due to its high global prevalence and strong association with gastrointestinal diseases such as chronic gastritis, peptic ulcer, and gastric cancer [1], [2]. Currently, this bacterium is recognized by the WHO as a priority threat. Although for many years the hostile environment of the stomach was believed to be inhospitable to microorganisms, subsequent research confirmed the pathogenic role of *H. pylori*, radically changing the understanding of these diseases [4]. It is estimated that more than 50% of the global population is infected with *H. pylori*, of whom approximately 15–18% may develop peptic ulcers, with a 2- to 6-fold increased risk of gastric

cancer [5],[6]. Moreover, factors such as age, alcohol consumption, and smoking further increase the risk of infection [7].

Currently, various reviews comprehensively address *H. pylori* infection, its prevalence, and its association with different diseases. For instance, Elbehiry et al. [8] present a scientific review highlighting the importance of early diagnosis of *H. pylori* infection and the need to develop new treatments. The review emphasizes the bacterium's virulence factors and current global therapeutic recommendations for its management. Additionally, a scientometric review article analyzes the association between *H. pylori* and gastric cancer, evaluating the evolution of global scientific output on this topic from 2003 to 2022 [9].

However, despite the growing scientific interest in *H. pylori*, there is currently no recent scientometric review that quantitatively analyzes the scientific output related to treatments and therapies aimed at its eradication. Such an analysis would allow for the identification of research trends, key authors, and the most influential journals in the field, thereby providing a comprehensive and structured overview of the scientific development surrounding therapeutic strategies against this bacterium. Furthermore, it would assist the academic community in identifying knowledge gaps and emerging challenges for future research.

In this context, the present article examines the evolution of the scientific literature on *H. pylori* and its associated therapies using scientometric analysis tools. To this end, a bibliographic search was conducted in the Web of Science (WoS) and Scopus databases, using terms related to the topic. The study includes an analysis of annual scientific output, the most impactful countries, authors, and journals, as well as scientific collaboration networks, to provide an updated overview of the field, highlight major contributions, and identifying potential avenues for future research.

2. Methodology

This study was conducted through a scientometric analysis that enabled an exploration of the current landscape of treatments targeting *H. pylori*. The information search was carried out using two high-impact scientific databases: WoS and Scopus, selected for their broad coverage and continuous updating of literature across various fields of knowledge [10] (see Table I). Moreover, these databases have been widely used by different authors for the development of scientometric review articles. For instance, O'Hern et al. [11] conducted a scientometric review on mobility in light vehicles, using WoS as their primary information source. Similarly, Xu et al. [12] carried out a review on ecotourism and sustainability, employing both WoS and Scopus for their literature search.

Table I. Search parameters used in WoS and Scopus.

Parameters	**Web of Science**	**Scopus**
Range	2004 - 2024	
Date	April 3, 2025	
Document type	Article	
Words	(TITLE ("Helicobacter pylori") AND TITLE-ABS-KEY (gastrointestinal AND diseases*) AND TITLE-ABS-KEY (treatment*))	
Results	660	677
Total WoS + Scopus	1128	

Several scientometric review articles on *Helicobacter pylori* address relevant topics such as its association with gastric cancer [9], [12], peptic ulcers [13], and the growing concern over antibiotic resistance [14]. These studies share the common feature of utilizing the WoS database for data collection, underscoring the importance of this source for accessing up-to-date and reliable information on the latest advances in *H. pylori* research.

After collecting the information, it was processed to generate figures and graphs to facilitate its visualization and analysis. The initial data processing was carried out using two Python scripts executed in the Google Colab environment, which enabled the construction of tables and visual representations related to scientific output and collaboration networks. The figures were preliminarily edited in Gephi 0.10.1 and later optimized for final presentation using Inkscape software.

Figure 1 presents the flow diagram summarizing the methodology used to organize the data obtained from the WoS and Scopus databases. This process was carried out in four stages. The first stage involved identifying the literature related to *H. pylori* treatment methods reported in both databases. In the second stage, a screening process was conducted to eliminate duplicate records (articles indexed in both platforms), reducing the total from 1,337 entries to 1,128 unique articles. Subsequently, data organization was performed through information mining, distributing the records across 22 spreadsheets. The third stage involved the scientometric analysis, and finally, the evaluation of scientific output, as well as the analysis of journals and authors, was conducted.

