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# A Bibliometric Analysis of Publications on Digestive Endoscopy From 1980 to 2024

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**Abstract**

**Aim:** This study aims to conduct a bibliometric analysis of publications in the field of digestive endoscopy.
**Material and Method:** Publications in the Web of Science (WoS) database were analyzed using the Bibliometrix program. The keyword “Endoscopy” was selected, and publications from 1980 to 2024 were evaluated.
**Results:** A total of 13,382 publications were analyzed. The annual growth rate of publications was 6.59%. The highest number of publications was recorded in 2021 (n = 877). The total number of authors across all articles was 44,697, with an average of 6.34 researchers per publication. The number of single-author publications was 709. In terms of publication and citation counts, the top three most influential journals were Gastrointestinal Endoscopy, Endoscopy, and American Journal of Gastroenterology. The most influential study was found to be Wireless Capsule Endoscopy, published in Nature in 2000 by Gavriel Iddan et al. The top three most influential researchers were Professor Jean-Marc Dumonceau from Switzerland, Professor Cesare Hassan from Italy, and Professor Jeanin E. van Hooft from the Netherlands. The most influential researcher of Turkish origin was Assistant Professor Özdal Ersoy from Acibadem University. Regarding the publication performance of countries, the leading contributors were the USA (n = 2,886, 21.5%), China (n = 1,421, 10.6%), and Japan (n = 1,356, 10.1%), while Türkiye ranked 15th (n = 190, 1.4%).
**Conclusion:** This bibliometric analysis comprehensively presents the development of research in the field of endoscopy from 1980 to 2024. The findings of this study will facilitate more efficient and focused research on endoscopy. Future analyses incorporating broader databases will contribute to a more comprehensive evaluation of scientific advancements in the field.

**Keywords:** Endoscopy, bibliometric analysis, Bibliometrix, digestive, Web of Science

## INTRODUCTION

Bibliometric analysis is a systematic method for evaluating and measuring scientific literature. Such studies analyze the number of publications, authors, citations, and other key indicators within a specific field, revealing trends in the literature, research collaborations, and the dissemination of knowledge (1,2). Bibliometric analyses are among the most widely used tools in scientific research, as they provide crucial data on which topics are more frequently studied, which authors are prominent in the field, and which studies receive the most citations (3).

Science mapping is one of the bibliometric analysis techniques used to understand the intellectual structure of a research field and its development over time (4). It is an effective method for visualizing knowledge domains and is widely utilized in analyzing academic productivity. This approach combines data mining, network analysis, and visualization techniques to assess scientific output. Researchers can track the evolution of a particular research area by utilizing various methods such as citation analysis, keyword co-occurrence, and scientific collaborations. With advancements in computational methods in recent years, science mapping has been acknowledged for providing more detailed and comprehensive analyses, significantly contributing to the understanding of scientific knowledge (5).

Endoscopy is a medical technique used to visually examine internal organs, and it has rapidly advanced in recent years. It is particularly crucial for diagnosing and treating diseases of the gastrointestinal system. Developments in this field have led to groundbreaking innovations in both diagnostic

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and therapeutic procedures. Compared to surgical interventions, endoscopic procedures offer the advantage of being minimally invasive, which accelerates patient recovery (6). The increasing number of scientific studies in the field of endoscopy has facilitated the broader and safer application of these techniques.

Given the significance of endoscopy in the medical field, the vastness and diversity of the literature in this area pose challenges for comprehensive evaluation (7). A bibliometric analysis of the existing literature on endoscopy is essential to understanding the development of this field and identifying future research needs (1). This study aims to conduct a bibliometric analysis of publications in the field of digestive endoscopy. The bibliometric evaluation of the endoscopy literature will contribute to conducting more efficient and focused research in this area.

## MATERIAL AND METHOD

The search strategy and workflow for studies on endoscopy are presented in Table 1. The research design and data collection stages were conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Since this study is a bibliometric analysis, it does not require ethical committee approval.

**Table 1. Search strategy and workflow of science mapping**

| Search Criteria | Publications Founds | Sections | Analysis |
|---|---|---|---|
| Web Of Science: [Endoscopy] (Title) | 29,815 | Performance Analysis | Main Information Publications |
| | | | Annual Scientific Production and Average Citation Per Year |
| | | | Sources' Local Impact |
| | | | Most Local Cited Documents |
| | | | Authors' Local Impact |
| | | | Authors' Local Impact from Turkey |
| | | | Corresponding Author's Country |
| Document Types: Article OR Review Article | 14,852 | Word Analysis | Word Cloud from Author's Keywords |
| Web of Science Index: SCI_EXPANDED, ESCI | 14,689 | Co-Citation Network Analysis | Papers Co-Citation Network |
| | | | Authors Co-Citation Network |
| | | | Sources Co-Citation Network |
| Language: English | 13,495 | Thematic Analysis | Thematic Map |
| Timespan: 1980-2024 | 13,382 | | |

In this study, the Web of Science (WoS) database, which is widely used for bibliometric analyses and literature searches, was utilized. WoS is a comprehensive and reliable citation indexing database developed for discovering, analyzing, and evaluating academic research. Through this indexing system, researchers can measure the impact of their studies, analyze academic collaborations, and stay updated on the latest developments in their fields (8).

The data search was conducted in the WoS database on February 9, 2025. In the next stage, the extracted data were refined and filtered. When searching for publications under the title [Endoscopy] in the WoS database, a total of 29,815 articles were identified. The document types were filtered as "Article OR Review Article," reducing the count to 14,852 articles. When the WoS index was limited to "SCI_EXPANDED, ESCI," 14,689 articles remained. Restricting the language to "English" further narrowed the dataset to 13,495 articles. Since new publications continue to be added to the database, studies from 2025 were excluded, resulting in a final dataset of 13,382 articles for analysis.

For the analysis of the obtained data, the Bibliometrix program was used. Bibliometrix is a recently developed open-source software based on the R programming language, designed for science mapping (9).

In this study, 13,382 articles were analyzed in four sections. The first section focused on performance analysis of publications in the field of endoscopy. The second section involved keyword analysis, the third section examined co-citation analysis, and the fourth section conducted thematic analysis. No keyword merging was performed to ensure a comprehensive analysis of all keywords.

## RESULTS

### Performance Analysis

The main bibliometric information of scientific publications on endoscopy is presented in Table 2. Between 1980 and 2024, a total of 13,382 publications were identified, with an annual growth rate of 6.59%. The publications have an average age of 12.8 years, and each document has been cited an average of 22.7 times.

