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EDITORIAL

- 3368 Remazolam combined with transversus abdominis plane block in gastrointestinal tumor surgery: Have we achieved better anesthetic effects?
Cao J, Luo XL, Lin Q
- 3372 Immune-related gene characteristics: A new chapter in precision treatment of gastric cancer
Gao L, Lin Q
- 3376 Navigating the labyrinth of long non-coding RNAs in colorectal cancer: From chemoresistance to autophagy
Yu JM, Sun CQ, Xu HH, Jiang YL, Jiang XY, Ni SQ, Zhao TY, Liu LX
- 3382 Importance of early detection of esophageal cancer before the tumor progresses too much for effective treatment
Ono T
- 3386 Early diagnosis of esophageal cancer: How to put “early detection” into effect?
Pubu S, Zhang JW, Yang J
- 3393 Colon cancer screening: What to choose?
Gomez Zuleta MA

REVIEW

- 3397 Research progress on the development of hepatocyte growth factor/c-Met signaling pathway in gastric cancer: A review
Wei WJ, Hong YL, Deng Y, Wang GL, Qiu JT, Pan F
- 3410 Research progress on the effect of pyroptosis on the occurrence, development, invasion and metastasis of colorectal cancer
Wang X, Yin QH, Wan LL, Sun RL, Wang G, Gu JF, Tang DC

MINIREVIEWS

- 3428 Importance of diet and intestinal microbiota in the prevention of colorectal cancer - colonoscopy early screening diagnosis
Jovandaric MZ

ORIGINAL ARTICLE

Retrospective Cohort Study

- 3436 Analysis of vascular thrombus and clinicopathological factors in prognosis of gastric cancer: A retrospective cohort study
Chen GY, Ren P, Gao Z, Yang HM, Jiao Y

- 3445** Application of fecal immunochemical test in colorectal cancer screening: A community-based, cross-sectional study in average-risk individuals in Hainan

Zeng F, Zhang DY, Chen SJ, Chen RX, Chen C, Huang SM, Li D, Zhang XD, Chen JJ, Mo CY, Gao L, Zeng JT, Xiong JX, Chen Z, Bai FH

- 3457** Effect of perioperative chemotherapy on resection of isolated pulmonary metastases from colorectal cancer: A single center experience

Gao Z, Jin X, Wu YC, Zhang SJ, Wu SK, Wang X

Retrospective Study

- 3471** Microvascular structural changes in esophageal squamous cell carcinoma pathology according to intrapapillary capillary loop types under magnifying endoscopy

Shu WY, Shi YY, Huang JT, Meng LM, Zhang HJ, Cui RL, Li Y, Ding SG

- 3481** Camrelizumab, apatinib and hepatic artery infusion chemotherapy combined with microwave ablation for advanced hepatocellular carcinoma

Zuo MX, An C, Cao YZ, Pan JY, Xie LP, Yang XJ, Li W, Wu PH

- 3496** Serum ferritin and the risk of early-onset colorectal cancer

Urback AL, Martens K, McMurtry HS, Chen EY, Citti C, Sharma A, Kardosh A, Shatzel JJ

- 3507** Combining lymph node ratio to develop prognostic models for postoperative gastric neuroendocrine neoplasm patients

Liu W, Wu HY, Lin JX, Qu ST, Gu YJ, Zhu JZ, Xu CF

Observational Study

- 3521** Efficacy of chemotherapy containing bevacizumab in patients with metastatic colorectal cancer according to programmed cell death ligand 1

Kang SW, Lim SH, Kim MJ, Lee J, Park YS, Lim HY, Kang WK, Kim ST

- 3529** Endoscopic detection and diagnostic strategies for minute gastric cancer: A real-world observational study

Ji XW, Lin J, Wang YT, Ruan JJ, Xu JH, Song K, Mao JS

Clinical and Translational Research

- 3539** Targeting colorectal cancer with Herba Patriniae and Coix seed: Network pharmacology, molecular docking, and *in vitro* validation

Wang CL, Yang BW, Wang XY, Chen X, Li WD, Zhai HY, Wu Y, Cui MY, Wu JH, Meng QH, Zhang N

Basic Study

- 3559** Expression and significant roles of the long non-coding RNA CASC19/miR-491-5p/HMGA2 axis in the development of gastric cancer

Zhang LX, Luo PQ, Wei ZJ, Xu AM, Guo T

- 3585** Insulin-like growth factor 2 targets IGF1R signaling transduction to facilitate metastasis and imatinib resistance in gastrointestinal stromal tumors

Li DG, Jiang JP, Chen FY, Wu W, Fu J, Wang GH, Li YB

- 3600** Dysbiosis promotes recurrence of adenomatous polyps in the distal colorectum
Yin LL, Qi PQ, Hu YF, Fu XJ, He RS, Wang MM, Deng YJ, Xiong SY, Yu QW, Hu JP, Zhou L, Zhou ZB, Xiong Y, Deng H
- 3624** Effect of acacetin on inhibition of apoptosis in *Helicobacter pylori*-infected gastric epithelial cell line
Yao QX, Li ZY, Kang HL, He X, Kang M
- 3635** Curcumin for gastric cancer: Mechanism prediction *via* network pharmacology, docking, and *in vitro* experiments
Yang PH, Wei YN, Xiao BJ, Li SY, Li XL, Yang LJ, Pan HF, Chen GX
- 3651** Lecithin-cholesterol acyltransferase is a potential tumor suppressor and predictive marker for hepatocellular carcinoma metastasis
Li Y, Jiang LN, Zhao BK, Li ML, Jiang YY, Liu YS, Liu SH, Zhu L, Ye X, Zhao JM

