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Araştırma Makalesi

Taenia saginata Üzerine Bir Bibliyometrik Analiz

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ÖZ

Taenia saginata (T. saginata), insanlarda taeniasis ve sığırlarda sistiserkoza neden olan küresel dağılıma sahip zoonotik bir helminttir. Günümüzde *T. saginata* insanlar için sağlık riskleri oluşturmakta ve hayvancılık sektöründe ekonomik kayıplara neden olmaktadır. Bu çalışma, *T. saginata* 'nın bilim camiasındaki tanımı ve bu alanda yapılan çalışmaların evrimini bibliyometrik analiz yoluyla keşfetmeyi amaçlamıştır. *T. saginata* ile ilgili literatür taraması için Web of Science veri tabanı kullanılmıştır. Web of Science veri tabanında 1980–2024 yıllarında yayınlanan tüm İngilizce araştırma makaleleri tespit edilmiştir. Veriler, *R* programlama dilinin "Bibliometrix" paketi ve VOSviewer kullanılarak analiz edilmiştir. Toplam 168 dergide yayınlanan 491 çalışma ile yürütülen araştırmada *T. saginata* için en etkili yazarlar, ülkeler ve enstitülerin yanı sıra en sık kullanılan anahtar kelimeler belirlendi. Veterinary Parasitology 32 makale ve 1017 atıf ile alanda en etkili dergi olarak belirlendi. En üretken ülke İngiltere olurken, Japonya en yüksek Çok Ülkeli Yayın oranına sahip oldu. En etkili yazarlar Leslie Jayne Stevenson Harrison, Akira Ito ve Pierre Dorny olmuştur. En sık kullanılan yazar anahtar kelimeleri "*Taenia saginata*", "*Taenia solium*" ve "*Cysticercosis*" olmuştur. Bu bibliyometrik çalışma, alandaki ilerlemeler ve araştırma işbirlikleri de dahil olmak üzere *T. saginata* araştırmalarına genel bir bakış sunmaktadır. Taeniasis, özellikle Afrika kıtası başta olmak üzere az gelişmiş ülkelerde önemli bir sorun olmaya devam etmektedir. Bu bölgelerdeki taeniasis salgınlarının kontrol ve eradikasyonuna öncelik verilmeli ve göç yoluyla diğer ülkeleri etkileme potansiyeli göz önüne alındığında, gelişmiş ülkelerdeki araştırma kurumları az gelişmiş ülkelerle ortak projeler başlatıp bu projelere finansal destek sağlamalıdır.

Anahtar kelimeler: *Bibliyometrik, Cysticercus bovis, Cyticercosis, Taenia saginata*

A Bibliometric Analysis on Taenia Saginata

ABSTRACT

Taenia saginata (T. saginata), is a zoonotic helminth with a global distribution that causes taeniasis in humans and cysticercosis in cattle. Currently, *Taenia saginata* poses health risks to humans and causes economic losses in the livestock sector. The aim of this study is to explore the definition of T. saginata in the scientific community and the evolution of studies in this field through bibliometric analysis. The Web of Science database was used to search the literature on Taenia saginata. All English research articles published in the Web of Science database between 1980 and 2024 were identified. The data were analyzed using the "Bibliometrix" package of R programming language and VOSviewer. In the research conducted with 491 studies published in 168 journals, the most influential authors, countries and institutes as well as the most frequently used keywords for T. saginata were identified. Veterinary Parasitology was identified as the most influential journal in the field with 32 articles and 1017 citations. The most productive country was England, while Japan had the highest Multiple Country Publication rate. The most influential authors were Leslie Jayne Stevenson Harrison, Akira Ito, and Pierre Dorny. The most frequently used author keywords were "*Taenia saginata",* "*Taenia solium*", and "*Cysticercosis*". This bibliometric study presents an overview of *Taenia saginata* research,

including advancements and research collaborations in the field. Taeniasis remains a major problem in underdeveloped countries, particularly on the African continent. Control and eradication of taeniasis outbreaks in these regions should be prioritised, and given the potential for other countries to be affected by migration, research institutions in developed countries should initiate and fund joint projects with less developed countries.

Key words: *Bibliometric, Cysticercus bovis, Cyticercosis, Taenia Saginata*

INTRODUCTION

Taenia saginata (T. saginata) is a helminth in the family Taeniidae. The adult *T. saginata* typically measures between 4 and 12 meters in length. This parasite comprises three main parts: the scolex, neck, and proglottid (segment). *T. saginata* is a dangerous parasite that can cause taeniasis in humans and cysticercosis in cattle (Torgerson, 2013). The primary intermediate host of *T. saginata* is cattle, while humans serve as the definitive host. Taeniasis, a zoonotic infection, is transmitted to humans by consuming raw or undercooked beef infected with cysticerci. The cycle perpetuates as cattle ingest proglottids through contaminated pasture and feed, which are disseminated in the feces of infected humans (Cabaret et al., 2002; Symeonidou et al., 2018) After being ingested by the intermediate host, the eggs of the parasite cross the intestinal wall and enter the bloodstream, eventually reaching the heart muscle. From there, they circulate through the larger bloodstream and can settle in various parts of the body, typically in the connective tissue surrounding the striated muscles. Here, the parasite undergoes transformation into cysticerci, known as Cysticercus bovis, and becomes infective after approximately 10 weeks. Cysticerci present in the striated muscles begin to calcify within a few months (Dorny and Praet, 2007). Taeniasis can lead to various symptoms including abdominal pain, diarrhea, weight loss, and anal itching. In some cases, it was reported to cause serious health issues like intestinal obstruction, perforation, and peritonitis (Dermauw et al., 2018). Diagnosis of *T. saginata* infection can be performed during routine meat inspection by making incisions in the connective tissues of striated muscles, including the masticatory muscles, heart, tongue, chest, and diaphragm, where Cysticercus bovis is commonly found (World Health Organization, 2005). However, it's important to note that meat inspection can only detect infected cattle with cysticerci. Previous studies reported that meat inspection has a misdiagnosis rate of approximately 50% (Dorny et al., 2000; Jansen et al., 2017). Consequently, the use of serological diagnostic tools such as ELISA, which detects antigens or antibodies, is recommended for the detection of *T. saginata* (Wanzala, 2002). Depending on the number of cysticerci present, it is recommended that the carcass be either destroyed or frozen (for at least 10 days at -18 °C) before consumption. However, it should be noted that exposure of meat to freezing can lead to a reduction in its economic value (Jansen et al., 2018). Since diagnosing cysticercosis in live animals is challenging, treatment options are limited. However, antihelminthic drugs such as albendazole, mebendazole, and praziquantel can be effective against cysticercosis in cattle (Tegegne et al., 2018). *Taenia saginata* has the potential to pose a problem in any country where beef consumption is prevalent. Taeniasis has been reported to have a high prevalence in African countries such as Kenya, Ethiopia, Zambia, South Africa, Zimbabwe, and Sudan ((Hendrickx et al., 2019).