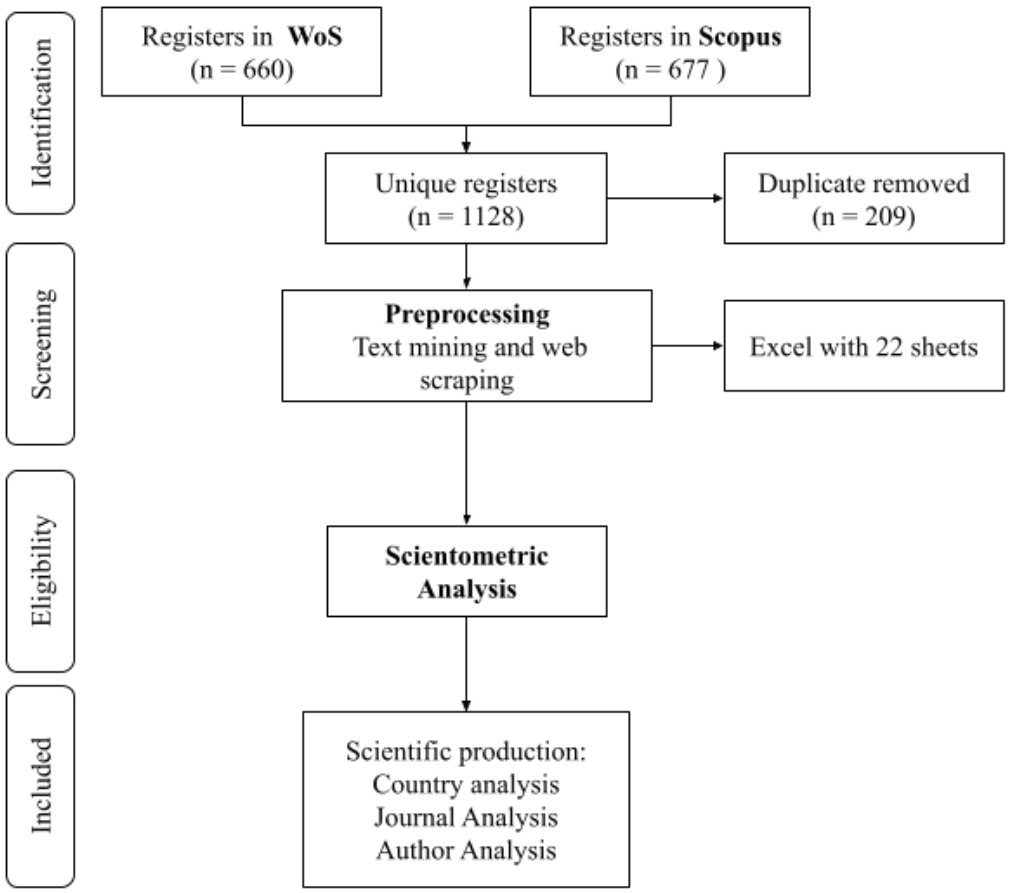

Figure 1. Flow diagram

3. Results

3.1. Scientific Annual Production

Figure 2 presents the results of scientific production over the past 20 years regarding treatment therapies against *Helicobacter pylori*, showing a growth rate of 5.09%. This facilitates the analysis of research trends and the informational dynamics involved in the development of therapies targeting this pathogenic organism. It can be observed that from 2004 to 2020, publications indexed in Scopus and WoS (green and yellow bars, respectively) exhibit a relatively consistent growth pattern. However, from 2021 to 2024, publications in WoS surpassed those in Scopus. Overall, a variable growth pattern is maintained across the data, with more pronounced changes occurring in 2012, 2022, 2023, and 2024. Additionally, four key periods are identified—latency, inflection, consolidation, and expansion—which enable a temporal segmentation of the different phases of scientific production dynamics and their impact. These changes and their corresponding phases are discussed below.

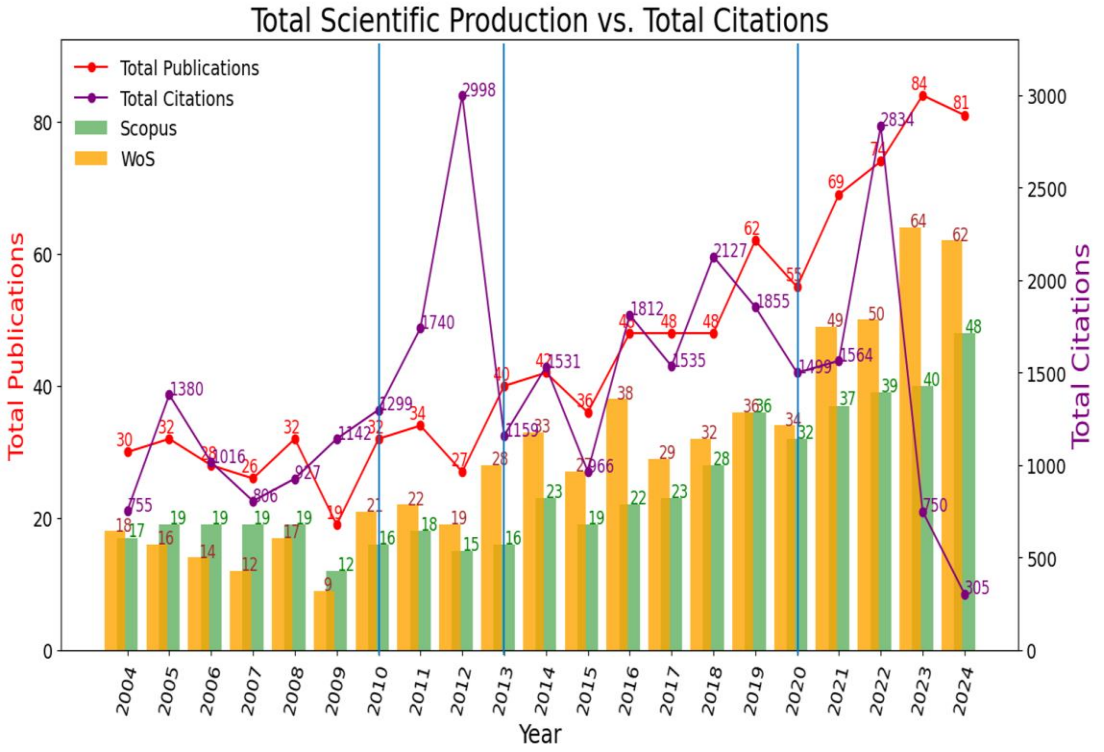

Figure 2. Trends in Total Scientific and Production and Citation (2004-2024).