META-ANALYSIS

- 3672** Efficacy of hepatic arterial infusion chemotherapy and its combination strategies for advanced hepatocellular carcinoma: A network meta-analysis
Zhou SA, Zhou QM, Wu L, Chen ZH, Wu F, Chen ZR, Xu LQ, Gan BL, Jin HS, Shi N

SCIENTOMETRICS

- 3687** Current trends and hotspots of depressive disorders with colorectal cancer: A bibliometric and visual study
Yan ZW, Liu YN, Xu Q, Yuan Y
- 3705** Research status and hotspots of tight junctions and colorectal cancer: A bibliometric and visualization analysis
Li HM, Liu Y, Hao MD, Liang XQ, Yuan DJ, Huang WB, Li WJ, Ding L

CASE REPORT

- 3716** Aggressive fibromatosis of the sigmoid colon: A case report
Yu PP, Liu XC, Yin L, Yin G
- 3723** Jejunal sarcomatoid carcinoma: A case report and review of literature
Feng Q, Yu W, Feng JH, Huang Q, Xiao GX

LETTER TO THE EDITOR

- 3732** Current and future research directions in cellular metabolism of colorectal cancer: A bibliometric analysis
Jiang BW, Zhang XH, Ma R, Luan WY, Miao YD
- 3738** Risk factors for the prognosis of colon cancer
Wu CY, Ye K

Contents

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AIMS AND SCOPE

The primary aim of *World Journal of Gastrointestinal Oncology* (WJGO, *World J Gastrointest Oncol*) is to provide scholars and readers from various fields of gastrointestinal oncology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGO mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal oncology and covering a wide range of topics including liver cell adenoma, gastric neoplasms, appendiceal neoplasms, biliary tract neoplasms, hepatocellular carcinoma, pancreatic carcinoma, cecal neoplasms, colonic neoplasms, colorectal neoplasms, duodenal neoplasms, esophageal neoplasms, gallbladder neoplasms, *etc.*

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Research status and hotspots of tight junctions and colorectal cancer: A bibliometric and visualization analysis

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Abstract

BACKGROUND

Colorectal cancer (CRC) is the third most common cancer worldwide and the second leading cause of cancer-related death. Over the past two decades, numerous researchers have provided important evidence regarding the role of tight junction (TJ) proteins in the occurrence and progression of CRC. The causal relationship between the presence of specific TJ proteins and the development of CRC has also been confirmed. Despite the large number of publications in this field, a bibliometric study to review the current state of research and highlight the research trends and hotspots in this field has not yet been performed.

AIM

To analyze research on TJs and CRC, summarize the field's history and current status, and predict future research directions.

METHODS

We searched the Science Citation Index Expanded database for all literature on CRC and TJs from 2001-2023. We used bibliometrics to analyze the data of these papers, such as the authors, countries, institutions, and references. Co-authorship, co-citation, and co-occurrence analyses were the main methods of analysis. CiteSpace and VOSviewer were used to visualize the results.

RESULTS

A total of 205 studies were ultimately identified. The number of publications on this topic has steadily increased since 2007. China and the United States have made the largest contributions to this field. *Anticancer Research* was the most prolific journal, publishing 8 articles, while the journal *Oncogene* had the highest average citation rate (68.33). Professor Dhawan P was the most prolific and cited author in this field. Co-occurrence analysis of keywords revealed that "tight junction protein expression", "colorectal cancer", "intestinal microbiota", and "inflammatory bowel disease" had the highest frequency of occurrence, revealing

the research hotspots and trends in this field.

CONCLUSION

This bibliometric analysis evaluated the scope and trends of TJ proteins in CRC, providing valuable research perspectives and future directions for studying the connection between the two. It is recommended to focus on emerging research hotspots, such as the correlations among intestinal microbiota, inflammatory bowel disease, TJ protein expression, and CRC.

Key Words: Colorectal cancer; Tight junctions; Bibliometric analysis; Research trends; Hot spots

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Core Tip: This bibliometric analysis evaluated the scope and trends of tight junction (TJ) proteins in colorectal cancer (CRC), providing valuable research perspectives and future directions for studying the connection between the two. It is recommended to focus on emerging hotspots such as the correlations among intestinal microbiota, inflammatory bowel disease, TJ protein expression, and CRC.

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INTRODUCTION

Globally, colorectal cancer (CRC) holds the position of the third most prevalent cancer and is the second top contributor to cancer-related deaths. The year 2018 saw global estimates suggesting around 1.8 million new cases and 881000 fatalities [1]. With its continued rise in Western countries, it is projected that by 2030, the global incidence of CRC will increase to 2.2 million new cases and 1.1 million deaths [2]. In China, it is estimated that there are more than 376000 new cases and 191000 deaths annually [3]. Despite regional variations and declining trends, the burden of CRC remains high due to population growth. Environmental factors such as obesity, Western dietary habits, smoking, and alcohol consumption are associated with CRC [4]. Additionally, genetic mutations and epigenetic changes are known to be involved in the occurrence and progression of CRC [5,6]. There is increasing evidence indicating a close association between tight junction (TJ) protein expression and CRC [7,8].

TJs are crucial intercellular connections essential for building epithelial barriers and maintaining epithelial polarity [9]. They regulate tissue homeostasis and integrity by controlling paracellular permeability and polarity. Beyond the static expression that promotes barrier function, TJs dynamically participate in regulating a range of cellular processes, including proliferation, migration, plasticity, and differentiation, all of which are central to cancer initiation and progression [10]. Numerous studies have confirmed that disrupting TJ integrity leads to cell invasion and proliferation and, consequently, the development of CRC and even distant metastasis [11-13].