**Table 2. Main information publications**

| Description | Results | Description | Results |
|---|---|---|---|
| Main Information About Data | | Authors Collaboration | |
| Timespan | 1980:2024 | Single-authored Docs | 969 |
| Sources (Journals, Books, Etc) | 2009 | Co-authors Per Doc | 6.34 |
| Documents | 13,382 | International Co-authorships % | 14.54 |
| Annual Growth Rate % | 6.59 | Document Types | |
| Document Average Age | 12.8 | Article | 11,269 |
| Average Citations Per Doc | 22.7 | Article; Book Chapter | 4 |
| References | 190,869 | Article; Data Paper | 5 |
| Document Contents | | Article; Early Access | 66 |
| Keywords Plus (ID) | 11,164 | Article; Proceedings Paper | 436 |
| Author's Keywords (DE) | 14,968 | Article; Retracted Publication | 9 |
| Authors | | Review | 1581 |
| Authors | 44,697 | Review; Book Chapter | 2 |
| Authors Of Single-authored Docs | 709 | Review; Early Access | 9 |
| | | Review; Retracted Publication | 1 |

The majority of publications in the literature consist of research articles (n = 11,269). Other document types include book chapters, data papers, early access articles, and conference proceedings. Additionally, a total of 190,869 references were cited across these publications. Data on author collaborations are also presented in the table. The total number of authors contributing to these publications is 44,697, with 709 single-authored papers. On average, there are 6.34 authors per publication, and the international collaboration rate is 14.54%. The number of author-provided keywords and Keywords Plus terms are 14,968 and 11,164, respectively, indicating that the field is supported by a comprehensive body of literature and shaped by diverse global collaborations.

Table 3 illustrates the annual distribution of scientific studies in the field of endoscopy between 1980 and 2024, along with the average number of citations per year. A significant increase in publication volume is observed over the years. While only 52 articles were published in 1980, the number of publications increased substantially in the 2000s, reaching 719 in 2020, 877 in 2021, and 869 in 2022. The highest number of publications was recorded in 2021, with 877 studies. An analysis of citation trends indicates that the average number of citations per year has increased over time but also exhibits fluctuations. For instance, during the 1980s, citation counts per year ranged between 0.4 and 0.8, whereas in the 2000s, they rose to levels between 1.5 and

2.5. The highest citation rate was recorded in 2019, with an average of 3.0 citations per publication, suggesting that significant studies in the field of endoscopy were published during this period, making a considerable contribution to the literature. However, in 2023 and 2024, a noticeable decline in citation rates was observed, which may be attributed to the fact that recently published studies have not yet accumulated sufficient citations. Overall, scientific output in the field of endoscopy has continuously increased over the years, demonstrating the growing academic interest in this area.

**Table 3. Annual scientific production and average citation per years.**

| Years | Publications | Citations | Year | Publications | Citations | Years | Publications | Citations |
|---|---|---|---|---|---|---|---|---|
| 1980 | 52 | 0.5 | 1995 | 88 | 1.5 | 2010 | 348 | 2.1 |
| 1981 | 55 | 0.8 | 1996 | 109 | 1.1 | 2011 | 415 | 2.0 |
| 1982 | 49 | 0.5 | 1997 | 134 | 0.9 | 2012 | 478 | 2.2 |
| 1983 | 48 | 0.4 | 1998 | 149 | 0.8 | 2013 | 485 | 2.2 |
| 1984 | 64 | 0.4 | 1999 | 165 | 1.0 | 2014 | 494 | 2.0 |
| 1985 | 44 | 0.4 | 2000 | 150 | 2.0 | 2015 | 554 | 2.2 |
| 1986 | 69 | 0.5 | 2001 | 155 | 1.5 | 2016 | 550 | 2.2 |
| 1987 | 63 | 0.6 | 2002 | 192 | 1.7 | 2017 | 512 | 2.6 |
| 1988 | 82 | 0.4 | 2003 | 177 | 1.8 | 2018 | 559 | 2.4 |
| 1989 | 88 | 0.5 | 2004 | 223 | 2.5 | 2019 | 548 | 3.0 |
| 1990 | 95 | 0.7 | 2005 | 244 | 2.5 | 2020 | 719 | 2.8 |
| 1991 | 107 | 0.8 | 2006 | 289 | 2.0 | 2021 | 877 | 2.2 |
| 1992 | 115 | 0.6 | 2007 | 342 | 1.8 | 2022 | 869 | 1.9 |
| 1993 | 97 | 0.9 | 2008 | 353 | 1.9 | 2023 | 834 | 1.2 |
| 1994 | 94 | 1.1 | 2009 | 386 | 1.9 | 2024 | 862 | 0.5 |

Table 4 evaluates the local impact of the most influential academic journals in the field of endoscopy based on various bibliometric indicators. The h-index and g-index represent both the overall productivity and the strength of highly cited articles within a journal, while the total citation count (TC) and number of publications (NP) reflect the journal's scientific contribution to the field. Additionally, the average citation per publication (TC/NP) measures the influence of a journal's articles, whereas the year of first publication (PY_start) is a crucial factor indicating the journal's academic longevity.

**Table 4. Sources' local impact.**

| Source | H-Index | G-Index | M-Index | TC | NP | TC/NP | PY-start |
|---|---|---|---|---|---|---|---|
| Gastrointestinal Endoscopy | 109 | 166 | 2.37 | 47865 | 902 | 53.07 | 1980 |
| Endoscopy | 99 | 168 | 2.152 | 38531 | 711 | 54.19 | 1980 |
| American Journal of Gastroenterology | 60 | 97 | 1.304 | 11755 | 213 | 55.19 | 1980 |
| Gut | 54 | 94 | 1.200 | 9019 | 109 | 82.74 | 1981 |
| Clinical Gastroenterology And Hepatology | 40 | 71 | 1.739 | 5161 | 93 | 55.49 | 2003 |
| World Journal of Gastroenterology | 40 | 57 | 1.739 | 5718 | 241 | 23.73 | 2003 |
| Gastroenterology | 39 | 69 | 0.848 | 7364 | 69 | 106.7 | 1980 |
| Scandinavian Journal of Gastroenterology | 36 | 54 | 0.783 | 4442 | 185 | 24.01 | 1980 |
| Digestive Diseases And Sciences | 35 | 51 | 0.761 | 4374 | 246 | 17.78 | 1980 |
| Alimentary Pharmacology & Therapeutics | 33 | 56 | 0.868 | 3422 | 83 | 41.23 | 1988 |
| Digestive Endoscopy | 32 | 54 | 1.684 | 4241 | 213 | 19.91 | 2007 |
| European Journal of Gastroenterology & Hepatology | 32 | 50 | 0.889 | 3280 | 157 | 20.89 | 1990 |
| Journal of Gastroenterology And Hepatology | 32 | 49 | 0.821 | 3304 | 151 | 21.88 | 1987 |
| Journal of Clinical Gastroenterology | 31 | 46 | 0.674 | 3045 | 141 | 21.60 | 1980 |
| Digestive And Liver Disease | 29 | 43 | 1.115 | 2763 | 140 | 19.74 | 2000 |
| Journal of Pediatric Gastroenterology And Nutrition | 28 | 47 | 0.636 | 2972 | 153 | 19.42 | 1982 |
| Endoscopy International Open | 25 | 39 | 1.923 | 2707 | 251 | 10.78 | 2013 |
| Inflammatory Bowel Diseases | 25 | 41 | 1.136 | 1766 | 49 | 36.04 | 2004 |
| World Journal of Gastrointestinal Endoscopy | 25 | 35 | 1.471 | 1987 | 137 | 14.50 | 2009 |
| Journal of Gastroenterology | 23 | 41 | 0.719 | 1762 | 47 | 37.49 | 1994 |