Bibliometric analysis refers to the application of mathematical and statistical methods to analyze outputs from a database related to a specific research area (Yu et al., 2020). Bibliometric analysis is a practical method for revealing the evolution of researchers, institutes, journals, countries, and research topics over time (Donthu et al., 2020). A literature survey showed that bibliometric analysis is increasingly utilized to uncover the social and intellectual structure of the field of animal diseases of parasitic origin, like in many disciplines in medicine and veterinary medicine. Mesdaghinia et al. (2015) conducted a bibliometric analysis to examine studies on risk assessment of the *Cryptosporidium* pathogen in water. Their findings suggest that the number of publications in this field is likely to decrease in the coming years. Using bibliometric analysis, Altun et al. (2023) analyzed the research status of *Dicrocoelium dendriticum*, a zoonotic trematode, worldwide. This study aims to evaluate research elements and collaborations in the field within the framework of specific metrics to determine the contribution of worldwide studies on *T. saginata* to the literature. The results of this study will provide researchers in parasitology or other related disciplines with a general framework of the field and the opportunity to quickly analyze the subject matter.

MATERIALS AND METHODS

Research methods

Bibliometric analysis is a tool for revealing and interpreting the literature in a particular research area. In this regard, bibliometric analysis should be regarded as a tool rather than the purpose of a study. Furthermore, researchers should have sufficient knowledge and experience with the relevant literature before deciding to conduct a bibliometric analysis (Öztürk and Gürler, 2021). Performance analysis metrics such as h-index, g-index, m-index, total number of articles, total number of citations, Journal Impact Factor (JIF), JIF quartile indicators, and collaboration percentages were utilized in this study. Additionally, bibliometric laws such as Lotka's and Bradford's Laws were employed for evaluating the data.

Data sources and statistical analysis

Clarivate Analytics' database Web of Science (WoS) was utilized to identify research trends on *T. saginata*, an important parasite in animal and human health. WoS has a large network of journals in the health field and publishes studies that comply with publication ethics (Merigó and Yang, 2017).

A search was performed on 18 February 2024 on the WoS database for the terms "*TAENIA SAGINATA*" or "*CYSTICERCUS BOVIS*" with the "All fields" option marked. This search resulted in 777 studies in the fields of Medicine and Veterinary Sciences. After limiting the results to document type (Research Article) and language (English), a total of 572 articles were listed. Out of the 572 articles obtained as a result of filtering, a further examination revealed that 81 studies did not reflect the topic or were on other Taenia species. Finally, the bibliographic dataset comprised 491 research articles (Figure 1).