Current research has focused on various members of the claudin family, elucidating their roles in CRC development. Cldn-2 is upregulated in CRC patients and is associated with poor survival. Depletion of Cldn-2 significantly promotes the transcription of N-myc downstream-regulated gene 1, leading to the termination of CRC growth and metastasis *in vitro* and *in vivo* [14]. Moreover, Cldn-2 has been shown to be associated with CRC stem-like renewal [15]. Abnormal expression and distribution of claudin-7, a key protein in epithelial cells, have been reported in various human malignancies, including lung, colon, ovarian, breast, gastric, esophageal, and prostate cancers, and are associated with cancer progression and metastasis [16]. Claudin-7 interacts with integrin β 1 to inhibit CRC cell proliferation and migration [17]. These studies collectively demonstrate the intimate relationship between TJ proteins and the metastasis of CRC, suggesting their potential as novel targets for CRC therapy.

Utilizing public literature sources like the Web of Science, bibliometric analysis, a statistical technique, is employed to examine and depict trends in research [18]. It's now a prevalent approach for evaluating the reliability, caliber, and influence of scholarly endeavors [19,20]. In recent years, an increasing number of studies have focused on TJ proteins and CRC. However, systematic research on the relationship between TJ proteins and CRC through bibliometric analysis has yet to be conducted. Through bibliometric analysis, researchers can better understand the current status, trends, and hotspots in this field. This study aimed to reveal new trends in TJ protein and CRC research, such as articles, journals, and cooperation patterns among key authors and institutions, and explore the research hotspots and future directions in the field through bibliometric analysis.

MATERIALS AND METHODS

Search strategy

This study utilized the Web of Science as the data source. All potentially relevant publications were collected based on the topic (TS) using the following search strategy: #1: [TS = (colorectal* OR colon* OR rectum* OR rectal*)] #2: TS = (cancer* OR neoplasm* OR carcinoma* OR adenoma*) #3: TS = (claudins* OR CLDNs* OR claudin* OR CLDN*), Final dataset: #1 AND #2 AND #3]. To capture as many data sources as possible, wildcards were used, which can substitute for any other character and allow keywords to have variable endings. For example, “cancer” would return both “cancer” and “cancers”. English articles published from January 1, 2001, to December 31, 2023, were retrieved.

Study selection

Figure 1 depicts the criteria for selection and the process of reviewing literature for this research. Concisely, our initial search involved entering search terms, followed by a review by two researchers of the identified publications, discarding those failing to satisfy the specified inclusion criteria: (1) Publications were limited to the English language only; (2) Document types included articles and reviews, excluding letters, comments, and conference abstracts; (3) Publications were sourced from the Science Citation Index Expanded database; (4) The search timeframe was from January 1, 2001, to December 31, 2023, spanning 23 years; (5) Publications focused on patients with CRC (including patients with CRC, preoperative and postoperative patients with CRC), CRC animal models, and CRC cell models and evaluated the relevance of the study subjects to intestinal TJ proteins; and (6) To avoid bias due to daily updates of the database, searches and screening of publications were conducted and completed on the same day.

Data extraction

Two researchers independently reviewed all included publications, downloaded them, and exported them into different file formats for analysis. The following indicators were extracted: The number of publications, citation frequency, countries, institutions, journals, authors, keywords, and the journal’s impact factor for the year 2023.

RESULTS

Global publication and collaboration trends

From January 1, 2001, to December 31, 2023, a total of 677 records were identified. Altogether, 239 records were omitted due to their nature as conference abstracts, letters, and continuous papers. An additional evaluation of the 438 remaining records was conducted either by reading abstracts or full texts. In the end, the bibliometric analysis incorporated 205 studies that satisfied both the inclusion and exclusion requirements (**Figure 1**). These papers were published by 1337 authors from 355 institutions in 32 countries and appeared in 127 journals. These articles cited 7060 references from 1361 journals. The number of annual and cumulative publications has significantly increased over the past 23 years. The peak number of papers was published in 2023 (24 papers) (**Figure 2**).

Country/region analysis

A total of 32 countries/regions have published research on TJ proteins and CRC. **Table 1** shows the five most productive countries. China had the highest number of publications, with 66 papers, followed by the United States (46 papers) and Japan (30 papers). The United States had the highest citation rate (3227 times), followed by Japan (1186 times) and China (994 times). Germany (74 times) and the United States (70.15 times) had the highest average citation rates.

The collaboration network among these countries is shown in **Figure 3A**. All countries contributed at least 3 publications in this field, with 10 countries represented in the network map. **Figure 3B** also illustrates the years of collaboration among countries, showing that China and the United States can be considered the central countries in the network and have had the closest mutual connections in recent years. Furthermore, the United States has connections with almost all countries in the network, with particularly close ties to Japan, South Korea, Canada, and Spain. Compared to the United States, China has fewer connections with other countries, with some connections to countries such as Japan and Germany.

Authors and journals

Additionally, we evaluated the most productive authors of the articles included in this study. Professor Dhawan P published the most papers, with a total of 17, followed by Singh AB (15 papers) and Ding Lei (9 papers). Similarly, Professor Dhawan P had the highest total number of citations (922), while Professor Sharma A had the highest average number of citations (83.6) (**Table 2**).

Next, the researchers analyzed the journals in which the articles were published from 2001 to 2023. A total of 127 journals published articles in this field, with the 9 journals with the greatest publication frequency listed in **Table 3**. The top three journals were *Anticancer Research* (8, 3.90%), *International Journal of Molecular Sciences* (7, 3.41%), and *Oncogene* (6, 2.92%). Among the top 9 journals, *Oncogene* had the greatest number of citations, with 410 citations and an average citation rate of 68.33, making it an influential journal in this field.