NP = Number of publications, TC = Total citations, TC/NP = Citations per paper, PY_start = Publication year starting

According to the table, Gastrointestinal Endoscopy (h-index: 109, g-index: 166, TC: 47,865, NP: 902, TC/NP: 53.07) and Endoscopy (h-index: 99, g-index: 168, TC: 38,531, NP: 711, TC/NP: 54.19) are among the most influential journals in the field, with high h-indices and total citation counts. American Journal of Gastroenterology (h-index: 60, TC: 11,755, TC/NP: 55.19) and Clinical Gastroenterology and Hepatology (h-index: 40, TC: 5,161, TC/NP: 55.49) also stand out due to their high citation rates per article (Table 4).

Although Gastroenterology has published only 69 articles, it has received a total of 7,364 citations, resulting in the highest citation-per-publication ratio (TC/NP: 106.7), demonstrating that its limited number of publications have had a significant impact. Newer journals such as Endoscopy International Open (PY_start: 2013) are not yet among the most influential in the field, with relatively low values (h-index: 25, TC/NP: 10.78). When examining the m-index calculated based on the journals' starting years of publication, Endoscopy International Open (m-index: 1.923), which began in 2013, and World Journal of Gastrointestinal Endoscopy (m-index: 1.471), which started in 2009, stand out as noteworthy. On the other hand, journals specializing in particular subfields, such as Inflammatory Bowel Diseases (TC/NP: 36.04) and Alimentary Pharmacology & Therapeutics (TC/NP: 41.23), continue to have a notable impact (Table 4).

Overall, long-established journals in endoscopy (e.g., Gastrointestinal Endoscopy, Endoscopy, American Journal of Gastroenterology, Gastroenterology) hold leading positions in the field due to their high total citation counts and strong h- and g-index values. However, newer journals have the potential to increase their impact over time as they publish more articles and receive more citations. This analysis provides a valuable framework for identifying the most influential journals in the field of endoscopy and understanding which journals have the greatest impact on future research directions (Table 4).

Table 5 evaluates the most locally cited (LC) articles in the field of endoscopy and their global citation (GC) performance. The year of publication (YP) indicates how long each article has been present in the academic literature, while LC/YP (Local Citations per Year) and GC/YP (Global Citations per Year) measure the annual impact of these publications. Additionally, the LC/GC ratio (%) serves as a key indicator for comparing local and global influence.

**Table 5. Most local cited documents**

| Document | YP | LC | LC/YYP | GC | GC/YYP | LC/GC Ratio% |
|---|---|---|---|---|---|---|
| IDDAN G. 2000. NATURE | 2000 | 779 | 31.160 | 2258 | 90.32 | 34.50 |
| PENNAZIO M. 2004. GASTROENTEROLOGY | 2004 | 401 | 19.095 | 706 | 33.62 | 56.80 |
| COSTAMAGNA G. 2002. GASTROENTEROLOGY | 2002 | 366 | 15.913 | 638 | 27.74 | 57.37 |
| PENNAZIO M. 2015. ENDOSCOPY | 2015 | 286 | 28.600 | 560 | 56.00 | 51.07 |
| ELL C. 2002. ENDOSCOPY | 2002 | 285 | 12.391 | 523 | 22.74 | 54.49 |
| TRIESTER SL. 2005. AM J GASTROENTEROL | 2005 | 270 | 13.500 | 478 | 23.90 | 56.49 |
| LIAO ZA. 2010. GASTROINTEST ENDOSC | 2010 | 253 | 16.867 | 477 | 31.80 | 53.04 |
| LEWIS BS. 2002. GASTROINTEST ENDOSC | 2002 | 251 | 10.913 | 426 | 18.52 | 58.92 |
| MYLONAKI M. 2003. GUT | 2003 | 193 | 8.773 | 358 | 16.27 | 53.91 |
| FIREMAN Z. 2003. GUT | 2003 | 189 | 8.591 | 311 | 14.14 | 60.77 |
| TRIESTER SL. 2006. AM J GASTROENTEROL | 2006 | 188 | 9.895 | 429 | 22.58 | 43.82 |
| KEZIRIAN EJ. 2011. EUR ARCH OTO-RHINO-L | 2011 | 188 | 13.429 | 455 | 32.50 | 41.32 |
| GRALNEV IM. 2008. ALIMENT PHARM THERAP | 2008 | 183 | 10.765 | 326 | 19.18 | 56.13 |
| ENNS RA. 2017. GASTROENTEROLOGY | 2017 | 162 | 20.250 | 262 | 32.75 | 61.83 |
| DIONISIO PM. 2010. AM J GASTROENTEROL | 2010 | 161 | 10.733 | 290 | 19.33 | 55.52 |
| APPLEYARD M. 2000. GASTROENTEROLOGY | 2000 | 160 | 6.400 | 332 | 13.28 | 48.19 |
| SCAPA E. 2002. AM J GASTROENTEROL | 2002 | 153 | 6.652 | 230 | 10.00 | 66.52 |
| CAREY EJ. 2007. AM J GASTROENTEROL | 2007 | 153 | 8.500 | 246 | 13.67 | 62.20 |
| RONDONOTTI E. 2018. ENDOSCOPY | 2018 | 148 | 21.143 | 282 | 40.29 | 52.48 |
| YAMAMOTO H. 2004. CLIN GASTROENTEROL H | 2004 | 147 | 7.000 | 508 | 24.19 | 28.94 |

Year of Publication (YP). YYP= Year 2025-Year of Publication. Global Citations (GC). Local Citations (LC)

According to the table, the article published by Iddan G. in 2000 (LC: 779, GC: 2,258) stands out as the most cited publication. With LC/YP: 31.16 and GC/YP: 90.32, it has maintained its impact over the years, and its LC/GC ratio of 34.5% indicates a strong balance between local and global influence. The 2004 publication by Pennazio M. (LC: 401, GC: 706) has also had a significant impact, with an LC/GC ratio of 56.8%, showing a dominance of local citations. Similarly, the 2002 article by Costamagna G. (LC: 366, GC: 638) has a high LC/GC ratio of 57.37%, demonstrating strong local influence. Another notable work is by Scape E. (2002), which has an LC/GC ratio of 66.52%, suggesting that its local impact is even stronger than its global reach. Among more recent publications, Rondonotti E.'s 2018 article has received 148 local citations, with LC/YP: 21.143 and GC/YP: 40.29, indicating a remarkably high annual citation rate. Additionally, Enns R.A.'s 2017 article published in Gastroenterology has an LC/GC ratio of 61.83%, confirming its significant local influence. These findings highlight that some articles maintain a strong local and global impact over time, while others exhibit a more regionally concentrated influence. Understanding these citation dynamics provides valuable insight into the dissemination and reception of research within the endoscopy field (Table 5).