3.1.1. Latency phase (2004-2010)

This period is characterized by a moderate growth rate of 1.08%, indicating a still limited contribution to the overall volume of publications. Editorial activity in the Scopus and WoS databases remains relatively steady, with a significant contribution of unique articles from both platforms. However, citation trends are highly variable, with notable peaks in 2005 (1,380 citations), 2009 (1,142 citations), and 2010 (1,299 citations). In 2005, the most cited article (191 citations) was published in *Alimentary Pharmacology and Therapeutics*, in which Myllyluoma et al. [15] evaluated the effects of a probiotic supplement on the efficacy of *Helicobacter pylori* eradication treatment. The results showed that the probiotic cocktail administered to participants not only significantly improved treatment response but also reduced associated side effects.

In 2009, the most cited article (169 citations) was published in the journal *Helicobacter*. This study compared two therapeutic regimens for the eradication of *H. pylori*: the standard triple therapy (proton pump inhibitor [PPI] + amoxicillin + clarithromycin) and a sequential quadruple therapy that included a nitroimidazole. The latter demonstrated higher eradication rates .

Likewise, in 2010, the most cited article (347 citations) was a review of the Japanese clinical guidelines for the diagnosis and treatment of *H. pylori*, also published in the journal *Helicobacter* [3]. This document represents a significant update in therapeutic strategies in Japan, particularly following the strengthening of evidence linking *H. pylori* to gastric cancer.

3.1.2. Inflection Phase (2010-2013)

This phase reveals a significant trend, with a growth rate of 7.72%, indicating an exponential increase in the number of citations relative to the total number of publications. This relationship becomes particularly notable in 2012, which recorded a total of 2,998 citations associated with only 27 unique publications across both databases—Scopus and WoS. Among the most highly cited works is the article by Malfertheiner et al. [3], [16], which received 1,723 citations and was published in the journal *Gut*. This paper presents the recommendations of the Maastricht IV/Florence International Consensus on the management of *Helicobacter pylori* infection. It addresses key topics such as diagnostic testing, treatment indications and contraindications, as well as available therapeutic strategies. Moreover, it places special emphasis on clinically related conditions such as dyspepsia, the use of nonsteroidal anti-inflammatory drugs (NSAIDs) or aspirin, gastroesophageal reflux disease, and extraintestinal manifestations of the infection. The paper also highlights the critical role of treatment in preventing gastric cancer and other associated complications.

The second most cited article (465 citations), also published in the journal *Gut*, evaluated the efficacy and safety of a single-capsule treatment consisting of a quadruple therapy (omeprazole + a combination capsule containing potassium bismuth subcitrate, metronidazole, and tetracycline) administered over 10 days, compared to the standard triple therapy (omeprazole + amoxicillin + clarithromycin for 7 days) for *H. pylori* eradication [17]. This highlights the significant impact of publications from that year on both scientific interest and contributions to the research community. This period can be defined as a turning point, not only due to the high value these studies provided to researchers in the field, but also because it marks a possible shift in the quality and innovation of the research being conducted. It is also noteworthy that WoS contributed slightly more publications than Scopus during this time.

3.1.3. Consolidation phase (2013-2020)

Scientific output during this phase exhibits a steady pattern and a sustained or increasing impact in terms of citation counts. The growth rate for this phase is 4.65%, further demonstrating a fairly stabilized increase in scientific production over this period. The relationship between total citations, the number of unique articles from both databases, and the citation trends across both sources (green and yellow bars) shows a relatively variable pattern. Moreover, the number of publications increased to a greater extent compared to the

inflection phase, highlighting this period as a foundational stage in the expansion of research within the field.

This phase is also marked by the emergence of publications that significantly contribute to advancing knowledge on the topic. For instance, in 2014, the *World Journal of Gastroenterology* published a scientific review article that examined the current state, future perspectives, and effective treatment strategies against *H. pylori* infection, particularly regarding diseases such as chronic gastritis, peptic ulcers, and gastric cancer [18]. Later, in 2016, *Wiley* published an article that garnered a total of 553 citations. This work focused on the growing global emergence of antibiotic resistance in *Helicobacter pylori*, identifying a correlation between rising resistance levels and a global decline in antibiotic treatment eradication rates [19]. These contributions reflect an academic stabilization and theoretical consolidation within the field.

In 2018, a consensus article was published in China addressing key and highly relevant topics related to the diagnosis, treatment, and management of *Helicobacter pylori* infection. This work standardized recommendations for managing the infection, including diagnostic methods, antibiotic treatment regimens, gastric cancer prevention, and the impact on the gastrointestinal microbiota [20]. Considering this, the period is characterized by greater research diversity and depth, with expanded methodologies and thematic approaches. It also reflects increased collaboration and the establishment of stronger research networks among authors.