Co-citation analysis

Co-citation analysis refers to the relationship between two (or more) papers that are simultaneously cited by one or more subsequent papers, forming a co-citation relationship[1]. This research method is used to measure the degree of

Table 1 Five most productive countries/regions for research related to tight junctions in colorectal cancer

Countries/regions	Publications	Citations	Citations per-publication
China	66	994	15.06
United States	46	3227	70.15
Japan	30	1186	39.53
South Korea	13	184	14.15
Germany	11	814	74.00

Table 2 Top 12 authors by publications

Author	Publications	Citations	Citations per-publication
Dhawan P	17	922	54.2
Singh AB	15	708	47.2
Ding Lei	9	137	15.2
Wang Kun	8	117	14.6
Xu Chang	8	117	14.6
Washington MK	6	423	70.5
Bhat AA	6	407	67.8
Ahmad R	6	303	50.5
Kinugasa T	6	239	39.8
Sharma A	5	418	83.6
Krishnan M	5	388	77.6
Li Wenjing	5	83	16.6

Table 3 Top 9 leading journals in the field of tight junctions and colorectal cancer research from 2001-2023

Journal	Publications	Citations	Citations per-publication	Journal IF (2023)	JCR
<i>Anticancer Research</i>	8	315	39.38	2.0	Q4
<i>International Journal of Molecular Sciences</i>	7	155	22.14	5.6	Q1
<i>Oncogene</i>	6	410	68.33	8.0	Q1
<i>Cancer Research</i>	6	337	56.17	11.2	Q1
<i>PLoS One</i>	6	241	40.17	3.7	Q2
<i>Oncology Reports</i>	5	134	26.80	4.2	Q2
<i>Cancer Management and Research</i>	4	75	18.75	3.3	Q3
<i>Biochemical and Biophysical Research Communications</i>	4	88	22.00	3.1	Q2
<i>Carcinogenesis</i>	4	114	28.50	4.7	Q2

relationship between references. Together, all the articles cited a total of 7060 references, with 46 papers cited at least 15 times. Papers cited more than 15 times were imported into VOSviewer for co-citation analysis and visualization (Figure 4A). The focus was divided into two main clusters, represented in green and red. Table 4 lists the top 6 research articles cited from 2001 to 2023 (data from the Web of Science database). The most cited article was “Claudin-1 regulates cellular transformation and metastatic behavior in colon cancer”, authored by Dhawan P, with 86 citations; this article focused on the expression and role of claudin-1 in colorectal carcinoma and metastasis. The next most cited articles were authored by Miwa N and Resnick MB and were cited 48 and 35 times, respectively. Analysis revealed that these six articles focused mainly on the expression of claudin-1 in CRC and its role in the development of CRC. Additionally, the expression and function of claudin-1 and claudin-7 in breast cancer were analyzed.

Table 4 Top 6 references with the most citations

Title	Citations of Web of Science	Author	Country	Journal	IF (2023)	JCR	Year
Claudin-1 regulates cellular transfor-mation and metastatic behavior in colon cancer	86	Dhawan P	United States	<i>The Journal of Clinical Investigation</i>	15.9	Q1	2005
Involvement of claudin-1 in the beta-catenin/Tcf signaling pathway and its fre-quent upregulation in human colorectal cancers	48	Miwa N	United States	<i>Oncology Research</i>	3.1	Q3	2001
Claudin-1 is a strong prognostic indicator in stage II colonic cancer: a tissue microarray study	35	Resnick MB	United Kingdom	<i>Modern Pathology</i>	7.5	Q1	2005
Multifunctional strands in tight junctions	35	Tsukita S	United Kingdom	<i>Nature Reviews. Molecular Cell Biology</i>	112.7	Q1	2001
Loss of the tight junction protein claudin-7 correlates with histological grade in both ductal carcinoma in situ and invasive ductal carcinoma of the breast	32	Kominsky SL	United Kingdom	<i>Oncogene</i>	8	Q1	2003
Claudin-2 expression increases tumori-genicity of colon cancer cells: role of epidermal growth factor receptor activation	31	Dhawan P	United Kingdom	<i>Oncogene</i>	8	Q1	2011

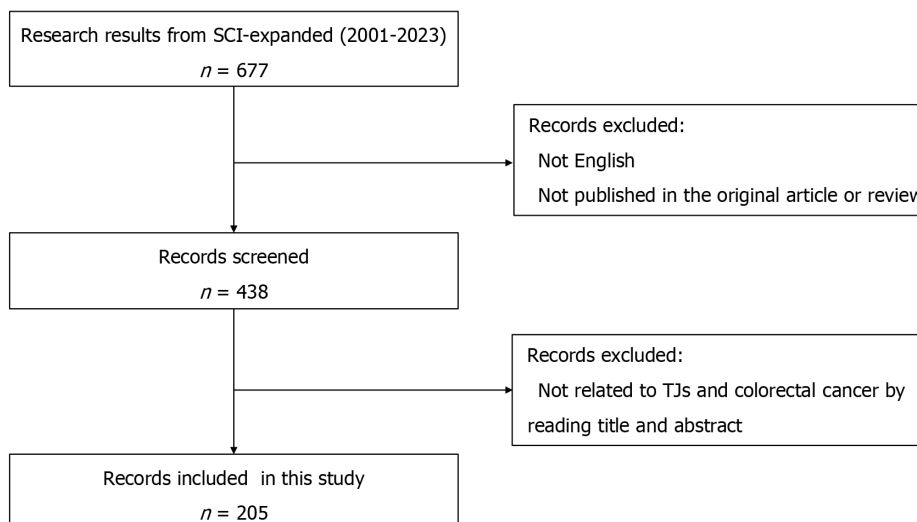


Figure 1 The flowchart of the literature screening process. SCI: Science Citation Index; TJ: Tight junction.