Table 6 evaluates the most influential authors in the field of endoscopy based on various bibliometric indicators. Three key bibliometric indicators developed to measure the scientific impact of researchers in the academic world are the h-index, g-index, and m-index. The h-index, proposed by Jorge E. Hirsch in 2005, indicates that a researcher must have at least h publications that have been cited at least h times (10). This index evaluates both productivity and impact together, but its main disadvantage is that it may remain low for new researchers.

**Table 6. Authors' local impact**

| Element | H-index | G-index | M-index | TC | NP | PY-start |
|---|---|---|---|---|---|---|
| Dumonceau JM | 53 | 58 | 2.650 | 13070 | 58 | 2006 |
| Hassan C | 51 | 112 | 2.684 | 12884 | 151 | 2007 |
| Fanelli RD | 42 | 57 | 1.680 | 5522 | 57 | 2001 |
| Van Hooft JE | 39 | 49 | 3.250 | 7416 | 49 | 2014 |
| Dinis-Ribeiro M | 38 | 77 | 2.375 | 8292 | 77 | 2010 |
| Eliakim R | 37 | 69 | 1.233 | 4862 | 80 | 1996 |
| Baron TH | 35 | 40 | 1.400 | 3863 | 40 | 2001 |
| Spada C | 35 | 72 | 1.750 | 5286 | 88 | 2006 |
| Ponchon T | 34 | 62 | 0.919 | 5833 | 62 | 1989 |
| Bisschops R | 33 | 68 | 1.941 | 4940 | 68 | 2009 |
| Cash Bd | 33 | 39 | 1.737 | 4876 | 39 | 2007 |
| Koulaouzidis A | 33 | 51 | 1.737 | 3085 | 114 | 2007 |
| Leighton JA | 33 | 47 | 1.435 | 5569 | 47 | 2003 |
| Dekker E | 32 | 49 | 1.778 | 4711 | 49 | 2008 |
| Tanaka S | 31 | 55 | 1.550 | 3199 | 87 | 2006 |
| Grainek IM | 29 | 50 | 1.318 | 4463 | 50 | 2004 |
| Rondonotti E | 29 | 62 | 1.261 | 4098 | 62 | 2003 |
| Tajiri H | 28 | 56 | 0.622 | 3198 | 66 | 1981 |
| Costamagna G | 27 | 57 | 1.038 | 4129 | 57 | 2000 |
| Fleischer DE | 27 | 36 | 0.771 | 4207 | 36 | 1991 |

NP = Number of publications, TC = Total citations, PY-start = Publication year starting

As an alternative, the g-index, developed by Leo Egghe in 2006, provides a system that places more weight on publications with higher citation counts compared to the h-index. The g-index requires that at least g publications receive a total of $g^2$ citations, providing a more equitable measurement for researchers with fewer but highly cited works (11). However, its main disadvantage is that a few highly cited papers can disproportionately influence the result (Table 5).

The m-index, on the other hand, adds the time factor to the h-index by calculating a ratio based on the academic career duration. This index, which is derived by dividing the h-index by the number of years since the researcher began their academic career, provides a more equitable evaluation for researchers at the start of their career (12). When all three indices are considered together, they allow for a more comprehensive analysis of a researcher's productivity and scientific impact.

Upon examining the table, Dumonceau JM (h-index: 53, g-index: 58, TC: 13,070) ranks among the authors with the highest academic impact. With his work since 2006, his m-index has reached 2.65, indicating high annual academic productivity. Similarly, Hassan C (h-index: 51, g-index: 112, TC: 12,884) has created a significant academic impact, publishing 151 papers (NP) and standing out for his productivity. His m-index of 2.684 shows that despite starting his career in 2007, he rapidly made an impact (Table 6).

Van Hooft JE (h-index: 39, m-index: 3.25) and Dinis-Ribeiro M (h-index: 38, m-index: 2.37) attract attention with their high index values. These high m-index values indicate that despite starting their academic careers later, they quickly increased their scientific impact. In particular, Van Hooft JE, who began his academic career in 2014, reached significant impact in just seven years (Table 6).

Among authors with longer academic careers, Eliakim R (PY_start: 1996, h-index: 37) and Tajiri H (PY_start: 1981, h-index: 28) stand out. Tajiri H, who published 66 papers and received 3,198 citations, shows a relatively low impact in terms of annual h-index growth, with an m-index of 0.622 (Table 6).

One of the most prolific researchers, Koulaouzidis A, has published 114 papers (NP) and is highly productive. However, with an h-index of 33 and a TC of 3,085, his total citation count is relatively lower compared to his publication count. Spada C and Tanaka S have also made significant contributions by publishing 88 and 87 papers, respectively, but they fall behind the top authors in terms of total citations (Table 6).

Overall, the authors who stand out in terms of academic activity and productivity include Dumonceau JM, Hassan C, Van Hooft JE, and Dinis-Ribeiro M. Authors like Tajiri H, Eliakim R, and Ponchon T, who have contributed to academic work over many years, have added a historical perspective to the field. These data provide valuable insights for identifying both highly cited and productive scientists in the field of endoscopy (Table 6).

Table 7 presents the local academic impacts of authors contributing to scientific research in the field of endoscopy from Türkiye.

**Table 7. Authors' local impact from Türkiye.**

| Element | H-index | G-index | M-index | TC | NP | PY-start |
|---|---|---|---|---|---|---|
| Ersoy O | 6 | 9 | 0.300 | 90 | 9 | 2006 |
| Bayraktar Y | 5 | 7 | 0.179 | 87 | 7 | 1998 |
| Akarsu M | 3 | 3 | 0.214 | 39 | 3 | 2012 |
| Akbulut UE | 3 | 3 | 0.273 | 43 | 3 | 2015 |
| Akın E | 3 | 3 | 0.176 | 29 | 3 | 2009 |
| Akpınar H | 3 | 3 | 0.176 | 67 | 3 | 2009 |
| Besısık F | 3 | 3 | 0.250 | 44 | 3 | 2014 |
| Demır K | 3 | 3 | 0.250 | 44 | 3 | 2014 |
| Evırgen S | 3 | 3 | 0.250 | 44 | 3 | 2014 |
| Ferhanoglu O | 3 | 3 | 0.500 | 22 | 3 | 2020 |
| Karaca C | 3 | 3 | 0.250 | 44 | 3 | 2014 |
| Kayhan FT | 3 | 3 | 0.273 | 80 | 3 | 2015 |
| Kaymakoglu S | 3 | 3 | 0.250 | 44 | 3 | 2014 |
| Oztas E | 3 | 3 | 0.200 | 18 | 3 | 2011 |
| Selvı E | 3 | 3 | 0.176 | 33 | 3 | 2009 |
| Sıvrı B | 3 | 4 | 0.150 | 38 | 4 | 2006 |
| Akcalı GE | 2 | 2 | 0.222 | 33 | 2 | 2017 |
| Akyüz F | 2 | 4 | 0.111 | 24 | 4 | 2008 |
| Akyüz U | 2 | 2 | 0.167 | 25 | 2 | 2014 |
| Almalıoglu Y | 2 | 2 | 0.333 | 64 | 2 | 2020 |