3.1.4. Expansion Phase (2020–2024)

During this phase, the total number of publications indexed in both Scopus and WoS increases exponentially, reflecting a heightened level of scientific output and research activity in the field. This trend is supported by a scientific production growth rate of 10.16%. It is noteworthy that the contribution of journals indexed in both databases remains relatively balanced throughout this period. Additionally, WoS surpasses Scopus in the total number of publications during this phase, contributing more significantly to the overall output.

In 2022, a more balanced relationship between total scientific production and total citations was observed. One of the most highly cited articles published in that year, appearing in the journal *Gastroenterology* (120 citations), investigated whether early eradication of *H. pylori* in asymptomatic individuals could reduce the long-term risk of developing gastric cancer (GC). The study concluded that the risk of GC decreases significantly, particularly when treatment is administered before the onset of premalignant gastric lesions [21].

Synergistically, in 2023, a nationwide epidemiological study design was proposed in China, with the primary objective of determining the prevalence of *H. pylori* infection within intrafamilial groups in order to identify how and how frequently transmission occurs within these household units. The study found that *H. pylori* infection is strongly associated with family cohabitation [22]. This article has accumulated a total of 71 citations, highlighting the

interest it has generated; however, it underscores the need to overcome the stationary phase in temporal analysis. The same consideration applies to other publications from that year.

A very important and notably variable aspect is the high total number of publications alongside a relatively low number of citations in the years 2021, 2023, and 2024. This inverse effect is primarily related to a temporal factor—that is, newly published articles require time to accumulate citations. Additionally, the sharp increase in the number of publications has led to a diversification of information across a broader range of thematic research areas, which may reduce the specificity of the content for certain researchers.

For example, one of the articles published in 2024 evaluated the impact of *H. pylori* infection on the effectiveness of anti-PD-1/PD-L1 immunotherapies in patients with various types of digestive system cancers. The study determined that *H. pylori* infection enhanced the immune response only in cases of gastric cancer, highlighting a context-specific effect [23]. Additionally, as a novel contribution, the research conducted on the efficient eradication of *H. pylori* and gastric cancer mediated by chitosan-modified molybdenum selenide [24]. Also represents a new and highly specific topic for this year. It may reflect divergences in the interests of other authors or indicate the need for greater research attention from other scientists working in the same field.

In general, the total number of citations and published articles from each database shows a highly variable trend, which is to be expected as it reflects a non-linear and dynamic pattern. This behavior represents, at different points in time, the evolving research impact of studies focused on therapies aimed at combating H. pylori infection.

3.2. Country Analysis

Scientific production on treatments for *Helicobacter pylori* was analyzed across ten countries, as shown in **Table II**. To assess the impact of these publications, the number of citations received was considered, while quality was determined based on quartile rankings provided by the Scimago Journal & Country Rank.

Although China clearly leads in the number of publications, with 215 articles (16.55% of the total), its citation share (9.85%) is relatively lower compared to the United States, which, with nearly half the number of publications (122 or 9.39%), accounts for 15.96% of total citations. Similarly, Italy surpasses China in citation count, establishing itself as the second-highest country in terms of citation proportion, with 10.09%. However, China ranks first in scientific production within Q1 journals, with 107 articles, ahead of countries such as the United States (49), Japan (46), and Italy (39), thus dominating high-quality research output on *H. pylori* treatment.

Table II. Country Contributions to *H. pylori* Search. Production, Citation and Quartile Distribution.

Country	Production		Citation		Quality			
	Count	%	Count	%	Q1	Q2	Q3	Q4
China	215	16.55	4917	9.85	107	38	13	26
Usa	122	9.39	7970	15.96	49	30	3	1
Japan	100	7.7	2951	5.91	46	28	9	4
Iran	96	7.39	1184	2.37	17	23	33	9
Italy	85	6.54	5039	10.09	39	24	8	2
Germany	44	3.39	3173	6.36	20	12	3	2
India	39	3.0	994	1.99	9	5	12	4
United Kingdom	35	2.69	2916	5.84	21	1	0	0
Korea	32	2.46	709	1.42	13	9	0	1
Spain	28	2.16	2254	4.51	15	5	5	1

In one of the most recent articles produced in China, Zhou et al. [25] evaluated the combination of probiotics with standard quadruple therapy for the treatment of *H. pylori*-infected peptic ulcers in 128 children. The researchers found that the combined therapy resulted in a higher ulcer healing rate, greater *H. pylori* eradication rate, and an increase in beneficial gut microbiota compared to treatment with standard quadruple therapy alone.

In its most recent article, the United States describes the structure of class 2 dihydroorotate dehydrogenase (DHODH), a key enzyme for the survival of *H. pylori*. Agarwal et al. [26] successfully resolved the crystal structure of DHODH and identified interactions with the flavin mononucleotide (FMN) cofactor, which facilitates the production of ubiquinone—essential for *de novo* nucleotide synthesis. Additionally, channels were discovered within DHODH that enable the transport of ubiquinones. These findings are significant for the development of targeted drugs against *H. pylori*, particularly those aimed at this enzyme.