Together, all the papers cited references from 1361 journals. We visualized the journals cited more than 50 times using VOSviewer, obtaining a co-citation network of cited journals (Figure 4B). Table 5 lists the 6 journals cited most frequently from 2001 to 2023 (data from the Web of Science database). The top three journals were *Cancer Research* (377 times), *Oncogene* (319 times), and *Gastroenterology* (285 times). The cited journals are represented by clusters of three different colors. The green cluster primarily consisted of basic journals such as *Cell Biology* and *Molecular Biology*. References to these journals were made to analyze recent research outcomes and offer theoretical backing for their investigations. Clinical journals focusing on gastrointestinal tumors formed the blue and red groupings.

Keyword visualization

The purpose of keyword co-occurrence analysis was to study the co-occurrence relationships between keywords in a set of publications, reflecting popular topics. A total of 205 research articles that met the inclusion and exclusion criteria were exported from the Web of Science database in pure text format, and keyword analysis was performed using VOSviewer, with a threshold set to 10. Combining some frequently recurring keywords and synonyms, a total of 47 keywords were identified. Figure 5A and B show that “expression” and “colorectal cancer” were the most prominent keywords. All identified keywords could be divided into 3 clusters, represented in red, green, and blue. These clusters represent the most prominent themes in this research field to date.

Figure 5C displays the average year of the appearance of keywords. The use of keywords such as “migration”, “apoptosis”, and “inflammatory bowel disease” has increased in recent years. Recent research has focused on the mechanisms of migration and apoptosis related to TJ proteins and their roles in the development of inflammatory bowel

Table 5 Top 10 journals with the most citations			
Journal	Citations of Web of Science	Journal IF (2023)	JCR
Cancer Research	377	11.2	Q1
Oncogene	319	8.0	Q1
Gastroenterology	285	29.4	Q1
Journal of Biological Chemistry	238	4.8	Q2
Journal of Cell Biology	203	7.8	Q1
PLoS One	162	3.7	Q2
Proceedings of the National Academy of Sciences of the United States of America	160	11.1	Q1
Gut	153	24.5	Q1
Journal of Clinical Investigation	145	15.9	Q1
Anticancer Research	140	2.0	Q4

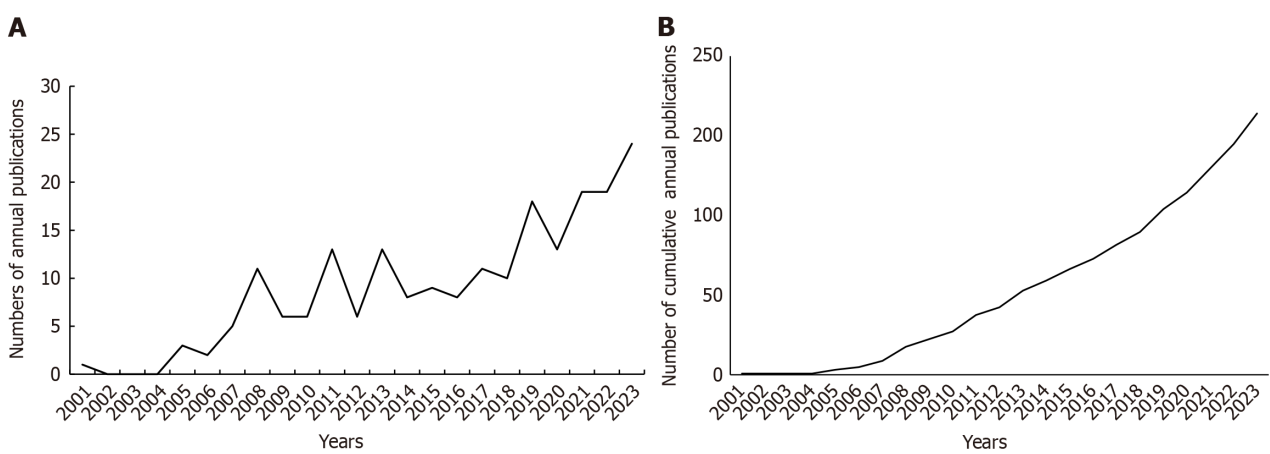


Figure 2 Global number of publications in the field of tight junctions and colorectal cancer from 2001 to 2023. A: The global annual number of published articles; B: The global number of annual cumulative published articles.