NP = Number of publications, TC = Total citations, PY-start = Publication year starting

The researcher with the highest h-index is Ersoy O (h-index: 6, g-index: 9, TC: 90). Since 2006, his work has resulted in an annual m-index value of 0.3. Following him is Bayraktar Y (h-index: 5, g-index: 7, TC: 87), who has been contributing academically since 1998. However, with an m-index of 0.179, his h-index has increased more slowly throughout his academic career. Researchers such as Akarsu M, Akbulut UE, Akın E, Akpınar H, Besisik F, Demir K, Evirgen S, Karaca C, Kayhan FT, Kaymakoglu S, Oztas E, Selvi E, and Sivri B are listed with an h-index of 3 and similar g-index values (3–4). Notably, Ferhanoğlu O, despite starting his work in 2020 (h-index: 3, g-index: 3, TC: 22), has made a significant contribution in a short time. His m-index of 0.5 indicates rapid progress early in his academic career. Overall, considering the scientific contributions to endoscopy from Türkiye, Ersoy O and Bayraktar Y stand out, while Ferhanoğlu O has achieved a significant citation rate despite having a relatively short academic career. However, it is evident that Turkish authors generally have lower h-index and total citation counts (Table 7).

Table 8 shows the countries with the most publications in endoscopy and their levels of international collaboration. Indicators such as total publication count (TCP), single-country publication count (SCP), multi-country collaborative publications (MCP), and the ratio of multi-country collaborations to total publications (MCP_Ratio) have been assessed. According to the table, the United States of America (USA) is the country with the highest academic output, with 2,886 publications. Of these, 2,572 are single-country publications, and 314 are multi-country collaborative publications. The USA's international collaboration ratio is 10.9%, indicating a moderate level of collaboration relative to its total publications. China (1,421 TCP, MCP_Ratio: 11.4%) and Japan (1,356 TCP, MCP_Ratio: 4.8%) are among the most productive countries following the USA, but Japan, in particular, has a relatively low international collaboration ratio. The United Kingdom, Italy, and Germany have both high scientific output and strong international collaborations. Italy's international collaboration ratio is 22.4%, and Germany's is 22.8%. Countries like France (25.2%), Canada (28.4%), and the Netherlands (24.7%) play highly active roles in scientific collaborations.

**Table 8. Corresponding author's country**

| Country | TCP | SCP | MCP | MCP Ratio |
|---|---|---|---|---|
| USA | 2886 | 2572 | 314 | 0.109 |
| China | 1421 | 1259 | 162 | 0.114 |
| Japan | 1356 | 1291 | 65 | 0.048 |
| United Kingdom | 869 | 705 | 164 | 0.189 |
| Italy | 680 | 528 | 152 | 0.224 |
| Germany | 631 | 487 | 144 | 0.228 |
| Korea | 582 | 548 | 34 | 0.058 |
| France | 333 | 249 | 84 | 0.252 |
| Canada | 327 | 234 | 93 | 0.284 |
| India | 321 | 298 | 23 | 0.072 |
| Netherlands | 287 | 216 | 71 | 0.247 |
| Spain | 251 | 211 | 40 | 0.159 |
| Australia | 210 | 170 | 40 | 0.190 |
| Israel | 198 | 161 | 37 | 0.187 |
| Turkiye | 190 | 184 | 6 | 0.032 |
| Belgium | 164 | 104 | 60 | 0.366 |
| Greece | 164 | 111 | 53 | 0.323 |
| Portugal | 148 | 128 | 20 | 0.135 |
| Brazil | 119 | 96 | 23 | 0.193 |
| Denmark | 115 | 87 | 28 | 0.243 |

TCP = Total number of publications by the corresponding author's country, SCP = Single country publications, MCP = Multiple country publications, MCP Ratio=MCP/TCP

Notably, Canada's 28.4% ratio demonstrates the country's high involvement in multinational projects. Among other countries in Asia, South Korea (582 TCP, MCP_Ratio: 5.8%) and India (321 TCP, MCP_Ratio: 7.2%) have relatively low international collaboration ratios, while China's 11.4% MCP ratio indicates more active participation in collaborations. Belgium (36.6%), Greece (32.3%), and Denmark (24.3%) stand out for their high MCP_Ratio values. Belgium is particularly notable for having the highest international collaboration ratio (36.6%), suggesting that much of the research in the country is conducted through international projects. Türkiye is listed with a total of 190 publications (TCP), but it has a very limited international collaboration rate. Of these, 184 publications are single-country publications (SCP), and only six are produced through multi-country collaboration. Türkiye's MCP ratio is 3.2%, one of the lowest international collaboration rates in the list (Table 8).

### Word Analysis

Word cloud is a technique widely used in text mining and visualization fields. This method visually represents the most frequent words in large text collections, with more frequently used words appearing larger and more prominent, while less frequently used ones are displayed smaller (13,14). Word clouds are an effective tool for quickly grasping the general content of texts and identifying key themes. Particularly in education and scientific article evaluation processes, the dynamic and interactive structure of word clouds adds a new dimension to traditional analysis methods (15). In Figure 1, the 50 most frequently used keywords in endoscopy research are presented in the form of a word cloud.

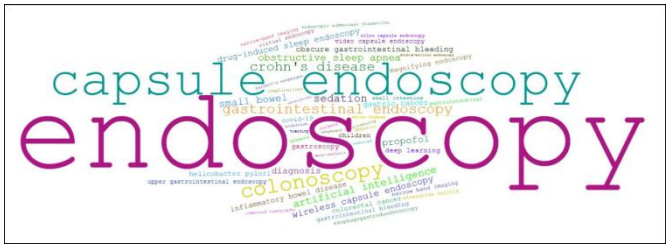


**Figure 1.** Word cloud from author's keywords.

When examining the most frequently used keywords in scientific studies within the endoscopy field, it is evident that the term "Endoscopy" appears 2,288 times, forming the main focus of the study. Among the endoscopic techniques, wireless imaging systems such as Capsule Endoscopy (n = 1,018) and Wireless Capsule Endoscopy (n = 182) stand out. In addition, concepts such as Colonoscopy (n = 428), Gastrointestinal Endoscopy (n = 288), Gastroscopy (n = 141), Upper Gastrointestinal Endoscopy (n = 121), Esophagogastroduodenoscopy (n = 107), Double-Balloon Endoscopy (n = 73), and Enteroscopy (n = 72) are also frequently researched. Moreover, advanced imaging methods such as Virtual Endoscopy (n = 110) and Narrow-Band Imaging (n = 115) are also represented in the scientific literature.