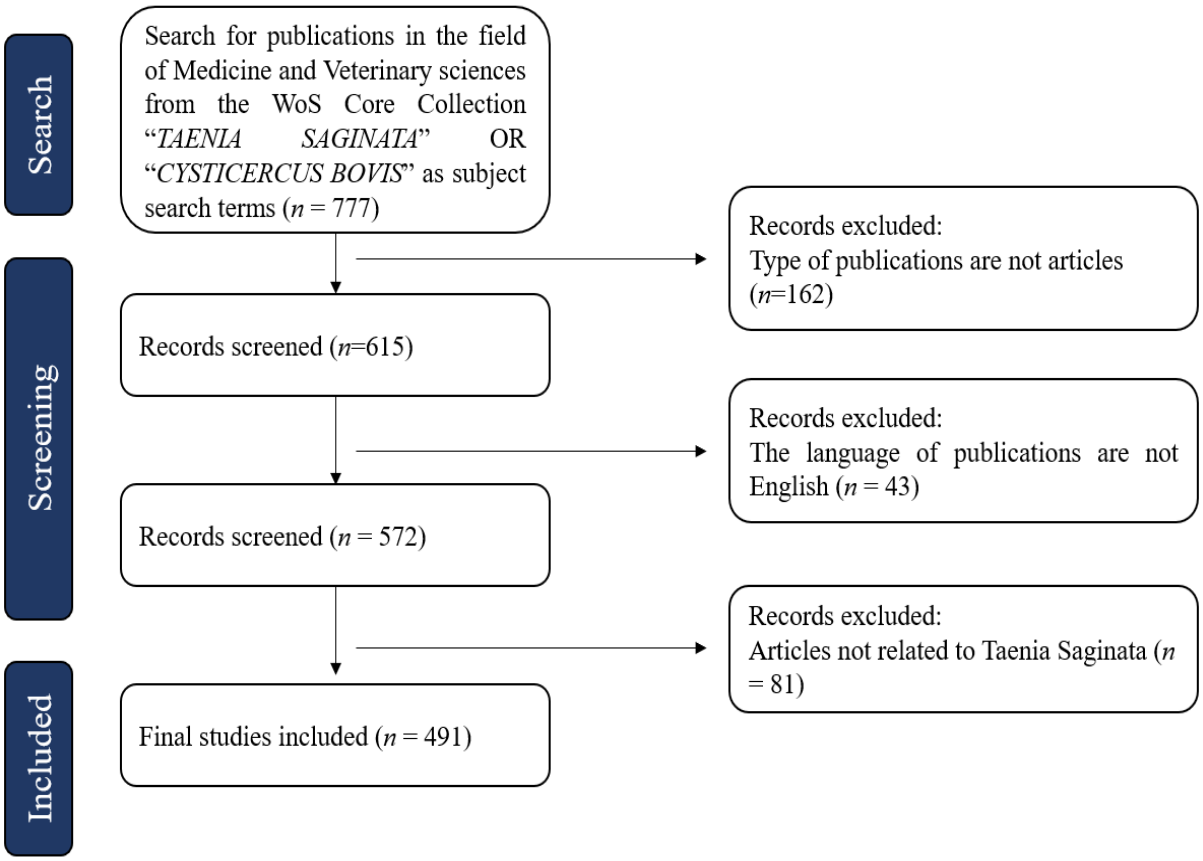

Figure 1. The publication selection procedures for the bibliometric analysis.

For data analysis and visualization purposes, the "Bibliometrix" package of *R* programming language and VOSviewer, a widely used software in bibliometric analyses, were used (Aria and Cuccurullo, 2017; Van Eck and Waltman, 2017). The performance analysis including the most frequent keywords, authors, countries, and journals in the examined field was conducted using the Bibliometrix package. Science mapping was done using Bibliometrix and VOSviewer.

RESULTS

General publication trends

According to the bibliometric data statistics, the studies included in the analysis were published in 168 different journals between 1980 and 2024. A total of 491 research papers on *T. saginata* have been published over a 44-year period. The total number of authors is 1718 and the number of single-authored studies is 38. The number of citations per article was 18.39 and the total number of references was 9775. The bibliometric data included 851 keywords plus and 880 author keywords. According to the author collaboration statistics, the mean article count per author was 0.28, the number of authors per article was 3.49, the number of co-authors per article was 5.02, the international co-authorship rate was 34.22%, and the collaboration index was 3.71. The number of authors who contributed to these studies was 1718, and their names were mentioned 2464 times. The author footprint index was found to be 0.31. A great portion of the studies (%92.26) were multi-authored articles (see Table 1).

Table 1. Main statistics on *T. saginata*

Description	Results
Main Information About Data	
Timespan	1980:2024
Sources (journals, books, etc.)	168
Documents	491
Annual growth rate (%)	-5.3
Average document age	17.9
Average citations per doc	18.39
References	9775
Document Types	
Article	456
Article; early access	17
Article; proceedings paper	18
Document Contents	
Keywords Plus (ID)	851
Author's Keywords (DE)	880
Authors	
Authors	1718
Author appearances	2464
Authors of single-authored documents	34
Authors of multi-authored documents	1684
Authors Collaboration	
Single-authored articles	38
Multi-authored articles	453
Authors per article	3.49
Articles per author	0.28
Co-Authors per article	5.02
Collaboration index	3.71
Author footprint index	0.31
International co-authorships %	34.22

The variation in the number of articles on *T. saginata* by time revealed that the article count followed a fluctuating pattern between 1980-2024. The overall growth rate during this period was -5.3%. While the number of publications was above the average (11.13) between 2006 and 2022, it showed a decreasing trend in 2023. In 2023, the number of articles on this topic was 6. As of February 2024, 1 study has been published (Figure 2).