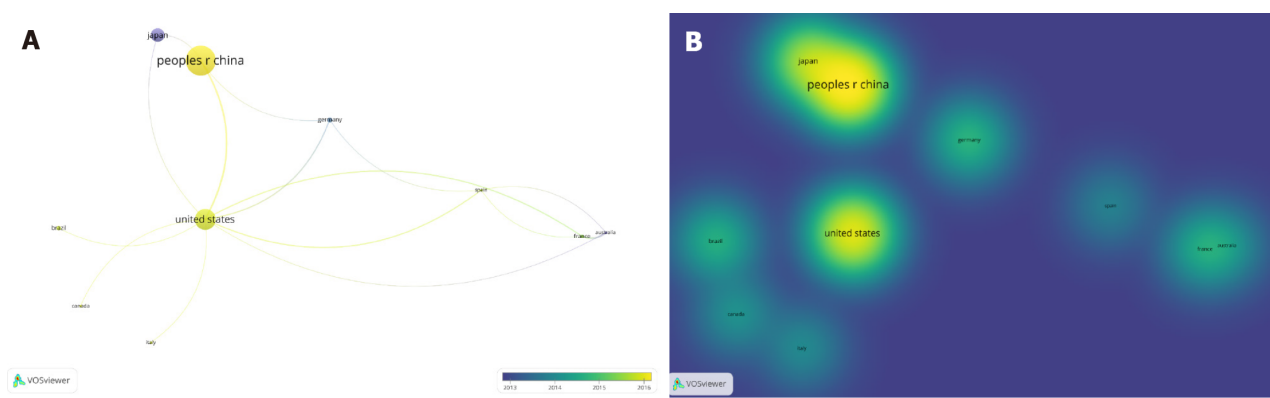


Figure 3 The cooperation network of countries/regions in the field. A: Dots represent countries, with larger dots indicating a greater number of publications. Clusters are marked using different colors, and links represent cooperation between countries; B: The cooperation network of countries/regions in the field. The colors represent the average years.

disease.

Keyword clusters consist of one or more keywords that have specific relationships with each other. Cluster analysis of keywords was performed using CiteSpace software, and Figure 5D shows a Q value of 0.6723 (> 0.3) and an S value of 0.8887 (> 0.7) are displayed, suggesting the clustering outcomes are both strong and plausible[21]. There were a total of 10 clustering patterns, 7 of which were selected for analysis. The cluster keywords included “microbiome” (Cluster 0),

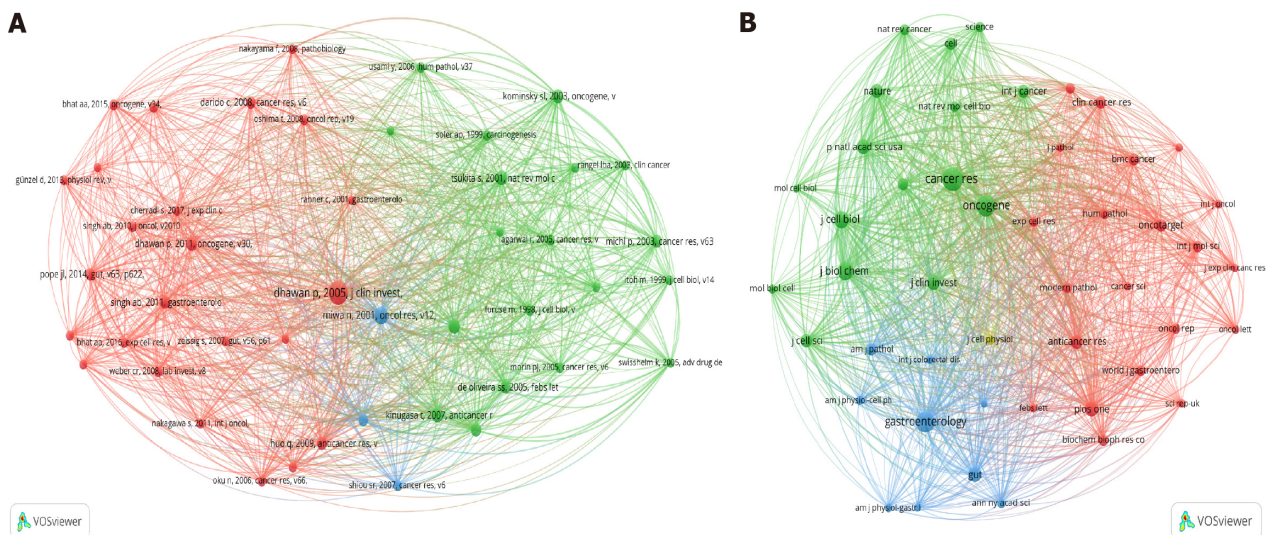


Figure 4 Reference co-citation analysis by VOSviewer. A: Dots represent references, with larger dots indicating a greater number of references. Clusters are marked using different colors, and the connecting lines represent a paper citing two different references separately; B: Co-citation relationships between journals. The circles represent the number of articles cited in a journal, and the connecting lines represent a paper citing two different journals separately.

“progression” (Cluster 1), “cell adhesion molecules” (Cluster 2), “*Clostridium perfringens* enterotoxin” (Cluster 3), “prognosis” (Cluster 4), “epithelial-mesenchymal transition” (Cluster 5), and “colorectal cancer” (Cluster 6). There are many connections between the nodes of these clusters, indicating a high degree of keyword co-occurrence in this field.

Keyword timeline visualization was used to display the classification and publication time of the keywords (Figure 6A). Most of the keywords appeared after 2005, with increasing focus on “activation”, “invasion”, “metastasis”, and “gene expression” in recent years. Additionally, this figure visualizes the publication times of the clusters and the relationships between different clusters. Cluster analysis in this research revealed that the predominant areas of interest in this domain are primarily the intestinal microbiota, cell adhesion molecules, prognosis, and epithelial-mesenchymal transition.

If certain keywords are concentrated in a particular period, they are called burst keywords. Burst keywords can reflect different stages of development in a field. CiteSpace was used to detect burst keywords to identify research frontiers in this field, with blue bands indicating the start and end times of the appearance of the word and red bands indicating the start and end years of the burst. The five most common groundbreaking keywords extracted from CRC- and TJ-related papers *via* CiteSpace are shown in Figure 6B. The keyword with the highest burst intensity was “inflammatory bowel disease” (burst intensity of 4.86), which has been a research hotspot in recent years. This keyword first appeared in 2010 and showed explosive growth in 2021, indicating that an increasing number of studies in recent years have focused on exploring the role of TJ proteins in the process of inflammation-induced carcinogenesis.