In terms of diseases, inflammatory bowel diseases such as Crohn's Disease (n = 272), Inflammatory Bowel Disease (n = 149), and Ulcerative Colitis (n = 102) are frequently investigated. Additionally, bleeding conditions such as Obscure Gastrointestinal Bleeding (n = 155) and Gastrointestinal Bleeding (n = 122), as well as cancer types like Gastric Cancer (n = 151) and Colorectal Cancer (n = 136), are significant areas of research. Gastrointestinal diseases like Barrett's Esophagus (n = 84) and Dyspepsia (n = 74) also hold a prominent place in the literature.

Patient comfort and sedation during endoscopy also emerge as important research areas. High frequencies of terms like Sedation (n = 219), Propofol (n = 193), Drug-Induced Sleep Endoscopy (n = 169), and Midazolam (n = 81) reflect the focus on anesthesia and sedation issues. When examining terms related to technology and artificial intelligence, concepts like Artificial Intelligence (n = 209) and Deep Learning (n = 138) indicate the growing importance of AI-supported applications in endoscopic diagnosis and analysis processes. Furthermore, advanced imaging techniques like Magnifying Endoscopy (n = 135) and Computed Tomography (n = 85) are frequently studied topics.

Studies focusing on specific patient groups and educational topics are also noteworthy. The high frequency of terms such as Children (n = 130) and Pediatric (n = 75) emphasizes the significance of endoscopic research involving pediatric patients. Additionally, the inclusion of the term Training (n = 75) in the list indicates the existence of scientific work related to endoscopy training.

### Co-Citation Network Analysis

Co-citation network is a bibliometric analysis method used to determine the relationships between scientific publications and to analyze influential works in the academic literature. Co-citation occurs when two publications are both cited by a third work at the same time (16). In co-citation network analysis, works that are frequently co-cited are considered connected, and these connections are visualized to create network structures. This allows for the identification of the evolution of specific topics, the impact of seminal works, and the detection of subgroups within a research field (17). In a scientific mapping study in the field of endoscopy, frequently co-cited papers can be identified, revealing the foundational sources of the field.

The document co-citation network (paper co-citation network) analysis was conducted by examining co-citations of endoscopy literature publications. The Walktrap algorithm was used, and the first 15 papers were analyzed. As shown in Figure 2, the co-citation network is divided into three clusters of nodes, represented by red, green, and blue-colored circles. These clusters visualize the citation relationships among endoscopy studies. The nodes (circles) in the network represent scientific papers, while the lines between the papers show co-citation relationships. The thickness of the lines indicates how frequently the papers are co-cited, and the size of the nodes represents the total number of citations each paper has received.

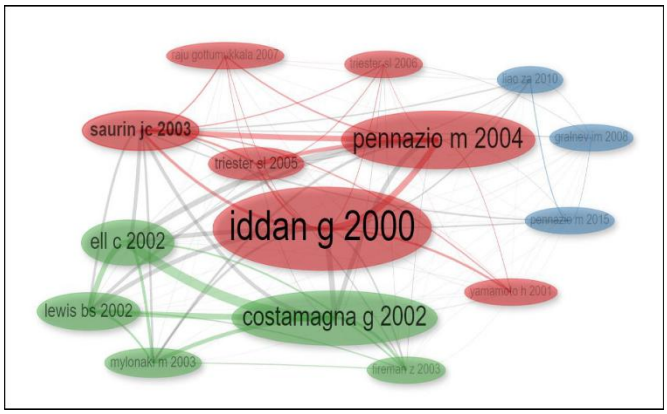


**Figure 2.** Papers co-citation network.

The largest node belongs to Iddan G's 2000 paper, indicating that this publication is one of the most co-cited foundational works in the field. The thickness of the links represents the frequency with which the papers are co-cited. The strong connection between Ell C 2002, Costamagna G 2002, Pennazio M 2004, and Iddan G 2000 highlights that these groups of studies are frequently co-referenced in the literature. Similarly, papers such as Iddan G 2000 and Costamagna G 2002 also exhibit significant connections.

The network is divided into different color clusters, each reflecting specific subfields or research trends. In the red cluster, papers such as Iddan G 2000, Pennazio M 2004, and Saurin JC 2003 are prominent, while the green group includes papers from Costamagna G 2002 and Ell C 2002. The blue cluster consists of more recent studies, including research by Liao ZA 2010 and Pennazio M 2015.

To analyze co-citations of authors in endoscopy publications, an author co-citation network analysis was performed. As shown in Figure 3, the co-citation network is divided into two clusters of nodes. The figure displays

authors who are frequently co-cited in the scientific literature on endoscopy and the relationships between them.

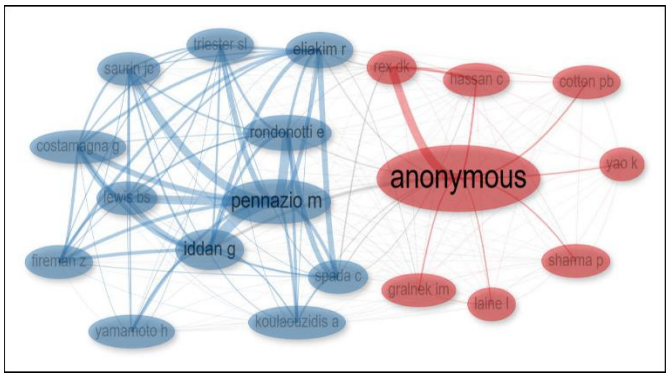


**Figure 3.** Authors co-citation network.

There are two main clusters in the graph. In the blue cluster, prominent authors include Pennazio M, Iddan G, Rondonetti E, Costamagna G, Lewis BS, Triester SL, Saurin JC, Eliakim R, and Spada C. The strong connection between Iddan G and Pennazio M indicates that their works are often co-cited in the literature. Similarly, the strong link between Pennazio M and Rondonetti E also shows frequent co-citation of their works. In the red cluster, the node labeled Anonymous is central and has strong connections with authors such as Rex DK, Hassan C, Cotton PB, and Sharma P. This group likely includes guidelines, reports, or multi-author works. The large size of the Anonymous node suggests that institutional publications, which may lack a single author, have had a significant impact in the field.

A source co-citation network analysis was conducted to examine the co-citations of sources in endoscopy publications. As shown in Figure 4, the co-citation network is divided into a single cluster of nodes. The size of the nodes represents the number of co-citations received by a journal, while the thickness of the lines indicates the strength of the co-citation connections between journals.