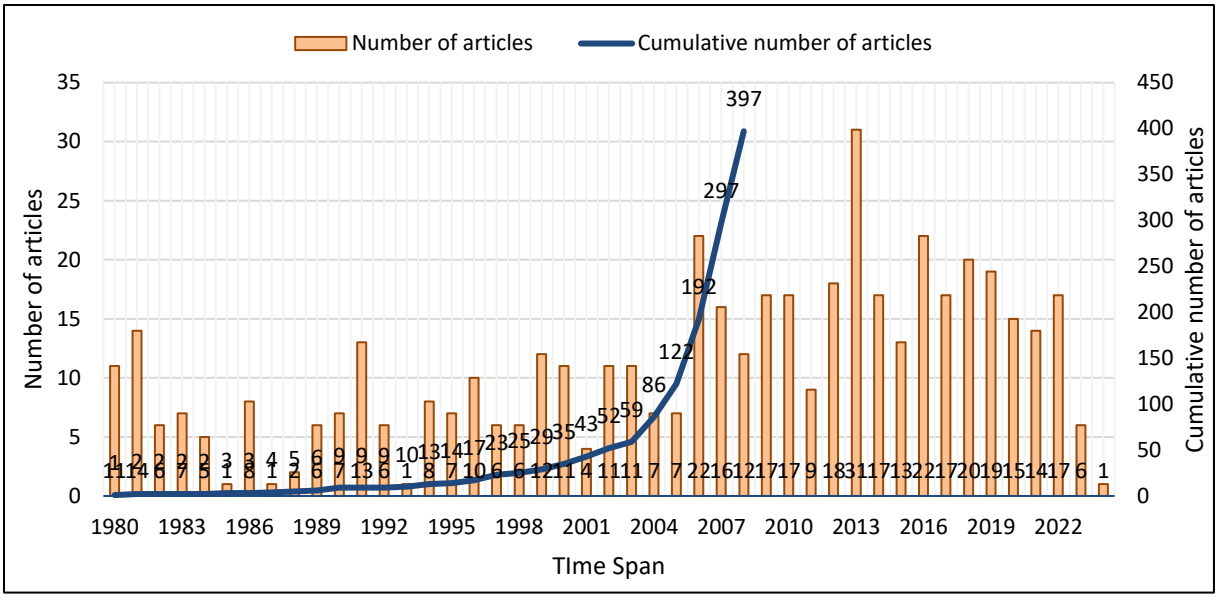

Figure 2. Annual scientific production on *T. saginata*

According to the relationships between the top 20 most influential sources (SO)", "authors (AU)", and "keywords (DE)" illustrated in Figure 3, the journals *Parasitology* and *Veterinary Parasitology* were identified as the most influential sources in this field. On the other hand, Leslie Jayne Stevenson Harrison, Pierre Dorny and Akira Ito were identified as the most influential authors. Additionally, "*taenia saginata*", "*taenia solium*", and "*cyticercosis*" were the most frequently used keywords.

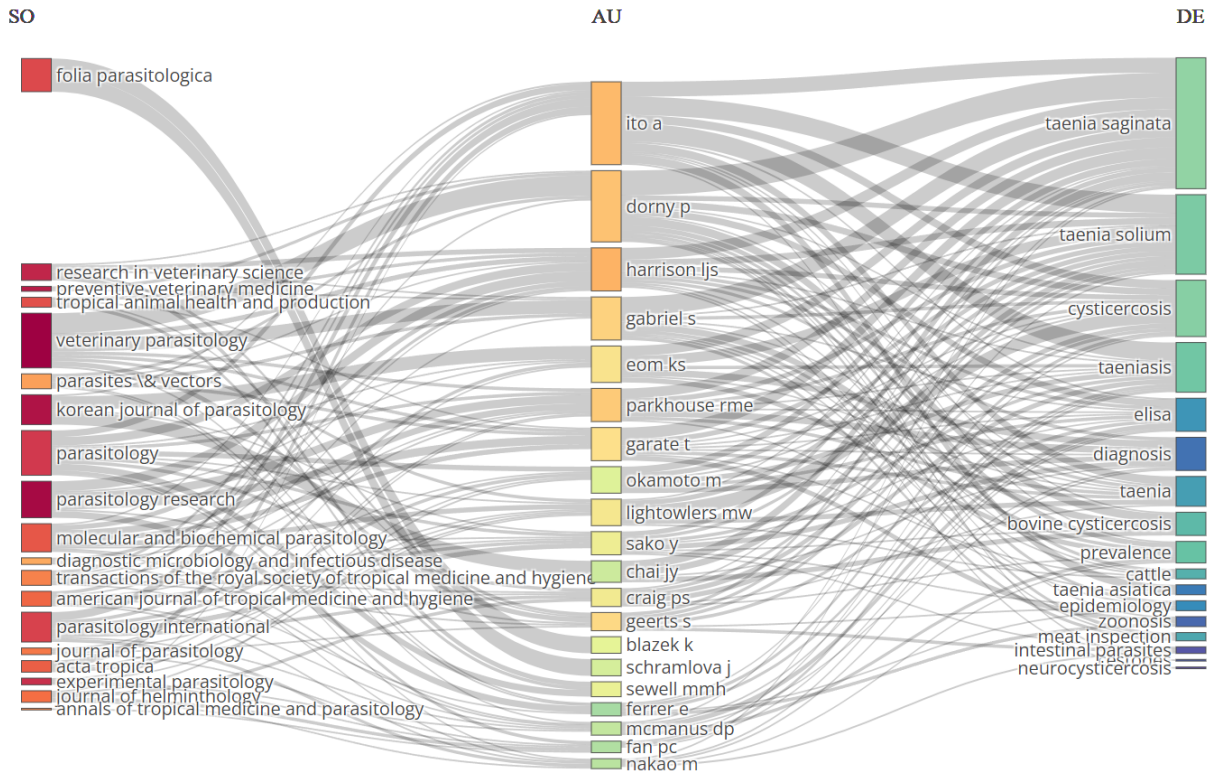

Figure 3. Three-area graph for the top 20 most influential sources (SO), authors (AU), and keywords (DE) on *T. saginata*

Most active journals

Using Bradford's law, *Veterinary Parasitology*, *Parasitology Research*, and *Preventive Veterinary Medicine* were identified as the top 3 journals with the potential to be a source for the field. Based on the scientific metrics, the top 2 journals were *Veterinary Parasitology* and *Parasitology Research*, respectively. According to its aims

and scope, *Veterinary Parasitology* focuses on high-quality research on the prevention, pathology, treatment, epidemiology, and control of parasitic diseases important for human and animal health. The *T. saginata* papers in the journal focus on its epidemiology, challenges in the meat industry, and its life cycle. *Parasitology Research*, on the other hand, addresses the diagnosis, treatment, and control of parasitic diseases that are significant in human health. The studies on *T. saginata* in *Parasitology Research* were primarily about molecular and histochemical diagnostic research, case reports, and environmental resistance. The international collaboration of the journals was about 30% and primarily between European journals (Table 2).