DISCUSSION

Studies have shown a close association between intestinal TJ proteins and CRC, leading to an increasing number of studies over the past two decades exploring the role of TJs in the occurrence and development of CRC[22-25]. Bibliometrics was used to analyze authors, institutions, countries, and references in the Science Citation Index Expanded literature database to understand research areas; trends were visualized using CiteSpace and VOSviewer. This research method provides a more comprehensive analysis of the literature and produces more intuitive results than conventional systematic reviews. To date, no bibliometric analysis has specifically focused on the relationship between TJ proteins and CRC. Therefore, for the first time, this study used bibliometrics to explore the applications and developments in this field from 2001 to 2023 and speculated on future research trends.

In this bibliometric analysis, we found an increase in the number of annual publications over the past 23 years. This trend indicates growing interest among researchers worldwide in this field. Until 2006, the number of publications related to CRC and TJ proteins increased slowly, followed by a significant increase in related publications after 2007, particularly in recent years (Figure 2). This phenomenon suggests recent rapid development in this field.

We analyzed the most influential countries, authors, and journals in this field. The top three countries accounted for approximately 60% of all publications. This result reveals significant research disparities among countries worldwide, with leading countries having a decisive advantage over others. There were 66 articles contributed by Chinese scholars, accounting for approximately 30% of all publications and producing an average citation rate of 15.06. The United States ranked second in terms of the number of publications, with 46 papers, which were cited 3227 times, for an average citation rate of 70.15. This finding indicates the central role of the United States in this field. In addition to China and the United States, the top five countries include Japan, South Korea, and Germany, indicating progress in these countries, likely as a result of significant government support for medical research, as most countries are developed nations. China

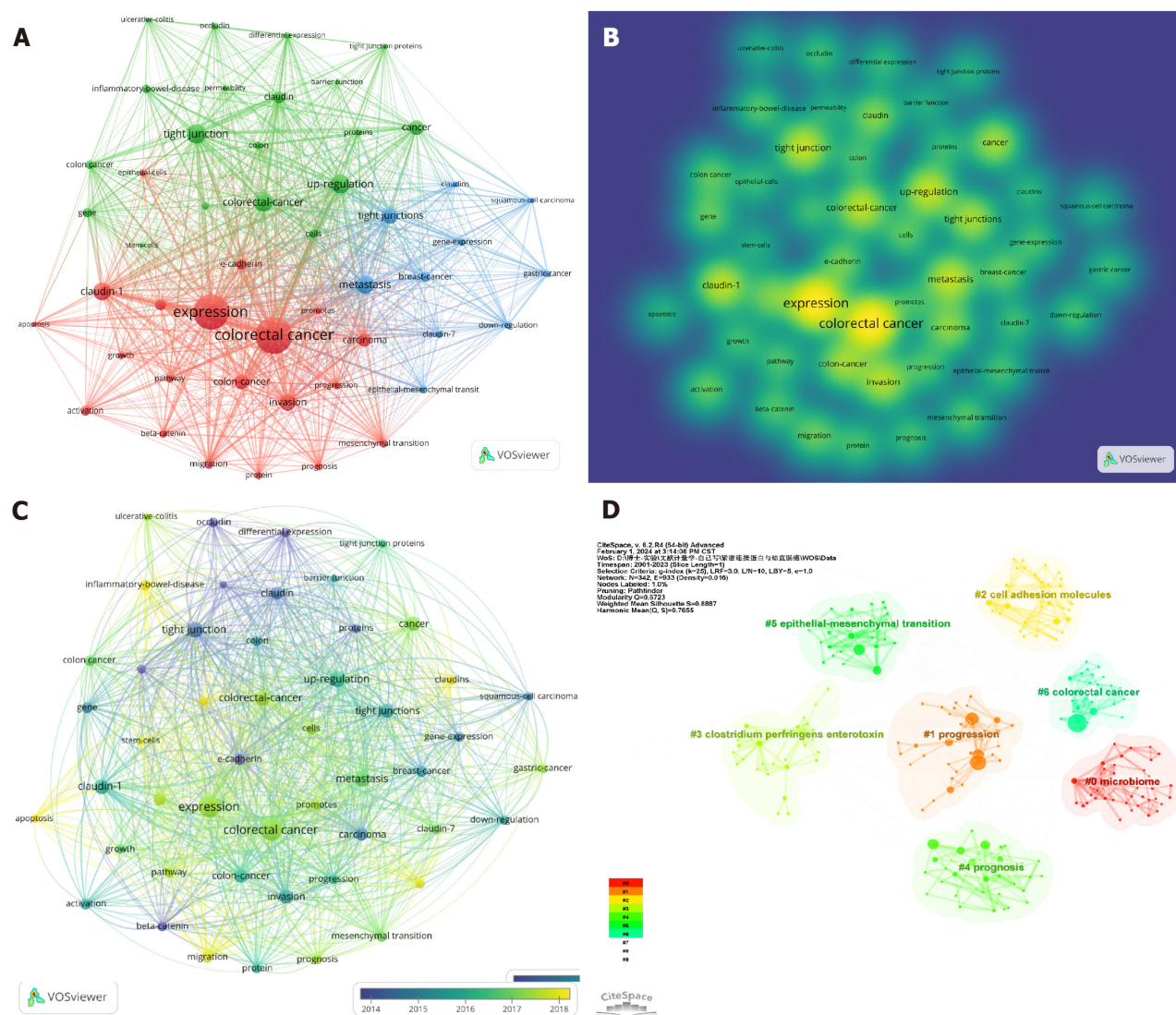


Figure 5 Visualization of keywords related to tight junctions and colorectal cancer research from 2001 to 2023. A: The cooperation network of keywords in the field. Dots represent keywords, with larger dots indicating a greater frequency of keywords. Clusters are marked using different colors, and links represent co-occurrence between keywords; B: The density of keywords in the field; C: Temporal view of keyword co-occurrence analysis (the node color represents the average year of keyword occurrence); D: Keyword clustering analysis in this field. Different colors represent different clusters. Each point represents a keyword, and the number on the node represents the cluster to which the keyword belongs. The different patterns represented a cluster. Tag# was allocated to clusters; the smaller the count was, the greater the number of keywords in the cluster.