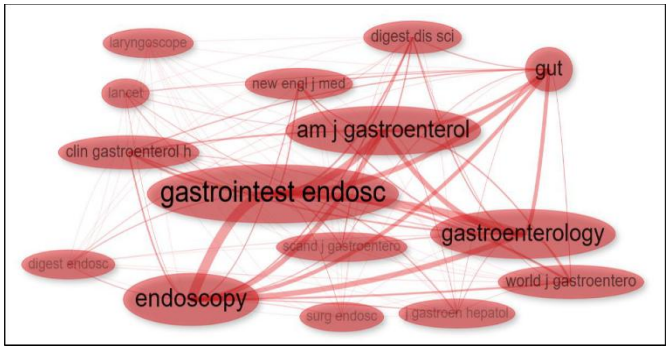


**Figure 4.** Sources co-citation network.

In the network, the largest nodes belong to the journals Gastrointestinal Endoscopy, Endoscopy, and Gastroenterology. This suggests that these journals publish central and highly impactful works in the field of endoscopy. Gastrointestinal Endoscopy holds the largest node, indicating that it is one of the core sources in the field and frequently cited. Other significant sources with strong connections in the network include the American Journal of Gastroenterology (Am J Gastroenterol), Gut, and World Journal of Gastroenterology. These journals are important scientific sources often co-cited in endoscopy-related publications. The sources located at the center of the network, with dense connections, contribute to the mainstream literature of the discipline. On the other hand, smaller and more peripheral nodes, such as Lancet, may be less directly involved in endoscopy but still contribute citations in certain specific areas of research. The strong connection between Gastrointestinal Endoscopy and Endoscopy highlights that studies published in these journals are frequently co-cited. Similarly, the strong link between Gastrointestinal Endoscopy and Gastroenterology indicates that the works published in these journals are often co-referenced in the literature as well.

**Thematic Analysis**

Thematic maps are an important bibliometric analysis method used to visualize the structure and development trends of topics in scientific fields. These maps are typically divided into four thematic regions based on centrality and density axes (9). Centrality indicates the importance of a topic within the overall research field and its connection to other topics, while density represents the internal coherence and development level of that topic (18).

Motor themes (high centrality and high density) form the backbone of the research field and are among the most critical topics. Niche themes (high density but low centrality) represent more specific and in-depth topics, often appealing to particular areas of expertise (19). Basic themes (high centrality but low density) show important topics within a broad research area that have not yet fully developed, while emerging or declining themes (low centrality and low density) represent topics with reduced scientific interest or those that are not yet fully matured (20). Thematic maps are considered an effective method for analyzing the current state of scientific fields and predicting future trends.

Figure 5 presents a thematic map of endoscopy research, generated using Bibliometrix, which covers each sub-period of research in the field. The map was created using the top 1,000 keywords repeated at least eight times. These frequently used keywords were grouped into thematic clusters, with each cluster represented by the top five most repeated keywords. Clustering was performed using the Walktrap clustering algorithm, and the size of the circles corresponds to the frequency of the keywords they represent.

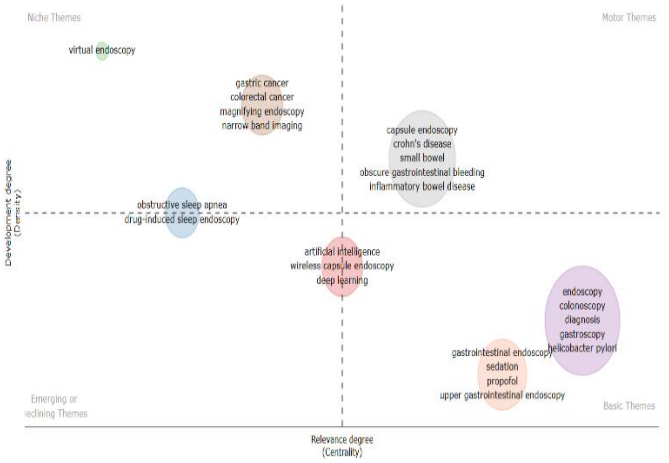


**Figure 5.** Thematic map.

The motor themes located in the top right quadrant represent the most important and actively developing topics in the field. Keywords such as Capsule Endoscopy, Crohn's Disease, Small Bowel, Obscure Gastrointestinal Bleeding, and Inflammatory Bowel Disease form a single thematic cluster in this quadrant and play a central role in endoscopy research. The emphasis on capsule endoscopy in the diagnosis and follow-up of small bowel diseases is notable. Crohn's Disease and Inflammatory Bowel Disease (IBD) lead to small bowel lesions that are difficult to detect using traditional endoscopic methods, making capsule endoscopy a revolutionary diagnostic tool for these diseases. Small Bowel connects these themes, highlighting the advantages of capsule endoscopy in detecting small bowel pathologies, while Obscure Gastrointestinal Bleeding shows its critical role in identifying the source of gastrointestinal bleeding, especially when it is not easily detected. These motor themes exhibit both high centrality and density, suggesting that they are well-developed and have a broad impact in the scientific literature.

The niche themes in the top left quadrant focus on more specific and advanced research topics in the field of endoscopy. The first thematic cluster, Virtual Endoscopy, represents an area that integrates artificial intelligence and imaging technologies as alternatives to traditional endoscopic methods. This non-invasive approach aims to improve clinical diagnostic processes. The second thematic cluster, including keywords such as Gastric Cancer, Colorectal Cancer, Magnifying Endoscopy, and Narrow Band Imaging, focuses on the role of endoscopy in cancer diagnosis and early detection. Magnifying Endoscopy and Narrow Band Imaging are advanced imaging techniques used to visualize tissue details more clearly, particularly for early-stage diagnosis of stomach and colon cancers. These niche themes reflect the technological advancements in endoscopy and the deepening expertise in clinical practice. These topics have high density, suggesting that they have been studied in-depth, but they have lower centrality, meaning that they are more specialized and not as widely spread across the literature.

The fundamental themes in the bottom right quadrant represent topics that play a central role in endoscopy but are still underdeveloped. The first cluster, consisting of keywords such as Endoscopy, Colonoscopy, Diagnosis, Gastroscopy, and Helicobacter Pylori, focuses on the general use of endoscopy, diagnostic processes, and especially the diagnosis of gastrointestinal diseases. Helicobacter Pylori, a significant gastric pathogen, plays a critical role in the management of diseases such as gastric ulcers and gastritis when detected through gastroscopy. The second cluster, including keywords like Gastrointestinal Endoscopy, Sedation, Propofol, and Upper Gastrointestinal Endoscopy, highlights the use of sedation and anesthesia to improve the applicability and comfort of endoscopic procedures. Propofol is commonly used as a sedative in endoscopy, while Upper Gastrointestinal Endoscopy allows for detailed examination of the upper gastrointestinal system. Overall, these themes reflect the evolving but still developing aspects of clinical endoscopic applications, with significant research potential. These thematic analyses provide a comprehensive view of the structure, development, and emerging trends within the endoscopy field.