Table 2. The *h*-index, *g*-index, *m*-index, and other scientific indices of the top 10 journals

Source	h index	g index	m index	TC	NP	CI	IC (%)	JIF	JIF Quartile	Country
Veterinary Parasitology	17	31	0.386	1017	32	31.78	32.74	2.6	Q1	Netherlands
Parasitology Research	13	19	0.361	410	28	14.64	38.96	2	Q3	Germany
Parasitology International	12	14	0.632	445	14	31.79	37.03	1.9	Q3	Japan
Experimental Parasitology	10	14	0.294	356	14	25.43	24.96	2.1	Q3	USA
Parasitology	10	14	0.227	475	14	33.93	41	2.4	Q2	England
Preventive Veterinary Medicine	10	15	0.333	247	17	14.53	40.82	2.6	Q1	Netherlands
Research in Veterinary Science	9	15	0.2	245	15	16.33	28.27	2.4	Q1	England
Acta Tropica	8	9	0.348	123	9	13.67	39.89	2.7	Q2	Netherlands
Molecular and Biochemical Parasitology	8	10	0.235	338	10	33.80	34.07	1.5	Q3	Netherlands
Journal of Helminthology	7	9	0.206	202	9	22.44	34.34	1.2	Q2	England

NP: Number of Publications, TC: Total Citations, CI: Citation Impact, IC: International Collaborations, JIF: Journal Impact Factor

Analysis of prolific authors

Considering the articles on *T. saginata*, the scientific metrics of the top 10 most influential authors regarding their scientific productivity are shown in Table 3. According to the h-index, g-index, and m-index scores, total publication, and citation counts, the top 3 most influential authors were Leslie Jayne Stevenson Harrison (England), Akira Ito (Japan), and Pierre Dorny (Belgium), respectively. The researchers displayed a high international collaboration (average 81.88%). Lotka's law suggests that in a given field, approximately 60% of authors contribute only one article, 15% contribute two articles, and 7% contribute three articles (Sudhier, 2013). In the field of *T. saginata*, 83.9% of the authors contributed to this topic with one publication, 8.8% with two publications, and 2.7% with three publications. Accordingly, this publication distribution was found not to comply with Lotka's law. In terms of Lotka's law, while the number of single-author articles is higher than the anticipated value, the number of articles with two and three authors was lower. The main reasons for these results are suggested to be the declining trend of the annual publication count, which had been high until 2019, and the fluctuating pattern of overall publications. Besides, according to Lotka's law, authors with more than 4 publications can be considered core authors in the field.

Table 3. The *h*-index, *g*-index, *m*-index, and other scientific indices of the top 10 authors

Author	h index	g index	m index	TC	NP	CI	IC(%)	Country
Harrison, Leslie Jayne Stevenson	17	26	0.378	753	33	22.82	88.9	England
Ito, Akira	16	29	0.571	870	29	30.00	80.6	Japan
Dorny, Pierre	15	22	0.6	867	22	39.41	91.2	Belgium
Parkhouse, Robert Michael Evans	13	21	0.317	513	21	24.43	93.3	Portugal
Gárate, Terésa	12	16	0.414	260	16	16.25	69.7	Spain
Lightowlers, Marshall W.	12	12	0.4	535	12	44.58	79.1	Australia
Craig, Phillip Simon	11	11	0.244	626	11	56.91	90.6	England
Eom, Keeseon S.	11	14	0.393	406	14	29.00	57.3	South Korea
Sako, Yasuhito	10	11	0.4	429	11	39.00	75.8	Japan
Gabriël, Sarah	9	18	0.391	477	18	26.50	92.3	Belgium

NP: Number of Publications, TC: Total Citations, CI: Citation Impact, IC: International Collaborations

To visually represent the collaboration between the most influential authors, co-authorship analysis identified authors with at least 2 articles and 2 citations on *T. saginata*. A total of 288 authors formed 9 clusters with 495 links. The top three authors with the highest co-authorship interactions were Akira Ito, Leslie Jayne Stevenson Harrison, and Robert Michael Evans Parkhouse (Figure 4).

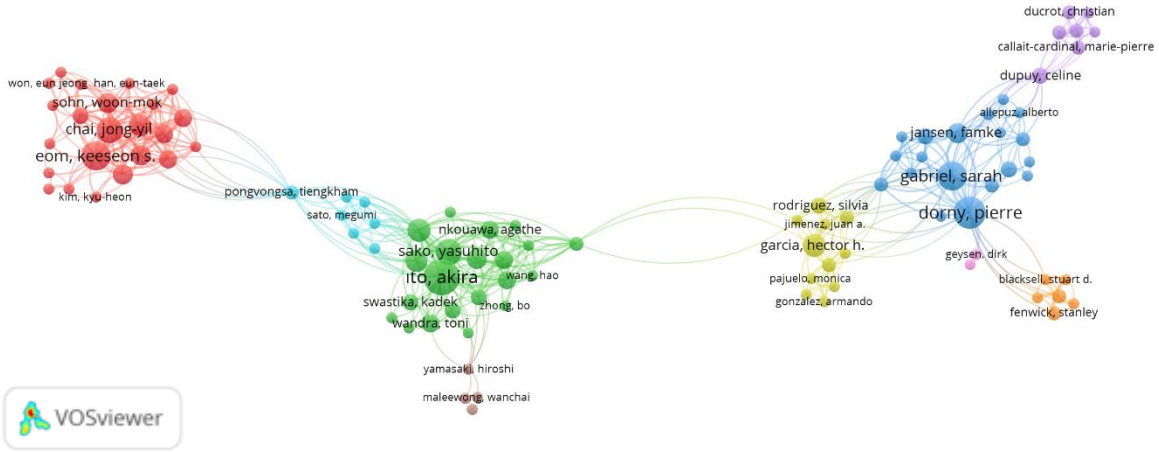

Figure 4. Co-authorship Map

Contribution of ınstitutes

A total of 643 institutes related to the authors were identified. The high number of institutes relative to the article count indicates a high collaboration rate in the field. The top 3 institutes with the highest number of publications in the examined field were the Institute of Tropical Medicine in Antwerp (Belgium), the University of Edinburgh (Scotland), and the University of Melbourne (Australia). Regarding international collaborations, the only institute with an international collaboration rate below 20% was Asahikawa Medical College (Japan) (Table 4).