Based on the affiliation of co-authors in each article, scientific collaboration between countries was established. In this regard, Figure 3 reveals a large community (blue) led by countries such as the United Kingdom, Italy, Spain, and Portugal, among others. Additionally, three proportionally similar communities can be observed, led by France (gray), Germany (brown), and the United States (green). While four well-defined communities are visible, there are countries that serve as connectors between them. A distinct community composed of Uruguay and Ecuador can also be seen, which remains unconnected to the other country groups.

These affiliations are of great importance for advancing research on *H. pylori*, as they enable the global scientific community to stay up to date with recent developments and to establish collaborative ties for cutting-edge research. In this context, in 2023, researchers from the United States, China, and Singapore published a study on the design and evaluation of antimicrobial copolymers aimed at specifically and selectively targeting *H. pylori* without harming the beneficial stomach microbiota. These polymers, under the acidic conditions of the stomach (pH 3.0), are capable of forming spherical structures that exhibit strong antimicrobial activity against *H. pylori*, whereas at more neutral pH levels such as those found in the intestine (pH 7.4), the polymers show no toxicity toward the gut microbiota. This approach represents a significant advancement in the development of more selective and specific treatment methods compared to traditional antibiotic therapies [27].

Similarly, researchers from Azerbaijan, Croatia, and the Czech Republic published an article in 2025 analyzing how the effectiveness of bismuth quadruple therapy (BQT)—which includes bismuth, a proton pump inhibitor, and two antibiotics—has changed over the period from 2013 to 2021 in the treatment of *H. pylori* infection. They evaluated data from 15,582 patients who received BQT. Among their findings, they reported that the use of BQT increased from 8.6% in 2013 to 39% in 2021, and that the *H. pylori* eradication rate consistently remained above 90% [28]. These findings are highly relevant in light of the growing challenge of antibiotic resistance.

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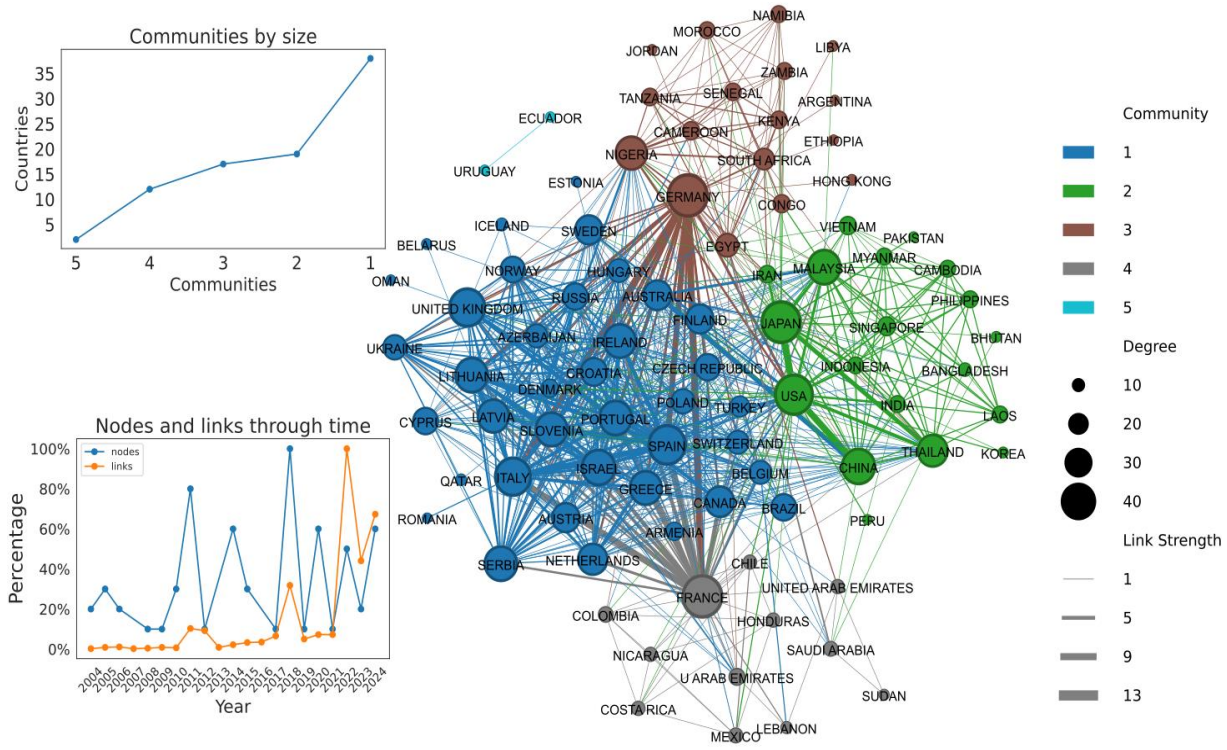

Figure 3. Global Collaboration Network by country in *Helicobacter pylori* research.

3.3. Journal Analysis

Table III presents a list of the scientific journals with the highest academic output on treatment methods for *H. pylori*. Regarding quartile classification according to the Scimago Journal & Country Rank, it is evident that most of the analyzed journals fall within the top quartile (Q1), indicating high editorial and scientific quality. In total, five journals belong to Q1, three to Q2, and only one is classified in Q4. This supports the notion that scientific production on *H. pylori* is primarily published in high-impact journals.