The cluster of niche themes, consisting of keywords such as Obstructive Sleep Apnea and Drug-Induced Sleep Endoscopy, focuses on the applications of endoscopy in the field of respiratory sleep disorders. This thematic cluster represents a multidisciplinary area where endoscopy intersects with sleep medicine, highlighting the growing interest in integrating sleep medicine with endoscopic technologies. The exploration of endoscopy's role in diagnosing and treating sleep-related breathing disorders, such as obstructive sleep apnea, reflects the broader trend of applying endoscopic techniques in specialized medical fields, with increasing interdisciplinary collaboration.

The cluster bridging emerging or declining themes and basic themes includes keywords such as Artificial Intelligence, Wireless Capsule Endoscopy, and Deep Learning. This thematic cluster underscores the increasing importance of artificial intelligence applications in endoscopy. The development of Wireless Capsule Endoscopy and the integration of Deep Learning into endoscopic practices represent the convergence of technology and clinical applications. These themes have high potential in terms of centrality, signifying that they could become significant research directions in the future of endoscopy. The integration of AI and deep learning technologies in endoscopic procedures is expected to enhance diagnostic capabilities, improve image analysis, and expand the scope of endoscopy, positioning these topics as pivotal for future advancements in the field.

## DISCUSSION

From the publication of the first article on endoscopy in 1980 to the end of 2024, a total of 13,382 articles were found in the Web of Science (WoS) database. The annual growth rate of publication numbers is 6.59%. The average age of publications is 12.8 years, and each document has been cited an average of 22.7 times. A total of 44,697 authors have contributed to these publications, with 709 single-author publications. On average, there are 6.34 researchers per publication, and the international collaboration rate is 14.54%. It was determined that while the number of publications per year was low in the 1980s (n = 50), it started to rise from 2004 (n = 223), peaking in 2021 with 877 publications. Based on these findings, it can be concluded that the topic of endoscopy remains relevant and that researchers' interest in this field is steadily increasing.

When evaluating the most influential academic journals in the field of endoscopy based on indices, publication numbers, and citations, Gastrointestinal Endoscopy stands out. As the official journal of the American Society for Gastrointestinal Endoscopy, it publishes 6.74% of all articles on endoscopy and can be considered the most influential journal. Endoscopy, the official journal of the European Society of Gastrointestinal Endoscopy, comes in second, publishing 5.31% of the articles. American Journal of Gastroenterology, the official journal of the American College of Gastroenterology, ranks third, publishing 1.59%

of the articles. Despite being indexed in WoS since 2013, Endoscopy International Open has emerged as a noteworthy journal due to its citation numbers and its publication of 1.87% of the articles, indicating strong potential for future influence.

The most influential study in the field of endoscopy, based on citations, is the 2000 article "Wireless Capsule Endoscopy" by Israeli electro-optical engineer Gavriel Iddan and colleagues, published in Nature. This study, which introduced the concept of wireless capsule endoscopy, revolutionized the painless imaging of the entire small intestine and marked the development of a new form of endoscopy (21). The second most influential paper, published by Professor Marco Pennazio and colleagues in 2004 in Gastroenterology, evaluated the sensitivity, specificity, and outcomes of capsule endoscopy in patients with obscure gastrointestinal bleeding. This technique proved to be an effective diagnostic tool, particularly in cases of suspected active or occult bleeding, accelerating diagnosis and reducing the need for alternative diagnostic methods (22). The third most influential paper, published by Professor Guido Costamagna and colleagues in 2002 in Gastroenterology, compared small bowel radiographs and video capsule endoscopy for suspected small bowel disease. This study demonstrated that video capsule endoscopy was superior to small bowel radiographs in evaluating small bowel diseases, though further evaluation was recommended due to potential interpretation challenges (23).

In terms of authorship and citations, Professor Jean-Marc Dumonceau from Switzerland is identified as the most influential researcher in the field, followed by Professor Cesare Hassan from Italy and Professor Jeanin E. van Hooft from the Netherlands. Among Turkish authors, Assistant Professor Özdal Ersoy (Acıbadem University) ranks first, followed by Professor Yusuf Bayraktar (Hacettepe University) and Professor Mesut Akarsu (Dokuz Eylül University), ranking second and third, respectively. The publication and citation numbers suggest that there is a need for increased visibility of Turkish publications in the international literature.

When evaluating the publication performance of countries, the USA (n = 2,886, 21.5%), China (n = 1,421, 10.6%), and Japan (n = 1,356, 10.1%) lead the field. Türkiye, with 190 publications accounting for 1.4% of total publications, ranks 15th, but only six articles have been produced through multi-country collaborations. The highest multi-country collaboration rate is seen in Belgium at 36.6%, while for Türkiye, this rate is only 3.2%, indicating that Türkiye's academic production in endoscopy remains largely national, with limited involvement in international collaborations.

The most frequent keywords in the studies analyzed were "endoscopy," "capsule endoscopy," and "wireless capsule endoscopy." These keywords, along with terms like "Crohn's Disease," "Small Bowel," "Obscure Gastrointestinal Bleeding," and "Inflammatory Bowel Disease," represent central themes in endoscopy research and are considered the most important and actively developing topics. Additionally, topics such as "Artificial Intelligence," "Wireless Capsule Endoscopy," and "Deep Learning" are emerging as key areas of interest, suggesting that the application of artificial intelligence in endoscopy will become increasingly widespread, making these topics significant for future research in the field.

One of the main limitations of this study is its reliance solely on the Web of Science (WoS) database. This may exclude significant studies available in other databases, such as PubMed and Scopus. Future research could involve comprehensive analyses that include multiple databases and repeated studies with updated data, providing a more holistic perspective. Another limitation of this study is the progressive development and increased accessibility of endoscopic instruments and imaging technologies over time. The widespread use of video endoscopy and digital image recording, particularly after the 1990s, has facilitated the documentation and publication of endoscopic procedures. Additionally, the number of journals focusing on endoscopy has significantly increased over the years. Therefore, it is important to take these factors into account when making comparisons across different time periods. Additionally, bibliometric analyses focus on the quantitative aspects of the publications reviewed but do not directly assess the scientific quality and methodological contributions of the studies. Therefore, bibliometric findings should be supported by qualitative analyses conducted by field experts, which would contribute to deeper interpretations and more comprehensive insights.

## CONCLUSION

This bibliometric analysis provides a comprehensive overview of the development of research in the field of endoscopy from 1980 to 2024. The findings indicate that the consistent increase in publication volume reflects the growing importance of endoscopy in both clinical practice and medical research. Citation patterns, analyses of leading authors, and influential institutions highlight global collaboration in this field, with high-impact research concentrated in technologically advanced regions. Furthermore, keyword trends suggest a shift towards minimally invasive techniques, artificial intelligence applications, and advanced imaging modalities, shedding light on future research directions. To advance endoscopy research, interdisciplinary collaborations—especially in fields like bioengineering, artificial intelligence, and nanotechnology—should be encouraged. Future studies focusing on the long-term outcomes and cost-effectiveness of new endoscopic methods could contribute to optimizing their clinical applications. By addressing these factors, researchers and clinicians will have opportunities to further enhance the role of endoscopy in modern medicine.

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