Table 4. The *h*-index and other scientific indices of the top 10 affiliations

Affiliation	Articles	IC (%)	Country
Institute of Tropical Medicine in Antwerp	50	84.86	Belgium
University of Edinburgh	50	58.98	Scotland
University of Melbourne	34	53.97	Australia
Chungbuk National University	31	28.73	South Korea
Ghent University	28	66.43	Belgium
Instituto de Salud Carlos III	25	48.21	Spain
Universidad Peruana Cayetano Heredia	24	79.32	Peru
Universidad Nacional Autonoma de Mexico	22	43.34	Mexico
Asahikawa Medical College	21	18.41	Japan
Seoul National University	19	30.22	South Korea

IC: International Collaborations

Contribution of countries

Publication and citation counts, as well as other scientific metrics regarding research on *T. saginata*, are listed in Table 5. In the dataset, the top 3 countries with the highest publication counts were England, Brazil, and Australia. The fact that the top 3 countries are from different continents highlights the potential of *T. saginata* to cause a problem on a global scale. In terms of citation impact, Australia had the highest CI value among the countries studied. The analysis of Multiple Country Publication (MCP) data revealed that only two countries, England and Japan, surpassed an MCP rate of 50%. These countries have demonstrated high international cooperation on *T. saginata*. Remarkably, nearly all publications from Brazil were conducted domestically.

Table 5. Publication count and collaboration metrics of the countries (top 10)

Country	TC	NP	CI	Frequency	SCP	MCP	MCP Ratio	Links	TLS
England	1140	46	24.78	0.094	19	27	0.587	30	87
Brazil	342	33	10.36	0.067	32	1	0.030	10	13
Australia	1331	31	42.94	0.063	25	6	0.194	14	29
Belgium	1020	31	32.90	0.063	20	11	0.355	25	53
Japan	775	26	29.81	0.053	8	18	0.692	16	56
China	295	19	15.53	0.039	12	7	0.368	13	30
Ethiopia	159	19	8.37	0.039	15	4	0.211	7	10
South Korea	339	19	17.84	0.039	10	9	0.474	4	6
USA	413	17	24.29	0.035	12	5	0.294	22	38
Denmark	270	13	20.77	0.026	9	4	0.308	16	17

NP: Number of Publications, TC: Total Citations, CI: Citation Impact, SCP: Single Country Publication, MCP: Multiple Country Publication, TLS: Total Link Strength

According to the collaboration network analysis of the countries, a total of 45 countries, each with at least 3 publications, formed an 8-cluster structure. However, only 6 clusters were observed to establish a collaboration network within themselves. The size of the nodes indicates the publication frequency of a country. Countries within the same color cluster tend to publish together more frequently. The highest international cooperation was observed in clusters associated with England, Belgium, Australia, and Japan (Figure 5).

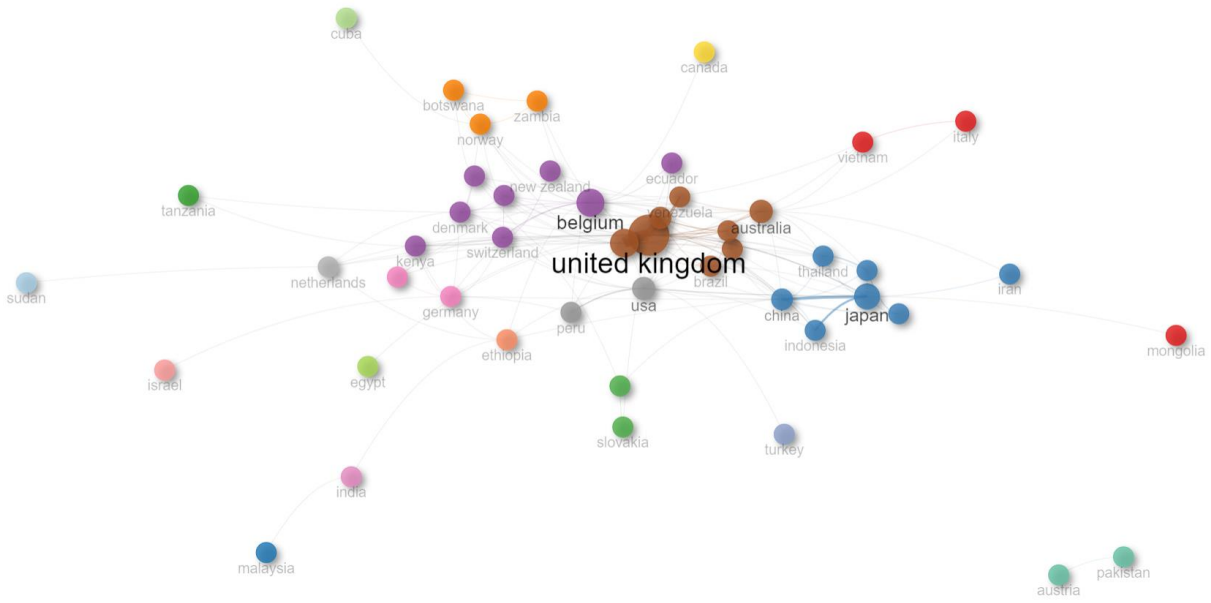

Figure 5. Map of cooperation between countries

Keyword analysis

Keyword analysis plays a key role in assessing changes in research trends within a specific field. The author's keyword network for keywords at least 3 times used is given in Figure 6. According to this author's keyword network, the most frequently used keywords were “Taenia saginata”, “Taenia solium”, and “Cysticercosis”. On the other hand, “epidemiology”, “prevalence”, “risk factors”, “abattoir”, and “intestinal worms” were identified as the recent popular keywords in the field. The keyword network was reviewed with the relevant literature and it was determined that studies on *T. saginata* are predominantly associated with the Taenia family, particularly Taenia solium. These two parasites are significant sources of taeniasis. Furthermore, recent studies primarily focus on the epidemiology and diagnosis of the parasite. Additionally, some studies emphasized the significance of meat inspections for diagnosing *T. saginata* in cattle, aiming to safeguard public

health in slaughterhouses and meat industries. Moreover, research on the economic losses attributed to *T. saginata* has increased in recent years.