Table III. Top Journals in *Helicobacter pylori* research. Publication Metrics and Impact.

Journal	SN	Wos	Scopus	Total	SJR	H-INDEX	QUARTILE
Helicobacter	10834389	43	27	62	1.174	94	Q1
World Journal of Gastroenterology	10079327	29	25	41	1.418	217	Q1
Journal of Gastrointestinal and Liver Diseases	18418724	13	0	13	0.674	62	Q2
Digestive and liver disease	15908658	4	9	13	1.091	113	Q1
Scandinavian Journal of Gastroenterology	00365521	4	8	11	0.689	133	Q2
American Journal of Gastroenterology	00029270	3	8	11	2.344	296	Q1
Chinese Journal of Gastroenterology	10087125	0	11	11	0.106	10	Q4
Frontiers in Cellular and Infection Microbiology	22352988	7	7	10	1.393	136	Q1
Digestion	00122823	5	8	10	1.111	92	Q1
Microbial Pathogenesis	08824010	8	7	10	0.825	107	Q2

The journal with the highest number of publications is Helicobacter, with a total of 62 articles (43 indexed in WoS and 27 in Scopus). This result is consistent, as it is a journal specifically dedicated to topics related to H. pylori and associated gastric diseases, making it a central outlet for scientific production in this field.

For example, in one of the most recent articles published in Helicobacter in 2024, researchers investigated how often H. pylori is incidentally detected during upper endoscopies performed on children undergoing evaluation for gastrointestinal conditions such as celiac disease (CD), inflammatory bowel disease (IBD), and eosinophilic esophagitis (EoE). The study found that

detection rates varied by geographic region and that only 40% of H. pylori-positive cases received eradication treatment, due in part to the lack of consensus on appropriate management strategies across different populations [29]. In this regard, the same journal has published articles aimed at generating consensus on the treatment of H. pylori infection [20]; [30]. The *World Journal of Gastroenterology* ranks second in terms of number of publications, with 41 articles, followed by the *Journal of Gastrointestinal and Liver Diseases* in third place, with 13 articles. These journals also exhibit a specialized focus on gastroenterology, making them key references for up-to-date information on *H. pylori* and advances in treatment strategies.

One study published in the *World Journal of Gastroenterology* by researchers from Zagazig University in Egypt evaluated the prevalence of *H. pylori* infection, its patterns of antibiotic resistance, and the influence of *cagA* and *vacA* virulence genes on the effectiveness of a 14-day triple therapy regimen with metronidazole, amoxicillin, and clarithromycin. The study found a low eradication rate (59.2%), highlighting the need to reassess these treatments in light of growing antibiotic resistance [28], [31].

Similarly, Demirci et al. [32] published an article in the *Journal of Gastrointestinal and Liver Diseases* evaluating the impact of *H. pylori* colonization density on the success of bismuth-based quadruple therapy. Their findings demonstrated a direct association between higher bacterial density and a more favorable treatment response.

In addition to publication volume, the H-Index was considered as an indicator of cumulative impact. In this regard, *The American Journal of Gastroenterology* stands out as the most influential journal, with an H-Index of 296—indicating that at least 296 of its articles have been cited at least 296 times. This value reflects a strong international presence and a remarkable ability to position its research within the scientific community.

However, this journal has not published recent studies on *Helicobacter pylori*; its last significant contribution dates back to 2013, when Nordenstedt and colleagues investigated the prevalence of histologic gastritis not associated with *H. pylori*. They found that 20.5% of patients with gastritis did not present infection by this bacterium [33]. This article has been cited 72 times by various authors.

World Journal of Gastroenterology (H-index = 217) and *Frontiers in Cellular and Infection Microbiology* (H-index = 136) also stand out for their high scientific output and impact in the study of *Helicobacter pylori*. The most cited article on this bacterium in the *World Journal of Gastroenterology*, with 241 citations, is by Gravina et al. [34], which reviews the possible association between *H. pylori* infection and extra-gastric manifestations, such as neurological, dermatological, hematological, ocular, cardiovascular, metabolic, allergic, and hepatobiliary conditions. In *Frontiers in Cellular and Infection Microbiology*, Sun et al. [7] published a review on the pathogenic mechanisms, diagnosis, and current treatments of *H. pylori*, which has reached 46 citations.

On the other hand, the analysis also identifies some journals with lower international visibility, such as the *Chinese Journal of Gastroenterology*, which, despite having 11 publications indexed in Scopus, has a very low SJR (0.106) and an H-index of 10.

Additionally, it is ranked in Q4, suggesting limited international reach—likely due to its regional focus or its orientation toward a more restricted audience. Regarding the SJR (Scimago Journal Rank) values—which reflect the weighted influence of a journal based on the quality of the citations it receives—the *American Journal of Gastroenterology* stands out with a score of 2.344, followed by the *World Journal of Gastroenterology* (1.418) and *Frontiers in Cellular and Infection Microbiology* (1.393). This indicates that articles on *H. pylori* are being disseminated through well-positioned journals within the academic landscape.