is the only developing country with the highest publication output, which can be attributed to the rapid growth in financial investment by the Chinese government in medical research, especially in cancer-related studies; this investment even surpasses that of most other countries except the United States. Additionally, with the world's largest population, China provides ample patient resources for clinical research, which may contribute to the significant progress in medical research in China[26,27]. Importantly, despite China's leading role in TJ proteins and CRC research, its partnerships with other nations/regions in this area are restricted; hence, China should intensify its collaborative efforts with other countries/regions. **Figure 3A** shows the collaboration among different countries; the United States is positioned at the center of the collaboration network, collaborating with multiple countries, including extensive collaboration with China. We also found that collaboration has become increasingly closer in recent years.

In terms of authorship analysis, Dhawan P from the United States had the highest number of publications, making him the most prolific scholar in this field. His research focused primarily on elucidating the mechanisms underlying the involvement of the TJ protein family member Cldn-1 in the development and progression of CRC. Among all the journals publishing related articles, *Anticancer Research* had the highest number of publications, followed by the *International Journal of Molecular Sciences*; the former is a journal focusing on oncology research, and the latter is a journal focused on molecular biology. Among the cited journals, *Cancer Research* ranked first in terms of the citation frequency, with a maximum impact factor of 11.2, followed by *Oncogene* and *Gastroenterology*, indicating the high academic influence of these journals in this research field. Notably, in the analysis of the articles cited in this study, the article titled "Claudin-1 regulates cellular transformation and metastatic behavior in colon cancer" published in 2005 had the highest number of citations[28]. This study demonstrated increased expression of claudin-1 in human primary CRC, metastases, and corres-



Figure 6 A timeline for keywords. A: The node's position on the horizontal axis represents the time when the keyword first appeared, and the node's size is positively correlated with the number of keywords. The lines between the nodes represent the correlation between two keywords. A redder color indicates that the keyword first appeared closer to 2023. The clusters with redder colors and larger nodes included more keywords, demonstrating that the issue of this cluster was a hot topic in the field; B: The top 5 keywords with the strongest citation bursts. The blue bar represents the period in which the keyword appeared; the red bar represents the interval in which the keyword was found to burst, indicating the start year, the end year and the duration of the burst.

ponding cell lines, with claudin-1 expression detected in the cell nucleus. Claudin-1 induces phenotypic changes in CRC cell lines, leading to alterations in the structure and function of epithelial-mesenchymal transition markers. Furthermore, additional data suggest that the regulation of E-cadherin expression and β -catenin/Tcf signaling may be potential mechanisms underlying claudin-1-dependent changes.

In terms of keyword frequency, “colorectal cancer” and “expression” were the most prominent keywords, indicating that the majority of studies focused on the correlation between TJ protein expression and CRC. Additionally, “inflammatory bowel disease” is currently a hot topic. Keyword cluster analysis, keyword temporal distribution, and keyword burst analysis revealed that early-stage researchers are still in a relatively macroscopic and superficial stage of exploration regarding the association between CRC and TJ proteins. Researchers have attempted to determine the relationships between TJ protein expression and human colorectal adenomas and cancer. In the midterm, research directions gradually extended to the pathogenesis level, and to some extent, certain interactions between CRC and TJ proteins have been identified, with research primarily focusing on the TJ protein family members Cldn-1 and Cldn-7. In recent years, numerous studies have elucidated the relevance of TJ proteins to inflammatory bowel disease in the occurrence of CRC, further exploring the role of the intestinal microbiota in the association between TJ proteins and CRC occurrence.

This study has certain limitations. First, we included only articles published in English, excluding non-English publications from the bibliometric analysis, which may have interfered with the results. Second, the publications were retrieved only from the Web of Science database, which may have resulted in some publications not included in the database being overlooked. The Web of Science database, the most widely used bibliometric analysis database, was designed for this type of analysis[29]. Additionally, the Web of Science database rigorously evaluates publications, ensuring high-quality literature[29-31]. Third, recent high-quality publications have only been published for a short time, which may result in

lower citation counts. Therefore, citation frequency may not accurately reflect the quality of publications.

CONCLUSION

This bibliometric analysis evaluated the scope and trends of TJ proteins in CRC, providing valuable research perspectives and future directions for studying the connection between the two. The number of publications in the TJs and CRC field has grown steadily over the past two decades. It is recommended to focus on emerging hotspots such as the correlations among intestinal microbiota, inflammatory bowel disease, TJ protein expression, and CRC.

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FOOTNOTES

Author contributions: Li HM contributed to the conception and design of the study, and drafted and revised the manuscript; Liu Y and Hao MD are responsible for literature searching and data collection; Liang XQ and Yuan DJ are responsible for statistical analysis and charting; Huang WB and Li WJ checked the manuscript for grammar and spelling; Ding L coordinated the design and facilities for this study, provided multiple support in terms of personnel, materials and methods for the conduct of this study. All authors all approved the final manuscript.

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