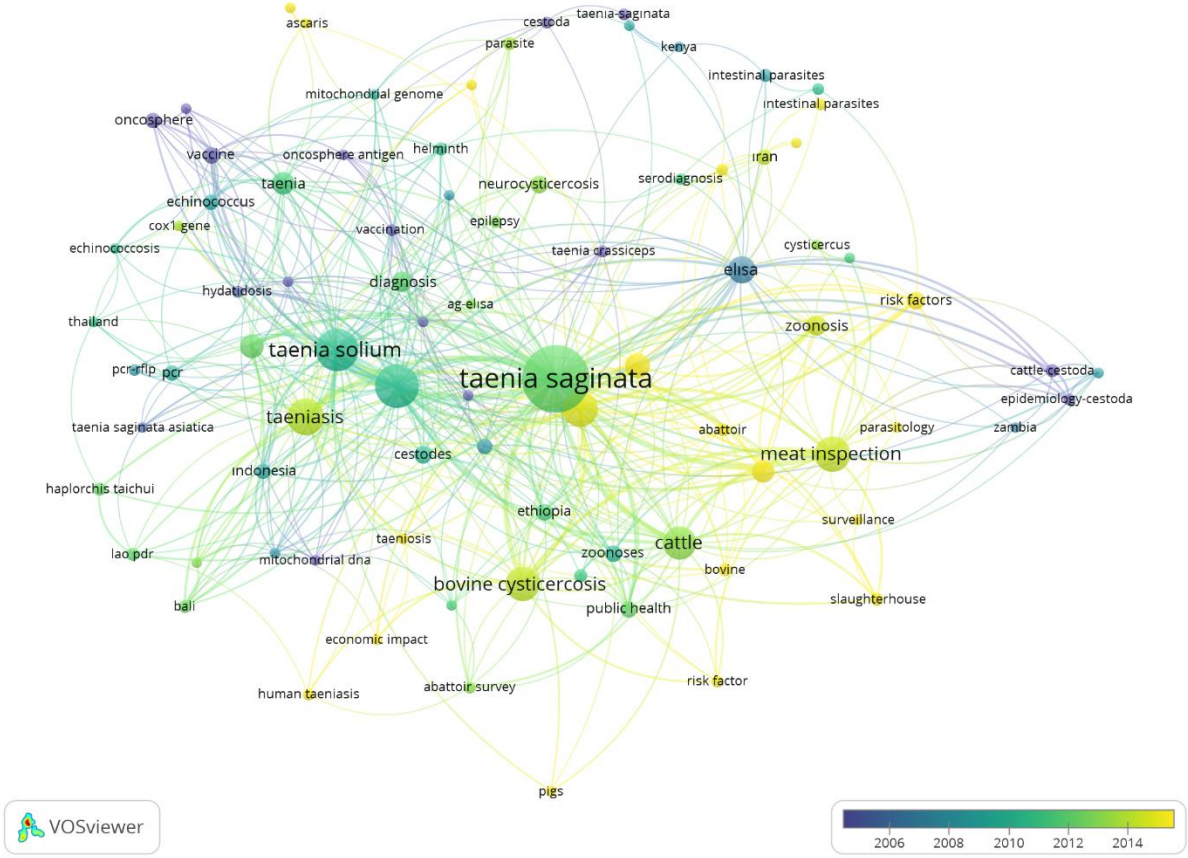

Figure 6. Network analysis for author keywords

Co-citation analysis

Co-citation analysis indicates how frequently two articles are cited together. For a minimum citation count of 20 on *T. saginata*, 87 journals were listed. In the bibliographic dataset, the top 3 journals with the highest citation count were *Veterinary Parasitology* (554 citations, JIF 2023 = 2.6, Q1), *American Journal of Tropical Medicine and Hygiene* (395 citations, JIF 2023 = 3.3, Q1), and *Emerging Infectious Diseases* (117 citations, JIF 2023 =11.8, Q1, respectively. To determine the most important references in the field, co-cited studies were examined. Accordingly, 106 references were listed for a minimum citation count of 10. The most co-cited study was authored by Pierre Dorny et al. entitled “Sero-epidemiological study of *Taenia saginata* cysticercosis in Belgian cattle” which focuses on determining the prevalence of *T. saginata* in cattle destined for slaughter in Belgium (Year:2000, co-citation count:54). The most co-cited second study, authored by Jacques Cabaret et al., entitled “The use of urban sewage sludge on pastures: the cysticercosis threat” highlights the risk associated with the utilization of sewage waste for fertilization on pastures (Year:2002, co-citation count:43). The co-citation analysis revealed a significant presence of prestigious journals covering human and animal diseases, as well as parasitology.

DISCUSSION

Cases of taeniasis caused by *T. saginata* are prevalent in countries with high beef consumption and inadequate meat inspection protocols (Dorny et al., 2000). Laranjo-González et al. (2016) analyzed reports from 50 different sources in Europe, revealing widespread cases of bovine cysticercosis across the continent for decades. Braae et al. (2018) reported that *T. saginata* is widely distributed in the Americas and governments need to conduct further epidemiological studies before regional response measures can be implemented. These reports indicate the worldwide prevalence of *T. saginata*, including in Europe and the Americas.