Overall, the journal analysis reveals that scientific production on *H. pylori* is concentrated in highly specialized outlets with strong bibliometric impact and international recognition. This preference for Q1 journals with high H-index values ensures that research findings achieve greater reach, enhance their visibility, and contribute to the generation of rigorous, high-quality knowledge in the clinical, therapeutic, and microbiological fields.

Figure 4 illustrates the three main clusters: publication, journal, and research group. The connections (links) between them represent co-citations—that is, the frequency with which two publications are cited together in the scientific literature. The *link strength* and the size of the nodes reflect the degree of connectivity of each element, indicating how often they are associated with other nodes in the network [35] Colors differentiate distinct thematic communities detected algorithmically—five in total, numbered from 1 to 5—where the green, orange, and purple nodes appear to be the most densely interconnected.

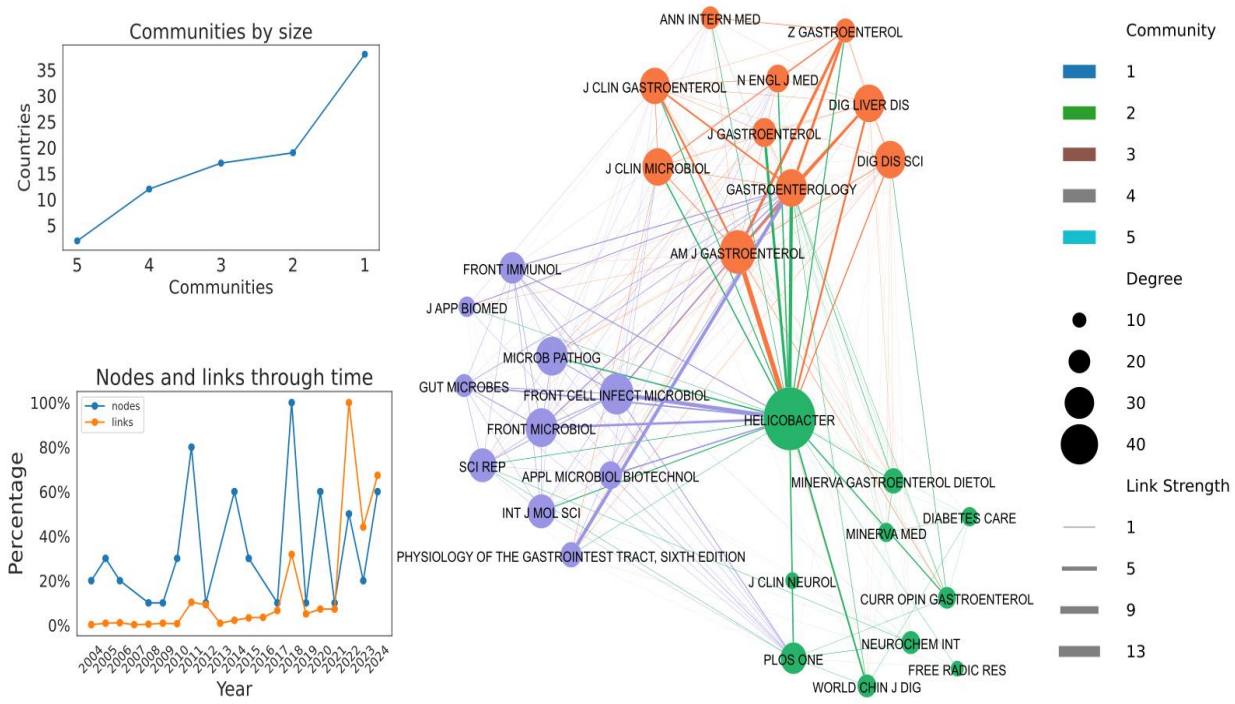

Figure 4. Citation Network of Journals: Communities and Interconnections in *Helicobacter pylori* Research.

This citation network analysis reveals not only the main research areas but also the thematic interdependence and convergence across disciplines. Moreover, it suggests the emergence and consolidation of new research focuses within the biomedical field, particularly those related to the interaction between the microbiome and digestive health [36].

The network also highlights central journals such as *Gastroenterology*, *Gut*, *Journal of Clinical Gastroenterology*, and *Applied and Environmental Microbiology*, which exhibit a high degree of connectivity and act as bridging nodes between communities. These publications serve as key dissemination points for interdisciplinary knowledge across subfields such as gut microbiota, gastrointestinal diseases, and applied immunology [37].

3.4. Author Analysis

Table IV presents the ten most prolific authors in *H. pylori* research, evaluated using multiple bibliometric indicators that provide insight not only into their scientific productivity but also into their level of impact and collaboration within the researcher network.

Table IV. Top 10 Most Prolific Authors in *Helicobacter pylori* Research and Their Affiliations.

Author	Papers Total	Total Citations	H-Index	Effective Size	Constraint	CDI
Kim J	26	831	11	472.08	0.01	0.04
Graham D	17	4493	16	705.05	0.01	0.05
Li Y	23	505	8	705.27	0.01	0.02
Malfertheiner P	19	3753	14	601.46	0.01	0.05
Chen Y	18	1271	8	603.57	0.01	0.02
Gisbert J	17	2801	9	563.61	0.01	0.02
Zhang Y	17	310	5	843.02	0.01	0.02
Zhou L	17	1539	12	201.74	0.02	0.02
Yamaoka Y	14	819	12	531.38	0.01	0.05
Chen C	13	794	8	291.98	0.01	0.02

Firstly, in terms of total number of publications, the list is led by J. Kim with 26 articles, followed by Y. Li with 23 and P. Malfertheiner with 19. However, when examining impact measured by total number of citations, D. Graham stands out significantly with 4,493 citations, followed by P. Malfertheiner with 3,753 and J. Gisbert with 2,801. This indicates that although they may not be the most productive in terms of publication count, their work has achieved high visibility and influence within the scientific community.

In terms of scientific impact, measured through the H-Index—which reflects both productivity and the consistency of a researcher's influence—D. Graham (H = 16) and P. Malfertheiner (H = 14) stand out with the highest values among the authors analyzed. These figures reinforce the points made in previous paragraphs regarding their significant contributions to the field, as evidenced not only by the volume of their publications but also by the frequency with which their work is cited, indicating sustained influence within the scientific community.

Similarly, the Effective Size metric serves as an indicator of how diverse an author's connections are within the collaboration network. For instance, authors such as Y. Zhang (843.02), Y. Li (705.27), and D. Graham (705.05) show the highest values for this metric, suggesting that they maintain broad and less redundant collaboration networks.

On the other hand, the values of Constraint and CDI (Component Disconnectedness Index) are consistently low for all authors (ranging between 0.01 and 0.05), indicating that their collaboration networks exhibit an open and well-connected structure. In this context, low Constraint values suggest that these authors are not reliant on a single collaborator or a closed group, allowing for greater structural autonomy and access to diverse information within their scientific collaboration networks. Similarly, low CDI values reflect that the networks in which they participate are cohesive and minimally fragmented, which facilitates knowledge circulation and enhances interdisciplinary collaboration.

In summary, the indicators analyzed regarding the therapy and diagnosis of *H. pylori* confirm that the authors studied are not only prolific but have also had a significant impact on the scientific output in this field. Furthermore, it is evident that they conduct their work within strong collaborative environments and are strategically positioned within the research landscape, which further enhances the relevance and reach of their contributions. Among these researchers, three stand out in particular: D. Graham, P. Malfertheiner, and J. Gisbert, whose scientific production has achieved notable influence in the area.

Upon further analysis of the impact of his publications, D. Graham emerges as the most cited author in this line of research. In particular, he has contributed to widely cited consensus statements and conferences that have been instrumental in advancing the clinical understanding and management of *H. pylori*. One such contribution is the *"ASEAN" Bangkok Consensus Report*, which addresses the prevalence of the bacterium and the incidence of gastrointestinal diseases and cancer in the region. The report aims to evaluate and implement diagnostic and treatment strategies tailored to local patterns of antibiotic resistance [37], [38].

Similarly, P. Malfertheiner has also played a prominent role in *H. pylori* research, particularly through a highly cited article that marked a milestone in the treatment of this infection. This study addresses the efficacy and safety of bismuth-based quadruple therapy, especially using the single-capsule formulation Pylera, for the eradication of *H. pylori*. This therapy stands out as an effective option, even in cases of resistance to commonly used antibiotics such as clarithromycin or metronidazole. Its relevance has been such that this method has been incorporated into international guidelines, including the Maastricht Consensus Conferences [39]. Like Graham D, Malfertheiner has also been actively involved in conferences and consensus statements, which explains the high citation rates of his more recent works [39], [40].

The third most-cited author is J. Gisbert, whose research trajectory is closely linked to that of Malfertheiner, due to the alignment of their research lines, particularly in the field of *H. pylori* diagnosis. Among his most recent publications are articles in the *Journal of Clinical Medicine* and *Gut*, in which he analyzes the efficacy of both invasive and non-invasive detection methods, as well as antibiotic therapies, evaluating their specificity and sensitivity [28] [41]. Regarding diagnosis, notable methods include stool antigen detection, the urea breath test, and gastrointestinal endoscopy.

Conclusions

The scientometric analysis conducted identified the evolution of scientific knowledge surrounding *H. pylori*, a bacterium that remains a key focus in global public health. Although this infection has been extensively studied for decades, academic and clinical interest has not waned; on the contrary, as evidenced by the annual scientific output on this topic, there is a growing trend, with new approaches further driving research at varying paces. The field has diversified into new lines of study, including the development of more effective therapies, antimicrobial resistance, and the personalization of treatments. Notably, this diversification has led to multiple research pathways that approach *H. pylori* through emerging molecular technologies as well as through improved existing methodologies, enhancing diagnostic sensitivity and contributing to more precise diagnosis and treatment.

It was evidenced that countries such as China, the United States, Japan, and Italy lead scientific production in this field, both in terms of the number of publications and bibliometric impact, reflecting the strength of their biomedical research systems. However, it is important to highlight that the quality of contributions is not always proportional to the quantity of publications, as observed in the relationship between citations and impact indices. Likewise, scientific collaboration networks play a crucial role in the consolidation of robust and up-to-date lines of research. The presence of well-defined and active co-authorship communities suggests that research on *H. pylori* is organized around international centers and groups with high technical capacity, which facilitates the circulation of knowledge and the joint development of therapeutic innovations.

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