Additionally, diagnosing cysticercosis during meat inspection in slaughterhouses is not always feasible, and the infection can be transmitted to developed countries through migration, particularly from African countries (Fabiani and Bruschi, 2013). This is why *T. saginata* remains a prominent research topic in the academic community. The analysis of the number of studies on *T. saginata* over time revealed that the number of studies was higher in 2006 – 2022 compared to previous periods. The rise in human cysticercosis cases in Europe during this period has significantly contributed to the increase in the number of studies on this subject (Laranjo-González et al., 2017).

This bibliometric analysis showed that the top three countries with the highest scientific productivity were England, Brazil, and Australia. Besides, Australia (1331) and England (1140), as the countries with the highest citation counts, serve as significant sources of research in the field. Furthermore, these three countries were found to be in the same cluster for multi-country collaboration network analysis. Regional outbreaks of cysticercosis can occur in the UK. Studies in the UK are mostly cross-sectional and experimental. In Australia, there has been a notable decrease in health issues related to Cysticercus bovis in recent years. However, it was highlighted that outbreaks may still occur due to several factors such as migration and carelessness. Therefore, the spread of the disease through human activity is mitigated by establishing sewage farms. Moreover, the National Livestock Identification Plan procedures are also implemented (Kiermeier et al., 2019). One of the noteworthy findings of this study is that Ethiopia is ranked among the top 10 most influential countries. Studies have presented regionally varying levels of taeniosis cases in Ethiopia, which are believed to stem from the consumption of raw meat by rural communities in certain regions such as Jimma, Borena, Arsi, and Bale regions, as well as in the southeastern and northeastern regions of the country, due to cultural and religious practices. Besides, potential carriers contaminating grazing areas in the region serve as another contributing factor ((Abunna, 2013; Jorga et al, 2020).

Regarding the institutions supporting studies in this field, the Institute of Tropical Medicine in Antwerp (Belgium) was identified as the primary publisher and the most cited organization. Furthermore, Belgium exhibited the highest level of international collaboration within its cluster in the collaboration network analysis. Given the significant economic impact of insurance costs associated with taeniosis caused by *T. saginata*, research organizations in Belgium are actively providing financial support for studies in this area (Jansen et al., 2018). To enhance epidemiological studies of *T. saginata* like Belgium, other countries should support institutions engaged in prevalence studies and encourage collaborations with underdeveloped countries.

The results of this bibliometric analysis indicate that researchers tend to prefer open-access publishing for research on *T. saginata*. However, it should be noted that authors who are unable to cover the open-access fees of popular journals in the field may face limitations in disseminating their work as widely as authors who can afford open-access publishing. Following the recognition of *T. saginata* as an endemic issue worldwide, some authors have placed increased importance on this topic and have consequently become influential researchers. The most influential authors in this field were identified as Leslie Jayne Stevenson Harrison and Akira Ito. Leslie Jayne Stevenson Harrison conducted studies on various topics, including molecular cloning and genetic research, diagnostic studies employing ELISA and PCR techniques, as well as DNA immunization (Ferrer et al., 2012). She has also conducted risk factor and prevalence studies in countries such as South Africa, Venezuela, and Kenya (Tsotetsi-Khambule et al., 2018). On the other hand, Akira Ito has published reports on a variety of topics including genetic and morphological characterization of *T. saginata*, nuclear and mitochondrial gene sequences, and preparation of immunodiagnostic antigens for *cysticercosis*. Moreover, Akira Ito has collaborated with researchers from many countries, including Thailand, Mongolia, Senegal, China, Indonesia, Romania, Cameroon, Madagascar, and France.

Veterinary Parasitology and *Parasitology Research* journals were found to have an increasing impact on *T. saginata*. For journals from Asia and Africa to support studies in the field, they need to establish national research pools and ensure they are indexed in international databases such as WoS, Scopus, and PubMed.

CONCLUSION

T. saginata is a dangerous parasite with implications for both human and animal health, as well as the meat industry (Uysal and Dokur, 2017). Accordingly, the study investigated the trends in the annual number of studies on *T. saginata* over a 44-year period, as well as the most influential authors, countries, institutes, and journals using the WoS database. The results indicate that countries such as Belgium and England, which allocate significant funding to research organizations, were influential in molecular, genetic, and cloning research. On the other hand, in countries such as Kenya, South Africa, and Ethiopia, where adequate preventive measures against *T. saginata* are lacking, studies primarily focus on parasite control and management. Some authors, particularly Leslie Jayne Stevenson Harrison, Akira Ito, and Pierre Dorny have

become core authors with their contributions to the field and have expanded their own and their countries' international collaboration network through their collaborative studies with other countries.

The most significant deficiency identified in the field is the insufficient data pool of countries for prevalence studies. The main reason for this situation is believed to be that some countries perceive *T. saginata* as a negligible risk and therefore do not allocate sufficient financial and organizational support for research in this field. Consequently, there is a need for enhanced inspections and record-keeping practices, particularly within meat industries. Additionally, it would be beneficial for developed countries to increase cooperation with underdeveloped countries in Asia and Africa.

Limitations

This bibliometric analysis offers a comprehensive and in-depth assessment of global research on *T. saginata*, covering animal and human health over a 44-year period. This study is considered a valuable source for future research on the worldwide health and economic impacts of *T. saginata*. Although this study objectively presents the research topic, it has some limitations. The primary limitations include the exclusion of studies found in databases other than WoS and the inclusion of only English studies in the analysis.

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